

Motutapu Restoration Plan Audit

September 2010

Helen Lindsay

DOCDM-645843

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Purpose

The purpose of this document is to review what has been achieved to date on the ecological restoration objectives of the Motutapu Restoration Working Plan (Hawley 1993) and to make recommendations to guide the next stage of the project. Chapter 1 outlines the achievements and Chapter 2 contains recommendations for the future.

Introduction

The Motutapu Restoration Working Plan was developed by the Auckland Conservancy of the Department of Conservation (DOC) in consultation with Ngai Tai ki Tangaki Trust and other interested groups and was endorsed by the Auckland Conservation Board in 1994. It contains objectives for the cultural, historic and ecological restoration of Motutapu.

The restoration of Motutapu is a large and complex project the goals of which may take generations to achieve. The restoration working plan was intended to give direction for the first five years of the project up to 1998 and has not been updated since, with the exception of an addendum dated June 1997 arising from an Evaluation of Progress in December 1996. However restoration work has continued on the basis of the objectives outlined in the plan which are still relevant.

Several stakeholders have direct interests on Motutapu - Ngai Tai, Ngati Paoa and Ngati Whatua tangata whenua, Department of Conservation (DOC), Motutapu Restoration Trust (MRT) which was established to support the restoration, Motutapu Farms Ltd (MFL) which holds the farming lease and has provided substantial financial assistance to the restoration work, Motutapu Outdoor Education Camp (MOEC) which holds a concession to run outdoor education programmes on the island, Fullers Ferries Ltd who operate ferry services to the island and the Rotary Club of Newmarket which has provided substantial resources for activities on the island. All of these groups have a role to play in achieving the objectives of the restoration plan.

The restoration project was initially managed by DOC staff on the island with financial support from MRT. However significant changes within the Department over the past ten years have resulted in MRT taking on more responsibilities including managing the revegetation programme and undertaking restoration of historic sites, though they remain in close association with DOC.

This audit reviews the achievements of the ecological restoration programme to date and makes recommendations to guide those ecological restoration activities currently being carried out. This audit is thus an interim review of just the ecological components until a wider update of the complete restoration plan can be undertaken. The recommendations made in this audit focus on the next five years, but take a 20 or 30 year view on the direction that restoration could take. A re-write of the restoration working plan is recommended to develop these recommendations into action plans.

Acknowledgements

This document has been prepared with the assistance of MRT members and DOC staff in particular Bridget Winston (MRT) Belinda Vernon (MRT) Russell Greenwood (MRT) Shane Wright (MRT) Claire Warren (MRT) Rick Braddock (MRT) Phil Brown (DOC), Steve Benham (DOC) and also Dave Towns, Richard Griffiths, Hazel Speed, Nick Turoa from DOC, John Duggan and Rick Braddock from Motutapu Farms Ltd and Laurie Beamish and James Brown from Ngai Tai.

Context

The conservation management strategy for Auckland (CMS) has been under review and is currently in draft. In this document Rangitoto and Motutapu are treated as one management unit. The draft management objectives for Rangitoto and Motutapu are as follows:

1. To maintain the ecological integrity of the Rangitoto Ecological District.
2. To protect the rural open space landscape of Motutapu through an appropriate grazing regime.
3. To continue to develop a restored landscape and habitat mosaic on Motutapu through an integrated programme for the protection of archaeological sites, appropriate revegetation and the reintroduction of native species.
4. To remove the last seven mammalian pest species from Motutapu and Rangitoto Island and maintain the pest-free status of the islands.
5. To research the effect of seasonal apiaries on Rangitoto Island's ecosystem.
6. To protect, in public ownership, representative examples of the Rangitoto baches.
7. To identify and enable further visitor opportunities on Motutapu and Rangitoto Island to allow for higher visitor numbers and enhanced visitor enjoyment of the islands. Further visitor opportunities should promote an understanding of the natural, historical and cultural values of the islands.
8. To provide for a limited range of public accommodation on Motutapu from camp site(s) to lodge(s) to encourage the public appreciation and enjoyment of the island.
9. To promote and support the operation of the Motutapu Outdoor Education Camp to enable the maintenance of the historic military complex, and as an opportunity to develop outdoor recreation appreciation.
10. To consider further opportunities for conservation and/or outdoor recreation education and appreciation on Motutapu, where these opportunities are complementary to existing outdoor education facilities and the preservation of the historic military complex at Administration Bay.
11. To have regard to Motutapu when making management decisions for Rangitoto Island, and vice versa.

In March 2009 a report was written for the Auckland Area Office of DOC by Tourism Resources Ltd outlining issues and options for Rangitoto and Motutapu. The recommendations in this audit do not compromise any of the options that are suggested in that report.

A major animal pest eradication programme was started on Rangitoto and Motutapu in 2009 and although the islands have not yet been declared pest free indications are that this eradication has been successful. The removal of the last seven animal pest species is a major contribution to the restoration and will have a positive impact on the health of ecosystems on the islands. However it also creates other management issues, for example more resources will need to be allocated to biosecurity to prevent reintroductions of these and other pests.

Farming on Motutapu is currently being carried out under a management agreement between DOC and MFL. DOC is reviewing how grazing on the island should continue to be carried out.

Chapter 1

Achievements of the Ecological Restoration Programme

The initial ecological restoration work on Motutapu involved the establishment of a nursery on the island in order to propagate native plants of species that were present on the island after the Rangitoto eruption. The objectives for this planting stated in the Motutapu Restoration Working Plan were:

1. To complement the drainage pattern, linking the coastal vegetation via the gullies and stream beds inland to upper catchments.
2. To emphasise the undulating landform and retain the predominantly open ridge character of the island
3. To facilitate ready access and views out to the Gulf
4. To provide a framework of natural habitats to the pasture whilst carefully avoiding the archaeological sites.
5. To establish blocks of forest to provide a variety of habitats for the future introduction of fauna.

Underlying these objectives was the principle that "any activities to enhance the ecological values of Motutapu must complement the indigenous character and future values of Rangitoto."

The programme was initially managed by rangers who were resident on the island. They were firstly employed by the Trust and then later by DOC. Their role was to grow the plants for the revegetation programme, manage the weed control programme and organize community participation in partnership with the Motutapu Restoration Trust. The role of MRT was primarily to raise the funds required for the restoration programme.

This regime was in place for the first nine years of the project (1994 to 2002 inclusive) and in that time the following was achieved:

- MRT was established
- A nursery was constructed adjacent to the schoolhouse at Gardiner Gap
- Large numbers of volunteers participated in nursery work and tree planting
- 208,000 plants were propagated and planted over 42 hectares primarily in paddocks 14 and 63 but also at Waikarapupu, Station Bay, Mullet Bay, Remnant 18 (1993), Bell South (now Vodafone) site, Remnant 19 (Panmure) and Billy Goat Pt remnants
- Mullet Bay, Panmure and Waikarapupu were adopted by Rotary groups.
- A weed control strategy was prepared and implemented
- Pohutukawa were planted (at 8 metre spacings) on the coastal headlands at Mullet Bay, Waikarapupu, in Bush Remnant 5 and at Station Bay
- Small plantings were carried out at Billy Goat Point
- A vehicle (Gator - ATV) was purchased to assist the revegetation work
- Fences were installed or upgraded to facilitate the planting programme and to protect forest remnants, wetlands and some realignment of fencing was carried out.
- Photopoint monitoring sites were set up
- Local control of rabbits was carried out
- MRT raised funds to carry out much of this work

In 2002 the DOC rangers left the island and were not replaced. A new chairman and five new trustees of MRT were appointed. A group of keen regular volunteers undertook to assist MRT to manage the propagation, planting and weeding programme. These trustees and volunteers took over supervision of the volunteer planting days and full management of the ecological restoration programme from 2003. MRT has continued propagation of between 15,000 and 28,000 plants annually and have also achieved the following in the eight years from 2003 to 2010:

Planting

- Propagated and planted approximately 144,000 trees and shrubs.
- Completed planting of paddock 63
- Completed planting of Panmure site
- Completed planting paddock 7 at Mullet Bay in association with Rotary Club of Newmarket
- Continued planting at Waikarapupu Bay with Downtown Rotary Club
- Infilled previously planted areas of paddock 14 with canopy species by a small group of key volunteers
- Some pioneer species were planted in Central Gully to assist with shading of weeds
- Planted Hospital paddocks A and B including the wetlands at the bottom of these paddocks.
- Planted half of Lower Watershed paddock

