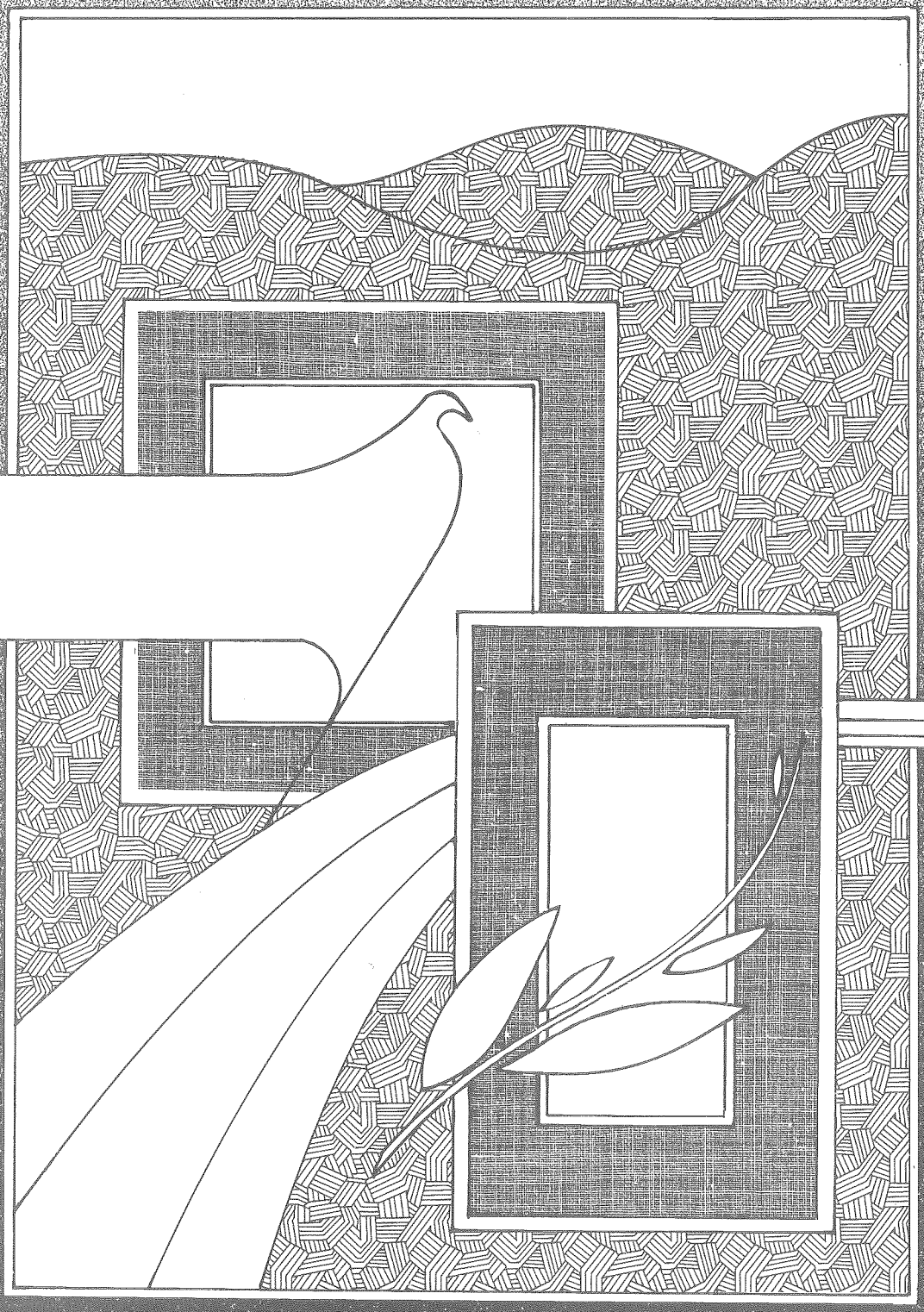
Auckland Conservancy

DEDICATED AREAS REPORT Number 15



Onekura Ecological Area

NEW ZEALAND FOREST SERVICE

ONEKURA ECOLOGICAL AREA

N.Z. FOREST SERVICE
AUCKLAND CONSERVANCY
C.P.O. BOX 39
AUCKLAND

David Willetts
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ONEKURA ECOLOGICAL AREA

CONTENTS PAGE NO.

Location (Fig. 1)

The Onekura Ecological Area occupies a large portion (2,350.85 ha) of the Waipapa River catchment in Puketi Forest. It forms the second largest forest tract in Northland along with Omahuta Forest and Manginangina Scenic Reserve (Ogle, 1982). The Ecological Area is almost entirely covered in indigenous forest. Some of it has been modified by human activities. Puketi Forest is located 21 km north of Kaikohe (approximate midpoint at map reference NZMS 1 N12 230 570), and is one of 17 forests in the Northland State Forest Park. Onekura is one of six Scientific Reserves in the Maungataniwha Ecological District (Biological Resources Centre, 1983). The combined area of these reserves is 6,253 ha.

Aerial colour photographs were taken in 1975 (N.Z. Aerial Mapping Survey No. 2911, Runs B, photographs 11-16, C photos 11-17, D photos 10-16 and E photos 10-11; scale 1:15 000).

Access (Fig. 2)

The Okaihau-Kaeo Road leaves State Highway 1 at Okaihau and leads on to Waiare Road. The eastern boundary of the Ecological Area follows Waiare Road from Pink Gates to Mokau Ridge Road (Fig. 2). Forest Road, which is about 9 km north of Okaihau along S.H. 1, provides access to the south-west corner of the forest. A tramping track leads from there through the Ecological Area.

Internal forest roads and tracks also provide access to the reserve (Fig. 2). Public use of internal roads is allowed by foot.

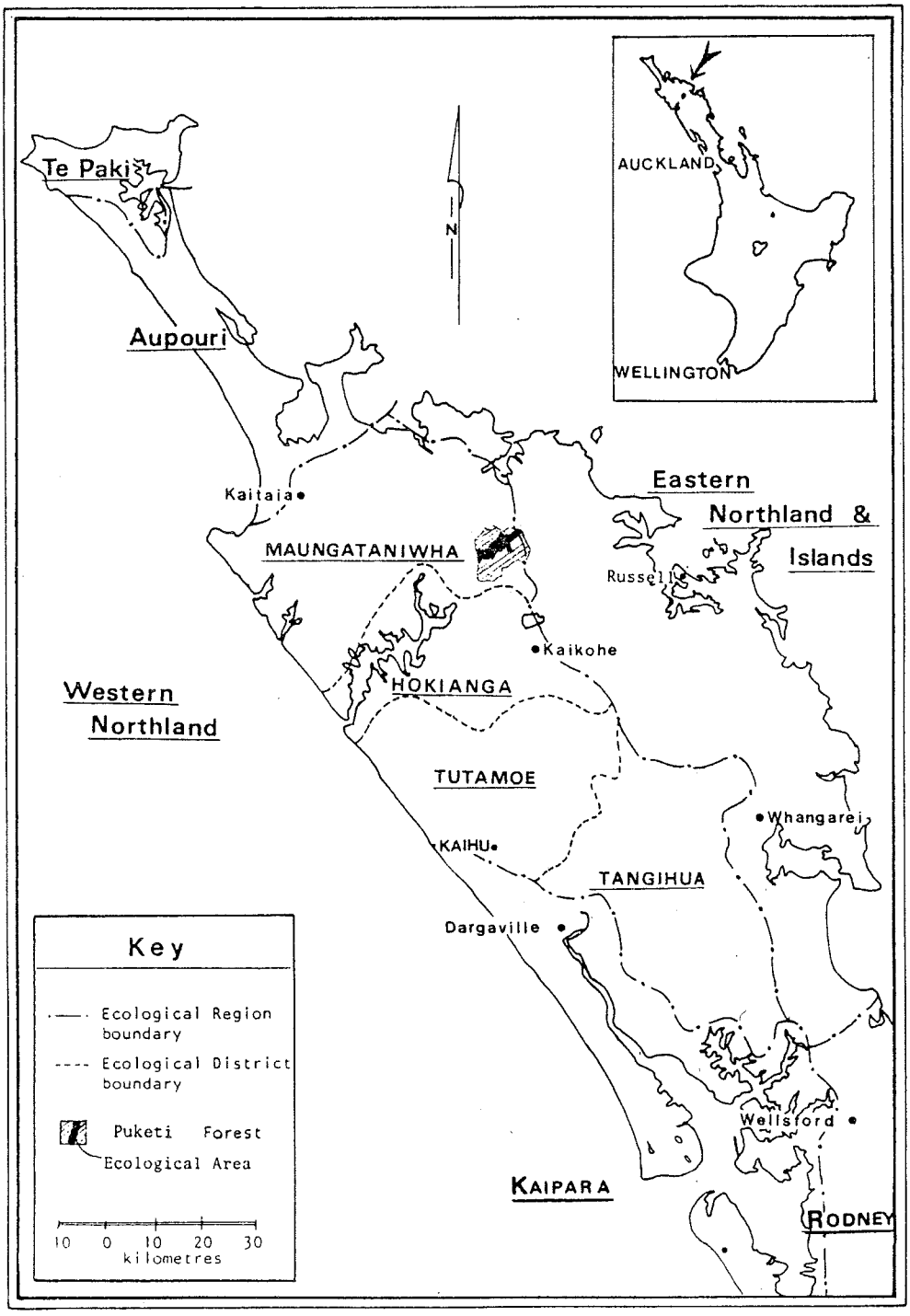
History of Gazettal

From the early 1970s, Auckland Conservancy considered several small areas for reservation in the Waipapa River catchment (N.Z.F.S. Kaikohe file, 34/1/4/0). In July 1979, J. Nicholls (scientist, F.R.I. Rotorua) proposed to amalgamate and extend these areas (Nicholls, 1979a). In August 1979 the Scientific Co-ordinating Committee (S.C.C.) (now the State Forests Scientific Reserve Advisory Committee) considered and approved the proposal with minor boundary changes. In July 1981, following approval in principle by the Minister of Forests in May 1980, gazettal of the Onekura Ecological Area occurred (N.Z. Gazette no. 80, p. 1909).

Rationale and Objectives of Designation

The reserve fulfils most of the criteria for the selection of Ecological Areas, as set down by the S.C.C. (1983). It is over 1,000 ha, is largely unroaded, and covers a range of land forms and vegetation types characteristic of the local area. However, the boundaries are complex and artificial, although several subcatchments are contained in the area.

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



(Based on Ecological Regions and Districts - 2nd Edition (Biological Resources Centre, 1983))

J. Nicholls (1979b) stated the objective of designating the Onekura Ecological Area as :

> "to preserve a broad transect across the least modified fully representative sector of the unique Omahuta-Puketi dissected greywacke upland, over the full altitudinal range from a very little above sea level up to 450 m."

Whether the reserve is actually fully representative is discussed in the final section of this report.

Topography

The main topographical feature of the reserve is the Waipapa River, which is bounded to the north and south by high ridges and flows south-west to join the Mangapa River, which forms the western boundary of the reserve. Mokau Ridge, varying in altitude from 300-460 m, forms the northern catchment boundary of the Waipapa River. Leading down from the high ridges to the Waipapa River are a series of irregular spurs and secondary ridges which are separated by deeply cut stream beds, making the terrain very dissected.

By contrast the river is gently graded, and its altitude varies from approximately 100 m to 30 m at the south-western corner of the reserve, where the Waipapa meets the Mangapa River. Overall, the altitude varies from 30 - 462 m in the Ecological Area. The steep subcatchments of the Waipapa have frequent waterfalls, perhaps the most spectacular being the Merumeru Falls which drop 90 m in three stages.

