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THE M AKETU MARAE
TOTARA WHAKATUPURANGA, KAWHIA

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ABSTRACT

Whakaruruhau, a programme to return the bush to marae as a source of natural resources, was piloted at Maketu Marae, Kawhia, by the planting of 850 totara trees, on a south-facing iron-sand scarp. Sixty percent of the trees have survived and have averaged 0.3 m growth in height each year since July 1989. The main cause of death has been smothering by kikuyu, blackberry, *Convolvulus*, and bracken (in order of importance). Loss rates would have been much greater if release from these weeds had not been regularly carried out in the first two years. The key to success has been close supervision by local marae people.

1. INTRODUCTION

Whakaruruhau means "to grow shelter". It is a tree programme for marae, and was so-named by Koro Wetere, the Minister of Maori Affairs at that time, with the generalized objective of "bringing the bush back" to marae. The programme was formally launched at the Maketu marae, Kawhia, by David Lange, then Prime Minister, on 1 November 1986 (Simpson 1988; Joyce 1989). The occasion was the Pacific Leaders gathering, hosted by Te Arikinui Dame Te Ata-i-rangi-kaahu.

> "Mr Lange said that the programme would lead to the establishment of small-scale forests on and around marae to produce traditional materials for building, carving and weaving. The new plantings would also enhance the surroundings of marae and provide shelter, chances to learn the skills of tree care and traditional methods of preparing materials, and possibly provide future employment and business opportunities."
>
> *(Nature Conservation Council Newsletter 64:* 8, 1987)

There are several reasons why Maketu marae emerged as a place to launch Whakaruruhau, and to be the place where the first totara trees were planted. First, Dame Te Ata-i-rangi-kaahu, the Maori Queen, supported the project from the outset as a positive activity for all Maori people. She maintains a residence at Maketu, and it is on her land that the first totara trees were planted.

Second, Mrs Te Aue Davis was also a strong supporter of the concept from the point of view of providing raw materials for weaving. She received support from the late Mr Hori Forbes, at the time Chairman of the Maketu Marae Committee. After Mr Forbes' death the project received ongoing support by the new Chairman, Mr John Keepa. Mrs