Fencing

- Installed electric fence around bush remnant 13 (Mullet Bay north and south sides)
- Installed electric fence to divide Hospital Paddock on western side from Lower Watershed paddock.
- Installed electric fence along western side of paddocks 14 and 63
- Installed fence around Central Gully and smaller wetland between paddocks 40 and 41 (Trev's Pond)
- Re-aligned fence on southern side of Central Gully/Home Bay Road
- Repaired fence in remnant 5
- Installed new fencing around nursery
- Assisted with fencing at Rakino wetland

Weed control

- Carried out extensive annual grid searching in core planted areas of Paddocks 14 and 63) and random ('search and destroy') weed control in bush remnants (Woolshed plot, Trev's Pond, Rakino wetland, Mullet Bay, Panmure site, Remnant 18, Vodafone site, Station Bay, MCEC, Remnant Bush 5). Hundreds of sacks of moth plant pods were removed each year and other invasive weeds such as woolly nightshade, evergreen buckthorn, inkweed, gorse, apple of Sodom, wattle seedlings, Moreton Bay fig, olive and privet also controlled.
- Eliminated thickets of apple of Sodom and gorse with the help of MFL
- Carried out follow up control after contractors controlled moth plant in Central Gully
- Raised funds for weed control at Sandy Bay
- Assisted DOC with control of evergreen buckthorn at Islington Bay cliffs

Nursery

- Refurbished the shade house
- Installed two toilets
- Installed an additional water tank
- Converted tennis court to standing out area with wind protection and irrigation system
- Purchased new equipment for nursery (trolleys, root trainer baskets, tubes, planter bags, seed trays and lawnmower)

Wildlife monitoring

- Organised three pre-eradication bird surveys (OSNZ)
- Organised one invertebrate survey
- Funded one pre-eradication reptile survey (with DOC funding subsequent surveys)
- DOC funded fish surveys

Other infrastructure

- Converted School House at Gardiner Gap to volunteer accommodation
- Purchased two trucks and ATV with tray for transport around the island
- Repaired the Red Barn to be used as volunteer base at Home Bay sponsored by the Rotary Club of Newmarket
- Raised funds and restored the Reid Homestead
- Raised funds and restored the Home Bay Wharf
- Developed Walk Motutapu network of tracks with the Rotary Club of Newmarket
- Established the Rotary Centennial Track through the Home Bay planting sponsored by the Rotary Club of Newmarket

Community involvement

- Database of volunteers, Friends and supporters more than doubled from 700 to 1600
- Increased number of public volunteer days to twice monthly all year round
- Averaged 20-30 volunteers per working day in summer (nursery and weed control) and 40-100 in winter (planting and weed control)
- Developed a programme for corporate groups to participate in mid week working days
- Upgraded newsletter to use as recruitment tool and communication device
- Established a website in 2003 which was updated in 2009
- Expanded the number and range of sponsors
- Established the 'Friends of Motutapu' in 2003
- Maintained participation of schools on weekends
- Produced brochure plus map for Walk Motutapu
- Installed signage for walkway at Gardiner Gap, Home Bay and at the top of the Rotary Centennial Track (Northern Junction) sponsored by Rotary Club of Newmarket. Smaller signs were also erected at Mullet Bay, Station Bay, Waikarapupu and Sandy Bays
- Developed the "The Dual" sports event in partnership with Total Sports Ltd
- Hold annual night out for volunteers with "awards"
- MRT Trustees drawn from a broad community base including other island stakeholders

Advocacy

- Presentations made to many groups about the project
- Established an annual heritage tour as part of the Auckland City Council Heritage Festival
- Educated volunteers on restoration techniques (plant propagation, planting and weed control)

It must be noted that MRT carries out a broad range of tasks including historical, cultural, ecological and recreational activities. The above achievements only concern the ecological restoration activities involving community participation.

It is clear from these achievements that major progress has been made on the ecological restoration objectives listed in the Restoration Working Plan, in particular the revegetation programmes. MRT has been successful in attracting significant community participation and it is this community interest, the partnership with DOC and the dedication of individual volunteers that has enabled this progress. MRT members have a strong commitment to the project and include a team of hard working volunteers with high capability.

In reviewing the list of objectives in the Motutapu Restoration Working Plan, 60% of the ecological restoration activities have been achieved and 36% of the community participation activities have been achieved. which would appear not to support this progress. However when the activities are analysed the objectives not reached in ecological restoration activities are mostly fencing of wetlands, allocation of management areas to groups, schools participation and the removal of exotic shelter belts. The objectives not reached on the community participation mostly concern interpretation and MOEC involvement. The only objectives listed for weed control were to write and implement a weed control strategy and to carry out spray trials both of which were done. However although weed control has become a major activity for MRT in order to protect their plantings, there were no objectives for weed control operations listed in the strategy. Therefore the achievements on weed control go far beyond the objectives listed.

Fencing of wetlands -

The planting of the Home Bay catchment and the weed control associated with this have occupied the majority of the volunteer work carried out. Because of this focus, it has not been possible to consider taking on the management of any other areas which would fragment the work and involve difficulties with transport. MRT does not want to fence off any area that it does not have the capacity to manage because of the threat of weed invasion.

Allocation of management areas to groups and schools -

Rotary clubs have taken on several areas to plant but this is the extent of these activities. School groups generally need to have weekday trips, which are difficult to accommodate due to the timing of transport to the island (to fit in with the school day), the cost of travel to the island and fewer volunteers available to supervise mid week days. Some schools participate in weekend trips but a higher level of school participation is not anticipated. Schools played a significant role in the planting on Tiriti Matangi Island but the difference there was that there was a full time DOC ranger managing the project. The Trust has found that the allocation of management areas to groups is not a satisfactory form of management due to groups dissolving, the profile of groups changing (eg age), the isolation of areas separate from the core planting areas generates logistical issues (moving people, plants around the island). Groups also tend to be interested in planting rather than weed control and interest wanes after the planting has been completed. MRT now encourages groups to adopt the project as a whole rather than a slice of it.

Removal of exotic shelter belts -

These objectives have not been prioritised by MRT, the farm or DOC and have not been achieved.

Interpretation -

18% of the community participation objectives concerned interpretation and only 1% of these interpretation objectives have been achieved. A significant part of the interpretation relates to the cultural history component of the project which is not covered by this audit. Interpretation signs relating to the overall project have been installed as part of the Walk Motutapu initiative. Interpretation signs relating to the gun emplacements have been installed. The Walk Motutapu brochure includes a broad overview of the restoration project.

MOEC involvement -

It was anticipated that MOEC would take responsibility for certain areas to plant and would get involved in monitoring. However with the exception of a small area of paddock 9 planted at Administration Bay MOEC's involvement has not been as high as expected.

Planting objectives -

95% of the original planting objectives in the Restoration Working Plan have been met the other 5% being the remainder of paddock 63 to the east of the road. However other sites have also been added to the original area.

Planting programme

The ecological restoration programme has concentrated to date mainly on the establishment of a dense native shrubland of pioneer species to commence the transition from pasture to forest. To date approximately 71 hectares of pasture has been converted to shrubland and a comprehensive weed control programme has been undertaken to protect these plantings from the effects of invasive weeds which are widespread on the island.

Pioneer plants were used to create this shrubland, a large component of these being manuka, kanuka and karamu which are effective in providing the shade required to eliminate grass and pasture species. These pioneer species were selected for their hardiness to the very exposed conditions and their ability to survive drought and included the following:

<i>Kunzea ericoides</i>	Kanuka
<i>Leptospermum scoparium</i>	Manuka
<i>Coprosma robusta</i>	Karamu
<i>Coprosma repens</i>	Taupata
<i>Cordylina australis</i>	Ti kouka (cabbage tree)
<i>Phormium tenax</i>	Harakeke (flax)
<i>Myoporum laetum</i>	Ngaio
<i>Metrosideros excelsa</i>	Pohutukawa
<i>Pseudopanax lessonii</i>	Houpara
<i>Pseudopanax arboreus</i>	Whauwhaupaku (five finger)
<i>Entelea arborescens</i>	Whau
<i>Pittosporum classifolium</i>	Karo
<i>Myrsine australis</i>	Mapou
<i>Dodonaea viscosa</i>	Akeake
<i>Podocarpus totara</i>	Totara
<i>Knightia excelsa</i>	Rewarewa

Recent vegetation survey work conducted by the Auckland Regional Council in the revegetated areas at Home Bay and Panmure sites showed the existing pioneer stands are dominated by manuka, kanuka and karamu. Where canopy closure has been achieved this method has been successful in shading out the pasture grass but there is still a large amount of grass present where the canopy is thin and there are light gaps, and the deep leaf litter required for a healthy forest ecosystem is slow to establish.