Apart from a small northerly part of the reserve which drains to Whangaroa Harbour, drainage is to the west into the Hokianga Harbour.

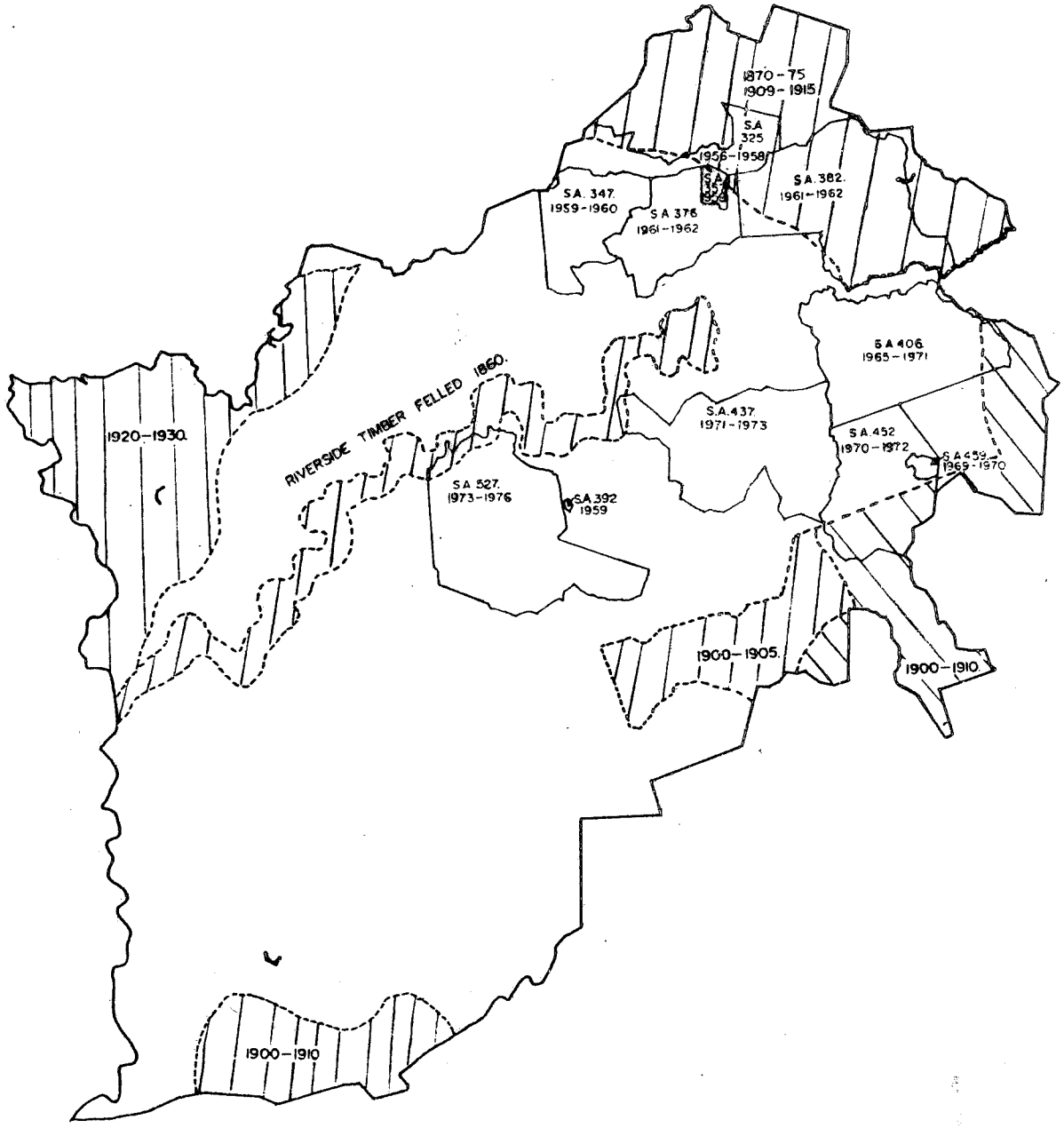
Climate

Rainfall in the reserve ranges from 2,000 mm to over 2,400 mm per year (N.Z. Met. Service, 1973). A rain-gauge maintained at Puketi Forest Headquarters (347 m a.s.l.) recorded a mean annual rainfall of 2,308 mm between 1970 and 1974 (N.Z. Met. Service, 1970-1974).

The nearest climatological recording stations are at Kaikohe and Kerikeri. The mean daily maximum and minimum temperatures at Kerikeri (1945-1973) were 20.0°C and 10.0°C. Equivalent measurements for Kaikohe (1973-1980) were 18.4°C and 11.0°C respectively (N.Z. Met. Service, pers. comm.).

Geology

The geology of the Ecological Area is dominated by an ancient marine volcanic formation of greywacke and argillite, which is part of the Waipapa group and is the oldest rock type in Northland, dating from up to 260 million years ago. This formation was uplifted from a marine basin called the N.Z. geosyncline, by a series of massive



OVERLAY I

KAURI DAM SITE

LOGGING PRIOR TO 1952.

NB: All dates and area boundaries approx.

ESTIMATED AREA OF WORKINGS.

LOGGING FOR THE PERIOD 1952 - 1976.

S.A.437. Sawmill Area Nos

Sawmill Area Boundaries

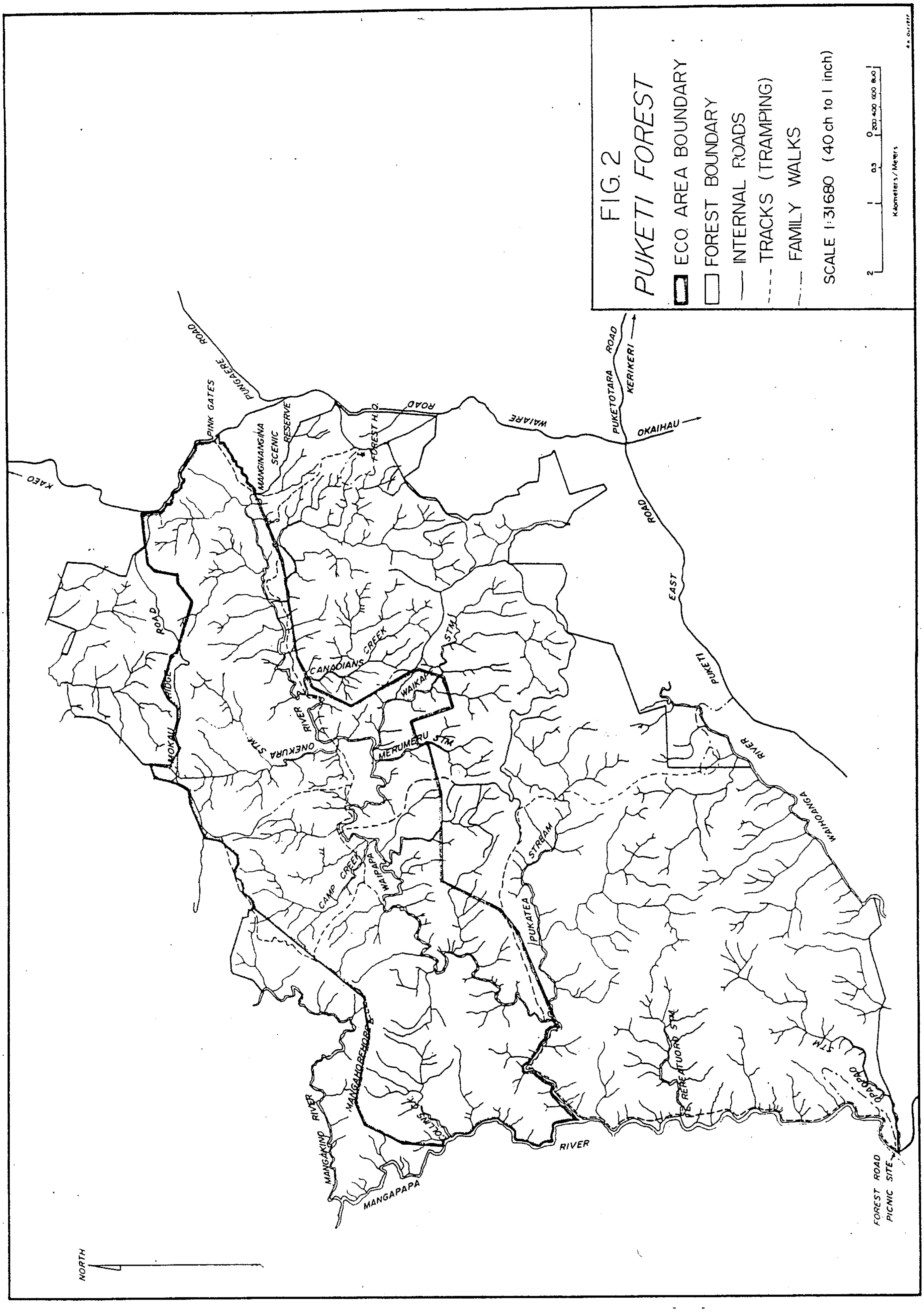


FIG 2
PUKETI FOREST
ECO. AREA BOUNDARY
FOREST BOUNDARY
INTERNAL ROADS
TRACKS (TRAMPING)
FAMILY WALKS
SCALE 1:31680 (40 ch to 1 inch)
Kilometers / Meters
KERIKERI
PUKETOTARA ROAD
OKAIHAU
WAIARE ROAD
PUNGAERE ROAD
PINK GATES
MANGINANGINA SCENIC RESERVE
FOREST H.Q.
KAEO
EAST PUKETI ROAD
WAIHOANGA RIVER
MOKAU RIDGE ROAD
CANADIANS CREEK
STM
WAIKAI
RIVER
ONEKURA STM
MERUMERU STM
CAMP CREEK
WAIPAPA
STREAM
PUKATEA
REREATUORO STM
OPAORO
STM
MANGAHOREHORE
MANGAKINO RIVER
MANGAPAPA
RIVER
FOREST ROAD PICNIC SITE
NORTH

earth movements (the Rangitata Orogeny), which reached their climax during the lower Cretaceous, 135-100 million years ago (Ballance, 1979). Omahuta and Puketi Forests are located on the central segment of this formation in Northland. The greywacke basement also extends down the eastern side of Northland, from Whangaroa Harbour to Kawau Island, obscured in places by younger sedimentary and volcanic rocks (Town and Country Planning Division, Ministry of Works, 1964).

Three small areas of blue-grey mudstone with beds of sandstone in places, are found in the reserve (Kermode, 1982). The north-eastern corner of the reserve has received considerable interest from mining companies due to the presence of mercuric oxide in a green sandstone/sandy clay material (N.Z.F.S. Kaikohe file 20/0/4).

A coal seam is reputed to be present near an old dam site beside the northernmost clumps of kauri in the north-east corner of the reserve (Lloyd, unpubl., 1971). Impure manganese-containing ore is located in a seam just above the junction of Waikape Stream and the Waipapa River. The seam is 1 m wide running approximately north-east, containing 28% manganese dioxide and 1-9% manganous oxide. Several soda springs occur in the upper reaches of the Waipapa River (Sexton, unpubl., 1939).

Pedology and Erosion

Soils in the Ecological Area are mainly derived from sedimentary rock and are mostly heavy clays with a high silica content (Sexton, unpubl., 1939). Te Ranga Steepland soil covers the bulk of the reserve. It is moderately to strongly leached and excessively drained. This type is liable to rapid sheet and slip erosion under pastoral use (Town and Country Planning Division, Ministry of Works, 1964).