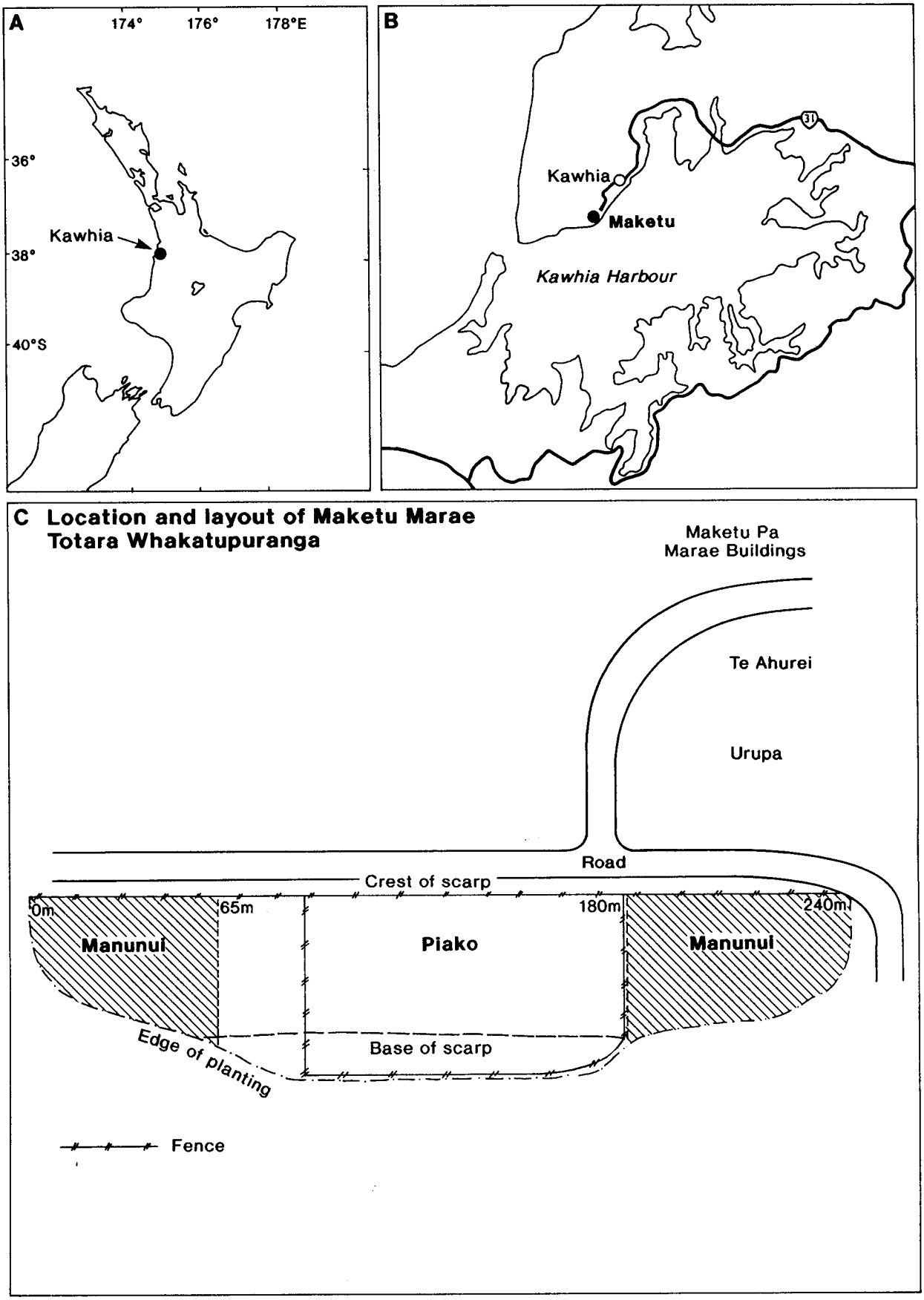

Figure 1 The locations of Kawhia and Maketu (A & B), and the layout (C) of the Maketu marae totara whakatupuranga.

Davis was also an advisor to the Commissioner for the Environment, Mr Ken Piddington, and both maintained links with the Minister of Maori Affairs, Koro Wetere. Mr Wetere's Office provided the funds ($2000) to purchase the totara trees that were to be planted several years after Whakaruruhau was launched.

Third, Maketu marae is located at the landing site of the Tainui canoe. (The historic pohutukawa tree Karewa or Te Tangi o Korowhiti, to which the canoe is said to have been moored, is still present on the adjacent coastline.) The site has a strong tradition for learning, being the site of a whare waananga centuries ago. There are current plans for a revival of the whare waananga in the form of a learning centre for traditional and contemporary Maori skills (John Keepa, pers. comm.). The growing of totara is clearly consistent with this development. The Totara Whakatupuranga is located just 100 m away from the Tainui canoe's resting place, Te Ahurei (Figure 1).

Over subsequent years the Department of Conservation has implemented whakaruruhau as part of its broader tree programme (Tu kakariki), at numerous marae.

2. THE PLANTS, SITE PREPARATION, AND PLANTING

2.1 The Plants

Two provenances of totara were selected for the planting:

1. **Piako** FRI Nursery, seed collection No. 2/0/84/44, from Ohinewai Stream, Piako River, at Tahuna (SW corner of Kopuatai Peat Dome); approximately 4 years old, averaging 103 cm tall; bare-root when planted.

2. **Manunui** Taupo Nursery (then DoC), seed collection No. 5685, from Manunui, Wanganui River, SE of Taumarunui; 2 year old plants, averaging 67 cm in height, grown in PB3 plastic bags and planted with soil attached.

It is unfortunate that seedlings from local Kawhia totara were not available, because the resulting trees may have been better adapted to the specific site (coastal iron-sand). It is strongly advised to grow plants from local seed for any revegetation project (Simpson 1991). However, although sometimes being regarded as "scruffy", the Taumarunui totara can form very large trees when grown in a forest environment (e.g., specimens in the Taumarunui motor camp). In fact, the two provenances are not readily distinguishable in size or growth characteristics after four years and both probably equate to a regional "central New Zealand" provenance (Bergin and Pardy 1987; Bergin and Kimberley 1990). Totara growing naturally around the Kawhia harbour may also belong to this broad regional provenance type. The planting lay-out (see Figure 1C) preserves the identity of the two provenances so that their characteristics can be recorded over time.