Recently MRT has decided to change the pioneer species mix, eliminating manuka and akeake and including more broadleaf species in the pioneer stands by the addition of the following species:

<i>Meliccytus ramiflorus</i>	Mahoe
<i>Pittosporum eugenioides</i>	Tarata
<i>Pittosporum tenuifolium</i>	Kohuhu
<i>Melicope ternata</i>	Wharangi
<i>Plagianthus regius</i>	Manatu (ribbonwood)

The reason for this change is to speed up the succession to a more complex forest. It is intended to promote species that will 'crown out' and shade out pasture grasses and weeds more quickly, as well as for enrichment of the leaf litter. Another benefit is to reduce the fire risk. It is proposed to grow plants to a larger size before planting out which it is suggested will increase the survival rate and reduce the number of plants per hectare therefore making the planting more efficient. A greater diversity of canopy species will also be planted within established plantings to provide more food sources for animal life (see appendix 1 for details of this plan).

This method requires a significant change in the way the plants are grown including the use of PB3 bags instead of root trainers and at present this is being done on a trial basis. This method will use more potting mix per plant (although not proportionately as fewer but larger plants will be propagated) and require a larger standing out area in the nursery. The nursery is to be expanded and upgraded, which will facilitate this. It is expected that if this method is implemented long term that the area of planting can be increased from approximately four hectares per annum in recent years to eight hectares per annum therefore speeding up pasture conversion.

The pioneer species planted have been sourced from both Motutapu and Rangitoto. Canopy species that have remnant population on Motutapu are also a source of seed for the second succession phase and are already naturally regenerating in the shrubland. Some canopy species have also been planted among the existing shrubland once it reached about five years old with seed sourced from these remnants and also from Waiheke. However the species diversity in the Motutapu forest remnants is very low and it will be necessary to introduce a variety of other plant species in order to reconstruct a natural forest succession containing all tier levels and the diversity required to support the components of a functioning forest ecosystem.

The Restoration Working Plan outlines the areas to be planted in the first five years of the project all of which are now in shrubland with the exception of the section of Paddock 63 to the east of the road, and with the addition of some smaller planted areas to enhance and buffer naturally regenerating sites. It has taken longer than appears to have been anticipated to plant these areas. The main factors contributing to this were the closure of the Home Bay wharf from 1995 to 2007 (and the resulting logistical issues with moving volunteers to planting sites) and lower nursery production in some years due to water supply issues (irrigation failures).

Apart from providing a numbering sequence of catchments the Restoration Working Plan does not indicate precisely the extent of planting over the longer term. MRT prepared and adopted a 'Ten Year Plan' in consultation with DOC and the farm to identify the areas to be planted over the period from 2005 to 2015. To facilitate planning processes, MRT requires certainty as to where plantings should be concentrated in future and in what sequence, and what species are appropriate to comprise the later phases of the plant succession leading to a mature forest. It is also important for MFL to be aware of where pasture will be retired for planting in the long term so that investment is not wasted on improving pasture in these areas.

Weed control

There are several very invasive weed species established on Motutapu which require constant control to prevent them from spreading and suppressing forest regeneration. The most significant of these are moth plant (*Araujia hortorum*) and evergreen buckthorn (*Rhamnus alaternus*). Mature moth plants were present in Central Gully during the early phase of the adjacent planting programme with wind dispersed seed blowing across the paddocks being planted. Large numbers of this weed therefore established in the disturbed ground among the native plantings. It appears that in the early days of the programme the impact of this weed was not fully appreciated and only subsequent experience has shown how difficult it is to manage. An enormous effort has been put in by volunteers to control this plant and thousands of seed pods have been collected each year, together with the control of thousands of seedlings and cutting and control of mature vines.

Contractors were funded by MRT and managed by DOC to remove the large moth plant infestation in Central Gully, which reduced the seed source. Contractors and MRT volunteers have carried out follow up work to prevent re-establishment. The aim of control is to prevent plants from reaching seeding stage particularly among the native plantings and substantial progress has been made on this. However the area under control is so large this is a very difficult task with the resources available. Despite many volunteer hours of grid searching and control, some plants continue to produce seed in the plantings and there is a constant threat of reinvasion from other areas on the island where control is not undertaken. Records from the Tiritiri Matangi Island weed control programme show that the seed of this species can last at least eight years in the soil, and probably longer so this will be an ongoing task for many years.

Large infestations of apple of Sodom (*Solanum linnaeanum*) were present in several of the paddocks where planting took place. Volunteers also spent many hours controlling this weed and were given substantial help from MFL with this task.

Evergreen buckthorn, woolly nightshade (*Solanum mauritianum*) and other invasive weeds are also present but in lesser numbers in the planted forest and are controlled as part of the grid search programme, however these species are in large numbers on coastal cliffs. Occasional work has been done on these coastal infestations but there are generally no resources for this. The proximity of the island to urban Auckland which is a constant source of weed invasion means that the threat of new species arriving is always present.

The size of the area to be managed is an ongoing issue for MRT as the capacity of the volunteers to carry out effective weed control over such a large area is limited. Each year this area increases in size by the area planted which means that the amount of time required for the control of weeds also increases.

Programme support

MRT members have a good working relationship with DOC staff at the Auckland Area Office. DOC staff regularly attend MRT technical committee meetings and provide technical advice. Logistic assistance is provided by DOC island staff if required, although this requirement has reduced after the purchase of two used trucks by MRT for volunteer transport.

MRT has been successful from time to time in raising funds to pay contractors to carry out tasks such as weed control and fencing and DOC staff have assisted with management of contractors working on these projects.

A potential issue for MRT is access to ongoing technical skills. Although DOC staff are extremely helpful they have limited time to give and there are many issues that require ecological knowledge to manage. It is not always easy to recruit skilled volunteers and even if volunteers are trained they do not always stay involved long term.

Partnerships

Overall relationships with other stakeholders are positive and working well but there are a number of issues that if addressed would improve the efficiency of the restoration activities

Role definition - There has been some confusion over roles between DOC and MRT, with MRT being at times unsure of the extent of their responsibilities. For example MRT currently does not have the capacity to control all the weeds on the island but feel that not controlling these will result in re-infestation of the areas that they have been clearing. This has caused the work to become a little scattered as the volunteers attempt to control areas beyond the main plantings to prevent this re-infestation. The size of the island means that access to more remote areas is always difficult and the travelling time required limits the amount of time that can be spent on the work. The issue for MRT is how much they are expected to take on and how to make decisions about priorities.

Integration of island activities - there are opportunities to improve integration of island activities to improve efficiency and expand the capacity of all the stakeholders to contribute to the objectives of the restoration plan. There has been a tendency to approach activities in isolation from each other. The farming operation, although its stated purpose is primarily to provide a grazing regime for preserving archaeological sites, is currently being managed as a commercial operation and therefore the management decisions that are made are not always in support of conservation objectives. However a profitable farming operation and conservation objectives are not mutually exclusive. MOEC have facilities set up for education and could include conservation but concentrate mainly on outdoor education activities. Archaeological sites have been identified within the planting areas but no attempt has been made to manage them in conjunction with the planting programme. These sites have simply been avoided and left as gaps in the forest cover which is detrimental to both the appearance of the sites and to the integrity of the forest. All the restoration objectives would be better served by a more integrated approach.

Current activities

Restoration activities continue with public trips for volunteers organised every second weekend which involve mainly planting and weed control in winter and nursery work and weed control in summer. These trips have typically between 20 and 60 participants but some planting days can have more than 100 participants. These volunteer days, particularly the planting days, are extremely valuable in maintaining community involvement and for the recruitment of new volunteers who may want to develop greater participation in the project.

MRT has several full time volunteers who manage the nursery, supervise and participate in the planting days and weed control activities, write newsletters and co-ordinate and carry out other management tasks. Monthly technical meetings are held where decisions are made about actions and priorities. Over the past eight years approximately 144,000 plants have been propagated and the planting expanded by approximately four hectares each year. A portion of MRT members' time is also taken up with applying for funding and seeking sponsors.

