Natural Pohutukawa in Taranaki

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1. Introduction

A Project Crimson report on North Taranaki pohutukawa (*Metrosideros excelsa* Sol. ex Gaertn.) was prepared in November 1994 by Marlene Benson, a consultant botanist from Taranaki (Benson, 1995). On 8 January 1995 I inspected the stand which Ms Benson had identified as most likely to be naturally occurring pohutukawa along the north Taranaki coast. The site is near Paparoa reef which lies at the base of cliffs between the Mimi River and Wai-iti stream. The pohutukawa trees are observed by walking south fromWai-iti at low tide, or from farmland along the crest of the cliff (Bruce Newton's farm).

Ms Benson identified three other potentially natural trees or groups of trees. Pukearuhe and wai-iti were visited but the overall characteristics of these sites suggest that naturalness is unlikely. Trees at Rapanui seem most likely to represent regeneration from planted stock.

Ms Benson's methods and report are particularly valuable because of the public interest generated by the project (see Taranaki Daily News, February 2 1995). Enthusiasm for ongoing conservation work has already been established.

The Paparoa pohutukawa occupy a stretch of coastal cliff 1-2 km in length. The cliff consists of a basal zone of Miocene papa (mudstone) overlain by numerous discrete layers of Quaternary sandstone, ash deposits (tephra) and thin organic layers representing former swampland (King *et al.,* 1993). The pohutukawa mostly occupy the upper layers but occasionally descend almost to sea-level. There are at least 100 small, but mature, trees and an equal or larger number of young trees, saplings and large seedlings less than 1 m tall.

Although natural pohutukawa have been formerly recorded at Urenui and Mimi, neither location has naturally occurring trees now. No others have been located north to Awakino. The closest confirmed population to the north is at Kawhia. Although some may eventually be found between Awakino and Taharoa, it is clear that the Paparoa stand is isolated. (Owen Wilkes, an archaeologist, has surveyed this coast for archaeological sites and has not observed any pohutukawa - pers. comm to Tony Walton, January 11 1995). Although there is a range of tree sizes, the small total number of plants makes the population vulnerable to erosion, possums and weeds. Hence it is important to understand the site well and to put in place practical conservation measures.

2. Associated Vegetation

Although little grows on the papa, the varied layers overtopping the basement rock provide niches for a dense vegetation. Dominant plants are harakeke (*Phormium tenax*), taupata (*Coprosma repens*, some of them with unusually large trunks 30 cm in diameter, forming small trees evidently of considerable age) and kawakawa (*Macropiper excelsus*). Karaka (some wind pruned to a shrub form), toitoi and koromiko (*Hebe stricta* var. *macroura*) are scattered throughout. A few tree ferns (perhaps diminutive mamaku), a single karo (which also reaches its southern limit in the region) and a hangehange (*Geniostoma rupestre* sp. *ligustrifolium*) with unusually round leaves, were noted. There are numerous coastal herbs (*Apium prostratum*, *Lobelia anceps*) and sedges. The understorey beneath the pohutukawa varies from almost bare ground, to a medium-dense cover of *Carex* sp.

A mosaic of vegetation types is created in relation to the erosion cycle.

3. Erosion Cycle

A heavy shower of rain at the time of inspection demonstrated the ease with which the cliff-face erodes. Rain dissolves the papa to form a milky runoff, and washes away upper sediment to form a brownish (often iron-stained) run-off. The rain-induced erosion is also associated with persistent wind erosion, and probably also sand deposition from the beach.

The greatest erosion force is the sea, which under-cuts the mudstone base in progressively enlarging wedge-shaped caves, the roofs of which collapse followed by collapse of the upper Quaternary strata to form a new vertical cliff-face. Gravity, wind and rain continue to erode the upper strata until a relatively stable slope, eventually completely revegetated, is regained. Then the cycle begins from the base again. It has been calculated (Bruce Newton, pers. comm.) that the cliff is receding at a rate of 30 m per century, or 30 cm per year. Of course, this is not uniform because the erosion process operates in a manner that produces a scalloped outline. The pohutukawa establish on the sheltered inner slopes, but as a result of ongoing erosion they eventually occupy headlands. Beach erosion at Urenui has been measured at 300 cm per year (Clayton and Nixon, 1985). Based on historical records Gibb (1978) concluded that similarly structured terraces in south Taranaki are eroding at 70 cm per year over the past 100 years.

