



Title of project:

Adapting the Principles of Te Rongoā into ecologically and culturally sustainable farm practice

Contract Number: 10-RF-32

Principal Investigator Marion Johnson

Organisation: The University of Otago

2012

This report was provided to Ngā Pae o te Māramatanga as a contractual obligation of the research project undertaken by the named researchers and funded by Ngā Pae o te Māramatanga. The report is the work of the named researchers and has been posted here as provided. It does not represent the views of Ngā Pae o te Māramatanga and any correspondence about the content should be addressed directly to the authors of the report. For more information on Ngā Pae o te Māramatanga and its research, visit the website on www.maramatanga.ac.nz

Adapting the Principles of Te Rongoā into ecologically and culturally sustainable farm practice

Funder Ngā Pae o te Māramatanga

Dr Marion Johnson



NPM Contract Number: 10 RF 32
Organisation: Otago University
Principal Investigator Name: Dr Marion Johnson
Funding Period and Term: 1 July 2010 to 30 June 2012

Contents

Contents.....	1
Executive Summary.....	1
Te Rongoā - Māori traditional medicine	2
Rongoā rākau	2
Rongoā and the land.....	3
Rongoā is local	3
The on farm pharmacy.....	4
Rongoā on farm	4
Te Putahi farm, Banks Peninsula; the link between research and reality.	6
Banks Peninsula	6
Te Putahi Farm	6
Animal health issues on Banks Peninsula.	7
Developing a Rongoā planting regime	7
Mapping Te Putahi.....	9
Relating mapping exercises to farm management.....	11
Biodiversity	11
Maintenance.....	12
Conclusion.....	12
Acknowledgements.....	13
References	14
Appendices.....	18
Appendix One Initial species selection for Rongoā plantings on Te Putahi	18
Appendix Two Native plants that can be grown on Banks Peninsula to support the fauna which Wairewa wish to see back on Te Putahi farm.....	20
Appendix Two continued Native plants that can be grown on Banks Peninsula to support the fauna which Wairewa wish to see back on Te Putahi farm	21

Executive Summary

The Te Rongoā project examines the possibility of translating the wealth of traditional knowledge regarding the medicinal use of New Zealand native plants into farm management. Whilst adapting Te Rongoā to stock is a novel way to address the problem of supporting animal health, the practice involves more than the administration of herbal remedies. By allowing stock access to a broad range of species their diet, and thus overall health, is improved. Rongoā rākau is largely local -local plants for local remedies. Not only do plantings contribute to animal health and the maintenance and health of the land, but also to local biodiversity and thus to the resilience of the farm. The concept of planting Rongoā species to improve animal health is entirely feasible; there is an increasing body of literature which surrounds zoopharmacognosy or the ability of animals to self-medicate if given the opportunity. In New Zealand there are records of stock preferences for particular plants, and an old tradition among shepherds to allow unwell animals' access to roadside verges and the mixture of species that used to be found there. Rongoā plantings, whilst creating on farm pharmacies for stock, also contribute to ecosystem services and the provision of species for cultural practices such as weaving, carving and harvesting mahinga kai and Rongoā for community use. The Te Rongoā research is centred on Te Putahi, a farm held in trust by the Wairewa community, on the Banks Peninsula in the South Island of New Zealand. The farm and community link the research to reality and confirm the feasibility of the proposals.

Te Rongoā - Māori traditional medicine

Māori traditional medicine, or Rongoā Māori, is a holistic vision of health in which the emphasis is on well-being rather than on addressing particular disease once health has been breached.

Māori traditional medicine employs a number of methods of healing, such as karakia and ritenga (rituals and incantations), mirimiri or soft tissue massage, romiromi or deep tissue massage and pressure, and rongoā rākau or herbal medicines (Mark & Lyons, 2010; Tribunal, 2011). Music has a history of being used in the healing process and today even line dancing (Walker, 2006). In other words, balance in life can be achieved through numerous channels; and to attain a state of wellness, connectedness is required on multiple levels.

The principles of Rongoā Maori have been conceptualised by several practitioners and exponents in an effort to explain the connectedness of the healing processes. Mason Durie has depicted health as a Whare Tapa Wha, a four-sided house. In this model, hinengaro (mental health), tinana (physical health), wairua (spiritual) and whānau (good family relationships) all combine to support the health of an individual (M. H. Durie, 1985).

Te wheke, the octopus, is used as a metaphor for the inter-relatedness of Rongoā by Pere: the head represents the family and the tentacles represent hinengaro (mental health), tinana (physical health), whanaungatanga (extended family), whatumanawa (emotional health), mauri (life principle), mana ake (unique identity) and hā a koro mā a kui mā (inherited strengths), all of which combine in a person to give them their stance and their health (Pere, 1997). Mark and Lyons illustrate their interpretation of Rongoā with Te Whetu, the star. The points of the star represent hinengaro (mind), tinana (body), wairua (spirit) whānau/whakapapa (family and genealogy) and whenua (the land). This model, drawing upon the views of practicing healers, emphasises the importance of connections to the land and suggests that these should be addressed as well for a state of well-being to emerge (Mark & Lyons, 2010).

McGowan holds that Rongoā is based upon Te taha wairua or spiritual awareness (McGowan, 2009). It is this spiritual link with the land that is often severed by city living or disrupted by land wrangles yet it is the spiritual link that underpins respect for the land. Durie also suggests that this spiritual aspect is an essential prerequisite for good health. Te Taha Wairua acknowledges our connections with the environment, the land, the water and all species - without this connection and the respect it engenders we are vulnerable (M. H. Durie, 1985).

Rongoā rākau

Māori identity is linked to the land, to mountains and rivers, to belonging to the land (M.H. Durie, 2001). Māori wisdom acknowledges a relationship and kinship with other species and that in fact “the trees and birds and all living creatures of the forest are tuakana (senior) to us” (McGowan, 2009). Having respect for the plants of the forest and closely observing them, in all seasons, at all stages of growth, leads to a greater understanding and from this knowledge comes the ability to use native plants for healing. McGowan (2009) suggests that observation of how plants defend themselves and heal themselves leads us to an understanding of how they may be used to heal human ailments and support health

Rongoā and the land

“Land is a symbol of continuity with those who have passed on to the spiritual world and respect for land augments ones spiritual strength” (Durie 1985).