Soils formed from igneous rocks are not extensive in the reserve, being small areas of fertile red clay on the higher northern ridges and in the eastern corner above Manginangina Scenic Reserve. There are four types of soil found in these areas :-

1. Otangaroa clay and sandy loam;
2. Mount Rex clay;

) weakly to moderately podzolised

3. a small area of Wharekohe sandy loam is located within the above soil types and is a podzol soil; and

4. to the north of these areas along parts of the northern boundary Rangiora clay and silty loam is found. This type is weakly podzolised.

These four soil types are imperfectly drained hill soils (Sutherland, 1980).

Slips occur quite frequently in the steep terrain of Puketi Forest (Beachman, unpubl., 1976), However, within the Ecological Area no large slips are evident on aerial photographs. A localised area west of Maungahorehore sub-trig has numerous small slips. There is

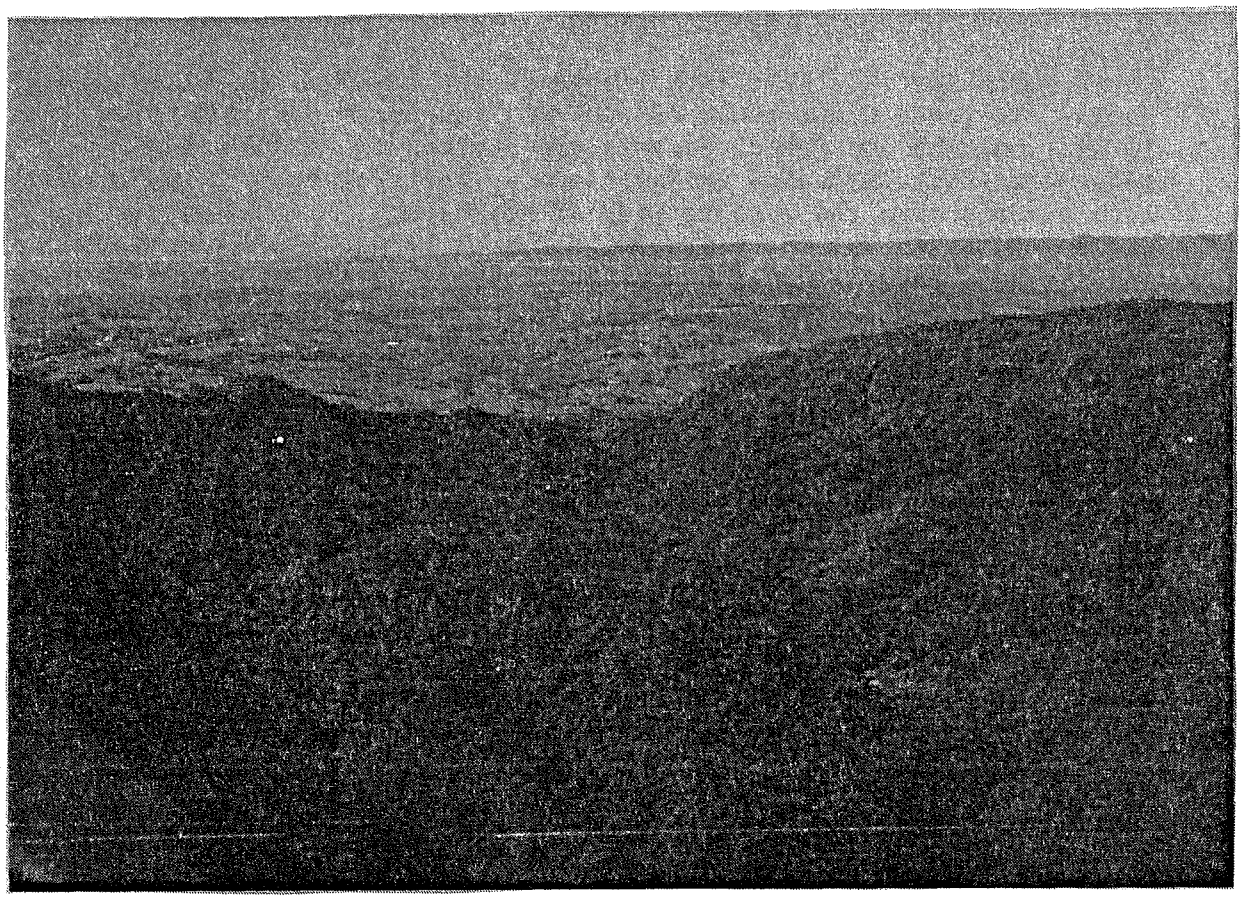


Photo 1 : Looking south down the lower Waipapa River Valley, with part of the Onekura Ecological Area in the left foreground (Photo by J.L. Kendrick).

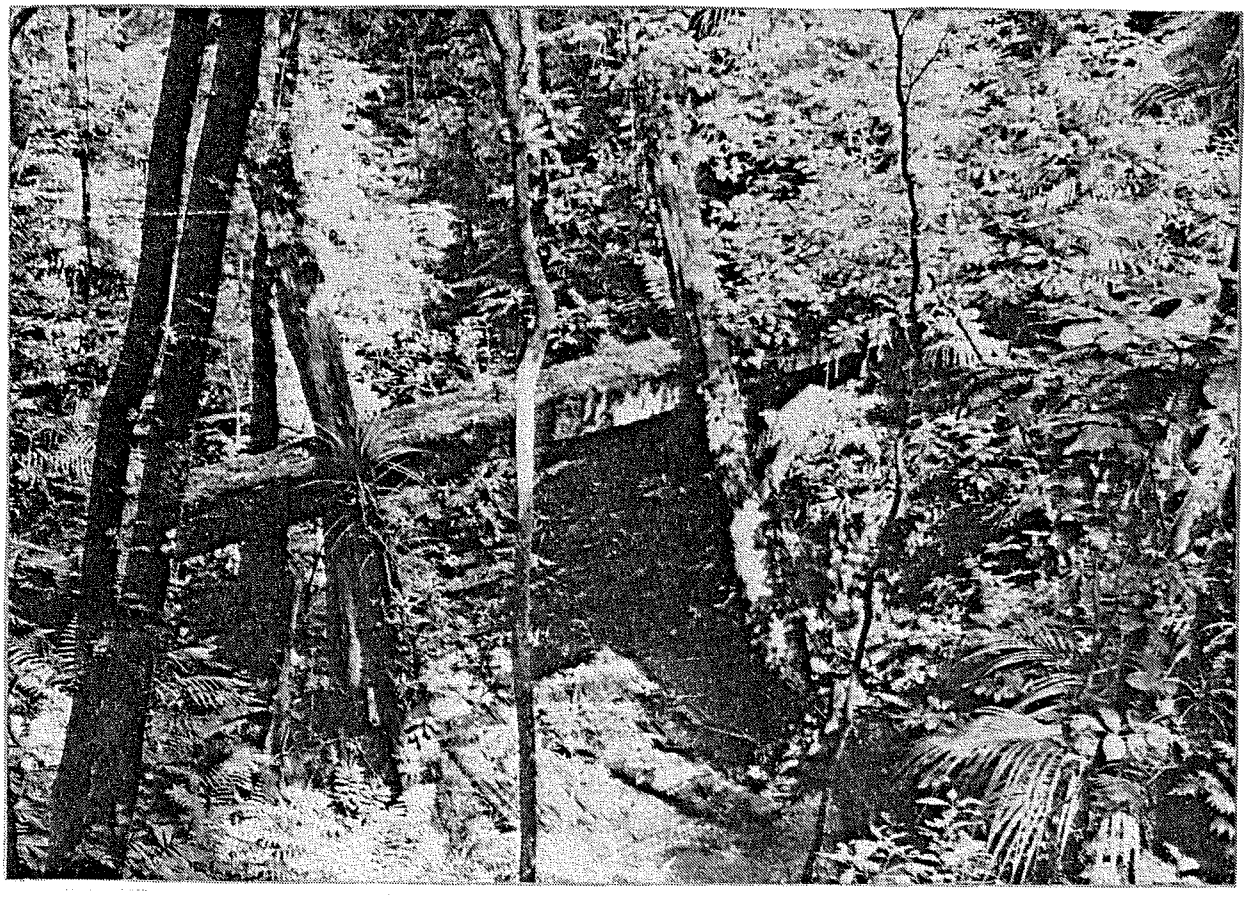


Photo 2 : Kauri dam remains in the north-east corner of the Ecological Area (Photo by J.L. Kendrick).

a potential for severe erosion should the forest cover be disturbed. This was shown when heavy rain caused serious erosion in catchments of the Waipapa River below the Ecological Area in 1976. Some catchments had been logged, while other places had only scrub cover (N.Z.F.S., unpubl., 1976).

Vegetation

The information used to give the following description was obtained largely from ten days fieldwork during August - early September 1984. Data supplied by P.J. Bellingham, and several internal Forest Service reports (Sexon, 1939; N.Z.F.S., 1957; Halkett, 1976) provided additional information. Overlay 2 of Figure 3 shows the location of the field descriptions made. Plots made from the 1976 report are grid referenced based on the NZMS 1 mapping series.

A plant species list giving both scientific and common names is provided in Appendix 1.

The method used for the 1984 fieldwork was a modified recce-type system recording species present in five tiers, and the dominant lianes and epiphytes. The tiers are :

emergents (above canopy height);
canopy;
subcanopy (minimum height 2 m);
shrub (2 m down to 50 cm); and
groundcover (below 50 cm).

Site descriptions were grouped into types based as closely as possible on those classified by Nicholls (1976). Further discussion of this technique is given by Burns (1983).

I have divided the vegetation into four types :-

1. mature kauri forest (A1, Nicholls 1976);

2. stands of small kauri trees or poles (A3, Nicholls 1976);

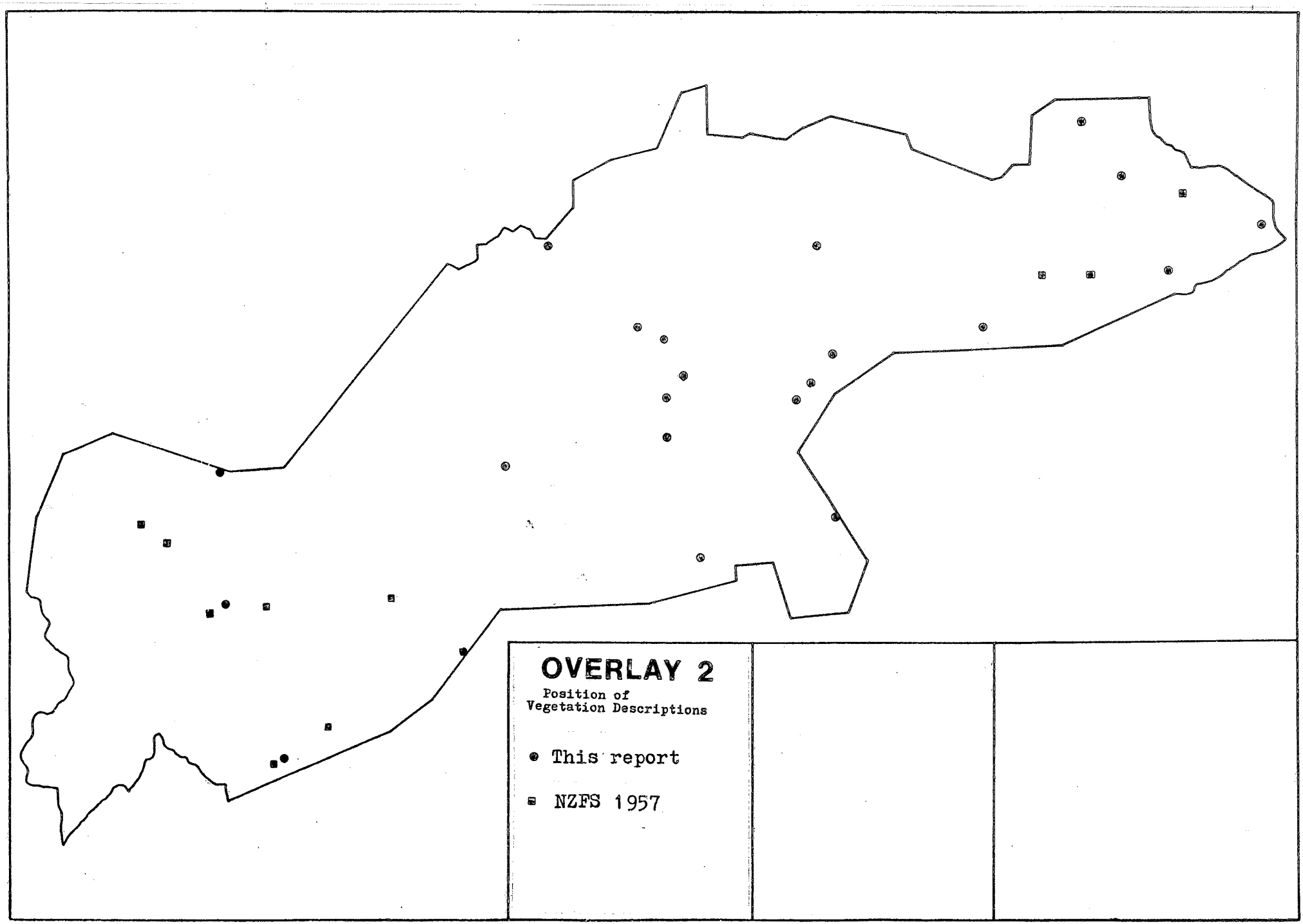
3. low altitude podocarp-hardwood forest (E2 and E3, Nicholls 1976); and