2.2 Site, and preparation

Kawhia has a benign climate for tree growth. Mean annual rainfall is 1410 mm with a summer minimum of 80 mm, and a winter maximum of 160 mm. Gales are occasional (two per year). The mean annual temperature is 14°C, with monthly means ranging from 10°C to 19°C and extremes of -1°C to 29°C. Ground frosts are rare. The fact that kauri reaches its southern limit immediately inland from Kawhia, places the area within a warm temperate climatic region. At approximately Latitude 38°S, Kawhia stands at the boundary of numerous northern species of plants.

The planting site is a south-facing escarpment of an iron-stone sand dune, just south of the Maketu marae (Figure 1). The site has possibly had human modification; by people moving sand so that the scarp more completely protects the northern flank of a flat garden area. This was formerly an irrigated kumara garden, which is now completely surrounded by raised dunes, like an amphitheatre. The sand has been augmented by the dumping of shells, forming a 25 cm-thick midden over the upper part of the site, and other waste (e.g., a few bottles and other domestic debris). The sand is fine-grained and appears to contain organic material in places. Terracettes formed by stock trampling indicate a former grazing regime, which would have also increased soil fertility.

Figure 2 View of the planting site before planting, in 1989.

The vegetation before planting consisted of fern (bracken and *Pteris comans*), grass and introduced weeds. Part of the surrounding duneland supports kanuka forest and scattered pohutukawa, along the eastern margin of a large expanse of *Pinus radiata* (Figure 2).

An adventive peach tree and a cluster of several tree privet (*Ligustrum lucidum*) are the only woody plants. At planting time the vegetation was dominated by more or less distinct zones of kikuyu grass, blackberry, bracken and pasture grasses (cocksfoot, paspalum, yorkshire fog, sweet vernal and browntop), with scattered lupin (*Lupinus arboreus*) throughout. Being south-facing the site is relatively moist, as indicated by the occurrence of buttercup, ragwort, and *Convolvulus* (field bind-weed, *C. arvensis*).

In preparation for planting, Maori Access workers cleared the blackberry and some of the kikuyu from the area, but no other site preparations were needed. John Keepa organised the support needed for the successful undertaking of the event.

2.3 Planting (5 July 1989)

Approximately 850 plants were brought to the site and before planting a karakia was recited over the plants by a kaumatua from Waipapa Marae, Mr Fred Porima, Ngati Hikairo (Figure 3). This established a seriousness of purpose and laid the foundation for ongoing maintenance of the trees.

Karakia is a fundamental link between creation (human activity) and creative powers (spiritual activity). Tree planting in particular lends itself to such incantations, requiring both human activity and creative power. The symbols of the trees themselves give rise to symbolisms associated with mans, majesty and strength, qualities that one would

Figure 3 Mr Fred Porima recites Karakia over the young trees, before planting of the Maketu marae totara whakatupuranga began, 5 July 1989.

wish in all of creation. Karakia also allows for ancient whakapapa to be recited and draws the distant past into the future. As is common with oral tradition the whakapapa remains intact but the presentation undergoes changes according to the orator and the age in which he or she lives. What is important is that the nature of karakia has remained basically the same, has survived centuries of change and has adapted to the sometimes uncompromising provisions of nature and human activity. Karakia is about creativity, that the trees may grow and survive, and human activity, the care required to nurture the trees: together, through Kaumatua or Kaikarakia, both aspects enhance the promise of sustained growth and the mana of Tane Mahuta. Whakaruruhau is an opportunity of enhancing and embracing Tane Mahuta at marae such as Maketu and allows for community involvement, particularly in places like Kawhia, where both Maori and Pakeha alike are able to feel inspired about the work they can undertake together.

A truckload each of sheep manure from local woolshed and rotten sawdust from a local sawmill was obtained at little cost and brought to the site by the Maori Access workers (Figure 4). These workers were helped with the planting by Department of Conservation staff from the Waikato Conservancy (Figure 5). The team was fed bountifully at the marae by local women. Active planting took 15 people approximately 6 hours.

Each tree was planted with a liberal supply of sheep manure and sawdust as fertilizer and soil conditioner. Being on a slope a flattened bench was first formed by removal of the vegetation. The spacing varied from 2 to 3 metres and plants were set in relatively irregular rows vertically up the slope.

Figure 4 **Marae workers assist in distributing sheep manure from a local farm to each planting site.**

The rain that fell on the site that night, after planting was completed, secured the roots in their new soil and was a fitting conclusion to an important event for Whakaruruhau. It was a memorable occasion for all who participated.