Healing the land

Durie (1985) points out that good health, in terms of a Rongoā Māori framework, requires balance. Health is reliant upon the resilience of the mind, spirit, body, family and spiritual connections. Durie also suggests that the truly healthy individual is the one who has these connections in balance and is not solely concerned with personal ambition. The health of the land is no different; there are many connections, frequently disrupted in an industrial agricultural model, that need to be nurtured for the land to become healthy. If we encourage the soil to become active once again it will promote the health of the communities drawing from it. Biological farming, a growing field of enterprise, seeks to enliven the soil again, to encourage the biota in the soil which in turn will provide nutrition to the plants above. If we diversify the crops we grow, providing habitat, nutrition and shelter for a myriad of species, emulating resilient natural communities, those connections will uphold our farm production over time. These ideas are not new. For example, Albert Howard drew upon these concepts to design his composting system (Howard, 1940). Leopold’s land ethic states that a thing that does not preserve the integrity of a biotic community is wrong (Leopold, 1949). Masanobu Fukuokado espoused “do nothing farming” and outcropped the most industrially productive farms in Japan (Fukuoka, 1978). Permaculture draws upon many similar concepts (Mollison, 1978). The principles of Rongoā Māori apply equally to healing the land as to healing those who walk upon it. Mark and Lyons (2010) quote a Rongoā practitioner who remarked that land was often a cause for clients requiring healing, yet the land itself often required healing “not necessarily separately from a client’s healing”. The link between the land and the health of indigenous peoples has been recognised internationally. For example, Wilson explores and expands the concept of “therapeutic landscapes” and draws a direct link between the landscape and the health of the people culturally associated with it (K. Wilson, 2003). People’s interactions with the land provide a spiritual connection to the land; those connections cannot be gained through concrete, dislocation or troubled minds. The land cannot be healed, nor managed with respect, if the connections to it are broken.

Rongoā is local

Healing practices vary across Aotearoa New Zealand There are regional and iwi based variations; there are also variations between healers (Jones, 2000). There are publications on Rongoā rākau or the plants used in healing that are generic: (Brooker, Cambie, & Cooper, 1987; Macdonald, 1973) and (Riley, 1994) . Others are local: (2012; Williams, 1996). But much of the knowledge of Rongoā is retained by practitioners and centred around their practices and their locality (Ahuriri-Driscoll et al., 2008).

It is a basic tenet of Rongoā that the plants are part of the landscape and their medicinal properties relate to the environment in which they are growing. Research into the chemistry of manuka (*Leptospermum scoparium*) across New Zealand bears this out (Maddocks-Jennings, Wilkinson, Shillington, & Cavanagh, 2005; Perry et al., 1997; Porter & Wilkins, 1998) as the authors all clearly demonstrate changes in the chemical composition of manuka across Aotearoa New Zealand.

Plants vary in the quantity and composition of their secondary compounds; those compounds that commonly have healing or health properties. Not only is there variation between individual plants but there is a seasonal variation. Māori practitioners were cognisant of this and Rongoā protocols relate to the availability of compounds as well as the sustainability of practices (McGowan, 2009). The production of secondary chemicals by plants is frequently a defence mechanism, rendering the taste of plants different, frequently bitter. Many practitioners recommend using leaves that have been bitten and have holes in them, believing that they are more efficacious. Farmers have noted that when cut and carting willow for stock feed, the taste changes over time and it is often not as palatable.

The on farm pharmacy

In an earlier time shepherds relied on the mixtures of species in pastures to help maintain the health of their stock. As the species mixture in pastures lessened they would rely on the long acre – the “weedy” strip between the fence and the roadside. Now the long acre has also largely disappeared and animals are reared on an unremitting diet of rye grass and clover.

The concept of zoopharmacognosy or self-medication amongst animals has had a renaissance driven by Huffman’s observations of the chimpanzees in Mahale National Park in Tanzania. Chimpanzees that were ill were observed to choose plants that were not a normal part of their diet and having ingested the plants they were observed to be healthier and to have lower parasite counts in their faeces (Clayton & Wolfe, 1993; M. Huffman & Seifu, 1989; M. A. M. A. Huffman, 2003). The literature surrounding the effectiveness of traditional plant remedies and the ability of farmed animals to treat themselves is also growing, for example in Africa (Githiori, Høglund, Waller, & Baker, 2004) South America (Lans & Brown, 1998) India (Sharma & Singh, 1989) and Europe (Pieroni, Howard, Volpato, & Santoro, 2004) and the United States (Villalba, Provenza, & Shaw, 2006).

There is evidence in New Zealand of the ingestion of native vegetation by farmed stock, usually records of the damage caused by farmed or feral animals (Forsyth, Coomes, Nugent, & Hall, 2002; Nugent, Fraser, & Sweetapple, 2001).

Given the opportunity, farmed animals will browse a range of vegetation. There is increasing debate as to the benefits particularly with respect to anti-parasitic plants, for example (Athanasiadou, Kyriazakis, Jackson, & Coop, 2001; Behura, Sahoo, & Satpathy, 2006; Eguale, Tadesse, & Giday, 2011; Hordegen, Cabaret, Hertzberg, Langhans, & Maurer, 2006; Litherland, Deighton, & Leathwick, 2008; Vatta, Kandu-Lelo, Ademola, & Eloff, 2011). Unfortunately much of the research is conducted in an artificial setting - animals held indoors and dosed with both parasite and plant - or is carried out on laboratory species and extrapolated to farmed stock. There are some positive results from this work but it ignores the holistic nature of health. In shoe horning the plant or an extract into a limited time frame, which may or may not be seasonally appropriate, challenging both the plant and the animal with a dose of the disease which again may not reflect the usual path of infection and placing the protagonists- plant, animal and disease - into an artificial arena, negative results are frequently returned despite a wealth of traditional knowledge supporting the efficacy of a particular plant. Research is required in New Zealand to record the diet choices farm stock make when given the opportunity, and the influence they may be having on animal health, in a holistic sense. It is also necessary to relate those diet choices to particular stressors or environmental events.

Rongoā on farm

Utilising Rongoā on farm will require management skills. Rongoā practitioners adhere to cultural practice, tikanga handed down over generations, which upholds the integrity of Rongoā harvesting and maintains the resource in good heart (Gallagher, 2009; McGowan, 2009). To really heal the land the plants and those dependent upon them and connected to them, we need to address the mauri,

the life force, of all the facets and components of the land. If we respect and care for the land and treat it well, we raise its mauri or well-being and that is reflected in the growth of plants on the land which is in turn reflected in the condition of animals grazing upon that land. “The basis of healing is mauri to mauri” (McGowan 2009).

There are further links between the philosophies of Rongoā and the management of the land. If farmers accept the concept of kaitiaki (guardianship) then they will respect the land. Animals have their own relationships with the land; given the opportunity they move into shelter ahead of storms, sheep select lambing sites well in advance. Animals move around a farm following known tracks and avoid areas that are not conducive to their well-being. In the Lakes district of England flocks are “hefted” to the hill - generations of the flock have lived on a particular section of moorland and remain there with no fences. Within a flock or herd there are matriarchal lineages and hierarchies and there is always a relationship with the shepherd.

