

FOREST REGENERATION ON URETARA ISLAND, OHIWA HARBOUR, BAY OF PLENTY

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ABSTRACT

A study was made of secondary kanuka (*Kunzea ericoides* var. *ericoides*) forest, the predominant plant community, on the main hill of Uretara (Ducker's) Island, Ohiwa Harbour, Bay of Plenty. Kanuka forms a tall (c.20m) canopy over sparse understoreys dominated by hangehange (*Geniostoma rupestre* var. *ligustrifolium*) and mingimingi (*Leucopogon fasciculatus*) on ridges; elsewhere, mamaku (*Cyathea medullaris*) forms a sparse subcanopy, and mahoe (*Meliccytus ramiflorus* ssp. *ramiflorus*), hangehange and kawakawa (*Macropiper excelsum* var. *excelsum*) a sparse understorey. Kanuka invaded abandoned pasture on most of the hill from c.1920 over a period of c.30 years, and is currently undergoing self-thinning; there is a smaller area of younger forest on the eastern side. In the shorter term, low tree fern-broadleaved forest is likely to succeed on most sites and in the longer term, semi-coastal broadleaved forest dominated by kohekohe (*Dysoxylum spectabile*) and puriri (*Vitex lucens*).

INTRODUCTION

In a recent study of coastal kanuka communities for the Department of Conservation, George Pardy and I had the pleasure of visiting Uretara (Ducker's) Island in Ohiwa Harbour, in order to look at the secondary kanuka forest which covers much of it. The largest of six islands in the harbour, Uretara covers some 73 ha and at its nearest point is only about 100m from the mainland. Access can be gained at low tide across the mudflats, but is easiest by boat from the easternmost ramp on the Port Ohope sandspit. The shallowness of most of the harbour meant that we had to take a fairly tortuous route via Poroporo Channel to the east of the island, and eventually landed at the small beach at the southeastern end.

History

Now a Scenic Reserve, the island has had a long and colourful history which bears recording. Many of the following details were kindly supplied by Leo Ducker, the first white child born at Ohiwa. There has obviously been a considerable history of Maori occupation, not surprising in view of the abundant