Figure 5 **Staff from the Department of Conservation active at the planting site.**

3. MANAGEMENT OF THE TREES

Day-to-day management of the site was undertaken by Mr Nick Smith, a marae elder who expressed enthusiastic support for the project. Mr Smith organised release cutting of the weeds (re-exposing the trees when they are in danger of being smothered); the laying of temporary plastic water pipe in the event of prolonged drought (this has not eventuated over the period since planting, mainly because of a fortuitous phase of cool summers); and most recently, the protection of the site by electric fencing to discourage trespass by horses (which may damage trees by trampling, rather than grazing). The committed involvement of John Keepa and Nick Smith has been a critical factor in the success of the totara patch to date. In the first 20 months following planting, the site was release cut three times, each requiring about ten person-days. The trees have now largely grown beyond the height of damaging weeds and will require little, if any, releasing again.

3.1 Survival and growth

Of the 850 trees planted, about 500 (60%) survive after four years. The causes of loss have been various:

- Nipped off by rabbits (4, small, tender Manunui stock only)
- Dug up by pigs (few)
- Cut off accidentally during releasing (few)
- Transplanted to another site (10)
- Succumbed at planting time (11, bare-root Piako stock only)
- Ongoing death at east end of site through tip-die-back caused by unknown factors, possibly salt-spray, drought and failed root development through grass sward competition (about 20)
- Insect browsing (bag moth caterpillars) is probably not fatal, but may contribute to die-back (few)
- Smothering by weed growth (the vast majority).

3.2 The impact of specific weeds

There are several weed species that have had significant impact on survival.

3.2.1 Kikuyu grass (*Pennisetum clandestinum*) This grass grows in dense spreading swards, leaf-bearing and flowering shoots above ground and thick, tough, interlaced rhizomes and fibrous roots below ground. Although kikuyu is toxic to some bovine stock under certain conditions, it can be grazed or mown to create a short, tight sward. Kikuyu was widespread across the site but tends to grow in patches from which all or most other plants are excluded. This may be the result of physical smothering and nutrient starvation only, or it may also involve allelopathy - the exclusion of other plants through toxic chemical exudates. Kikuyu was most difficult to plant into, owing to the depth of the sward (up to 1 m) and the toughness of the stems and roots, and it soon colonised the bare soil around each totara tree by growing in from the margins. The young totara trees were no match for the heavy, leafy, shoots which simply forced

the flexible totara stems over and buried them beneath the grass canopy. Very few trees planted into kikuyu have survived. A mistake was made by planting the younger, smaller and more flexible Manunui stock in the dense kikuyu zones at the west end of the site. It is interesting to note that at last inspection (Spring, 1993) the kikuyu seemed etiolated and unthrifty, and it is possible that the absence of significant stock trampling since the totara were planted has prevented young shoots from emerging. Frost may also have killed more elevated shoots.

3.2.2 Blackberry (*Rubus fruticosus*) Like kikuyu, blackberry grows in vegetatively expanding patches with aerial branches looping over to root at the tip and establishing new plants, with tough underground stems and fibrous roots. Although much of the aerial system of shoots was cleared, and most buried stems removed from each planting site, enough remained to regrow over much of the original area. By clinging to the totara stems by leaf and stem prickles, blackberry pulls the totara down (especially through wind movement and gravitation down the scarp slope) and over-tops them. The totara trees can remain alive underneath the blackberry (which is deciduous in winter) but unless released can never extricate itself, and will eventually die. By being hidden they can be cut off accidentally during releasing operations.

3.2.3 Field bind-weed (*Convolvulus arvensis*) The annual convolvulus stems emerge from fleshy, spreading underground rhizomes and entwine around any vegetation. The stems are very flexible and seem almost to be contractile because totara trees are bent over by the vines and held down by further vine entwining-growth onto surrounding vegetation. The broad convolvulus leaves also smother the totara foliage. Convolvulus was a major problem in the first two years and was probably stimulated to grow by the cultivation and fertilizer. The elastic rhizomes made removal difficult. After four years however, convolvulus has ceased to be a problem, probably because there is less disturbed ground to stimulate its growth.