If Rongoā species are routinely planted on farms, not only will the land and stock benefit but communities have the opportunity to practice Rongoā, to pass on the knowledge and to train practitioners in the art of harvesting, preparing and administering Rongoā rākau.

Te Putahi farm, Banks Peninsula; the link between research and reality.

Banks Peninsula

Banks Peninsula (Te Pātaka o Rākaihautū) covers an area of approximately 1000 square kilometres on the south coast of Te Waipounamu (the South Island) of Aotearoa New Zealand (Figure.1.). The land is of volcanic origin, and rises steadily from sea level to a height of 919m, the summit of Mt Herbert.

Before the arrival of man the Peninsula was forested with hardwoods and Podocarps such as Totara (Burrows, 1994). Kanuka stands, indicative of forest clearance by fire, were noted around many Maori settlements in the late 1800s when large scale clearance began for milling and agriculture. At this point the land was still largely covered with podocarps and a mixed angiosperm understory (Burrows, 1994). Pasture is the most common vegetation type (H. Wilson, 2009) on the Peninsula today, with pockets of native bush, plantation, scrub, wetland and tussock.



Figure 1. Location of Banks Peninsula, Te Waipounamu, South Island, Aotearoa New Zealand

Te Putahi Farm

Te Putahi is a 449ha sheep and beef farm located in the Southern Bays of the Banks Peninsula (Figure 2). The farm currently carries 800 mixed breed ewes and 60 cattle. Three hundred hoggets are being carried forward to increase the breeding flock and 30 heifers to increase the cattle numbers. Fifty six calves will be weaned this year and 400 lambs will be taken through, the balance having been sold prior to an anticipated summer drought. During the last 20 years Te Putahi has had few chemical inputs and is progressing towards organic certification by the year 2015.

Te Putahi is an essential part of the Wairewa vision of an integrated mahinga kai cultural park comprising Wairewa (Lake Forsyth), the foreshore of the farm, on which a matatai has been placed, and the farmland. The vision is to provide for future generations with respect to place, cultural

opportunities such as tuna harvest and the practice of Rongoā, and a reliable source of sustenance. The vision is to protect the whenua (land), koiora kanorau (biodiversity), wai māori (freshwater) and wai moana (sea) of Papatūānuku (mother earth) ki uta ki tai (from the mountains to the sea)". (Robin Wybrow pers. comm.).



Figure 2. Location of Te Putahi farm in the Southern Bays on Banks Peninsula

Animal health issues on Banks Peninsula.

According to Gribbles Veterinary Pathology Laboratory in Christchurch (Fairley pers.comm.) the major animal health problem on Banks Peninsula is parasitic infection; gastrointestinal parasites in sheep, cattle and deer and lungworm in deer. Other animal health issues include enterotoxaemia in animals that haven't been vaccinated, enzootic pneumonia in lambs and both encephalitic and enteric listeriosis. The veterinary practice in Little River confirmed the problem disease spectrum and emphasised the importance of parasite management on farms on the peninsula. Robin Wybrow, speaking as manager of Te Putahi, confirmed that parasitism was the primary animal health concern. Other issues included pregnancy toxemia, pink eye, scours and shaky lambs.

Developing a Rongoā planting regime

To reduce the task of selecting Rongoā species to manageable proportions the prevalent animal health issues were addressed first and then the overall health and management of stock. If farmed animals have access to a range of species with a reputation as tonics their disease resistance is raised. A broader diet contributes to resistance both through a healthier feeding regime, contributing to a more robust immune system, and the ingestion of secondary chemicals that may have a pharmaceutical effect. As all farmers wish their young stock to grow as well as possible, species with a reputation for improving lactation were identified, as were species with a reputation for treating wounds. Animals spend some considerable time in the yards, and planting trees and shrubs with a reputation for wound healing will not only provide first aid for the inevitable knocks and cuts but also provide shade and shelter and browse.

To develop a suggested planting scheme, species were selected from the generic literature on Rongoā that were described as antiparasitic, tonic, aiding diarrhoea (scour) and lactation, wound healing, and helpful in chest complaints. The species selected had to be palatable, able to survive browsing and recover well, be nontoxic and grow in the Banks Peninsula. Some of the suggested herbaceous species are not native to Banks Peninsula but are in common usage, and the older varieties had been incorporated into Rongoā practice. For example: Nanī, Keha, Maori turnip, (*Brassica campestris*) Huainanga, Fat-hen (*Chenopodium album*) Kopakopa, Pārerarera, plantain (*Plantago* spp.), Kāpeti, Māori cabbage (*Brassica oleracea*).

Having created a species list (given in Appendix One) consideration must then be given as to where to plant on the farm. The purpose of Rongoā plantings is to give the stock the opportunity to broaden their diet and to self-medicate but the farm must still provide good grazing. Plantings should perhaps be confined to less productive areas of pasture land, ideally areas that are erosion prone or are already in need of restoration. Consideration must also be given to the protection and planting of riparian margins. To provide good access to shrubby or forestry Rongoā, double fencing of the boundaries of productive pastures is ideal, or planting browse very close to the fence line where productive pasture abuts poorer land or a riparian zone. In the initial planning stages, the areas of the farm can be designated at one end of the scale as good pasture = no planting. At the other end of the scale in desperate need of restoration = retire for the foreseeable future. The land in between may range through low density planting (agroforestry/silviculture), mixed planting (Rongoā and commercial species) at different densities, largely long term commercial planting with Rongoā around the margins, to “medicinal” paddocks which might contain plantains, brassicas, celeries, cresses and other herbaceous species.

Mapping Te Putahi

In order to visualise putative planting schemes Te Putahi was mapped in conjunction with the School of Surveying at Otago University. The farm was surveyed in its entirety and two and 10 metre contour maps produced. The 10 metre contour map (Figure.3) and the orthophotographic image of the farm (Figure.4) were then converted into a digital terrain map.