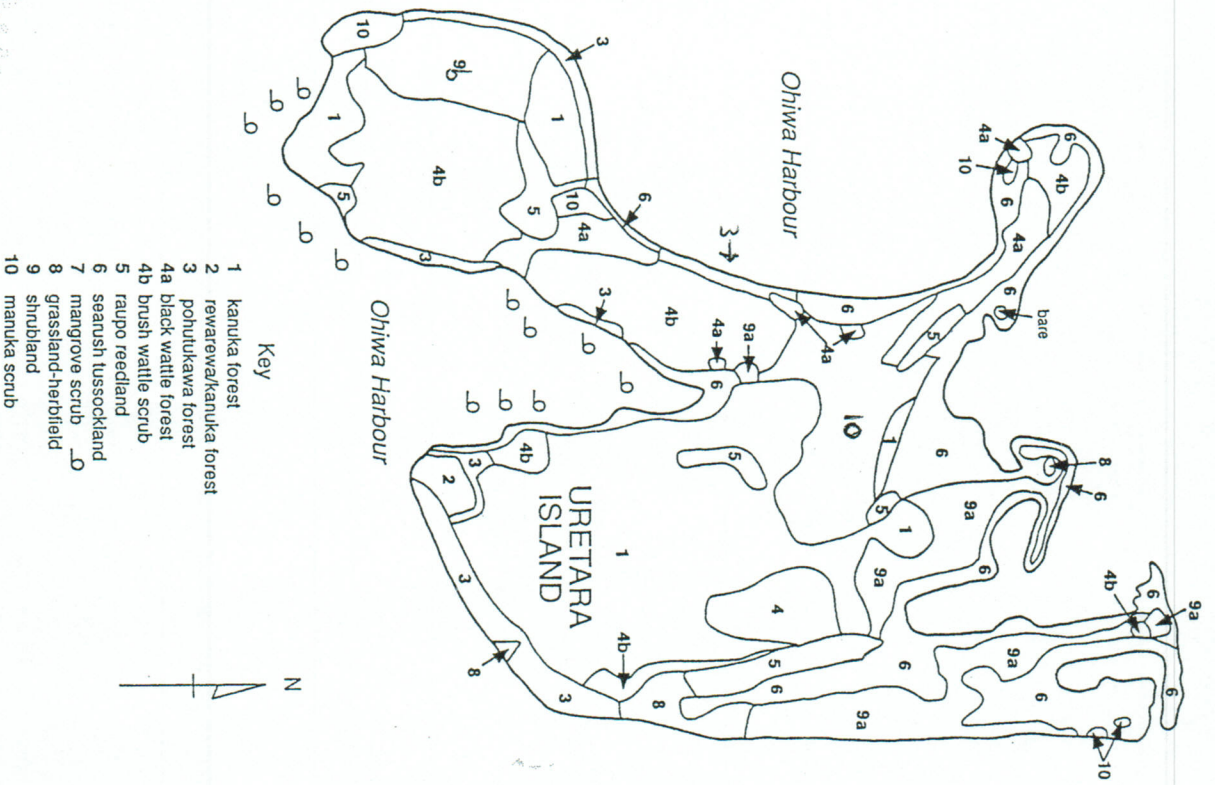


Fig. 1. Vegetation map of Uretara Island, Ohiva Harbour (from Beadel and Shaw, 1988).

shellfish beds in the surrounding harbour. At least two pa sites are known, a smaller, older one on the western side, and a more extensive younger one on the main hill (58m a.s.l.) on the eastern side of the island. Some 27 ha on this side were bought from the Maori owners in 1839 by one A.J. Nicholas, an early trader and shipbuilder, who built a kauri house and lived there until c.1842 (Melvin 1964). Later, a land war veteran called Biddle grew wheat on flatter parts of the island. The last Maori occupants left in 1895 after a massacre by mainland raiders; the island was then declared "tapu" and unfit for human occupation. Around the turn of the century, Frank Duckers leased the island from the Crown for 1 shilling/year; at this stage the island was largely covered in kanuka scrub and overrun by wild pigs (*Sus scrofa*).

The Duckers first settled at Ohiva, where Frank worked as a stevedore in the coastal shipping trade, and his wife, Lily, ran the store and Post Office. Later they moved to the island. They cleared the kanuka scrub in 1909-1910, providing land for cattle grazing and potato and maize crops. Wattle were introduced for a tanning industry. The lean-to hut with dirt floor (possibly the "Maize Crib" built by Nicholas) was later replaced by a new house on the eastern side of the main hill, still visible on aerial photographs taken in 1945. The Duckers left the island in 1919 for a farm at Woodlands, near Opoitiki, selling the improvements to a Mr Cunningham of Waingaro. Another son, Norman, revisited in 1950 and was amazed at the regrowth of kanuka on the abandoned pasture.

Soils and climate

Soils are yellow-brown pumice soils derived from Kaharoa Ash, Taupo Tepira and older volcanic ash (Pullar *et al.* 1978). Climate is mild, humid and relatively sheltered, with a mean annual temperature of c.14°C and mean annual rainfall of 1200-1600 mm (New Zealand Meteorological Service 1985). The prevailing wind direction is northwest, although strong winds tend to come from the southwest (Tomlinson 1976).

Fauna

Brush-tailed possums (*Trichosurus vulpecula*) were present in considerable numbers in April 1990, and may have been introduced deliberately; an eradication programme is currently in progress. Deer, probably sambar (*Cervus unicolor*), visit the island, but pigs no longer appear to be present. The island is within reach of rats (*Rattus* spp.) and stoats (*Mustela erminea*) (I.A.E. Atkinson, pers. comm.).

Vegetation

The present day vegetation of the island has been described and mapped by

Beadel and Shaw (1988). Secondary kanuka forest covers nearly a third of the island, mostly in a large tract on the eastern hill (Fig. 1). Wattle forest and scrub (containing brush wattle (*Paraserianthes lophantha*) and black wattle (*Racosperma mearnsii*)) covers nearly a quarter, mostly on the western side. A narrow strip of pohutukawa (*Metrosideros excelsa*) forest occurs in places around the coast. The remainder is occupied by a variety of wetland communities, some of them saline.

METHOD

Six 20 x 20m (0.04 ha) temporary plots were subjectively placed on a variety of sites (ridge, midslope) in the main kanuka forest patch on the eastern hill. Diameters of all trees (over 10cm dbh) were measured and recorded in each plot. In a "nested" 10 x 10m subplot, diameters of all saplings (2.5-10cm dbh) were measured and recorded. In a nested 5x5m subplot, numbers of seedlings over 15cm high were recorded. Ground cover was recorded in semi-quantitative percentage cover classes (0-1, 2-5, 6-25, 26-50, 51-75, 76-95, 96-100%) in the smallest subplot. A selection of eighteen kanuka trees, covering the range of sizes, was felled, and sections obtained for sanding and aging later; it was impractical to take kanuka cores.