4. manuka/pole podocarp scrubland.

The extent of these types is shown on Overlay 1 of Figure 3. Tables at the end of this section show the stand structure of the forest types.

1. Mature Kauri Forest (A1, Nicholls 1976) (stand structure, table 1).

Although this forest type is a striking feature of some forest views, only a relatively small portion of the reserve is occupied by mature kauri forest. The large kauri usually occur on ridge tops, well drained slopes, and knolls. Small side streams may have a closed kauri canopy above them. The boundary of this forest type is often


OVERLAY 2
Position of
Vegetation Descriptions
This report
NZFS 1957

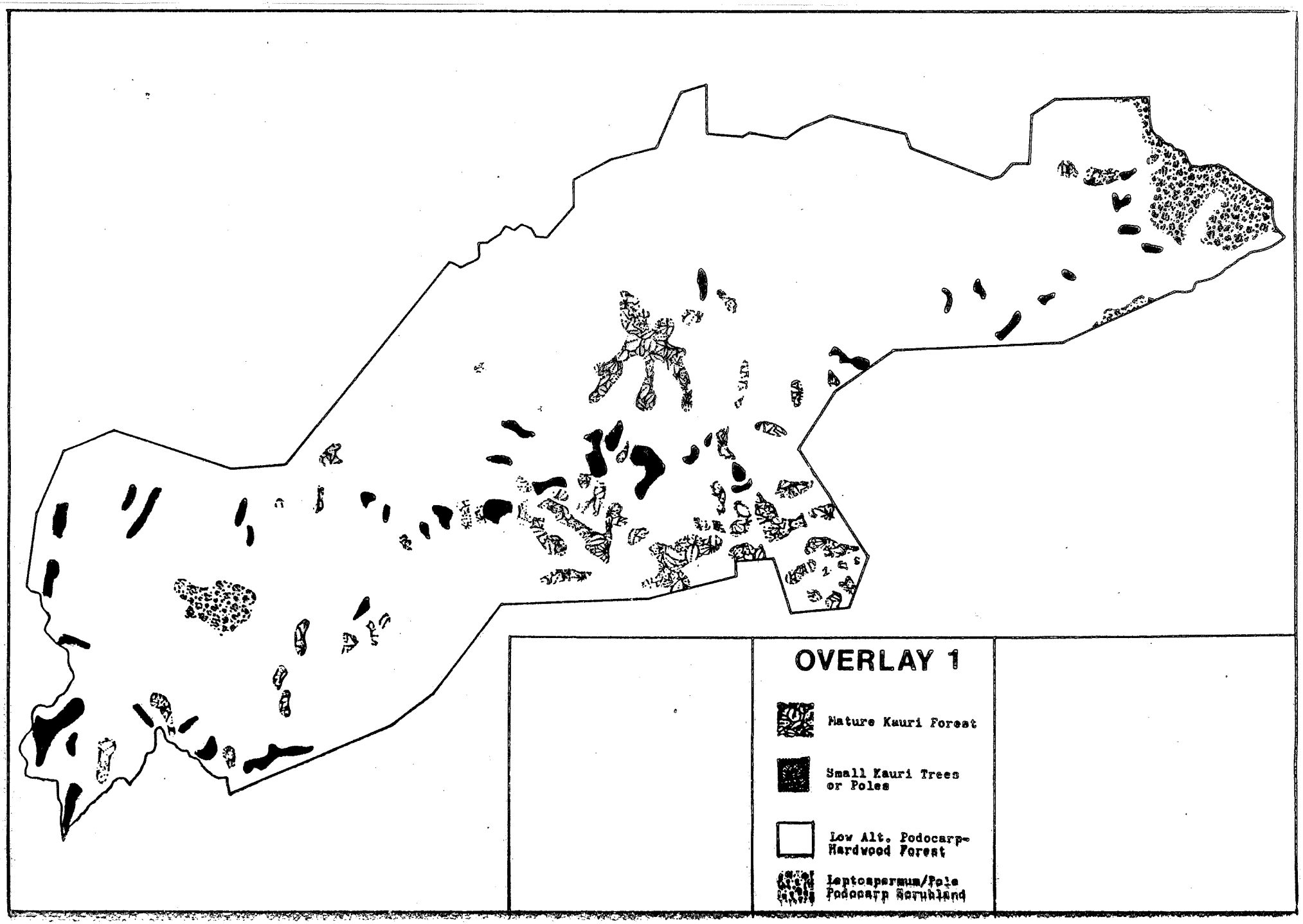
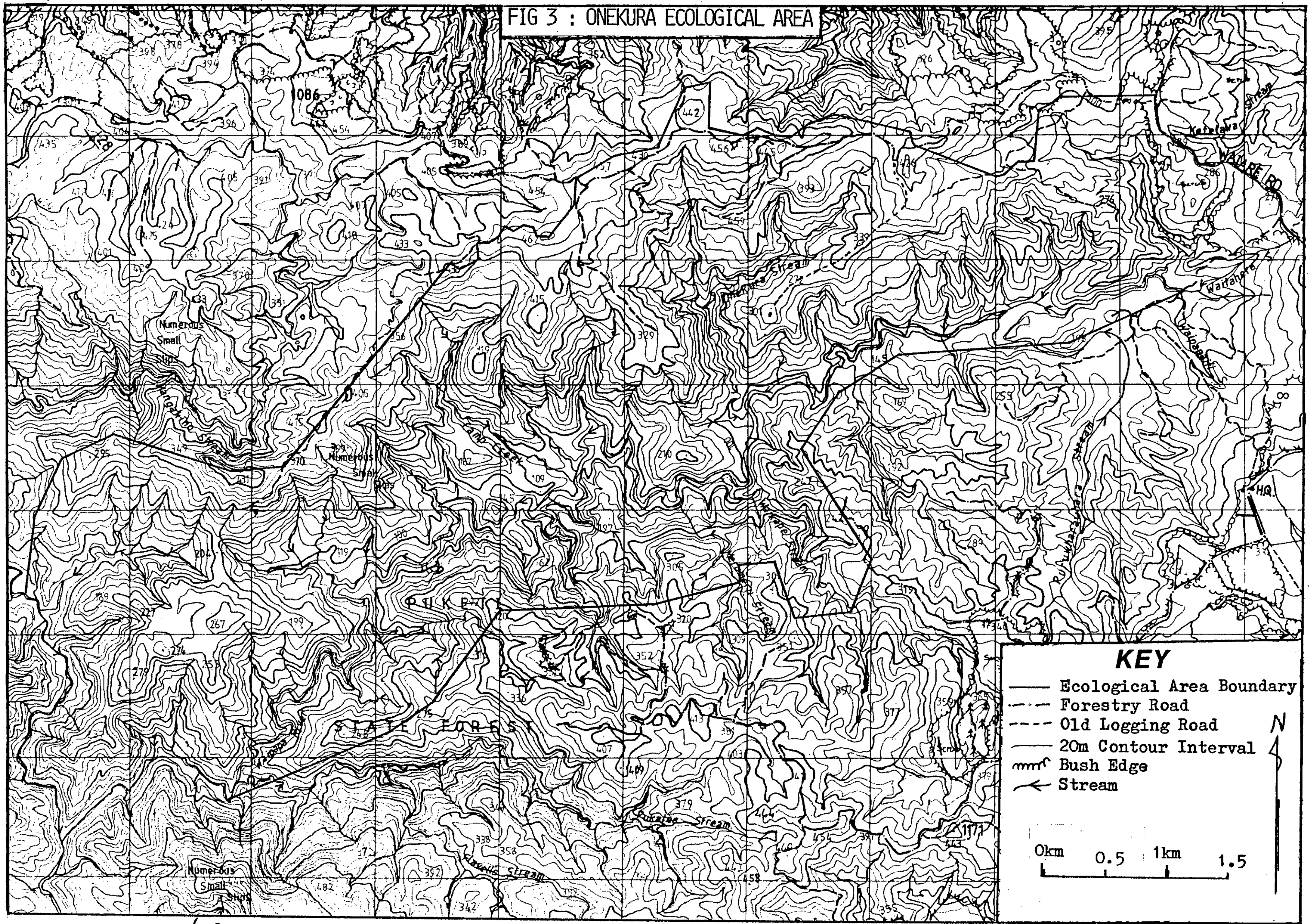

OVERLAY 1
Mature Kauri Forest
Small Kauri Trees or Poles
Low Alt. Podocarp-Hardwood Forest
Leptospermum/Pole Podocarp Scrubland

FIG 3 : ONEKURA ECOLOGICAL AREA



(from NZMS 270 series,map P05A, Dept of Lands and Survey, 1981)

clearly demarcated, and the stands are generally fringed by large rimu (Halkett, unpubl., 1976). The mature kauri occur either as a frequent emergent or forming a dense high canopy, overtopping a predominantly podocarp tier. The following podocarps occur together : Hall's totara, miro, rimu, tanekaha and monoao, listed in order of numerical abundance in Puketi Forest kauri stands (Halkett, unpubl., 1976). Less common podocarps found are kawaka and silver pine. Hardwoods (e.g. rata) are uncommon in the canopy.

The relative abundance of species in each kauri stand can vary widely e.g. tawari is a subcanopy dominant along the Walnut track, while tawa is common in the Onekura stand. In the Onekura stand (west of Onekura Stream), the subcanopy association varies from tawari or tawa dominated, to tawheowheo/mairehau/toatoa/*Corokia buddleioides* near Onekura Bluff (P.J. Bellingham, N.Z.F.S. botanist, pers. comm.)