The nursery upgrade is under way to provide facilities required for the changes that are being implemented to the planting method as mentioned above. To implement the objective of enhancing the diversity of plants on the island, seed for a more diverse list of species for propagation is being sourced from other Hauraki Gulf islands or adjacent mainland. MRT are working with other Hauraki Gulf island restoration groups to develop a list of plants suitable for introduction to Motutapu and neighbouring islands and to identify the seed sources for these.

The recent animal pest eradication programme is a huge step forward for the ecological restoration project. DOC funding of this programme has shown a commitment to the project which has made a big contribution to the morale of volunteers. The unassisted arrival of three new species of native (endemic) birds on the island in recent months, two of which are a result of translocations taking place on neighbouring islands, also gives renewed energy to the restoration efforts. When the island is declared pest free there will be the opportunity to also commence introduction of animal species to Motutapu which will progress the restoration objectives and enhance community awareness and interest in the project. It will also provide opportunities for MRT volunteers to diversify their activities which may assist in volunteer retention.

The success of the restoration project so far can be attributed to the dedication of a small group of volunteers who have committed to spending a large amount of time contributing to the management of the project. For several of these volunteers it is a full time unpaid job. It is an indication of how much can be achieved by inspiring public participation and investing in the time required to manage this.

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Chapter 2

Recommendations

Planting

Based on the restoration objectives outlined in the original restoration working plan and recent discussions the following principles are recommended to guide the planting programme:

- The ecological integrity of the Rangitoto Ecological District will be protected
- Plants will be propagated on the island
- Introduced plants will be sourced from the Inner Gulf Islands Ecological District (IGIED), the Rangitoto Ecological District or adjacent mainland (to be further defined in a plant translocation proposal)
- The planting regime will take an approach that minimises maintenance
- The restoration will encourage all the components of a functioning native ecosystem
- The planted forest will be as contiguous as possible to reduce edge effects
- Plantings will be catchment based and include the restoration of wetlands in the contiguous forest
- The majority of the planted forest will be established in proximity to Home Bay
- Plantings and forest remnants will be linked where practical
- Key viewing shafts and vistas will be maintained
- Management of archaeological sites will be integrated into the planting programme

Other key points

- Forest remnants will continue to be protected outside the main planting areas. They may have enhancement planting done where this will not take away from the main effort around Home Bay.
- Wetlands within the proposed planting area will be restored
- Wetlands outside the proposed planting area will be progressively fenced to protect them, or stock impacts may be reduced on these wetlands by only grazing sheep near them.
- Weeds will be monitored and controlled
- The eradication of the remaining animal pests will be completed
- Farming operations will complement the planting programme
- Biosecurity will be a high priority for all activities

These principles reflect the ecological restoration objectives of the Motutapu Restoration Working Plan and the management objectives of the CMS.

The desired outcome is to produce and plant appropriate plants to establish a contiguous self-perpetuating native forest ecosystem which has ecological integrity, incorporates gully to ridge habitats, integrates with the cultural landscape, is free of pests and which requires minimal maintenance.

Forest establishment

Taking the above planting principles into account it is recommended that restoration efforts in the short term (2010 – 2015) concentrate on extending the existing planted forest at Home Bay to include all the Home Bay catchment and to link this with the Central Gully catchment. (see fig 1).

This means planting the Watershed paddocks, the eastern portions of paddocks 14 and 63 and Dog Trial paddock. Depending on new fencelines, it is likely that some of Loop paddock to the west of central gully will also need to be planted.

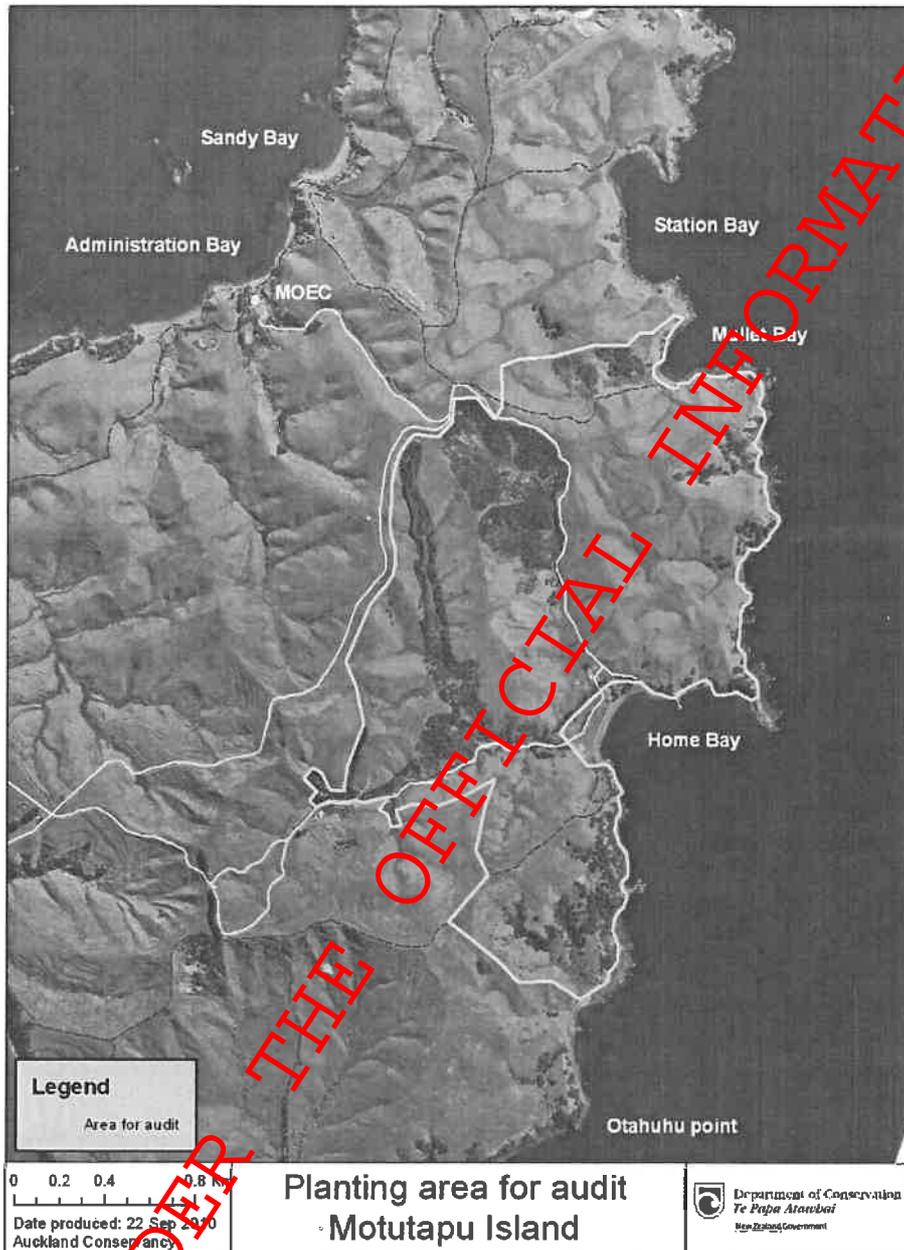


Figure 1. General outline of the proposed planting area for Motutapu up to c. 2035

In the longer term (beyond 2015) is it recommended to include:

- All catchments to the east of the Home Bay planting to link with the Mullet Bay planting
- A planting to link central gully with remnant five (the large coastal forest remnant south of Home Bay)

- The majority of the catchment to the west of central gully.

This would make a total restoration area of approximately 330 hectares depending on final fence lines etc. Of the 330ha, 55ha is already planted. There is a further 210ha or so to be planted (though some of the area is archaeological site and so may remain in grass). The remainder is made up of forest remnants.

Planning the details for the planting of this area will be subject to further consultation with tangata whenua, and organizations such as the NZ Archaeological Association and Historic Places Trust. Another issue that will have to be considered is that some parts of this area are steep with few established tracks and access may be difficult so careful planning with regard to access will be required.

Including this area will provide a contiguous forest, include restoration of wetland habitats within the contiguous forest and will maintain the planting in close proximity to Home Bay which will facilitate community participation and continue to give high public profile to the restoration efforts.