3.2.4 Bracken fern (*Pteridium esculentum*) Because the site is a steep slope, bracken fern fronds tend to fall down-slope when they are unsupported. This caused some smothering of totara seedlings, especially in combination with more serious weeds. In many respects bracken seems to be good for tree establishment because the coarse open canopy protects the soil and young trees as well. The trees are now above the height of the bracken and the damage has ceased.

3.2.5 Other vegetation It is possible that a dense sward of pasture grasses at the eastern end of the site deprived the young trees of space for root growth, and water during summer: cocksfoot, paspalum, yorkshire fog, sweet vernal and browntop are common and contribute to the smothering effects of other weeds. Broad-leaved plants have become established in the bare ground around some trees - buttercup, scotch thistle, plantain (*Plantago lanceolata*), ragwort, *Senecio bipinnatisectus* , lupin, lotus and hawkesbeard (*Crepis capillaris*). Some of these have become less common over time (e.g. scotch thistle), while others such as lotus and buttercup are now more common. These species do not smother young totara trees and in fact probably have a positive influence by covering bare soil, enhancing soil fauna biodiversity and enriching soil fertility by returning leached nutrients to the surface.

The only zone of totara mortality occurring after four years is on the pasture-grass dominated eastern end. This zone is more exposed to wind and salt-spray and the soil is probably less fertile and more prone to drought. Removal of the grass sward from around each tree and mulching the bare surface may improve survival.

3.3 Other potential problems

3.3.1 Bag-moths (Kopi, Whareatua, Puu a Rakataura; *Oeceticus omnivorus*) The larvae of bag- or case-moths defoliate shoots by feeding on young totara leaves and attaching older leaves to their bag. They can defoliate young shoots. In 1993 one or a few caterpillars were seen on many trees. On one tree 30 bags were seen, of two sizes, 5 cm long and 1-2 cm long, and this seems to suggest that reproduction is occurring. It is likely that this tree will grow little new foliage in the 1993/94 growing season. If bag-moths occur in epidemic proportions their damage may be substantial, but overall they are not presently significant.

The Maori name Puu a Rakataura refers to the silken bag as the "flute of Rakataura", Rakataura being the goddess of music. Even after only four years the totara are attracting animals which are significant in the identity of the Maori culture. This is an essential purpose behind bringing the bush back to marae: the establishment of living resources at a centre of learning.

3.3.2 Yellow leaves Zones of yellowing, mature leaves occur occasionally. It has the appearance of a nutrient, perhaps mineral, deficiency. It is not a problem at present but should be monitored. The iron-sand soil has not been tested for mineral content and it is distinctly possible that deficiencies in key elements like magnesium could occur before an adequate forest-generated top soil develops from the totara litter itself.

3.3.3 Changing social landscape Since the totara were planted in 1989 the surrounding area has become more intensively used. A number of papakaainga houses (family residences built on marae land) have been built along the crest of the dune so that the question of trees ultimately blocking the view has been raised. Although gaps have occurred in the block, the increased use of adjacent land discourages the planting of more trees to fill these gaps.

When first planted, a few trees were located on flat land at the base of the escarpment. This land is now planned to become part of a garden and consequently the trees have been moved to a nearby slope. Some of these have survived, but it would obviously be preferable not to plant trees in potentially inappropriate places in the first place. This is an aspect of planning. Any place can become inappropriate with changes in land use. Because trees are very long-lived, and in this type of soil cannot seriously be considered candidates for transference, any potential changes in land use from now on need to be examined with regard to the totara trees. It is very important that future users of the area are made aware of the presence, needs, and significance of the totara trees and their long-term future role as part of the learning centre.

3.4 Overcoming problems

3.4.1 Weed growth and releasing Repeated releasing in the first two years has proved to be essential. The totara trees were not planted in strictly straight lines because a "natural" landscape pattern was initially desired. However, if trees had been in predictable places they would have been easier to locate. The young trees were not staked when planted. Had a large supply of stakes, such as manuka stems, been available, the position of each tree would have been obvious and releasing would have been easier.

3.4.2 Tree form Staking could also have enhanced the form of the young trees by ensuring the upright growth of a leader. A few of the Piako stock have developed two leaders or have assumed a "sprawling" habit. Eventually staking and pruning will encourage these trees to assume an upright form so that they can persist in the developing canopy and form a trunk of potentially useful timber. Pruning has not been attempted to date, nor has staking and tying. Overall, "poorly" shaped trees are few.