Numerous softwood and hardwood species occur in the prolific subcanopy, some of the most common being rewarewa, tawa, tawari, miro, kauri, towai, hinau, neinei, and heketara. In the shrub tier a thick sward of *Gahnia xanthocarpa* and kauri grass, sometimes mingled with *Metrosideros albiflora, Dicksonia lanata, Rubus* spp. and/or kiekie, is characteristic. Kanono and towai are also frequently in the shrub tier. Little ground cover can grow where the shrub tier is dense, but in open patches mosses and filmy ferns such as kidney fern and *Hymenophyllum sanguinolentum* are common. Epiphytes and lianes include *Collospermum hastatum, Astelia solandri,* kiekie, several rata species, mangemange, epiphytic orchids and *Asplenium polyodon.*

The kauri stands in Puketi Forest have a high diversity of podocarps in comparison to other parts of Northland. A kauri type map in Halkett (unpubl. 1976) shows the locations of kauri in Puketi Forest in fine detail.

2. Small Kauri Trees or Poles (A3, Nicholls 1976) (stand structure, table 2).

Stands of young kauri usually occur on lower portions of ridges in the reserve. Scattered mature kauri occur in this type, but most kauri are under 70 cm d.b.h. Rimu and miro are occasionally emergent amongst abundant kauri. The canopy is open, with frequent pole kauri and miro, and occasional other pole podocarps, tawa and toru. In the dense subcanopy are abundant Kirk's daisy and mingimingi at about 3-4 m, and frequent kauri, tanekaha, rewarewa and lancewood of all sizes. Abundant Kirk's daisy, frequent *Gahnia xanthocarpa* and occasional kauri grass, *Coprosma lucida,* kauri saplings, ponga, *Dicksonia lanata* and hangehange occupy the shrub tier. Where the shrub layer is open, *Lycopodium* spp., *Gahnia* spp., kiekie, *Blechnum fraseri* and filmy ferns are constituents of the groundcover. Numerous species of ground orchids occur in season. *Metrosideros albiflora* sometimes forms a thick sward in the shrub tier or ground tier, as well as occupying upper tiers. Other common lianes and epiphytes are *Collospermum hastatum,* kiekie and *Metrosideros* spp. A variation on this forest type occurs on the ridge west of Camp Creek, where tall young podocarps outnumber the pole kauri.

The overall impression in these stands is of vigorous regeneration. Young ricker stands occur in small areas through Puketi Forest, and were mapped by Sexton (unpubl., 1939), who stated that this type was affected by past logging operations.

3. Low Altitude Podocarp-Hardwood Forest (E2 and E3, Nicholls 1976) (stand structure, table 3).

This is by far the most extensive forest type, occurring throughout the altitudinal range in the reserve. Rimu and rata are frequently emergent, although pukatea and other podocarps are locally dominant according to site conditions. Towai, taraire and kohekohe are canopy dominants. Towai is more common on hillsides and ridges, whereas tall taraire-kohekohe forest occupies the valley floors. At lower altitudes (below 300 m) groves of puriri and nikau occur on some rich soil sites. Puriri is uncommon above 300 m while tawa, kohuhu and hinau increase their presence higher up. Rewarewa is common throughout. Nikau and tree ferns dominate the close subcanopy. A wide variety of hardwoods occur in the subcanopy and the shrub layer, where kanono and *Melicytus macrophyllus* are common. Groundcover becomes thick where the canopy is open. On some hillsides kiekie forms a dense tangle. *Blechnum fraseri*, bush rice grass, hook sedge and *Lastreopsis hispida* are common, as are *Pneumatopteris pennigera* and *Elatostema rugosum* in damp areas. Kiokio is common where the upper tiers are light. Epiphytes and lianes are abundant and varied. Kiekie, supplejack, rata vines, bush lawyer and *Clematis* spp. may occur in all tiers. *Clematis paniculata* and *Earina mucronata* were flowering and therefore conspicuous during the field inspection.

In this forest type, a variety of podocarps assume dominance in localised areas. I have identified four podocarp sub types :-

a. A stand of matai and kahikatea occurs on the river flat by the mouth of Camp Creek. These species usually have a scattered distribution elsewhere in the reserve. Large rimu and totara also occur in the stand.

b. Stands of large rimu and less frequent Hall's totara are occasionally found on level areas above 300 m. Most of this subtype occurs outside the Ecological Area e.g. in several places along the Maungahorehore track.

c. On the damp south facing slopes in the headwaters of Camp Creek. pukatea and miro are frequently emergent with rata, rimu, Hall's totara and occasional kahikatea.

d. A subtype occurs scattered through the reserve on small sections of ridge tops, with dense small miro and Hall's totara dominating the canopy, and sometimes rimu and monoao are present. The understorey contains several species also associated with kauri forest, e.g. tawari, neinei, mapou, mingimingi and kauri grass.

The understorey of the first three subtypes is little different from the main podocarp-hardwood forest type.

4. Manuka/Pole Podocarp Scrubland (stand structure, table 4).

This vegetation type is mainly found in two areas which are at opposite ends of the reserve (see overlay 1, Fig. 3). The area along the eastern section of the reserve boundary is dominated by manuka, or occasionally kanuka or towai. *Dracophyllum lessonianum*, *Hakea* spp. and rewarewa also occur in the open canopy. Scattered kauri, rimu and tanekaha poles up to 8 m are sometimes emergent and occasional Hall's totara saplings are evident. The subcanopy is also open, with towai, mingimingi, and *Dracophyllum lessonianum* common, and occasional *Cordyline australis*, *C. banksii*, *Hakea* spp. manuka *Coprosma lucida*, mapou, hangehange, heketara, kanono and five finger. Kiokio, bracken and *Gleichenia dicarpa* form a tangled ground-shrub layer. Towai, kanono, mingimingi, turutu and *Gahnia pauciflora* also occur in the shrub layer. Seedlings of subcanopy and canopy species occur where ground and shrub layers are open. *Lycopodium* spp., *Schizaea fistulosa* (rare), *Drosera peltata* and several orchid species occur on drier sites. In wetter sites *Juncus* spp. and *Baumea* spp. are found. Epiphytes are scarce, usually comprising mosses and lichens with occasional *Earina autumnalis* and *Hymenophyllum sanguinolentum*.

During the 1957 Ecological Forest Survey (N.Z.F.S., 1957), ring counts taken on *Leptospermum* spp., rimu and towai poles in this area showed them to be approximately 28 - 30 years old. Old kauri stumps and head logs were encountered during that survey in both main scrub areas.

Another scrubland area is situated at the western end of the reserve, south of Maungahorehore summit. The central portion of scrubland is on a swampy plateau with a scattered manuka overstorey and a groundcover of *Baumea* spp., *Schoenus tendo*, *Juncus gregiflorus*, kiokio and *Scirpus reticularis*. Around this area is a manuka dominated scrub association with more frequent softwoods than the scrubland beside Waiare Road. Other species found in this area include miro, kohuhu, hinau and toru in the canopy, Kirk's daisy, toru, kauri grass and ponga in the understorey and *Drymoanthus adversus* on manuka trees.

Several dense pole podocarp stands occur on ridges around this central plateau. Rimu is numerically dominant, although tanekaha and Hall's totara assume local dominance. Manuka is occasional in the crowded canopy and scattered kauri up to 8 m occur in these stands. Leaf litter is thick and there is little groundcover. *Schizaea dichotoma* was encountered in one stand. Table 4 shows the species common to both scrubland areas.

A Forest Service botanist, P.J. Bellingham, who worked in Puketi Forest from November 1982 to October 1984 recorded a number of unusual plants. Three uncommon filmy ferns, *Hymenophyllum armstrongii*, *H. atrovirens* and *Trichomanes strictum* occur in the Ecological Area. *Loxoma cunninghamii*, a fern of localised distribution in Northland, and *Hebe acutiflora*, listed as endangered by Williams and Given (1981), are found on the banks of the Waipapa River. Other rare plants include *Pratia physaloides*, *Pittosporum virgatum*, and what may be a new species of *Davallia*. *Brachyglottis myrianthos* occurs at it's northern known limit in the reserve (P.J. Bellingham, pers. comm.).

TABLE 1 : MATURE KAURI FOREST

TIER	← INCREASING DOMINANCE →				
	HEIGHT (m)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT*	20-32		kauri	rimu	
CANOPY	10-18		kauri tanekaha rimu miro	tawa Hall's totara northern rata	monoao
SUB-CANOPY	2-10		tawa tawari miro rimu rewarewa kauri	taraire monoao toatoa heketara *Nestegis montana* towai neinei	silver pine kawaka mangeao
SHRUB	0.5-2	*Gahnia xanthocarpa* kauri grass	kiekie kanono towai mingimingi	mairehau Kirk's daisy karapapa *Melicytus macrophyllus* mahoe *Coprosma lucida*	*Cyathodes juniperina*
GROUND-COVER	0-0.5		*Blechnum fraseri* *Cardiomanes reniforme*	*Lindsaea trichomanoides* *Metrosideros perforata* *Nertera dichondraefolia*	
EPIPHYTES AND LIANES		*Collospermum hastatum*	*Metrosideros perforata* mangemange *Astelia solandri*	*Metrosideros* spp. *Asplenium polyodon* hounds tongue *Rubus australis* filmy ferns *Earina mucronata*	

DISTRIBUTION: Ridge tops and well drained slopes below 400 m a.s.l.

NOTES: *Sometimes there are no emergents when kauri forms a high canopy. (Type A1, Nicholls 1976)

TABLE 2 : SMALL KAURI TREES OR POLES

TIER	← INCREASING DOMINANCE →				
	HEIGHT (m)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	20-25	kauri		rimu miro	
CANOPY	11-18		kauri miro	rimu Hall's totara tawa toru	
SUB-CANOPY	2-10	mingimingi Kirk's daisy	kauri ponga lancewood towai kanuka rewarewa tanekaha	miro *Nestegis montana* neinei toru tawa hangehange	toatoa monoao
SHRUB	0.5-2	Kirk's daisy	*Gahnia xanthocarpa*	kauri kauri grass *Coprosma lucida* ponga *Dicksonia lanata* hangehange	
GROUND-COVER	0-0.5		*Lycopodium* spp. kidney fern *Blechnum fraseri* *Gahnia* spp. kiekie	*Schizaea dichotoma* *Lindsaea trichomanoides* ground orchids* *Dawsonia superba*[*2]	
EPIPHYTES			*Metrosideros albiflora* *Collospermum hastatum* kiekie *Metrosideros perforata* *M. diffusa*	*Earina mucronata* *Hymenophyllum* spp. *Astelia solandri* mangemange filmy ferns	

DISTRIBUTION: Usually on low sections of ridges.

NOTES: * in season
*2 large moss
(Type A3, Nicholls 1976)

TABLE 3 : LOW ALTITUDE PODOCARP - HARDWOOD

TIER	← INCREASING DOMINANCE				
	HEIGHT (m)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	18-35		rimu northern rata	matai miro Hall's totara pukatea kahikatea	monoao kawaka
CANOPY	9-15	taraire towai	kohekohe tawa mamaku rewarewa	miro kohuhu hinau makamaka puriri nikau kiekie	
SUB-CANOPY	2-9	nikau ponga wheki	taraire kohekohe Kirk's daisy kanono mahoe kiekie	heketara pigeonwood neinei towai supplejack titoki	
SHRUB	0.5-2	kanono	*Melicytus macrophyllus* ponga wheki kohekohe hangehange	pate mahoe karapapa towai lacebark kiokio kiekie	
GROUND-COVER	0-0.5		*Blechnum fraseri* bush rice grass hook sedge *Pneumatopteris pennigera* parataniwha	*Asplenium lucidum* kiokio manamana *Lastreopsis hispida* *Dianella nigra* kiekie	
EPIPHYTES AND LIANES		filmy ferns	*Metrosideros fulgens* *Collospermum hastatum* *Astelia solandri* *Earina* spp. *Phymatosorus* spp *Asplenium* spp.	*Tmesipteris* spp. supplejack kiekie *Metrosideros perforata* *Pittosporum kirkii* *Pseudopanax edgerleyi*	*Metrosideros carminea*

DISTRIBUTION: Throughout the majority of the Ecological Area.