RESULTS

Age and history of the Forest

The eighteen felled kanuka (diameter range 10-50cm) ranged in age from 31 to 75 years, averaging 55 years. Almost all were between 40 and 70 years old, implying a "wave" of establishment between c.1920 (when farming on the island was finally abandoned) and 1950. Growth-rates were fast, on a par with those of young kanuka planted on fertile lowland sites in North and northern South Islands (G.F. Pardy, pers. comm.). Average diameter growth over the life of the trees was just over 0.4cm/year, and height growth nearly 0.3m/year. The larger trees sampled were significantly older ($p < 0.01$) than the smaller trees, and had also grown significantly faster ($p < 0.05$) than them. The shape of the diameter/age relationship, albeit of a limited sample, suggests that most trees are in the phase of maximum diameter growth. Diameter distributions are somewhat erratic though mostly unimodal.

Present structure and composition

The forest today consists of tall, well spaced kanuka forming a more-or-less

continuous canopy c.18m high (shorter on ridges, taller in gullies); scattered rewarewa (*Knightsia excelsa*) occurs in the canopy at the southern end of the tract. Although kanuka is overwhelmingly dominant in terms of basal area (Table 1) it accounts for only one-sixth of saplings and trees, on average (Table 2). On moister mid and lower slopes, mamaku (*Cyathea medullaris*) forms a scattered subcanopy, accounting for one-quarter to one-third of basal area and a substantial number of stems. There is a sparse understorey of mahoe (*Melicope ramiflora* ssp. *ramiflora*) and hangehange (*Geniostoma ruperire* var. *ligustrifolium*) saplings and seedlings, and kawakawa (*Macropiper excelsum* var. *excelsum*) seedlings (Tables 3, 4). On upper slopes and ridges, the kanuka canopy has been damaged by wind in places and is more open; tree ferns are rare or absent and there is a better developed understorey. Hangehange and mingimingi (*Leucopogon fasciculatus*) saplings are prominent, along with hangehange, kawakawa and mahoe seedlings. Ground cover everywhere is mainly litter, with scattered brush wattle seedlings, hook sedges (*Unchida* spp.) and rasp fern (*Doodia media* ssp. *australis*). Rare fragments of old-growth forest survive in some gullies, with a few large kohekohe (*Dysoxylum spectabile*) and puriri (*Vitex lucens*).

Table 1: Basal area (m²/ha) of live woody species in secondary kanuka forest on Uretara Island

Species	Plots					
	Ridge		Slope			
	1	2	3	4	5	6
Kanuka	15.3	32.1	35.8	28.6	21.1	28.3
Mamaku	2.5	-	-	11.5	11.9	12.8
Mahoe	-	0.2	5.0	2.0	-	2.2
Pongai	-	-	-	5.1	3.3	-
Rewarewa	1.2	1.2	2.7	-	-	-
Hangehange	3.8	1.5	1.5	0.1	-	0.5
Others	2.0	2.8	1.6	0.3	0.3	0.7
Total	24.8	37.8	46.6	47.6	36.6	51.5

Cyathea dealbata

Table 2: Density (stems/ha) of live trees (>10cm dbh) of woody species in secondary kanuka forest on Uretara Island

Species	Ridge			Slope		
	1	2	3	4	5	6
Kanuka	525	400	225	200	200	550
Mamaku	150	-	-	400	575	525
Rewarawa	100	75	125	-	-	-
Pongai	-	-	-	175	125	-
Kohuhu	-	50	-	-	25	-
Mahoe	-	-	75	-	-	25
Others	-	-	-	25	-	-
Total	775	525	450	800	925	1100

Table 3: Density (stems/ha) of live saplings (2.5-10cm dbh) of woody species in secondary kanuka forest on Uretara Island

Species	Ridge			Slope		
	1	2	3	4	5	6
Hangehange	1800	1600	500	100	-	700
Mahoe	-	300	775	600	-	1000
Kawakawa	-	-	550	-	-	400
Mingimingi	100	600	75	-	-	-
Mamaku	-	-	-	-	100	-
Kanuka	100	-	-	-	-	-
Rewarawa	-	-	50	-	-	-
Others	400	400	350	-	-	-
Total	2400	2900	2300	700	100	2100

Table 4: Density (stems/ha) of established seedlings (> 15cm high, <2.5cm dbh) of woody species in secondary kanuka forest on Uretara Island

Species	Ridge			Slope		
	1	2	3	4	5	6
Hangehange	2400	3600	8800	2400	6400	19800
Kawakawa	9200	400	3200	5600	-	2000
Mahoe	4400	4400	-	2400	-	1600
<i>Coprosma rhamnoides</i>	800	400	7200	-	-	-
Pongai	-	-	-	2800	2400	-
Mamaku	-	-	-	2000	800	-
Pigeonwood	-	-	4000	-	-	-
<i>Coprosma lucida</i>	800	-	-	-	-	-
Kohuhu	-	-	400	-	-	-
Kohkekehe	-	-	-	400	-	-
Mingimingi	-	100	-	-	-	-
Total	17600	8900	23600	15600	9600	14400