There are a large number of archaeological sites in the proposed area to the east of the main planting. Where planting has taken place in the past archaeological sites have been avoided but no plan for their management has been developed. Rather than simply avoiding these there is an opportunity to develop techniques for the integration of these sites into the planting by determining appropriate species to establish there to enhance visibility and interpretation. As planting is not appropriate on these sites, trials should be undertaken to determine what is the best method for establishing appropriate species on existing archaeological sites within the existing and new plantings (e.g. distribution of seed of the native grass species *Microstachya stipoides*).

Plant production

The Motutapu Restoration Working Plan included the establishment of a nursery to grow the plants and this has worked well for the establishment of the pioneer plants which are easy to grow in root trainers and can be produced in large numbers. Taking over management of the nursery was a big challenge for MRT as nursery production is very vulnerable without a resident caretaker to ensure that watering systems are functioning and that potential disease in plants is detected early. It would not have been possible to manage the nursery without the commitment of the full time volunteer who has been available to spend six days a week on the island.

More sophisticated methods may be required for the secondary succession and threatened species establishment. Some native plants are quite difficult to grow in nursery facilities and require greater expertise than may be found among the volunteers.

To address this issue consideration has been given to growing some plants in commercial nurseries on the mainland or Waiheke Island. However transportation of live plants from other sites poses a high risk to island biosecurity through the threat of introduction of pests. Plant and soil diseases and animal pests such as Argentine ants and rainbow skinks can establish in planter bags and be transported with the plants. It is therefore preferable to upgrade the island nursery and ensure the nursery volunteers continue to receive appropriate training, advice and support in plant propagation. The upgrade to the nursery currently being carried out will provide facilities for the propagation of more sensitive plants.

Planting methods

Pasture conversion planting

The objective of restoration planting is to speed up the natural process of re-colonisation by planting natives which shade out the pasture, provide a seed source and “kick start” the natural succession process.

The establishment of a dense shrubland of pioneer species to convert the pasture to forest has been facilitated using a generally accepted method of planting pioneer species at about 1 to 2 meter spacing in order to quickly shade out the pasture plants.

As mentioned in Chapter 1 MRT has decided recently to change this method to include a wider range of species earlier in the revegetation effort and to introduce more mature phase species earlier than previously. (see appendix 1 for details of this plan). Planting of these species will be done at greater spacing than previously i.e. from 1.5m spacing to 2.5m. This new pioneer planting method should be conducted initially on a trial basis for approximately three years to ensure that it is successful before adopting it on a larger scale.

It will be important to closely monitor survival rates of the various species in the trial plantings as with greater spacing there is the risk of greater competition from grass and weeds and some plants do not cope as well with the exposure to wind that manuka, kanuka and karamu can tolerate. However the fact that plants will have more robust stems and the root systems will be better established in the PB3s than they would be in root trainers may compensate for this.

More preparation will be required before planting takes place as paddocks that are due for planting in the next three years contain kikuyu grass. This grass is a strong competitor and can easily smother young trees. It will require spraying with herbicide during the previous summer (in December) with follow up spot spraying of regrowth (in April) before the planting season. Careful spot spraying may also be required during the first two years after planting to ensure that this grass does not reinvade before the trees become large enough to start shading it out. It should be noted that the farming operation is currently considering kikuyu grass based pasture in the future. If the plantings are surrounded by kikuyu grass paddocks it will be important to establish very closed forest on the margins as soon as possible.

The inclusion of taupata should be reconsidered where kikuyu grass is present in inland plantings as this is a coastal cliff species and generally does not provide enough shade to suppress kikuyu grass on its own. If it is used then it will be important to ensure that it is in low numbers and mixed with other bushier plants so that it does not get planted in groups. In the Motuora Island plantings kikuyu grass was not shaded out quickly enough to prevent reinvasion where taupata was planted in groups even when the spacing was at 1m.

Mature phase planting

As mentioned in Chapter 1 mature phase species that have remnant populations on Motutapu are a source of seed for the establishment of the canopy tier and some are already naturally regenerating in the shrubland but more diversity of species is required.

The new nursery plan proposes three objectives for the mature phase planting as follows:

1. Provision of sanctuary to endangered species.
2. Assistance with weed suppression from long-lived species.
3. Ecological optimisation of fauna requirements for fruit and/or nectar.

The reasons behind these objectives are outlined in Appendix 1.

This plan has been carefully thought through and provides strong arguments to support the proposal. However there are some problems associated with it.

To support these objectives the plan proposes to introduce several plants that do not have provenance in the Inner Gulf Island Ecological District (IGIED) or adjacent mainland for the ecological optimisation objective and for the provision of sanctuary to threatened plants.

Motutapu is classified as a recreation reserve and therefore it would be conceivable to include species that may compromise its ecological integrity. However owing to its proximity to Rangitoto, the introduction of out of provenance species to Motutapu is a potential threat to the ecological integrity of the Rangitoto ED, the protection of which is an underlying principle of the restoration project. The successional processes on Rangitoto are of high scientific importance (D Towns pers comm.) and should not be further compromised.

There are many species of threatened plants that have provenance in the IGIED or adjacent mainland so it is recommended that these be given sanctuary on Motutapu ahead of any out of provenance species. Even species within provenance can be extremely difficult to establish despite the fact that they are within their natural geographical range and climatic conditions, as threatened plants are generally more sensitive. Attempting to establish threatened plants outside their natural range could be even more difficult.

It is also proposed in the nursery plan to have a planting regime on the Motutapu cliffs to include longer lived old growth cliff specialist plants to facilitate greater suppression of weeds such as evergreen buckthorn which are in large numbers on these cliffs.

The species suggested for planting the cliffs include pohutukawa, tawapou and milk wood but also include coastal maire which does not have provenance in the IGIED or adjacent coastal mainland and does not occur naturally in the large numbers required for the implementation of this plan (E. Cameron pers comm.). It is therefore recommended that further discussion with experts should take place before any implementation of this plan.

Although the merits of this plan should be considered, it is however recommended that MRT do not take on any responsibilities for planting or weed control outside the areas adjacent to Home Bay in the near future as they do not currently have the capacity to do so.

It is recommended that a large variety of appropriate species both threatened and non threatened, which have provenance in the IGIED or adjacent mainland, be identified to establish the secondary succession phase. Seed should be sourced from naturally growing plants on neighbouring islands and adjacent mainland sites. These will be propagated in the nursery and planted both alongside the pioneer species (hardier species) and among the established shrubland.

Work has already commenced in conjunction with other Hauraki Gulf Island restoration groups on identifying appropriate species and quantities for translocation within the IGIED. This joint project will provide the greater diversity required in the nursery plan and will give MRT the opportunity to develop relationships which will assist in obtaining seeds and assistance with developing wider propagation skills.

In some cases it will be possible to distribute seed instead of planting, for example, large seeds such as tawapou and karaka can be direct sown on the ground among leaf litter, and grass and sedge can be sown in more open areas such as archaeological sites. However this requires a larger amount of

seed than that needed for nursery propagation, so it is recommended that this is only attempted with species for which there is a large amount of seed available. To reduce volunteer effort consideration should be given to allowing those species already established in forest remnants on the island to disperse naturally. This is already happening with species such as karaka despite the fact that a large gape is required for bird distribution of these seeds, so seed distribution need only be undertaken where this is not happening. It has been observed from research undertaken on Motuihe Island (Heiss-Dunlop 2004) that starlings can disperse seeds as large as olives.

Principles for selecting flora species for introduction

The introduction of any plant species that is not currently present on Motutapu is considered by DOC to be a translocation and will require a translocation permit. The following principles are recommended to be used in considering plant species for translocation:

- Any species of plant that has been recorded as being present in the IGIED or adjacent coastal mainland (as defined in Appendix 2) and for which there is suitable habitat available.
- Threatened species not previously occurring in the IGIED will be considered on a case by case basis in consultation with tangata whenua, botanists, and Species Recovery Programmes, and provided they do not have the potential to compromise the ecological integrity of the Rangitoto Ecological District.

Plant species that meet these criteria are listed in appendix 2.