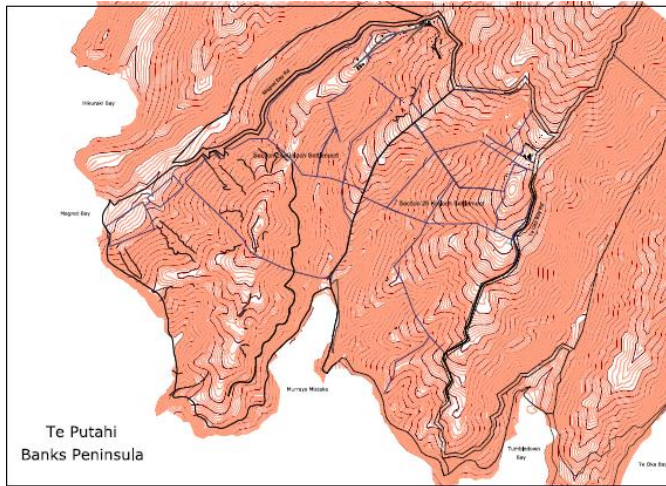


Figure 3. Contour map of Te Putahi farm



Figure 4. Orthophotographic map of Te Putahi Farm

Working in conjunction with the School of Surveying, Environment Canterbury, and Roger May of Tomorrows Forests, Geographical Information Systems (GIS) layers were developed depicting various aspects of the farm such as rivers and streams, existing plantations and shelter belts, tracks and erosion prone areas. Then, using Stability Index Mapping methodology (Pack, Tarboton, Goodwin, & 1998), a stability index was computed illustrating areas of the farm that could be

classified as stable, moderately stable or unstable (Figure 5). The stability index was then incorporated into a GIS layer to indicate the areas of the farm that were unstable (not suited to pastoral farming), moderately stable or stable (suited to grazing). Areas of unstable land should ideally be planted at a reasonable density with the aim being to restore the land. Rongoā species could be planted around the margins for immediate use and throughout the planting site for intermittent use as planted species matured and the land cover and soil stability increased. The grazing land would ideally be planted with Rongoā browse around the margins and with small patches or single trees within the paddock. Areas of intermediate pasture quality might be transferred into herbal leys creating medicinal paddocks for use at key times in the year such as when parasite levels are increasing in pasture, or briefly prior to lambing. The moderately stable land, or erosion prone land, could be used in a mixture of grazing and Rongoā, or grazing Rongoā and commercial species - for example in the long term, totara or rimu might be harvested.

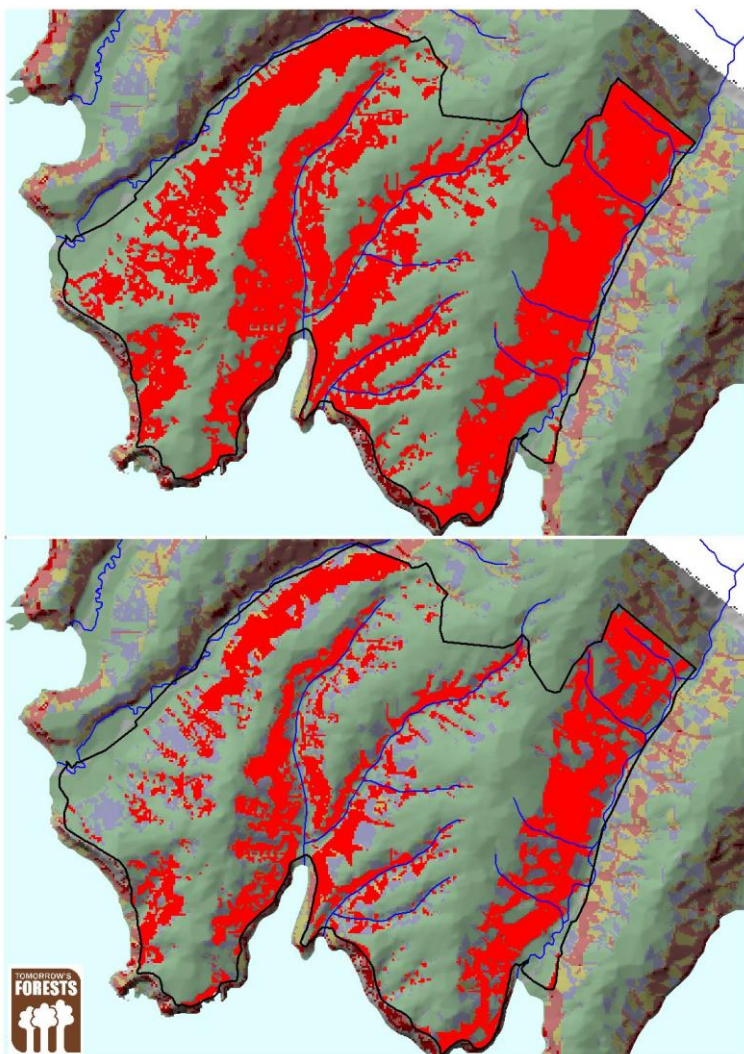


Figure 5. Illustration of the stability classification of Te Putahi. In the upper map, land classified as unstable and moderately stable is highlighted in red (302ha). In the lower map, just the unstable land has been highlighted (238ha). Map courtesy of Roger May

Relating mapping exercises to farm management

Stability index mapping gives a useful indication of where land should be retired or how it might be best used but bears no relationship to the current functioning of the farm. On most farms many of the areas indicated as moderately stable or even unstable are in pasture and grazed regularly. Even if they are recognised as erosion prone or actively eroding they may be utilised frequently because of the stocking level and feed requirements at certain times of the year. Very rarely do land managers take a long term view and the steadily decreasing productivity of these areas is not acknowledged. After a slip has occurred it is estimated that, over 20 years, pasture production on the site will recover to 70-80% of the pre slip level, but there will not be a full recovery (Lambert, Trustrum, & Costall, 1984). Once the futility of applying pressure to highly erosion prone areas has been recognised, discussion can turn to planting regimes. When trees and shrubs have become established it is possible to browse and graze under them. Planted areas can be utilised as feed banks for times of drought and for emergency shelter and feed in bad weather.

Figure 6 illustrates how differences in management can impact on the land. The photographs are taken in the west of the farm. The first area is at the south-western end of the western section of land identified as unstable, and the second is at the north-western end. Although the land in the second photograph is not clear and is covered in “scrub” it maintains diversity, has not slipped and is providing feed and shelter. The land in the first photograph has been conventionally cleared and grazed and is now unproductive, carries no diversity and will remain so for many years.