Because the rate of natural erosion is so great no surface can survive for long and even the oldest trees are relatively young - probably a maximum of 200-300 years - and small. Growth is evidently slow, as indicated by the short length of the annually produced leafy shoots (about 2-4 cm), and by the substantial amount of branch dieback and epicormic shoot growth. The cause of these latter features is root exposure caused by the soil erosion. The inherently dry quality of the sandy soil and windy weather probably also restrict the rate of growth. Genetic adaptation to survival at the southern most natural limit for pohutukawa which this population appears to represent, might also include a relatively slow growth rate.

4. The pohutukawa trees and population

The population appears to be healthy in the sense that a wide range of sizes and, probably, ages are represented. Seedlings establish on relatively stable, open surfaces before these are covered by other vegetation such as taupata and flax. The seedlings are mostly wind pruned to hug the slope, but eventually form trees with several erect trunks. Some individuals have dead former trunks surrounded by new growth, indicating cycles of growth based on erosion events which damage and expose the roots. Some trees are held in place only by their roots, the base of the trunk being completely exposed by erosion.

Most of the trees and seedlings were flowering, but not heavily. Flowering can begin when the plants are less than 1 m tall. The large amount of vegetative growth this year indicates that flowering should be heavier next year. Flower colour is variable from dark red to pink-red, the former predominating. The flower clusters seem smaller in diameter than is typical of pohutukawa. This reflects an overall smallness of plant parts. The trees themselves are not massive and the largest trunks measure less than 50 cm diameter and 10 m in height. The shoot growth increments are short, only about 2-4 cm long, compared with 5-6 cm in pohutukawa further north. The leaves are mostly distinctly small, only 4-6 cm long and 1-1.5 cm in diameter (Figure 1). However, the leaves on different plants vary so that a degree of genetic diversity is present (seen also in flower colour).

5. Is the stand natural?

5.1 Ngati Mutanga legend identifies these plants as being brought by the waka Tokomaru from the Kermadec Islands. In other words, the trees have been in the tribal area for a long time (at least 500 years) and are sufficiently unique and important to have a special story to explain them.

5.2 The population is multiple aged and is adapted to the extremely rapid but predictable pattern of erosion. The landforms, soils and pohutukawa trees are united into a natural pattern: the trees establish on inner, bare slopes, hold the slope beneath them and eventually become old trees on headlands. Because of the rate of change the oldest trees are probably only 200-300 years old.

5.3 The understorey consists of a wide range of coastal plants, from small trees to herbaceous ground plants. The composition appears to be consistent with the local pattern and may even have species that are characteristic of pohutukawa forests elsewhere, such as *Carex* sp.

5.4 Some variation in leaf-size and flower colour indicates a range of diversity that is a common feature of pohutukawa elsewhere and is often characteristic of a colonising species.

5.5 However the overall small size of the leaves (and inflorescences and other plant parts) could be interpreted as an adaptation to the marginal conditions manifest at the leading or trailing edge of migration south since the post Pleistocene climatic amelioration. This speculation needs to be tested by wider morphological comparisons. In contrast to the planted pohutukawa at Wai-iti, 3 km to the north, the trees at Paparoa vary rarely form significant aerial roots.

5.6 The Paparoa population is geographically separated from mature planted pohutukawa in the immediate vicinity. Although many have been planted around the Wai-iti stream, only a single young plant occurs between there and the Paparoa reef population, several kilometres distant.

5.7 The character of the place, the physical features of the trees themselves, their botanical associates, and local stories about their significance, all point strongly to a conclusion that these pohutukawa represent a natural stand in Taranaki, and have a heightened significance by probably being the southernmost natural stand in New Zealand. The plant's features do not support an origin from the Kermadec Islands, where the "pohutukawa" exist as an entirely different species (*Metrosideros kermadecensis*) from that on mainland New Zealand (*M. excelsa*).

6. Conservation issues

6.1 On the assumption that this stand of pohutukawa is natural, it is very important, because it represents the southern most known occurrence of pohutukawa in New Zealand and is presumed to have genetic features which are adaptive to a "species limit" ecology. The stand is likely therefore to add a significant component to intraspecific diversity in pohutukawa.

It may represent the only natural stand of Taranaki pohutukawa, and therefore is not only of social, educational importance, but can also be a source for future propagation.

Owing to the national and regional importance the stand has high conservation value, and therefore needs management that is appropriate to these values.

6.2 LAND TENURE

As a result of natural erosion, causing the coastline to recede, it is highly likely that the coastal cliff falls within a private land title. This means that the trees are "owned" by local landowners and are not part of the public estate.

This, of course, is not necessarily a problem but it does mean that the crown has no legal responsibility to protect the trees or supply resources to manage them effectively. Given the small size of the single stand and the highly dynamic environment, it may be difficult for private owners to take full responsibility in the long term.