Wetlands

Motutapu is one of the few potentially pest free islands in the Hauraki Gulf that is of sufficient size to support extensive wetlands which are one of the most important habitats identified for protection in the Auckland Conservancy (Lindsay et al 2009). There are very few coastal wetlands left to provide habitat for a number of threatened species in the region. Wetlands are therefore a high priority for restoration on pest free islands. However it is acknowledged that MRT does not currently have the capacity to restore all wetland habitats on Motutapu as these are extensive and scattered and would create too many isolated pockets of vegetation which would be difficult to manage. MRT should therefore focus on restoring (fencing and planting the catchments) only those wetlands within the proposed planting areas.

In the longer term however a priority will be to fence off all streams from grazing and this has already been commenced by the establishment of fences around several wetlands including the most recent in the Administration Bay catchment. The priority should be to fence the main arm of the wetlands. Fencing of the fingers feeding into the main arm could be completed at a later date. It will be important not to create large areas needing to be planted and maintained weed free. Options to serve this purpose are to fence these wetlands close to the bottoms of their gullies, or to only graze sheep in larger areas of pasture that are fenced off (sheep will do less damage to the wetlands than cattle).

Keeping stock out of streams is part of good farming practice and therefore fencing of the remaining streams could be undertaken by the farming operation. Funding for this could potentially be provided either by a lessee or by MRT depending on how the farm is managed. However these areas should not be retired from grazing until there is the capacity to manage the subsequent planting and weed control that will be necessary. However there is the opportunity to protect some wetlands in the meantime and enhancing their water quality by constructing fences around those that currently contain kikuyu grass (as at Station Bay) as this will suppress other weed invasion.

Weed control

A large amount of time is spent on weed control each year and substantial gains have been made, but it is still a very high maintenance programme which can result in burn out among volunteers, as maintaining the energy and motivation for such an enormous task is difficult. Decisions on priorities are currently left to individual volunteers rather than having a strategic approach. No comprehensive records of the weed control programme are currently kept and therefore it is difficult to measure progress and determine effectiveness except from the anecdotal knowledge of the volunteers.

It is easier to get public participation in planting activities than in weed control which requires a very regular and dedicated team of volunteers who need to be well trained and quite fit. The new planting method, if successful, will potentially increase the managed area even more rapidly and so it will be important to implement a more sustainable weed control programme to increase effectiveness and reduce the time spent.

A weed control strategy was developed in the early days of the project (Wotherspoon and Wotherspoon 1997) and although this provides a strategic framework it does not give direction to annual operations on the ground. It is recommended therefore that, as an addition to this strategy, a comprehensive weed control operating plan is developed and an annual weed control planning procedure is established. Included in this plan would be recommendations for which tasks are suitable for volunteers to take on and which tasks require the services of professional contractors for which funds will need to be raised.

To assist with efficiency and consistency of the weed control effort it is recommended that the planted area should be divided into management blocks for grid searching operations (eg approximately 5 hectares each). These should be marked in the field (eg with flagging tape or plastic markers) to ensure consistent coverage of the whole area and to facilitate recording of work carried out. A map should be produced of these blocks which can be used during field operations to determine and record the areas covered. A new block will be created each year which will be the area planted that year. These blocks could also be used to assist with recording of the second succession planting.

Some trees appear to have been propagated from seed of species that were listed in the Restoration Working Plan as being inappropriate for the island (e.g. *Pittosporum buttonianum*) and seedlings of these are now widespread. Inappropriate natives should be included in the weed control operation to protect the ecological integrity of the islands.

To address the problem of the weed management area increasing before the existing area is under control, an alternative approach that could be considered would be to slow down the planting effort while determining the effectiveness of the new planting method. This would free up volunteers to work on increasing the diversity of species planted and infilling in the pioneer stands and would allow a "catch up" phase for the weed control programme.

Animal Species Translocations

The introduction of missing taxa and threatened and uncommon species are an important component of the ecological restoration programme. The objective of species introductions is to replace components of the ecosystem which are missing or in low numbers and to protect threatened species from the predation that they would encounter on the mainland.

There is also an advocacy objective. It has been proven from other island sanctuary projects such as Tiritiri Matangi that providing the opportunity to view rare species in the wild stimulates interest from the public, which attracts sponsorship for the project and is an effective way of delivering conservation messages.

The planted shrubland, together with the comprehensive animal pest eradication programme which has recently been carried out on Rangitoto and Motutapu, provides the opportunity to consider the introduction of several animal species within the next ten years. It is expected that the islands will be declared pest free by the end of 2011 thus allowing animal translocations to commence. No translocations of threatened species should be considered unless the island is declared pest free.

The following principles are recommended for the selection of animal species for translocation:

- Species that will not compromise the ecological integrity of the Rangitoto ED
- Species for which appropriate habitat exists or will exist in future
- Species that would not arrive unassisted
- Species known to have been present in the area from fossil record
- Species not known to have been present which are not well protected regionally or nationally on a case by case basis

For the purpose of prioritizing species the following criteria could also apply

- Species which will not compromise future translocations
- Species for which maintenance costs are currently low.

Species which currently meet these criteria and which are not present on Motutapu are as follows:

Land birds

North Island Brown Kiwi	<i>Apteryx australis</i>
Brown Teal	<i>Anas chlorotis</i>
North Island Fern bird	<i>Bowdleria punctata vealeae</i>
Whitehead	<i>Moboua albicilla</i>
North Island Saddleback	<i>Philesturnis carunculatus rufusater</i>
North Island Tōmūtū	<i>Petroica macrocephala toitoi</i>
Takahe	<i>Porphyrio mantelli</i>

There is suitable habitat for Takahe currently on Motutapu but the management costs for this species should be investigated before it is considered for translocation.

Reptiles

Northern Tuatara	<i>Sphenodon punctatus</i>
Pacific gecko	<i>Hoplodactylus pacificus</i>

Robust skink	<i>Cyclodina alani</i>
Ornate skink	<i>Cyclodina ornata</i>
Whitaker's skink	<i>Cyclodina whitakeri</i>
Marbled skink	<i>Cyclodina oliveri</i>
Duvaucel's gecko	<i>Hoplodactylus duvaucelii</i>

There is currently habitat for a range of reptiles on Motutapu. Five species of reptiles are already recorded as present and it is possible that more species have survived in very low numbers and are as yet undetected. Reptile monitoring has been carried out during the pest eradication programme and monitoring should be continued on an annual basis for at least ten years before translocations are considered to ensure that there are no remnant populations still present. Therefore no reptile species except tuatara are recommended for introduction in the next ten years.

Invertebrates

Flax snail	<i>Paryphanta busbyi busbyi</i>
Giant flax weevil	<i>Anagotus fairburnii</i>

Freshwater fish

Giant kokupu	<i>Glaxias argenteus</i>
Black mudfish	<i>Neochanna diversus</i>

Extensive wetlands present the opportunity to introduce threatened freshwater fish species.

Mammals

Long tailed bat	<i>Chalinolobus tuberculatus</i>
-----------------	----------------------------------

Assuming pest free status the animal species recommended for translocation in the next ten years are those for which the current habitat is suitable. The bird species for translocation will generally be either ground dwelling or poor flyers as it is expected that other species will arrive naturally.

Seabirds are also likely to self introduce with a lower level of pests present. Encouragement of seabirds will be beneficial to the restoration by contributing to soil quality, forest succession processes and the creation of habitat for invertebrates and reptiles (Towns 2002). Other restoration projects are experimenting with acoustic attraction systems for seabirds and these could also be tried on Motutapu. Surveys to determine whether there are any breeding seabirds already present (which could include acoustic monitoring) should be carried out before any other action is taken.

Fencing

Fencing is a major issue for the conservation management of the island. Stock should be kept out of wetlands, streams, the coastal margins and planting areas. The maritime environment is very hard on fence wires and so a high level of maintenance is required. This has not been adequately funded in the past.

A rolling five-year fencing plan should be made so that key sections of fence get the maintenance that they require and that new fencing can be budgeted or fundraised for. Planting areas should align

with existing fences where possible so that money and effort does not need to be put into temporary fencing.

Annual planning

In order for progress to be measured and to facilitate planning, a set of specific objectives should be prepared for the next three to five years.