NOTES: (Type E2, Nicholls 1976, tending towards E3 at higher altitudes)

TABLE 4 : MANUKA/POLE PODOCARP SCRUBLAND

TIER	← INCREASING DOMINANCE →				
	HEIGHT (m)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	8 m			kauri tanekaha rewarewa rimu	kahikatea
CANOPY	5-7		manuka kanuka pole podocarps	kauri *Hakea* spp. *Dracophyllum lessonianum* towai toru	
SUB-CANOPY	2-5		towai manuka *Dracophyllum lessonianum*	pole podocarps mapou mingimingi rewarewa	
SHRUB	0.5-2		kiokio *Gleichenia dicarpa* mingimingi	five-finger towai *Gahnia* spp. *Coprosma lucida* bracken	
GROUND-COVER	0-0.5		*Lycopodium* spp.	*Juncus* spp. *Baumea* spp.	
EPIPHYTES				*Earina autumnalis* *Hymenophyllum sanguinolentum* *Drymoanthus adversus*	

DISTRIBUTION: Two main locations, one at each end of the Ecological Area.

NOTES : This table gives the species common to both scrub areas.

The following statement by Nicholls (1979b) indicated the importance he attributed to the kauri forest in the reserve :

> "The occurrence of old growth kauri forest less than 150 m a.s.l., as some of these are, in an extensive forest environment, cannot be matched elsewhere in the Hokianga Ecological District." (The district name and boundaries have since been changed, see Fig. 1.)

Introduced Animals and Forest Condition

Scientific and common names for animals mentioned in the text are given in Appendix 2.

Eight rat traps were set over four nights by the Mokau Ridge gate, but no rats were caught. Of 76 circular 4 m^2 plots examined in the reserve, three (4%) contained possum pellets and two contained seeds chewed by rodents. Pig sign was seen throughout the reserve and was most plentiful in the more remote areas. Wild cattle, once a problem in Puketi Forest, are now to be found only in the area south of Maungahorehore where one was encountered during the field inspection. Horse tracks were seen on the Waipapa River bed. Horses can be taken up the riverbeds in Puketi Forest by permit only.

Goats were in Puketi Forest before 1935 (N.Z.F.S. Kaikohe, file 6/4, 1935). No goat sign was noticed during the field inspection, although some was seen recently near Waikape Stream (P.J. Bellingham, pers. comm.). New Zealand Forest Service culling operations have recently kept the goat population low in Puketi Forest. Cullers also shoot cattle and pigs when they are encountered. (Ministerial approval has been given to shoot cattle in Puketi Forest).

Possums spread north into Puketi Forest by the mid 1970s and are now found throughout the forest (J. Beachman, N.Z.F.S. Ranger, pers. comm.). Moderate possum browse was recorded on five finger during the field inspection, and in two places browse was heavy on *Mida salicifolia*. Browse was also recorded on tree fuchsia, kohekohe, mahoe, and large-leaved mahoe. Kanono saplings with branches snapped were recorded south of Maungahorehore, and were probably browsed by cattle. Smashed snail shells may be attributable to pig predation (Ogle, 1982). Several smashed shells were encountered in the reserve.

Although pigs are widespread, their numbers are probably controlled by pig hunting, which is popular. An average of 83 permits per annum for pig hunting in Puketi were issued from 1980-1983.

Ship rats were caught in the Ecological Area in 1983 and cats have also been seen (P.J. Bellingham, pers. comm.). A stoat was seen during the field inspection for this report. An interesting recent introduction was the release of 1,000 rainbow trout fingerlings in the Waipapa River by the Bay of Islands Acclimatisation Society in 1979. However, following gazettal of the Ecological Area, further liberations of trout fingerlings would compromise the Guidelines for Ecological Area Management (held on Auckland Conservancy file 6/0/19).

Photo 3 : Waterfall in Waikape Stream (Photo by J.L. Kendrick).

Regeneration of canopy species is evident at all vegetation description sites. No forest tiers are noticeably open except where logging has occurred. Remnant softwoods in logged stands may be susceptable to windthrow. In Puketi Forest thick groundcover formation after logging was found to inhibit the regeneration of canopy seedlings (Halkett, unpubl., 1976).

In the scrub areas softwood regeneration is plentiful indicating that these may become the dominant canopy trees in these areas. Palatable species favoured by possums are still common in the reserve, probably indicating that possums are still in the relatively low numbers.

Waiare Road, the only external boundary of the reserve, is unfenced. Stock trespass is not a problem there at present. Goats seen on Pirau Ridge Road in September may be entering the forest from farms to the west.

Presence of Exotic Plants

The most widespread exotic plants in the reserve are *Eupatorium riparium* and *Eupatorium adenophorum*. Mokau Ridge Road and its numerous subsidiary logging roads support a variety of adventives including numerous pasture species, gorse and blackberry. Waiare Road, which forms the reserves eastern boundary, also supports a variety of exotic species. Old records (Sexton, unpubl. 1939) indicate that some tracks in the Ecological Area have long been infested with *Eupatorium* spp. and other weeds. *Hakea salicifolia* and *H. acicularis* occur in both main scrub areas and also off Mokau Ridge. Sexton (unpubl., 1939) thought that *Hakea acicularis* could be a threat to regeneration, but his impressions appear to have proven unfounded in the subsequent 45 years. Both *Hakea* spp. provide unwelcome competition, however, in these regenerating areas.

The presence of *Eupatorium* spp. in the reserve poses a potential threat to the regeneration of indigenous streamside plants (P.J. Bellingham, pers. comm.). Further down river at Forest Road, *Eupatorium* spp. are already problem weeds.

Native Fauna

Scientific and common names for animals mentioned in the text are listed in Appendix 2.

The Wildlife Service rates the tract of forest containing the Onekura Ecological Area as outstanding wildlife habitat (Ogle, 1982). The main faunal feature of the reserve is its kokako population. It contains about half of the approximately 100 birds known to be in Puketi Forest. This is by far the largest known kokako population in Northland, and is of national as well as regional significance. Fernbirds were heard near Waiare Road during the recent field inspection. The range of the fernbird is decreasing in Northland due to habitat destruction (Ogle, 1982). Two birds rare in Northland forests, the North Island kaka and the red-crowned parakeet, are known to be in the Ecological Area (P.J. Bellingham, Forest Service botanist, pers. comm.). Ogle (1982) recorded the North Island brown kiwi, *Hoplodactylus pacificus* and kauri snails in Puketi Forest.

An unusual record for a Northland Ecological Area, by Sexton (1939), is of mullet which were seen above the junction of the Waipapa and Mangapa Rivers during the spawning season. Fresh water mussels are known to be in the Waipapa (J. Beachman, N.Z.F.S. Ranger, pers. comm.). During the field inspection freshwater limpets, freshwater crayfish, and two species of fish were seen in the Waipapa River.

Information on invertebrates in the reserve is sketchy. Sexton's (unpubl., 1939) report includes a list of invertebrates found in Puketi Forest.

Human History and Influence

In pre-European times, probably the only activity by Maoris in the reserve would have been food-gathering. The township of Okaihau, some 10 km south of the reserve, was one of the first areas of European settlement in New Zealand. Puketi Forest, including the Ecological Area, became a source of primary industry in the district including timber production, gum-digging and gum-bleeding (Sexton, unpubl., 1939).

Puketi Forest was purchased from the local Maoris by the Crown in 1859 for 249 pounds sterling. The forest was then under the control of the Lands Department and blocks were successively transferred to the Forest Service, which took overall control in 1922.

The earliest recorded logging in the reserve occurred in 1860 when a group of Canadians felled timber along the banks of the Waipapa River. While under Lands Department control large areas of kauri were felled and driven down the rivers in Puketi Forest. Dam sites mapped by Sexton (unpubl., 1939) are shown on Overlay 1, Fig. 2. After 1922 logging was confined to extraction of dead and fire-killed timber until 1952, when logging commenced in a consecutive series of Sawmill Areas until 1979. Hence logging roads are found throughout Puketi Forest. Most of the logging roads in the reserve lead down from Mokau Ridge towards the Waipapa. Apart from those used as tramping tracks, the roads are overgrown.

A hurricane in 1959 caused severe windthrow in parts of the reserve. Over the next two years 4227 m^3 of kauri and 1251 m^3 of podocarps were salvaged, mostly from within the reserve. A more detailed historical review of logging in Puketi Forest can be found in Halkett (unpubl., 1976). Fires were frequent in the old timber workings. Some occurred during logging whilst others were lit deliberately after logging to induce rough grazing for stock (Halkett, unpubl., 1976). Some of these areas are now the scrubland areas of the reserve.

Since kokako were 'discovered' in Puketi Forest in 1979, there has been a moratorium on logging while a joint Forest Service - Wildlife Service study of the species is carried out.

Gum bleeding and collection occurred extensively through Puketi Forest, often by poachers. Authorised collectors continued gathering gum from old bleed wounds up until 1952 (Halkett, unpubl., 1976). Bleeding scars can be seen on some kauri in the Ecological Area.

Title to the Takapau Block of Puketi Forest, some 2294 ha, was subject to a long-running dispute between the Crown and members of the Ngatiwhui Tribe. The northern part of this block is in the Ecological Area. The following extract is from a Working Plan by Conway (unpubl.,1955).

> "Despite the ruling of the Royal Commission in 1948 that the area and timber on it were the property of the Crown, trespass again occurred in 1950, resulting in a conviction in the Magistrates Court."

The matter of Supreme Court action was resolved by the main defendant's death in 1952.

The north-east corner of the reserve has received attention from mining companies since 1971. Over the period 1971-1976 prospecting licences were held on behalf of the Western Mining Corporation by W.S. Hughes (application 39/70). Two locations of mercury, one of which is in the reserve, (Beachman, unpubl., 1984) and a sulphide deposit were located.

Application no. 31359 for a prospecting licence covering the same area was made by a 50:50 venture between Minzimp Pty Ltd and the Fletcher Mining and Exploration Co. Ltd on the 19th of September 1975. The application was withdrawn in March 1976 following a drop in the price of mercury.

In July 1982 exploration licence no. 33196 covering 90.658 km^2, including the eastern corner of the Ecological Area, was granted to Australian Marine Resources and Element Research Pty Ltd for two years. This company later applied for a prospecting licence (application no. 31-1317) covering 3874 ha including 265 ha in the eastern corner of the reserve.

In December 1984 the Minister of Forests gave his consent to prospecting licence application 31-1317 with the condition that the Ecological Area be excluded from the application area (N.Z.F.S., Auckland, file 20/0/4).

Poaching of pigeons in the reserve has been a continual problem (N.Z.F.S., Kaikohe file 6/4) The poachers often enter the forest on horseback, according to local Forest Service personnel.

Recreational Facilities and Opportunities

A system of tramping tracks and family walks exists in Puketi Forest and is shown on Figure 2. Picnic and camping facilities are available at Forest Road and at the Forest H.Q.. Picnic facilities are also available at Manginangina Scenic Reserve, about 2 km past the turn-off to the Forest H.Q., along Waiare Road.

There has been a steady increase in the recreational use of Puketi Forest over the last three years (C.P. Adams, Forest Caretaker, pers. comm.). Several expeditions have rafted down the Waipapa River, but it is only suitable for rafting when the river is high. There is an excellent nature trail at the Forest H.Q. Local pighunters often hunt in the reserve.