6.3 LAND FORM-VEGETATION DEVELOPMENT

Several dead trees lie on the beach, many living trees show signs of die-back, and the roots are often exposed by soil loss. Two young saplings were killed by a recent slip. Cliff-face collapse, surface slipping, wind erosions and rain washing combine to create a geologically unstable environment to which the trees are adapted. Although the stand is healthy within itself, its small size, its isolation from any other stand nearby, and the recorded loss of reputedly natural pohutukawa to the south, all indicate a tenuous position. It is vital that erosion is not exacerbated by any additional factor.

6.4 Possums are common (Bruce Newton, pers. comm. January S 1995) and may have contributed to tree die-back. It would be wise to maintain permanent bait stations within the stand. Goats have been seen, but are rare, but they and other browsers could restrict seedling establishment.

6.5 WEEDS/PLANTED EXOTICS

In former times, pines, bamboo, and silver poplar were planted along the crest of the cliff to slow erosion. These plants are occupying space that could be filled, more effectively, by pohutukawa.

More significant, however, are weed species such as boxthorn, gorse, cocksfoot, *Solanum nigrum* and inkweed (*Phytolacca octandra*). These light-demanding species colonise open sites and could potentially prevent the establishment of the minute pohutukawa seedlings.

6.6 GENETIC POLLUTION

Honey bees and bumble bees were observed in the flowers, and throughout Taranaki large flocks of starlings were observed in the pohutukawa. Sparrows also feed on the nectar. There are numerous planted pohutukawa around farmhouses, camping grounds, on roadsides and in the towns. The physical characteristics of many of the planted trees (eg, large leaves, heavy aerial root beards, and flower colour such as yellow, scarlet or brown-red) indicate clearly that they are not of the reputedly natural Taranaki form. Therefore, it is almost certain that any seed formed by the Paparoa stand will have genetic input from non-Taranaki pohutukawa, and any seedlings established recently will have new genetic characteristics. The seed from Paparoa trees should not be used at present for propagation of the true Taranaki provenance unless pollination is restricted experimentally. (Marlene Benson is conducting hand pollination experiments now.)

Until a reliable pollination procedure is put in place, only cuttings from the oldest trees (that presumably pre-date the possibility of genetic pollution) should be used.

7. Management requirements

7.1 CONFIRM CONSERVATION SIGNIFICANCE

Pohutukawa are known to colonise human-made sites throughout coastal North Island and it is possible therefore that the Paparoa stand is human-induced (planted by pre-European Maori). For the reasons stated, I doubt this. However attempts to prove the natural status should be undertaken so that all doubt is removed. This may be especially important if local resources are required for management.

Possible methods to help prove naturalness are:

7.1.1 Ecological survey to understand the relationship between erosion and colonisation.

7.1.2 Literature and other study to determine the unique character of the site, as an explanation for survival of Pohutukawa there (eg, does sediment deposition from the Mimi River to the south, lessen the amount of coastal erosion?).

7.1.3 Botanical survey to understand the structure and composition of the coastal vegetation to see if a full spectrum of expected or uncommon associates (eg, karo, *Carex* sp., *Hebe speciosa*) is present.

7.14 Invertebrate and fungal survey to identify Pohutukawa associates that would not normally be present in a human-generated population.

7.1.5 Testing of DNA or enzymes to determine the range of variation and whether the pattern observed is characteristic of natural stands.

7.1.6 Wood or trunk samples from trees that have fallen through coastal erosion may reveal the age of trees through C^{14} or the number of tree rings.

7.1.7 Coastal survey between Awakino and Kawhia should be undertaken to identify any other Pohutukawa stands for comparison with Paparoa.

7.2 PROTECTION

On the assumption that the stand is natural the status in terms of health, regeneration and threats should be determined through collaboration with the land owners (three). A detailed report on the needs for protection can be prepared with suggestions about covenanting, an interpretation facility, fencing requirements, weed control, possum control, avoidance of genetic pollution, propagation and planting.

Fortunately the significance of the trees in slowing down the apparent rate of soil loss is obvious to the landowners and a desire to fence and replant has been expressed by Mr Bruce Newton. Other adjacent owners needs to be approached to determine their views and to share evidence of the conservation importance of the area.

I believe that it is desirable to replicate the stand at a suitable site nearby. Cutting-grown plants need to be established as immediate protection against extinction and genetic pollution, but a longer-term programme of seedling propagation is required.

7.3 MANAGEMENT PROPOSAL

Project Crimson and the Department of Conservation have collaborated to fund Ms Marlene Benson for the survey that has revealed the Paparoa site. Because of her expertise and local knowledge, and, in particular, the high regard with which she is held by the local community, both Maori and Pakeha, Ms Benson is very well suited to coordinate further work, perhaps with the technical assistance of biologists and the practical management assistance of DoC's New Plymouth Field Centre.