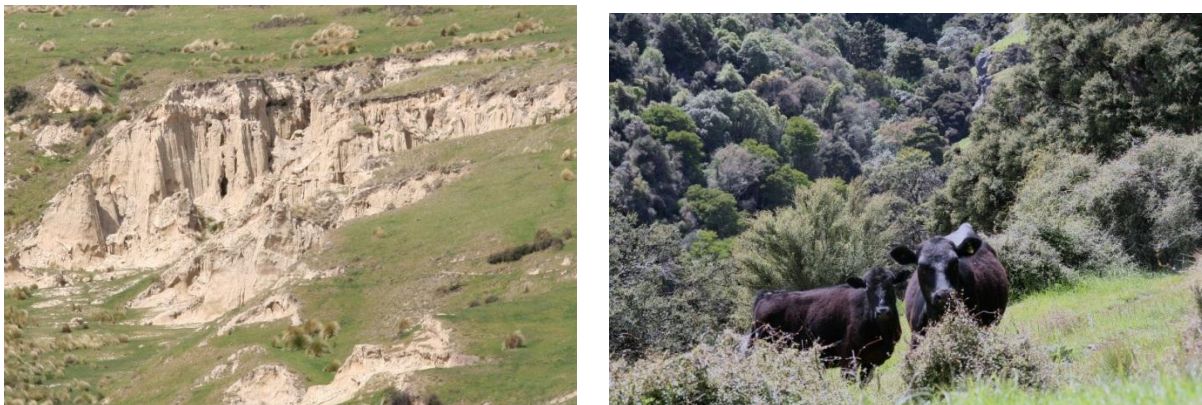


Figure 6. Photographs of contrasting unstable slopes on Te Putahi farm. The left hand photograph is of an area that has been cleared and farmed conventionally, the right hand photograph an area on which cover has been retained.

Biodiversity

If a farm is being planted for Rongoā, by default habitat is being created and feed sources are provided for a range of species. Many communities mourn the loss of familiar species or species which figure in legends and treasured tales, so it is sensible when considering planting regimes, to include plants that will support the survival of a range of fauna. Trees such as kowhai (*Sophora microphylla*), mahoe (*Melicactus ramiflorus*), broad leaf (*Griselinia littoralis*) and five finger (*Pseudopanax arboreus*), and small leaved shrubs such as the coprosmas, porcupine shrub (*Melicactus alpinus*), poataniwha (*Meliocope simplex*), matagouri (*Discaria toumatou*) and snowberry (*Gaultheria antipoda*) provide habitat for many species of birds, geckos and invertebrates. Kanuka and manuka provide excellent habitat and also act as a nurse crop for regenerating native bush.

Robin Wybrow, on behalf of Wairewa, suggested that the birds that the community would most like to see on the farm were Kereru (*Hemiphaga novaeseelandiae*), Tūi (*Prosthemadera novaeseelandiae*), pīwakawaka the fantail (*Rhipidura fuliginosa*), ruru the owl (*Ninox novaeseelandiae*), and pipiwharau the Shining cuckoo (*Chrysococcyx lucidus*). Wairewa would also like to ensure that, should Weka (*Gallirallus australis*) be reintroduced to the east coast of the South Island, habitat would be available at Te Putahi. Koura or freshwater crayfish (*Paranephrops zelandicus*, *P. planifrons*) and Kokopu (*Galaxius spp*) would be welcomed to the creeks and Jewelled gecko (*Naultinus gemmeus*) to the land. A list of the species required for habitat and feed for the desired fauna is given in Appendix 2.

Many of the plants selected for Rongoā rākau will provide habitat and feed sources for native fauna. However, to ensure the survival of desired species, it is crucial that feed and cover are available throughout all seasons. Planned Rongoā plantings should be supplemented with species that contribute to the perceived gaps. Many of the species that are ideal habitat and feed sources for native fauna are also highly palatable to stock and will contribute to a broader and healthier diet, for example broad leaf (*Griselinia littoralis*), mahoe (*Melicytus ramiflorus*) and five finger (*Pseudopanax arboreus*) are highly preferred browse.

Maintenance

Thought must be given to maintenance and management of all plantings before a programme commences. In the early stages trees and shrubs will need to be relieved of competition from grasses until they are well established. Some native trees will establish well with a light to moderate grazing regime (Wilson 2009). Controlled grazing pressure reduces competition from aggressive grasses and encourages tree growth, and many young trees for example, totara (*Podocarpus totara*) and lacebark (*Hoheria angustifolia*) will recover from a light browsing if the surrounding grass is controlled.

At all times pests such as possums, rats and mustelids will have to be controlled if wildlife and native plants are to flourish. When planning and costing a programme of Rongoā planting, additional items such as fencing, maintenance and pest control must be factored in.

Conclusion

The exercise of mapping the farm with respect to possible forestry plantings conducted in conjunction with Roger May of Tomorrows forests showed that alternative crops are a viable option on Te Putahi. Forestry models are available showing calculations of carbon credits for long term commercial plantings. The carbon value of native vegetation is much lower but the multiple benefits provided are enormous. A manuka stand confers many benefits, not simply carbon sequestration, least of which is acting a nursery for regenerating indigenous bush. It would be quite feasible to plant large swathes of Te Putahi into forestry, earning carbon credits whilst utilising Rongoā species planted or naturally regenerating on the forest margins. Alternatively areas of the farm could be planted with Rongoā species and earn credits on the plantings.

The project has successfully developed the concept of applying the principles of Rongoā to land management. But much more research is needed in the field of Rongoā for stock, including the validation of improved animal health over the long term. Longer term monitoring of the steady return to health of the land and increases in biodiversity above and below ground is also required to prove the concept to sceptics. Although there is scope for much laboratory based work on native plants it is suggested that to remain true to the principles of Te Rongoā a holistic approach should be maintained.

Rongoā plantings encourage the revival of cultural practices, not only harvesting of Rongoā rākau but also reinforcing a connection to and knowledge of the land. With the inclusion of species such as

Harakeke, materials become available for weaving and over time carving materials are also once again available.

Acknowledgements

This project would not have been possible without the support, vision and encouragement of Robin Wybrow. The School of Surveying at Otago University, Professor Brent hall, Dr Tony Moore, Mr Phil Rhodes, post graduate students Mr Jeremiah Gbolagun and Mr Sam Coutts and undergraduates Riki Cambridge, Tom Kitto and Tim Hastings provided all the mapping support. Roger May of Tomorrows Forests provided further mapping support and robust discussion.

Dr Shaun Ogilvie provided sage ecological advice and Shaun Cunningham provided excellent support on the habitat requirements of native fauna.

Thank you, Robin and Wairewa, for the privilege of working with you.

Thank you Ngā Pae o te Māramatanga for funding the research and providing ongoing support, aroha and encouragement.

References

. (2012), from <http://www.kawhia.maori.nz/healing-plants-1.html>

Ahuriri-Driscoll, A., Baker, V., Hepi, M., Hudson, M., Mika, C., & Tiakiwi, S. (2008). The future of rongoā Māori: Wellbeing and sustainability. A report for Te Kete Hauora, Ministry of Health Christchurch: Institute of Environmental Science and Research.

Athanasiadou, S., Kyriazakis, I., Jackson, F., & Coop, R. L. (2001). Direct anthelmintic effects of condensed tannins towards different gastrointestinal nematodes of sheep: in vitro and in vivo studies. *Vet Parasitol*, 99(3), 205-219.