It would also be helpful in achieving objectives to prepare an annual work plan which sets out all the tasks to be completed within the year and which is agreed by all the members of MRT. It is recommended that this be prepared in August each year as this is just prior to the time of seed sowing and therefore the start of the annual cycle of activities. This would document the activities throughout the seasons and the sequence in which they will be carried out. These plans would include:

- The number of plants required to be produced in the nursery.
- The exact area in which these plants will be planted
- The preparation required for this planting area and the timing of this
- The number and species of plants for which seed collection is required for the following year and subsequent years
- The weed control that will be carried out and in which blocks
- The fencing that needs to be done
- The archaeological survey work that needs to be carried out and the timing of this
- Translocation proposals that need to be written
- Translocations that will be carried out
- The budget that will be required to support this programme
- How much of this budget is available and how much will need to be raised

At the end of July each year a report should be produced to document what has been achieved from the annual plan and reviewed to see if there are any objectives not reached and the reasons for this. This document could be used to report to DOC and for communication with supporters and sponsors.

Partnerships

Farming

The Restoration Working Plan states that European farming on the island dates back to the 1840's and has had an extensive impact on the natural values of Motutapu through clearance of forest, introduction of plants and animal pests, draining of wetlands and degradation of waterways by stock trampling and effluent. However it was recognized that appropriate pastoral farming is one of the most satisfactory regimes for preserving archaeological sites. The primary objective of the restoration programme is the protection and enhancement of the cultural landscape and the great majority of archeological sites are managed by grazing. The grazing regime also plays an important role in the control of weeds.

MFL currently has a management agreement with DOC for farming on Motutapu. The main objective of the farming operation is currently to run it as a commercial enterprise. However MFL has contributed substantially to the restoration programme by investing large sums in the control of weeds such as Apple of Sodom and fencing to protect the planted areas from stock. MFL has also

been a consistent supporter of MRT over the years including funding for an administrator, insurance, securing accommodation for volunteers (School House), providing accommodation for MRT contractors and assisting with logistics on the island.

However conflicting objectives can arise between those of the ecological and cultural restoration programme and the requirement of the farm to make a profit. Decisions may therefore be made about farming practice which are not necessarily compatible with conservation objectives. The farming operation also poses a risk to pest free status, with the movement of stock trucks onto the island and importation of feed being potential avenues for re-introduction of rodents and pest invertebrates. If a lease is relatively short term it is difficult for the lessee to feel confident in investing for the longer term and the restoration programme also impacts on the farming operation.

There is potential to develop the farming operation on Motutapu into a model of best practice sustainable pastoral farming that is compatible with ecological processes. It could become a showcase for the production of food without degradation of the natural environment. An essential aspect to such a model would require the pastoral farming techniques adopted to be complimentary to and support archaeological and ecological conservation objectives. This ongoing farming operation could be either DOC managed or operated under a farm lease or other tenancy type arrangement.

Sustainable pastoral farming would be an appropriate approach for a conservation island and would integrate the operation with the cultural, ecological, biosecurity, educational and recreational objectives of the restoration project. Initially the management of wetlands would be a good focus for developing the model.

Options for the management of Motutapu are outlined in a report written by Tourism Resources Ltd in 2009. One of these includes the continuation of a lease agreement. If a lessee were to be involved it would be necessary to find someone who, as well as supporting the primary objective, was willing to invest for the longer term and who recognized the benefits of promoting sustainable farming rather than purely working for short term profit. This objective would have to be included as a condition of the lease. The current lessee has expressed interest in investing in a sustainable farming model but only if it were possible to get a longer term lease.

Education

One of the objectives for education in the restoration plan is the integration of MOEC activities into the restoration programme. MOEC has been involved in some planting on the island but not on an ongoing basis. The main emphasis of their programme is on outdoor education pursuits.

It is important that people who use conservation islands for recreation are aware of the impacts that they may have on the biodiversity values of these places. In recognition of this DOC has carried out a widespread public awareness campaign throughout the Hauraki Gulf Marine Park in recent years with particular emphasis on preventing the re-introduction of pests to pest free islands. MOEC's activities have the potential to be a risk to pest free status because of the equipment that they bring on to the island.

There are opportunities to focus on learning about the environmental impacts of recreational activities and particularly imparting to young people their responsibilities to care for public space which they wish to use. These messages are particularly important given the threat of re-introduction of pests to islands by recreational boat use. The Motutapu restoration project provides an ideal opportunity to integrate these messages into their education programmes for recreational users.

MOEC's educational activities could also integrate with the farming operations and there are also opportunities for involvement of students in historic and archaeological restoration activities.

Community involvement

It is clear that significant progress has been made on the ecological restoration objectives of the Motutapu Restoration Working Plan. Less progress appears to have been made on the cultural objectives and this could be largely because of the greater community involvement in the management of the ecological restoration programme. If it were possible to have the same involvement in the cultural activities greater progress may also be possible with these. It is recommended therefore that DOC investigate how more encouragement can be given to the involvement of the public in cultural, archaeological and historical activities.

Summary of recommendations

Management

- Set restoration objectives for the next five years
- Prepare annual operating plans and report on these at the end of the year
- Divide planted areas into management blocks of approximately five hectares each and number and map these
- Mark out the area to be planted each year and add it to the management blocks.
- Consult with iwi and archaeological associations over how to integrate archaeological sites into the plantings
- Update the Restoration Working Plan covering all restoration objectives with an emphasis on integrating all island activities

Planting

- Trial new planting method before possible permanent implementation
- Monitor these trial plantings over three years
- Carry out follow up control of kikuyu grass in recent plantings
- Carry out kikuyu control in preparation for next planting
- Carry out archaeological surveys to identify sites in next planting
- Identify appropriate plant species to establish on these archaeological sites.
- Concentrate planting over the next five years to link the Home Bay planting with Central Gully
- Concentrate future planting in the area north east of Home Bay.
- Consider reducing area planted each year until new method is proven.
- Propagate mature phase species and infill in pioneer stands
- Prepare and implement a comprehensive mature phase planting plan which includes location and habitat for each species
- Consider options for the management of wetlands (eg partnership between DOC, MRT and MFL)

Plant production

- Prepare translocation proposals for plants identified for introduction
- Identify appropriate seed sources for external seed collection
- Work with other restoration groups to set up a team of seed collectors
- Work with other restoration groups and professionals to acquire more propagation skills

Weed control

- Prepare and implement a comprehensive weed control operating plan using management blocks to ensure efficiency and consistency
- Concentrate weed control only on the Home Bay and Central Gully catchments unless more resources become available
- Identify which tasks should be done by volunteers and which could be undertaken by contractors
- Consider raising more funds for weed control
- Recruit and train more volunteers for weed control

Animal translocations

- Prepare an animal translocation plan

Fencing

- Prepare a rolling five year fencing plan

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Appendix 1
Motutapu – An Island Ark for the Future
Shane Wright, March 2009

Objectives:

1 – To revegetate all or part of Motutapu Island while maintaining the ecological integrity of the project by seeking to emphasise plant populations of appropriate provenance to Motutapu or the adjacent islands of the Hauraki Gulf, particularly Rangitoto, Waiheke, Rakino and Ponui. However, Motutapu is also less than 10km distant from the North Shore mainland and, given its similarities in topography and climate, that area should not be overlooked as a potential seed source where difficulties are experienced with collection from the islands themselves.

2 – To ensure that the revegetation effort attempts to achieve in as prompt a manner as possible the regrowth of a mature-phase coastal forest canopy on Motutapu, with high tree species diversity, that will subsequently optimise carrying capacity for native fauna, including arthropods, birds and reptiles. Highest carrying capacity would be achieved by emphasising long-lived tree species of the old-growth forest that produce useful blossom and/or fruit.

3 – To provide a refugium, in particular, for mature-phase tree species from the Hauraki Gulf region that now otherwise subsist at scattered localities of limited range and are suffering ongoing population declines. Such species include *Streblus banksii*, *Nestegis montana*, *Nestegis cunninghamii* and *Nestegis apetala*. This objective therefore parallels – albeit with greater attention to distributional integrity – the similar effort now being widely applied for bird species such as kokako and stitchbird.