Research Carried Out and Suggested

A study prepared for a Forestry Science degree was carried out on kauri in Puketi Forest by Latter (1932). Extensive inventories of Puketi Forest aimed mainly at timber trees, have been carried out by Sexton (unpubl., 1939) and Halkett (unpubl., 1976). The Wildlife Service sent a Fauna Survey Unit to Puketi Forest in 1978 and a Field Survey Unit in 1979. Their findings form the basis for the faunal species list in Appendix 2. Three kokako population surveys have been carried out in Puketi Forest (Anderson, P., (1979); Hay, J.R., and A. Saunders in 1979; Anderson, P., Bellingham, R.M., Bellingham, P.J., and A.M. Davis in 1983). The Wildlife Service office in Whangarei holds the survey data.

Moinnudin Ahmed of Auckland University, collected some data in Puketi Forest for his Ph.D. thesis on the dendrochronology and ecology of kauri (Ahmed, unpubl., 1984). Hugh Best, a Wildlife Service scientist, has been studying kokako behaviour in Puketi Forest whilst Peter Bellingham, a Forest Service botanist, has been concurrently studying the botany of kokako territories. Their joint results should be published by mid 1985. Only part of their research has been conducted in the Ecological Area. Glenda Wardle of Auckland University collected data from Puketi Forest for her M.Sc. thesis on observations of the structure and dynamics of kauri forest (unpubl., 1984). In September 1984 Dr P. Buchanan of the D.S.I.R. collected several specimens of the bracket fungus *Heterobasidion annosum* from the Ecological Area as part of his research on this species.

The results of Bellingham and Best's studies may well suggest further avenues of research in Puketi Forest.

Summary, Discussion and Recommendations

The Onekura Ecological Area covers 2351 ha, mainly in the catchment of the Waipapa River, but partly in the Mangapa River catchment. The Waipapa catchment is very dissected although the river itself is gently graded. The reserve covers part of an uplifted greywacke-argillite formation in central Northland. The major soil type is Te Ranga Steepland soil, which is moderately to strongly leached and excessively drained. Small earth slips are widespread in the Ecological Area.

I have divided the vegetation into four main types; mature kauri forest, small kauri tree or pole stands, low altitude podocarp-hardwood forest and manuka/pole podocarp scrubland. The low altitude kauri forest in the reserve is without parallel in the Maungataniwha Ecological District and extremely rarely matched outside it.

The Onekura Ecological Area is one of the most floristically and faunistically important reserves in Northland. *Hebe acutiflora*, and *Davallia* sp. are probably the rarest species recorded there. The reserve is also important as the Northland stronghold for *Pittosporum virgatum* and monoao (local elsewhere). *Brachyglottis myrianthos* occurs at by far its northern known limit in the reserve (P.J. Bellingham, pers. comm.). The Ecological Area is part of a tract of forest which has been rated as outstanding wildlife habitat. It contains part of the large kokako population in Puketi Forest. Kaka are uncommon and red-crowned parakeet extremely rare in the reserve.

Logging started in 1860, and occurred sporadically in the reserve until 1979. Several mining companies have shown interest in part of the reserve since 1971. Good tramping tracks are available in the forest, which is receiving increasing recreational usage. Possum browse is the most noticeable vegetation damage by introduced animals in the reserve. The pig population is higher in remote areas, while goat numbers are currently low. Exotic plants are widespread in the reserve, one of the main potential problems being the two *Eupatorium* spp.

A number of human activities such as mining and recreation pose potential threats to the reserve. The most likely system for mining mercury in Puketi Forest is open pit mining (Beachman, unpubl., 1984). The Waipapa River catchment should be excluded from any proposed mining in the area. Because there are several species of rare riverside flora, camping in the Waipapa River bed should be controlled, perhaps by establishing a few set campsites. Horses should no longer be permitted to enter Puketi Forest. Thus there is a pressing need for the establishment of management guidelines for the reserve.

Peter Bellingham (pers. comm.), who recently spent a year in the field in Puketi Forest, has suggested that the reserve has a number of shortcomings:

1. The reserve boundaries are complex and artificial and only enclose part of the Waipapa catchment. These factors are contrary to the S.C.C.'s (1983) guidelines for selection of Ecological Areas.

2. The reserve is not fully representative of the vegetation in the area e.g.

   i. The highest and lowest parts of the Puketi Forest and their associated vegetation types are omitted.

   ii. The reserve does not include the regionally rare gumland/acid bog area in Puketi Forest and it's associated plants (e.g. *Epacris pauciflora*, *Schoenus brevifolius*).

   iii. Some of the best kauri stands are on north-facing slopes of the Waipapa catchment which are excluded from the Ecological Area.

   iv. Important floral features of Puketi Forest are not in the reserve e.g. *Grammitis rawlingsii* and *Schizaea bifida* (which is rare in Northland).

3. The reserve does not adequately protect the kokako population, as 60% of the known population is outside the Ecological Area.

These shortcomings would be largely rectified by making the catchment boundary of the Waipapa River the Ecological Area boundary. However, there are several boundary options possible; these would need to be studied should a decision be made to enlarge the reserve.

Based on the above discussion, the following management recommendations are made in order of priority.

1. That goats be culled to the lowest practicable level, and that cattle and pigs continue to be shot by the culling team when encountered.

2. That the effects of possums on the vegetation be assessed.

3. That mining activities be precluded from the Waipapa River catchment.

4. That a management plan be produced expeditiously for the Ecological Area, taking into account the forthcoming results of H. Best and P.J. Bellingham's study.

5. That fencing be upgraded around the forest boundary.

6. That N.Z.F.S. no longer issue permits for horses to enter Puketi Forest.

7. That N.Z.F.S. investigate weed control contingencies for the reserve.

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APPENDIX 1 : BOTANICAL SPECIES LIST - ONEKURA ECOLOGICAL AREA

Common names are in brackets after the scientific
e.e. *Agathis australis* (kauri)

FERNS

	Adiantum cunninghamii	
	A. fulvum	(black maidenhair)
P	*A. hispidulum*	(rosy maidenhair)
P	*A. viridescens*	
	Anarthropteris lanceolata	(lance fern)
	Arthropteris tennella	
	Asplenium bulbiferum ssp. *bulbiferum*	(manamana, hen and chicken fern)
	A. bulbiferum ssp. *gracillimum*	
	A. flaccidum ssp. *flaccidum*	(raukatauri, hanging spleenwort)
	A. lamprophyllum	
	A. oblongifolium	(shining spleenwort)
	A. polyodon	
	Blechnum chambersii	
	B. discolor	(piupiu, crownfern)
	B. filiforme	(climbing sweetfern)
	B. fluviatile	
	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, silver fern)
	C. medullaris	(mamaku, black tree fern)
	C. smithii	(katote, soft tree fern)
P	*Davallia* sp.	
	Deparia petersenii (= Athyrium japonicum)	
	Dicksonia lanata	
	D. squarrosa	(wheki)
	Diplazium australe (= Athyrium australe)	
	Doodia media ssp. *australis*	
	Gleichenia cunninghamii (= Sticherus cunninghamii)	(tapuwae kotuku, umbrella fern)
	G. dicarpa	(waewae-kaka, tangle fern)
P	*G. flabellata (= Sticherus flabellata)*	
	G. microphylla	(waewae-kaka, tangle fern)
P	*Grammitis ciliata*	(strap fern)
P	*G. pseudociliata*	"
	Histiopteris incisa	(swamp fern)
P	*Hymenophyllum armstrongii*	(filmy fern)
P	*H. atrovirens*	"
	H. demissum	"
	H. dilatatum	"
	H. ferrugineum	"
	H. flabellatum	"
	H. flexuosum	"
P	*H. lyalli*	"
	H. multifidum	"

P = P.J. Bellingham, pers. comm.

	H. revolutum	(filmy fern)
	H. sanguinolentum	(piripiri)
	H. scabrum	(filmy fern)
P	*Hypolepis lactea*	
	Lastreopsis glabella	
	L. hispida	
	Leptopteris hymenophylloides	(heruheru, crepefern)
	Lindsaea trichomanoides	
	Loxoma cunninghamii	(Northland fern)
	Lygodium articulatum	(mangemange)
	Paesia scaberula	(ring fern, pig fern, hardfern)
	Phymatosorus diversifolius	(kowaowao, hound's tongue)
	P. scandens	(moki, fragrant fern)
	Pneumatopteris pennigera	(pakauroharoha)
	Polystichum richardii	(tutoke, shore shield fern)
	Pteridium esculentum	(bracken)
	Pteris macilenta	
	P. tremula	(shaking bracken)
	Pyrrosia serpens	(leather-leaf fern)
	Rumohra adiantiformis	(climbing shield fern)
	Schizaea dichotoma	(fan fern)
	S. fistulosa	(comb fern)
	Trichomanes elongatum	(filmy fern)
	T. endlicherianum	"
P	*T. strictum*	"
	T. venosum	"

FERN ALLIES

	Lycopodium cernuum	(club moss)
	L. deuterodensum	"
	L. varium (incl. *L. billardieri*)	"
	L. volubile	"
A	*Selaginella kraussiana*	
	Tmesipteris elongata ssp. *elongata*	
	T. elongata ssp. *robusta*	
	T. lanceolata	
	T. sigmatifolia	
	T. tannensis	

GYMNOSPERMS

	Agathis australis	(kauri)
A	*Cryptomeria japonica* (1)	(Japanese cedar)
	Dacrycarpus dacrydioides	(kahikatea)
	Dacrydium cupressinum	(rimu)
	Halocarpus kirkii	(monoao)
	Lagarostrobus colensoi	(silver pine)
	Libocedrus plumosa	(kawaka)
	Phyllocladus glaucus	(toatoa)
	P. trichomanoides	(tanekaha)
	Podocarpus hallii	(Hall's totara)
	P. totara	(totara)
	Prumnopitys ferruginea	(miro)
	P. taxifolia	(matai)

P = P.J. Bellingham, pers. comm.
A = Adventive
(1) Planted in places along Mokau Ridge Road

DICOTYLEDONS

	Acaena anserinifolia	(bidibid)
	Ackama rosaefolia	(makamaka)
	Alectryon excelsus	(titoki
	Alseuosmia banksii	
	A. macrophylla	(karapapa)
	A. banksii x *A. macrophylla*	(N.Z. honeysuckle)
	(i.) A. x *quercifolia)*	
	(ii.) linear-leaved type)	
	Aristotelia serrata	(wineberry, makomako)
	Beilschmiedia tarairi	(taraire)
	B. tawa	(tawa
P	*Brachyglottis myrianthos*	
	B. repanda	(rangiora)
	Callitriche muelleri	(starwort)
	Carmichaelia aligera	(broom)
	Carpodetus serratus	(putaputaweta)
	Centella uniflora	
A	*Cirsium vulgare*	(Scotch thistle)
	Clematis cunninghamii (C. parviflora)	
	C. paniculata	(puawhanganga)
	Coprosma arborea	(mamangi)
	C. areolata	
	C. grandifolia	(kanono)
	C. lucida	(karamu)
	C. parviflora s.s.	
	C. rhamnoides	
	C. robusta	(karamu)
	C. spathulata s.s.	
	C. tenuicaulis	
	C. propinqua x *robusta*	
A	*Conyza floribunda*	(fleabane)
	Coriaria arborea	(tutu)
	Corokia buddleioides	(korokio)
	Corynocarpus laevigatus	(karaka)
A	*Crepis capillaris*	(hawksbeard)
	Crocosmia x *crocosmiflora*	(montbretia)
	Cyathodes fasciculata	(mingimingi)
	C. juniperina	"
A	*Digitalis purpurea*	(foxglove)
	Dodonaea viscosa	(akeake
	Dracophyllum latifolium	(neinei)
	D. lessonianum	
	D. sinclarii	
	Drosera peltata ssp. *auriculata*	(sundew)
P	*D. binata*	
	Dysoxylum spectabile	(kohekohe)
	Elaeocarpus dentatus	(hinau)
	E. hookerianus	(pokaka)
	Entelea arborescens	(whau)
	Elatostema rugosum	(parataniwha)
	Epilobium nerterioides	
	E. rotundifolium	
A	*Erica lusitanica*	(heather)
A	*Eupatorium adenophorum*	(Mexican devil weed)
A	*E. riparium*	(mist grass)
A	*Fragaria vesca*	(strawberry)
	Fuchsia excorticata	(tree fuchsia, kotukutuku)
	Galium propinquum	