Behura, N. C., Sahoo, N., & Satpathy, S. (2006). Antinematodal activity of pod hairs of *Mucuna prurita* in buffalo calves. *Indian Veterinary Journal*, 83(6), 673.

Brooker, S. G., Cambie, R. C., & Cooper, R. C. (1987). *New Zealand Medicinal Plants*. Auckland, New Zealand Heinemann.

Burrows, C. J. (1994). Fruit, seeds, birds and the forests of Banks Peninsula. *New Zealand Natural Sciences*, 21, 87-108.

Clayton, D. H., & Wolfe, N. D. (1993). The adaptive significance of self-medication. *Trends in Ecology & Evolution*, 8(2), 60-63. doi: 10.1016/0169-5347(93)90160-q

Durie, M. H. (1985). A Maori perspective of health. *Social Science & Medicine*, 20(5), 483-486. doi: 10.1016/0277-9536(85)90363-6

Durie, M. H. (2001). *Mauri Ora: The dynamics of Māori health*. Auckland New Zealand: Oxford University Press.

Egualé, T., Tadesse, D., & Giday, M. (2011). In vitro anthelmintic activity of crude extracts of five medicinal plants against egg-hatching and larval development of *Haemonchus contortus*. *Journal of Ethnopharmacology*, 137(1), 108-113. doi: 10.1016/j.jep.2011.04.063

Forsyth, D. M., Coomes, D. A., Nugent, G., & Hall, G. M. J. (2002). Diet and diet preferences of introduced ungulates (Order: Artiodactyla) in New Zealand. *New Zealand Journal of Zoology*, 29(4), 323-343. doi: 10.1080/03014223.2002.9518316

Fukuoka, M. (1978). *The one-straw revolution an introduction to natural farming* (C. Pearce, Trans.). USA: Rodale Press, Inc.

Gallagher, K. (Writer). (2009). *Earthwhisperers Papatuanuku*: WickCandle Film.

Githiori, J. B., Hoglund, J., Waller, P. J., & Baker, R. L. (2004). Evaluation of anthelmintic properties of some plants used as livestock dewormers against *Haemonchus contortus* infections in sheep. *Parasitology*, 129(Pt 2), 245-253.

Hordegen, P., Cabaret, J., Hertzberg, H., Langhans, W., & Maurer, V. (2006). In vitro screening of six anthelmintic plant products against larval *Haemonchus contortus* with a modified methyl-thiazolyl-tetrazolium reduction assay. *J Ethnopharmacol*.

Howard, A. (1940). *An Agricultural Testament*: Oxford University Press.

Huffman, M., & Seifu, M. (1989). Observations on the illness and consumption of a possibly medicinal plant *Vernonia amygdalina*, by a wild chimpanzee in the Mahale Mountains National Park, Tanzania. *Primates*, 30(1), 51-63. doi: 10.1007/bf02381210

Huffman, M. A. M. A. (2003). Animal self-medication and ethno-medicine: exploration and exploitation of the medicinal properties of plants. *The Proceedings of the Nutrition Society*, 62(2), 371-381.

Jones, R. (2000). Traditional Maori Healing. *Pacific Health Dialogue*, 7(1), 107-109.

Lambert, M. G., Trustrum, N. A., & Costall, D. A. (1984). Effect of soil slip erosion on seasonally dry Wairarapa hill pastures. *New Zealand Journal of Agricultural Research*, 27(1), 57-64.

Lans, C., & Brown, G. (1998). Ethnoveterinary medicines used for ruminants in Trinidad and Tobago. *Preventive Veterinary Medicine*, 35(3), 149-163. doi: 10.1016/s0167-5877(98)00066-x

Leopold, A. (1949). *A Sand County Almanac*. New York: Oxford University Press.

Litherland, A. J., Deighton, D. L., & Leathwick, D. M. (2008). An evaluation of anthelmintic properties, assessed using faecal nematode egg counts, of New Zealand native flax (*Phormium tenax*). *New Zealand Veterinary Journal*, 56, 339-342.

Macdonald, C. (1973). *Medicines of the Māori : from their trees, shrubs, and other plants, together with foods from the same sources*. Auckland, New Zealand: Collins.

Maddocks-Jennings, W., Wilkinson, J. M., Shillington, D., & Cavanagh, H. (2005). A fresh look at manuka and kanuka essential oils from New Zealand. *International Journal of Aromatherapy*, 15(3), 141-146. doi: 10.1016/j.ijat.2005.07.003

Mark, G. T., & Lyons, A. C. (2010). Māori healers' views on wellbeing: The importance of mind, body, spirit, family and land. *Social Science & Medicine*, 70(11), 1756-1764. doi: DOI: 10.1016/j.socscimed.2010.02.001

McGowan, R. (2009). *Rongoa Maori A practical guide to traditional Maori Medicine*. Tauranga New Zealand: Rob McGowan.

Mollison, B. (1978). *Permaculture One: A Perennial Agriculture for Human Settlements*: Transworld Publishers.

Nugent, G., Fraser, W., & Sweetapple, P. (2001). Top down or bottom up? Comparing the impacts of introduced arboreal possums and 'terrestrial' ruminants on native forests in New Zealand. *Biological Conservation*, 99(1), 65-79.

Pack, R. T., Tarboton, D. G., Goodwin, C. N., & (1998). *The SINMAP Approach to Terrain Stability Mapping*. Paper presented at the 8th Congress of the International Association of Engineering Geology, Vancouver, British Columbia, Canada.

Pere, R. (1997). *Te wheke: A celebration of infinite wisdom*. New Zealand: Ao Ake Global Learning Ltd.

Perry, N. B., Brennan, N. J., Van Klink, J. W., Harris, W., Douglas, M. H., McGimpsey, J. A., . . . Anderson, R. E. (1997). Essential oils from New Zealand manuka and kanuka: Chemotaxonomy of *Leptospermum*. *Phytochemistry*, 44(8), 1485-1494. doi: 10.1016/s0031-9422(96)00743-1

Pieroni, A., Howard, P., Volpato, G., & Santoro, R. F. (2004). Natural Remedies and Nutraceuticals Used in Ethnoveterinary Practices in Inland Southern Italy. *Veterinary Research Communications*, 28(1), 55-80. doi: 10.1023/B:VERC.0000009535.96676.eb

Porter, N. G., & Wilkins, A. L. (1998). Chemical, physical and antimicrobial properties of essential oils of *Leptospermum scoparium* and *Kunzea ericoides*. *Phytochemistry*, 50(3), 407-415. doi: 10.1016/s0031-9422(98)00548-2

Riley, M. (1994). *Māori Healing and Herbal - New Zealand ethnobotanical sourcebook*. Paraparaumu: Viking Sevenses NZ Ltd. .