DISCUSSION

The existing kanuka forest on Uretara Island has arisen from gradual invasion of abandoned pasture over some 30 years. Kanuka has relatively poor long-distance dispersal ability (Boden 1971 in Kirschbaum and Williams 1991) and it is reasonable to assume that fragments of the previous seral scrub survived the major clearing early in the century to provide the seed source for the current forest. Rough pasture in the region today frequently contains remnants of natural vegetation, mostly of early successional species like kanuka. Aerial photographs taken in 1945 show more-or-less closed canopy forest on most of the area of the main hill now occupied by kanuka forest, with a mosaic of grassland, bracken (*Pteridium esculentum*) fernland (?) and scrub on the remainder. Thus kanuka forest of at least two broad age classes is present on the island, only one of

which (the older) has been sampled in the present study. Growth-rates here have been as fast as any recorded in natural forest, reflecting the relatively benign climate and, probably, low initial densities. In places on ridges, other early successional species (e.g., mingimingi and kohuhu (*Pitiosporum tenuifolium* var. *tenuifolium*)) are dying out.

The average diameter of dead standing and fallen kanuka over all plots was considerably smaller (17.7 cm) than the average of living trees (26.6cm); the kanuka population appears to be undergoing self-thinning. The trees which are dying established somewhat later, on average, than the bulk of the survivors, and have been suppressed by them for most of their lives. Current densities of kanuka are rather lower than those recorded by Esler and Astridge (1974) in similar-aged teatree (*Kunzea leptospermum*) forest on the Waitakere Range, which had undergone intense self-thinning; it may be that on Uretara Island there has been no intense self-thinning of dense young stands. There is no replacement, and with a normal lifespan of 80-150 years (Burrows 1973), the kanuka canopy is expected to begin disintegrating several decades from now.

Apart from scattered rewarewa, mainly on ridges, no potential successors to the existing tall canopy are present in most of the forest. Puriri and kohekohe seedlings, probably originating from trees in surviving fragments of old-growth forest, occur only locally, mainly in the vicinity of parent trees. Of smaller species which could form a new canopy, lower than the existing one, only mahoe is reasonably widespread, as saplings and seedlings; pigeonwood (*Hedyocarya arborea*) is more local, and fivefinger (*Pseudopanax arboreus*) more local still. The potential of brush wattle, small seedlings of which are quite widespread, to contribute to any future canopy is uncertain; there are no current plans to remove the existing seed source.

Limited re-establishment of kanuka following the eventual disintegration of the existing canopy is possible, especially on ridges; Esler (1967) noted self-replacement of kanuka in similar forest on windswept ridges on Kapiti Island. In the longer term, and in the absence of possums, semi-coastal broadleaved forest rather like existing remnants and containing kohekohe and puriri over mahoe, kawakawa and hangehange may develop over much of the island. Pohutukawa may establish locally after mass movement or fire.

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REFERENCES

- Beadel, S.M. & Shaw, W.B. 1988. Taneatua Ecological District. Biological Survey of Reserves Report No. 12. Department of Conservation, Wellington.
- Burrows, C.J. 1973. The ecological niches of *Leptospermum scoparium* and *L. ericoides*. *Mauri Ora* 1: 5-12.
- Esler, A.E. 1967. The vegetation of Kapiti Island. *New Zealand Journal of Botany* 5: 353-393.
- Esler, A.E. & Astridge, S.J. 1974. Teatree (*Leptospermum*) communities of the Waitakere Range, Auckland, New Zealand. *New Zealand Journal of Botany* 12: 485-502.
- Kirschbaum, S.B. & Williams, D.G. 1991. Colonisation of pasture by *Kunzea ericoides* in the Tuhindilla Valley, ACT, Australia. *Australian Journal of Ecology* 16: 79-90.
- Melvin, L.W. 1964. Thomas Black: an early trader and settler in the Bay of Plenty. *Historical Review* 12: 105-111.
- New Zealand Meteorological Service 1985. Climatic Map Series 1:200 000. *New Zealand Meteorological Service Miscellaneous Publication* 175.
- Pullar, W.A., Hewitt, S.R. & Heine, J.C. 1978. Soils and land use of Whakatake Borough and environs. Bay of Plenty, New Zealand. *New Zealand Soil Bureau Bulletin* 38.
- Tomlinson, A.I. 1976. Climate in Wards 1. (comp.) 1976. *New Zealand Atlas*. Government Printer, Wellington.