There is an obvious need to undertake scientific and management work and a further proposal to Project Crimson is an obvious means of identifying and funding priority actions.

8. Recommendation

Based on the final report submitted by Ms Marlene Benson, and subsequent inspection of the Paparoa pohutukawa site, the Department of Conservation should prepare a proposal for funding by the Project Crimson Trust, to undertake a study to further understand the Paparoa site and pohutukawa trees and to identify and initiate a conservation management programme that will ensure its survival, and community appreciation.

9. References

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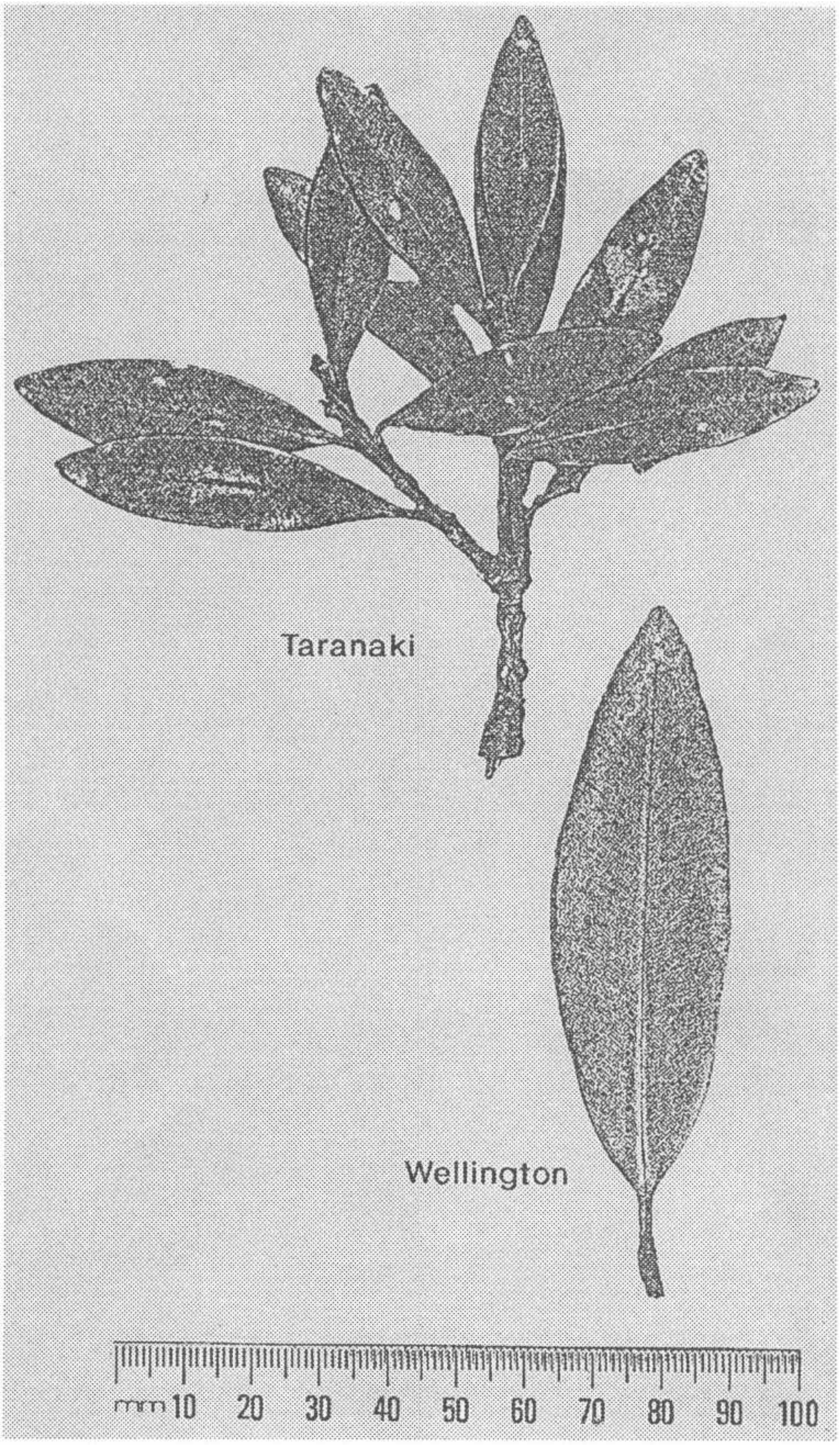

Figure 1. Comparative leaf size in reputedly natural Taranaki and introduced Wellington pohutukawa.