Sharma, P. K., & Singh, V. (1989). Ethnobotanical studies in NorthWest AND Trans-Himalaya. V. Ethno-veterinary medicinal plants used in Jammu and Kashmir, India. *Journal of Ethnopharmacology*, 27(1-2), 63-70. doi: 10.1016/0378-8741(89)90078-0

Tribunal, W. (2011). *Ki Aotearoa Tēnei-Factsheet 8 Rongoā (Traditional Māori Healing)*. Wellington New Zealand: Watangi Tribunal Retrieved from www.waitangitribunal.govt.nz.

Vatta, A. F., Kandu-Lelo, C., Ademola, I. O., & Eloff, J. N. (2011). Direct anthelmintic effects of *Cereus jamacaru* (Cactaceae) on trichostrongylid nematodes of sheep: In vivo studies. *Veterinary Parasitology*, 180(3-4), 279-286. doi: 10.1016/j.vetpar.2011.03.025

Villalba, J. J., Provenza, F. D., & Shaw, R. (2006). Sheep self-medicate when challenged with illness-inducing foods. *Animal Behaviour*, 71(5), 1131-1139. doi: 10.1016/j.anbehav.2005.09.012

Walker, H. (2006, 30 November 2006). kuia learns to kick up her feet, *The Daily Post*.

Williams, P. M. (1996). *Te Rongoa Maori Maori Traditional Medicine*. New Zealand: Reed Publishing.

Wilson, H. (2009). *Natural History of Banks Peninsula* (First ed.). Christchurch New Zealand: Canterbury University Press.

Wilson, K. (2003). Therapeutic landscapes and First Nations peoples: an exploration of culture, health and place. *Health & Place*, 9(2), 83-93. doi: 10.1016/s1353-8292(02)00016-3

Appendices

Appendix One Initial species selection for Rongoā plantings on Te Putahi

Scientific name	Māori or common name	Action	Growth form
<i>Acaena anserinifolia</i>	Piripiri, Bidybid	Tonic	Herbaceous
<i>Alectryon excelsus</i>	Titoki, New Zealand Ash	Chest TB	Tree/shrub
<i>Amygdalus persica</i>	Pīiti, Peach	Tonic	Tree/shrub
<i>Apium prostratum</i>	Tūtae kōau, wild celery	Tonic	Herbaceous
<i>Aristotelia serrata</i>	Makomako, Wine berry	Tonic	Tree/shrub
<i>Barbarea vulgaris</i>	Toi, Winter cress	Tonic	Herbaceous
<i>Brassica campestris</i>	Nanī, Keha Maori turnip	Tonic	Herbaceous
<i>Brassica oleracea</i>	Kāpeti Māori cabbage	Tonic	Herbaceous
<i>Brassica rapa</i>	Pōhata, Wild turnip	Tonic	Herbaceous
<i>Calystegia sepium</i> , <i>C. Soldanella</i>	Pōhue, Pōhuehue, Pōpōhue, Panahi, Rauparaha Bindweed	Lactation, Scour	Climber
<i>Cardamine debilis</i>	Panapana, NZ bitter cress	Tonic, Scour	Herbaceous
<i>Chenopodium album</i>	Huainanga, Huainga Fat-hen,	Tonic, antiparasitic	Herbaceous
<i>Coprosma acerosa</i>	Tātaraheke, Tarakupenga Sand coprosma	Tonic	Tree/shrub
<i>Coprosma robusta</i>	Karamū	Tonic	Tree/shrub
<i>Cordyline australis</i>	Ti kōuka, Cabbage tree	Tonic, Scour Lactation	Tree/shrub
<i>Corynocarpus laevigatus</i>	Karaka	Wounds	Tree/shrub
<i>Cortaderia spp.</i>	Toetoe Haumatangi	Scour, Styptic Antiparasitic	Herbaceous
<i>Dacrycarpus dacrydioides</i>	Kahikatea, White pine	Tonic,	Tree/shrub
<i>Elaeocarpus hookerianus</i>	Pōkākā White hinau	Tonic, Scour	Tree/shrub
<i>Eucalyptus globulus</i>	Purukamu, Blue gum	Scour, Chest, Wounds	Tree/shrub
<i>Gaultheria antipoda</i>	Pāpapa, Korupuka, Snowberry	Lactation	Tree/shrub
<i>Geum urbanum</i>	Kopata Common avens, Herb Bennett	Scour	Herbaceous
<i>Geranium microphyllum</i>	Namunamu Small leaved geranium native cranesbill	Chest, TB	Herbaceous
<i>Gnaphalium keriense</i> , <i>Gnaphalium luteo-album</i>	Puatea, Pukatea Cudweed	Scour	Herbaceous
<i>Hebe strictissima</i>	Koromiko Banks peninsula koromiko	Tonic, Scour, Wounds	Tree/shrub
<i>Hierochloa redolens</i>	Kāretu, Scented, Holy grass	Fungicide	Herbaceous
<i>Hoheria populnea</i> <i>Hoheria angustifolia</i>	Hōhere Lacebark Houhi Narrow leaved lacebark	Chest	Tree/shrub
<i>Kunzea ericoides</i>	Kanuka	Scour	Tree/shrub
<i>Lepidium oleraceum</i>	Nau, Heketara, Cooks scurvy grass	Tonic	Herbaceous
<i>Leptospermum scoparium</i>	Mānuka	Scour	Tree/shrub

Appendix One continued **Initial species selection for Rongoā plantings on Te Putahi**