4. GROWTH

The increment of growth has been recorded annually since planting (Figure 6). On average, an increase in height of 107 cm has occurred. The tallest individuals are now almost 3 m tall and are assuming the form of small trees, each with a sturdy, straight trunk and a dense canopy from base to tip. Although the Piako stock was larger than Manunui stock when first planted (103 cm and 66 cm respectively) this difference has largely been obliterated by the initially faster growth of the container-grown Manunui plants. Unfortunately, the Manunui stock was planted at the two ends of the site (see Figure 1C), the western end becoming swamped by kikuyu and the eastern end experiencing ongoing die-back problems. The increase in the range of sizes over the last year seems to indicate that the healthy trees grow more each year, while unthrifty trees remain small. Forty six per cent of the surviving trees (about 230) are now taller than the mean: 197.2 cm (Figure 7). If these trees continue to expand at this rate without further loss, then a dense grove of young totara will eventually cover most of the one hectare patch, with scattered small openings where mortality has been concentrated.

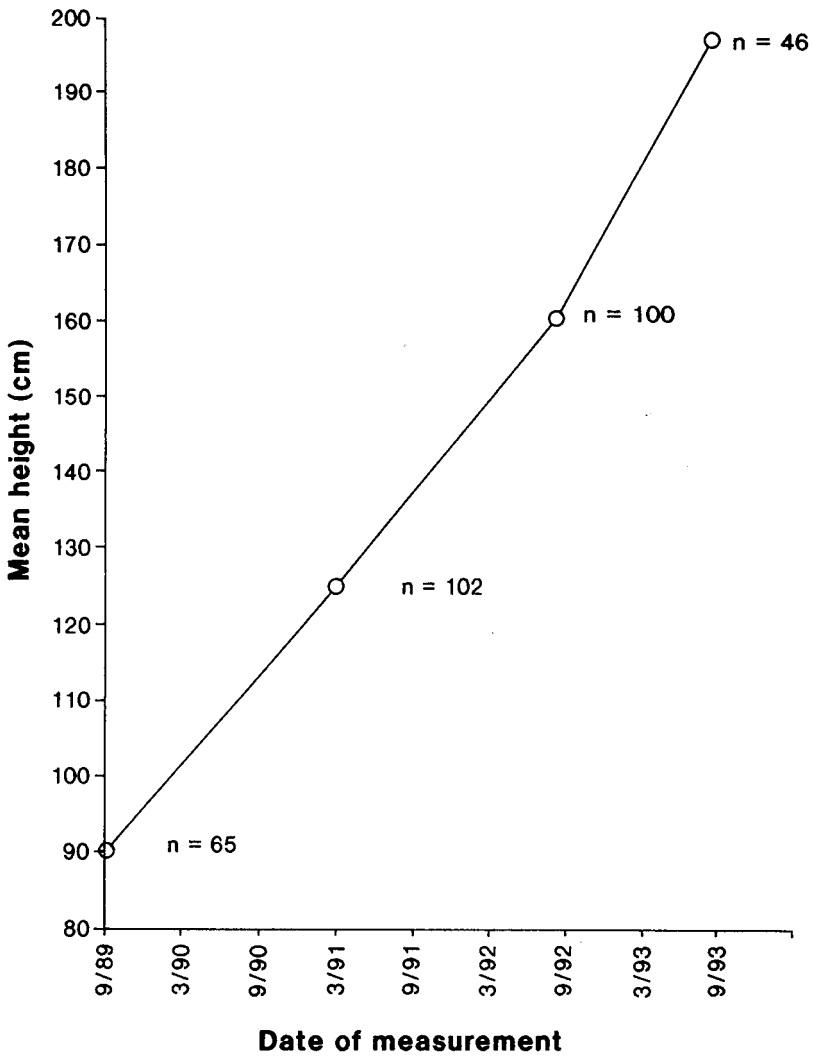

Figure 6 Growth in height of totara at Maketu marae, since September 1989. (n = sample size)

Good growth is fairly evenly distributed over the site, but appears to be somewhat greater towards the base of the scarp (which may be moister), and is also greater in the bracken fern-dominated areas. This probably reflects the negative impact of nutrient and moisture competition by grass and the initial smothering retardation induced by blackberry and kikuyu. Bracken tends to be prominent in higher fertility sites.

Whereas growth in height has been fairly regular, at 0.3 m/year, the last year has seen substantial thickening of the foliage-bearing side

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