P = P.J. Bellingham, pers. comm.
A = Adventive

	Gaultheria antipoda	
	Geniostoma rupestre var *crassum*	(hangehange)
	Gnaphalium gymnocephalum	
	G. sp. (c.f. *involucratum)*	
	G. keriense	
A	*G. spicatum*	
	Gonocarpus incanus	
P	*G. micranthus*	
	Gratiola sexdentata	
	Griselinia lucida	(puka, shining broadleaf)
	Gunnera monoica	
A	*Hakea salicifolia*	(willow-leaved hakea)
A	*H. sericea (H. acicularis)*	(prickly hakea)
	Haloragis erecta var. *erecta*	
	Hebe acutiflora	
	H. stricta var. *stricta*	(koromiko)
	Hedycarya arborea	(pigeonwood)
	Helichrysum aggregatum	
	Hoheria populnea var. *populnea*	(lacebark)
P	*Hydrocotyle elongata*	
	H. dissecta	
P	*Hypericum japonicum*	
A	*Hypochoeris radicata*	(catsear)
P	*Ileostylus micranthus*	
	Ixerba brexioides	(tawari)
	Knightia excelsa	(rewarewa)
P	*Lagenifera pumila*	
	Laurelia novae-zelandiae	(pukatea)
A	*Leontodon taraxacoides*	(hawkbit)
	Leptospermum ericoides	(manuka)
	L. scoparium	(kanuka)
	Litsea calicaris	(mangeao)
P	*Lobelia anceps*	
	Lophomyrtus bullata	(ramarama)
A	*Lotus pedunculatus*	
	Macropiper excelsum	(kawakawa)
	Melicope simplex	
	Melicytus macrophyllus	(large-leaved mahoe)
	M. micranthus	
	M. ramiflorus	(mahoe)
A	*Mentha pulegium*	(pennyroyal)
	Metrosideros albiflora	(akatea, climbing rata)
	M. carminea	(climbing rata)
	M. diffusa	(climbing rata)
	M. fulgens	(climbing rata, akakura)
	M. perforata	(climbing rata, akatorotoro)
	M. robusta	(northern rata)
	Mida salicifolia	(willow-leaved maire)
P	*Muehlenbeckia australis*	
	Myrsine australis	(mapou, red matipo)
	M. salicina	(toro)
A	*Nasturtium officionale*	
	Neomyrtus pedunculata	(rohutu)
	Nertera depressa	
	N. dichondraefolia s.s.	
	N. setulosa	
	Nestegis lanceolata	(white maire)
	N. montana	(narrow-leaved maire)
	Olearia furfuracea	

P = P.J. Bellingham, pers. co..

A = Adventive

	O. rani	(heketara)
	Oxalis lactea	
P	*Paratrophis microphylla*	(turepo)
	Parsonsia capsularis	(akakiore)
	Peperomia urvilleana	
	Phebalium nudum	(maire hau)
	Pittosproum cornifolium	(karo)
	P. kirkii	
	P. tenuifolium	(kohuhu)
P	*P. virgatum*	
A	*Plantago lanceolata*	(narrow-leaved plantain)
A	*P. major*	(broad-leaved plantain)
	P. raoulii	
	Pomaderris kumeraho	(kumerahu)
	Pratia angulata	
	P. physaloides	
	Pseudopanax arboreus	(five-finger)
	P. crassifolius	(lancewood)
	P. edgerleyi	(raukawa)
P	*Pseudowintera axillaris*	(horopito)
A	*Prunella vulgaris*	(selfheal)
	Quintinia serrata	(tawheowheo)
	Ranunculus hirtus	
A	*R. repens*	(stream buttercup)
	Rhabdothamnus solandri	(waiu-atua)
	Rubus australis	(bush lawyer)
	R. cissoides	"
A	*R. fruticosus* agg.	(blackberry)
	Schefflera digitata	(pate)
A	*Senecio bipinnatisectus*	(Australian fireweed)
A	*S. diaschides*	
A	*S. jacobaea*	(ragwort)
	Senecio kirkii	(Kirk's tree daisy)
	S. minimus	
P	*S. myrianthos*	
P	*Solanum nodiflorum*	
	Toronia toru	(toru)
A	*Ulex europaeus*	(gorse)
	Viola filicaulis	
	Vitex lucens	(puriri)
	Wahlenbergia marginata	
	Weinmannia silvicola var. *silvicola*	(towai)

MONOCOTYLEDONS

	Acianthus fornicatus var *sinclarii*	
	A. reniformis	
A	*Agrostis capillaris*	(browntop)
A	*Anthoxanthum odoratum*	(sweet vernal)
	Astelia solandri	(kowharawhara, perching lily)
	A. trinervia	(kauri grass)
A	*Axonopus affinus*	(narrow-leaved carpet grass)
	Baumea rubiginosa	
	B. teretifolia	
	Bulbophyllum pygamaeum	(epiphytic orchid)
P	*Carex dissita*	
P	*C. lessoniana*	

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A = Adventive

	Collospermum hastatum	(perching lily)
	C. microspermum	"
	Cordyline australis	(cabbage tree, ti)
	C. banksii	(ti ngahere)
	C. pumilio	(ti karaha)
	Cortaderia fulvida	(toetoe)
A	*C. jubata*	(pampas grass)
	Corybas orbiculatus	
P	*C. oblongus*	
	C. rivularis	
	Cyperus ustulatus	
	Dendrobium cunninghamii	(epiphytic orchid)
	Dianella nigra	(turutu, blueberry)
	Drymoanthus adversus	
	Earina autumnalis	(Easter orchid)
	E. mucronata	(epiphytic orchid)
P	*Echinopogon ovatus*	(hedgehog grass)
A	*Eragrostis brownii*	(Baygrass)
	Freycinetia baueriana ssp *banksii*	(kiekie)
	Gahnia lacera	
	C. pauciflora	
	G. setifolia	
	G. xanthocarpa	(toi-kiwi)
	Holcus lanatus	(Yorkshire fog)
A	*Juncus articulatus*	(jointed rush)
	J. gregiflorus	
	J. pallidus	
	J. planifolius	
A	*J. tenuis*	
A P	*Lachnagrostis filiformis*	(N.Z. wind grass)
	Lepidosperma australe	
	Libertia grandiflora	(native iris)
	L. pulchella	"
	Microlaena avenacea	(bush rice grass)
	M. stipoides	(meadow rice grass)
P	*Microtis unifolia*	
	Oplismenus imbecillis	
A	*Pennisetum cladestinum*	(kikuyu grass)
	Phormium cookianum	(mountain flax)
	Pterostylis banksii	
	P. graminea var. *rubricaulis*	
	P. trullifolia	
	Rhopalostylis sapida	(nikau)
	Ripogonum scandens	(supplejack)
P	*Rytidosperma gracile*	
P,A	*R. penicellatum*	
	Schoenus apogon	
	S. maschalinus	
	S. tendo	
P	*Scirpus inundatus*	
	S. reticularis	

P = P.J. Bellingham, pers. comm.

A = Adventive

A	*Sporobolus africanus*	(rats tail)
P	*Thelymitra longifolia*	(ground orchid)
	Uncinia banksii	(hook-sedge)
	U. uncinata	"
	U. zotovii	"

P = P.J. Bellingham, pers. comm.

APPENDIX 2 : FAUNAL SPECIES LIST - PUKETI FOREST

(after N.Z. Wildlife Service 1978 and 1979 unless otherwise stated)

NATIVE BIRDS

2	*Anas chlorotis*	brown teal
	A. superciliosa	grey duck
2	*Anthus novaeseelandiae*	N.Z. pipit
	Apteryx australis mantelli	N.I. brown kiwi
2	*Ardea novaehollandiae*	white-faced heron
2	*Botaurus poiciloptilus*	Australian brown bittern
	Bowdleria punctata vealeae	N.I. fernbird
	Callaeas cinerea ssp. *wilsoni*	N.I. kokako
	Chalcites lucidus	shining cuckoo
	Circus approximans	Harrier hawk
1	*Cyanoramphus novaezelandiae*	red-crowned parakeet
	Emberiza citrinella	yellowhammer
1	*Eudynamis taitensis*	long-tailed cuckoo
	Gerygone igata	grey warbler
	Halcyon sancta	kingfisher
	Hemiphaga novaeseelandiae	N.Z. pigeon
2	*Himantopus leucocephalus*	pied stilt
	Hirundo neoxena	welcome swallow
	Larus dominicanus	southern black-backed gull
	Nestor meridionalis	N.I. kaka
	Ninox novaeseelandiae	morepork
	Petroica macrocephala	pied tit
	Phalacrocorax carbo	black shag
2	*Porphyrio melanotus*	pukeko
	Prosthemadera novaeseelandiae	tui
	Rhipidura fuliginosa	N.I. fantail
	Tadorna variegata	paradise shelduck
	Zosterops lateralis	silvereye

INTRODUCED BIRDS

Acridotheres tristis	myna
Alauda arvensis	skylark
Anas platyrhynchos	mallard
Carduelis carduelis	goldfinch
C. chloris	greenfinch
C. flammea	redpoll
Emberiza citrinella	yellowhammer
Fringilla coelebs	chaffinch
Gymnorhina hypoleuca	white-backed magpie
Lophortyx californicus	Californian quail
Passer domesticus	house sparrow
Phasianus colchicus	pheasant
Platycercus eximius	eastern rosella
Prunella modularis	hedge sparrow
Sturnus vulgaris	starling
Synoicus ypsilophorus	brown quail

1 = P.J. Bellingham, pers. comm.

2 Probably recorded in an area outside of Puketi Forest in the 10,000 yd square, by the Wildlife Service (1978).

	Turdus merula	blackbird
	T. philomelos	songthrush

INTRODUCED MAMMALS

	Bos taurus	cattle
	Capra hircus	feral goat
1,3	*Felis catus*	feral cat
1,2,3	*Mustela erminea*	stoat
1,3	*Rattus rattus rattus*	ship rat
	Sus scrofa	pig
	Trichosurus vulpecula	bush-tailed possum

OTHER INTRODUCED ANIMALS

1	*Hyla aurea*	Australian frog
	Salmo gairdnerii	rainbow trout

NATIVE INVERTEBRATES

	Diplodon menziesi	fresh-water mussel
2	*Latia neritoides*	fresh-water limpet
	Paranephrops planifrons	koura, fresh-water crayfish
2	*Paratya curvirostrus*	fresh-water shrimp
	Paryphanta busbyi busbyi	kauri snail
	Rhytida greenwoodi	native snail

NATIVE LIZARDS

	Hoplodactylus pacificus	gecko
3	*Cyclodina aenea*	gecko

NATIVE FISH

	Anguilla dieffenbachii	long-finned eel
4	*Cheimarichthys fosteri*	torrent fish
2	*Galaxia* sp.	kokopu
4	*Gobiomorphus huttonii*	redfinned bully
4	*Mugil cephalus*	mullet

1 = Sexton, 1939
2 = L. Forester and D. Willetts, field inspection for this report
3 = P.J. Bellingham, Forest Service botanist, pers. comm.
4 = D. Bartram, N.Z.F.S. Kaikohe, pers. comm.