Scientific name	Māori or common name	Action	Growth form
<i>Lophomyrtus obcordata</i>	Rōhutu NZ myrtle	Scour, Wounds	Tree/shrub
<i>Macropiper excelsum</i>	Kawakawa, Pepper tree	Tonic, Antiparasitic, Chest, Wounds	Tree/shrub
<i>Melicytus ramiflorus</i>	Māhoe Hinahina Cowleaf Whiteywood	Tonic	Tree/shrub
<i>Myrsine australis</i>	Māpou Red Matipo	Antiparasitic	Tree/shrub
<i>Nasturtium officianale</i>	Kōwhitiwhiti, Wātakirihi, Watercress	Tonic	Herbaceous
<i>Pelargonium inodorum</i>	Kopata, scentless pelargonium	Scour	Herbaceous
<i>Phormium tenax</i>	Harakeke, NZ flax	Tonic, Fungicide, Antiparasitic, Styptic	Herbaceous
<i>Pittosporum eugenioides</i>	Tarata Lemonwood	Chest, Wounds	Tree/shrub
<i>Plantago spp.</i>	Kopakopa, Pārerarera Plantain	Tonic	Herbaceous
<i>Pneumatopteris pennigera</i>	Piupiu feather fern Pakau, gully fern	Antiparasitic	Fern
<i>Podocarpus totara</i>	Tōtara	Tonic, Wounds (splints)	Tree/shrub
<i>Prumnopitys ferruginea</i>	Miro	Styptic, Antiparasitic, Wounds	Tree/shrub
<i>Pseudopanax crassifolius</i>	Horoeka, Lancewood	Scour	Tree/shrub
<i>Pseudowintera colorata</i>	Horopito, Pepper wood	Tonic, Scour, Fungicide, Wounds	Tree/shrub
<i>Pseudopanax edgerleyi</i>	Raukawa	Antiparasitic	Tree/shrub
<i>Ripogonum scandens</i>	Kareao, Supplejack	Tonic, Antiparasitic, Wounds	Climber
<i>Rorippa palustris</i>	Hanea, Ponui, Marsh cress	Tonic	Herbaceous
<i>Rubus cissoides</i>	Tarāmoa, tātarāmoa Bush lawyer	Scour, Antiparasitic, Chest	Climber
<i>Salix babylonica</i>	Whiro ,Weeping willow	Tonic	Tree/shrub
<i>Schefflera digitata</i>	Patē Seven finger	Fungicide	Tree/Shrub
<i>Sonchus olearus</i>	Puha, sow thistle	Tonic, Wounds	Herbaceous
<i>Taraxacum magellanicum</i>	Tohetaka, Tohetake, NZ dandelion	Tonic	Herbaceous

Appendix Two **Native plants that can be grown on Banks Peninsula to support the fauna which Wairewa wish to see back on Te Putahi farm**

Scientific name	Māori and common name	Native fauna that is particularly dependent upon this plant
<i>Alectryon excelsus</i>	Titoki	kereru, tūi
<i>Aristolelia fruticosa</i>	Shrubby wine-berry	tūi
<i>Aristolelia serrata</i>	Makomako, Wineberry	kereru, tūi
<i>Carpodetus serratus</i>	Putaputāwētā, Marbleleaf	tūi
<i>Coprosma areolata</i>	Mikimiki, Thin leaved coprosma	tūi
<i>Coprosma crassifolia</i>	Mikimiki, Thick leaved coprosma	tūi
<i>Coprosma lucida</i>	Karamū	kereru, tūi, fantail
<i>Coprosma propinqua</i>	Mikimiki	tūi, gecko
<i>Coprosma rhamnoides</i>	Mikimiki	kereru
<i>Coprosma rigida</i>	Rigid mikimiki	tūi
<i>Coprosma robusta</i>	Karamū	kereru, tūi, fantail
<i>Coprosma rotundifolia</i>	Round leafed mikimiki	tūi
<i>Coprosma rubra</i>	Mikimiki	tūi
<i>Coprosma virescens</i>	Mikimiki, Green coprosma	tūi
<i>Coprosma wallii</i>	Mikimiki	tūi
<i>Cordyline australis</i>	Ti kōuka, Cabbage tree	kereru, tūi
<i>Coriaria arborea</i>	Tree tutu	fantail
<i>Corokia cotoneaster</i>	Korokio, wire netting bush	Kereru, tūi
<i>Dacrycarpus dacrydioides</i>	Kahikatea	Kereru, tūi
<i>Discaria toumatou</i>	Tūmatakuru, Matagouri	gecko
<i>Elaeocarpus hookerianus</i>	Pōkākā	tūi
<i>Fuchsia excorticata</i>	Kōtukutuku , Fuchsia	kereru, tūi
<i>Fuchsia perscandens</i>	Climbing fuchsia	tūi
<i>Griselinia littoralis</i>	Kāpuka, Broad leaf	kereru, tūi
<i>Griselinia lucida</i>	Puka or shining broadleaf	tūi
<i>Hedycarya arborea</i>	Porokaiwhiri, Pigeonwood	kereru
<i>Ileostylus micranthus</i>	Pirita, Green mistletoe	tūi
<i>Kunzea ericoides</i>	Kānuka	kereru, shining cuckoo, gecko
<i>Leptospermum scoparium</i>	Mānuka	shining cuckoo, gecko
<i>Lophomyrtus obcordata</i>	Rōhutu, Native myrtle	kereru, tūi
<i>Macropiper excelsum</i>	Kawakawa, Pepper tree	kereru, tūi, fantail
<i>Melicytus ramiflorus</i>	Māhoe, Whiteywood	kereru, tūi, fantail
<i>Metrosideros diffusa</i>	Akatea, White climbing rata	tūi
<i>Muehlenbeckia australis</i>	Pōhuehue	kereru, tūi, gecko
<i>Myoporum laetum</i>	Ngaio	kereru
<i>Myrsine australis</i>	Māpou. Red matipo	tūi
<i>Passiflora tetrandra</i>	Kohia, native passion vine	tūi
<i>Pennantia corymbosa</i>	Kaikōmako	kereru, tūi
<i>Phormium tenax</i>	Harakeke, Flax	tūi
<i>Pittosporum eugenioides</i>	Tarata, Lemonwood	tūi
<i>Pittosporum tenuifolium</i>	Kōhūhū, Black matipo	tūi
<i>Plagianthus regius</i>	Mānatu , Ribbonwood	kereru
<i>Podocarpus totara</i>	Tōtara	kereru, tūi, gecko

Appendix Two continued **Native plants that can be grown on Banks Peninsula to support the fauna which Wairewa wish to see back on Te Putahi farm**

Scientific name	Māori and common name	Native fauna that is particularly dependent upon this plant
<i>Prumnopitys taxifolia</i>	Mataī	kereru, tūi
<i>Pseudopanax arboreus</i>	Whauwhaupaku, Five finger	kereru, tūi
<i>Pseudopanax colensoi</i>	Orihou, Mountain five finger	tūi
<i>Pseudopanax ferox</i>	Fierce lancewood	tūi
<i>Pseudowintera colorata</i>	Horopito, Pepperwood	kereru, tūi
<i>Ripogonum scandens</i>	Kareao, Supplejack	kereru, tūi
<i>Schefflera digitata</i>	Patē, Seven finger	kereru, tūi
<i>Senecio minimus</i>	Fireweed, Native groundsel	shining cuckoo
<i>Solanum aviculare;</i>	Northern Poroporo	kereru
<i>Solanum laciniatum</i>	Poroporo	kereru
<i>Sophora microphylla</i>	Kōwhai	kereru, tūi