4 – To maintain in the revegetation process the relative proportions of species abundance and dominance seen in pre-existing old-growth coastal forest so that the replanted forest of the Motutapu interior eventually comes to resemble a typical mature-phase association dominated by: *Vitex lucens*, *Beilschmiedia tarairi* and *Podocarpus totara* with lesser numbers of, in decreasing rank, *Dysoxylum spectabile*, *Corynocarpus laevigatus*, *Nestegis lanceolatus*, *Beilschmiedia tawa*, *Hedycarya arborea*, *Pouteria costata*, *Alectryon excelsus*, *Prumnopitys taxifolia*, *Metrosideros robusta*, *Prumnopitys ferruginea* and *Nestegis cunninghamii*. Under this rationale, the cliffed margins of the island should eventually come to be dominated by: *Metrosideros excelsa* and *Pouteria costata* with a tall substage of *Streblus banksii* and *Nestegis apetala*. Similarly, swamp forest should come to be dominated by: *Dacrycarpus dacrydioides* and *Syzygium maire* with *Fuchsia excorticata* in the substage on drier margins, but with unfruitful and only weakly floral *Laurelia novaezelandiae* planted more sparingly. Again, forest on ridge and spur crests, and on steep dry upper slopes should come to be dominated by: *Nestegis lanceolatus*, *Podocarpus totara*, and *Prumnopitys taxifolia* with lesser numbers of, in ranked order, *Sophora microphylla*, *Knightsia excelsa*, *Agathis australis*, *Phyllocladus trichomanoides*, *Weinmannia silvicola*, *Dacrydium cupressinum* and *Nestegis montana*.

Tree species that, because of absence from Motutapu or because of doubts as to provenance there, but that do occur on Waiheke should be collected as seed from that larger island. Given the now tiny area of remnant forest on Motutapu, and the very small populations there, even those species which are on the island should probably also be collected from Waiheke to broaden the genetic base for the future forest. Species absent from Motutapu and that occur only as tiny dysfunctional populations on Waiheke, with little available seed, [eg. *Nestegis montana* and *Streblus banksii*] should be collected from a wider radius of ca. 80km embracing the Hauraki Gulf islands and the North Shore mainland – this would do little harm and much good in terms of ensuring self-sustaining populations of those, now needy, species on Motutapu under Objective 3.

Useful early-mid succession trees that should be used by preference in the pioneering stages of revegetation in the Motutapu interior [instead of fire promoting, manuka and kanuka] are: *Pittosporum crassifolium*, *Pittosporum tenuifolium*, *Pittosporum eugenioides*, *Pseudopanax lessonii*, *Melicope ternata*, and *Melicytus ramiflorus*. These hardy species grow rapidly and produce broad, dense shading canopies of adequate stature that prevent water loss from the soil and that suppress grass growth. In this sense they represent ideal fire-safe pioneers to provide a nursery for the mature-phase trees described in Objective 4. The pittosporums are, however, problematic because of their vulnerability to insect attack, although the remaining species on the list are complementary to that shortcoming because of their resistance to predation [this limitation also applies to Karaka and Pohutukawa amongst mature forest trees]. The two groupings should thus be planted together in mixtures to ensure adequate survival and growth for the pioneering sward in the event of serious predation. *Coprosma repens* and *Myoporum laetum* are the recommended pioneers for sparing use [they are also strong competitors with mature-phase species] on coastal cliffs. However, they should not be used in the island interior, where they are ecologically inappropriate. Very competitive *Phormium tenax* should also be used only sparingly for windbreaks and side-shelter in swamp forest regeneration. In all of the above instances the diversity of the pioneering sward is best limited to a few species so that the focus in the project is not deflected from mature-phase tree species. The effect of this emphasis would be to help to expedite the, ultimately much greater, reward of a complex and productive old-growth forest.

Additionally, *Nestegis apetala* from islands and headlands in coastal forest in Northland and the Hauraki Gulf should be considered for Motutapu. The nearest locality for this species is ca. 55km from Motutapu on Hauturu. It would be very useful on seaward faces such as cliffs and headlands because it is hardy to marine exposure while producing valuable fruit. It also occupies the same forest substage cliff margin niche as the highly invasive *Rhamnus alaternus*. It would thus occupy a position as a mature-phase [as opposed to successional – eg. *Coprosma repens*], competitor to *Rhamnus* so permanently slowing its rate of spread. For these reasons *N. apetala* would be highly complementary to the two large mature-phase tree species otherwise occupying such habitat, namely, *Metrosideros excelsa* and *Pouteria costata* [that would form the overstorey above it]. *N. apetala* shares this habitat with those two species in natural associations within its

existing range. *M. excelsa* is not fruitful while *P. costata* and *N. apetala* produce fruit at different times - so spreading the delivery of food to future occupants of the life zone. Although inclusion of this species would represent an admittedly very small transgression of Objective 1, the net effect of its introduction is likely to be positive because of its substantial capacity to contribute to Objective 2 in difficult exposed coastal settings and to limit the cost of control for *Rhamnus*. It would also receive refuge on Motutapu under Objective 3 since it now occurs in small and declining populations.

Similarly, *Nestegis cunninghamii*, which occurs infrequently in low elevation mature-phase forest across the Auckland Isthmus, in Northland and on the Barrier Islands, should be considered for the Motutapu project. The nearest island locality for this species is ca. 55km from Motutapu on Hauturu, although its mainland distribution puts it much closer to Motutapu than that. Black Maire would be a most useful tree to use sparingly in the revegetation of the island because it is probably the hardiest of New Zealand's large lower-slope species in terms of its capacity to survive the extreme conditions of the early stages of regeneration where there is exposure, drought and competition from grass [particularly in the challenging setting presented by the unsheltered Motutapu grassland]. It would therefore be a valuable tree to serve the aim of promptness under Objective 2 in the revegetation of the island. Black Maire grows into a large tree - up to 23m - lives for several hundred years, and produces heavy crops of useful fruit. Given its rarity in the Hauraki Gulf region it would also receive refuge on Motutapu under Objective 3.

Several important mature-phase tree species occurring in the Hauraki Gulf region have been excluded from the preceding lists because of their extreme vulnerability to root rot and therefore to their lack of straightforward response both in the nursery and following planting out. These include: *Litsea callicaris*, *Toronia toru*, *Nothofagus truncata*, *Elaeocarpus dentatus*, *Phyllocladus tostoa*, *Pseudopanax arborea*, *Halocarpus kirkii* and most Asteraceae. They might eventually be planted and find haven on the steepest, driest slopes on Motutapu, but their inclusion in the earlier stages of the revegetation work is not recommended because of the wasted effort that they would entail.

Many substage/understorey or early-mid successional species have been excluded from the above listings. These include: the larger understorey coprosmas [eg. *macrocarpa*, *lucida*, *robusta*, *grandifolia*], mamangi, kawakawa, makomako, rangiora, heketara, mapou, toro, houhere, manatu, akeake, nikau, ti kouka, putaputaweta, kaikomako, puka, pate, horoeka, haekaro and hangehange. Such species would eventually be important in secondary niches on a forested Motutapu but they should not be planted in the early stages of the revegetation when they might compete with the large mature-phase species listed in Objective 4. Those large species are needed as the priority to form a permanent main canopy. The analogy is with building a house before its chattels are installed. The listed marginal species are also differentiated from the eight species suggested above as useful pioneers [and that are, by contrast, proposed for immediate planting] because they produce inadequate canopies in terms of stature, spread or density for the main objective of facilitating mature-phase regeneration. However, these marginal species are nonetheless essential to a future balanced forest on Motutapu. Accordingly, they should be introduced to plantings ca. 10 years after commencement of regeneration at a given

site [depending on the rate of regrowth of the main canopy species]. Tree fern species, which are highly suppressive in the pioneering stages of regrowth, should not be planted. They are easily dispersed by their spores and should be left to introduce themselves.

First monitoring of the performance of a new planting regime on Motutapu as described above should probably take place at year 3 from commencement (to examine the pioneer plantings) and at year 5 (to examine the mature-phase plantings).

Motutapu Restoration Trust – 2010-2015 Nursery Plan

Shane Wright, November 2009

This is a comprehensive Nursery Plan for 2010-2015 on Motutapu Island to support more complete revegetation and ecological restoration programmes there. It takes account of the input of the Department of Conservation during 2009 over the period of change and growth in the revegetation effort that has been underway in that time. It also incorporates recent alterations to the earlier version of this document that have been suggested by MRT personnel. As such the enlarged nursery regime proposed below is intended to give both certainty and finality to DoC in respect of the MRT's intentions regarding plant species for revegetation over the coming years and to provide a stable platform for the restoration programme itself. Given the requirement that DoC has signalled that the MRT Nursery is to become the sole source of potted plants for the island at the completion of the Nursery upgrade, this document is also intended to provide the basis for the Nursery's function and propagation planning in the medium term. The plan also provides for a comprehensive trophic support base to birds and other fauna since it ensures that a wide range of plant species, particularly the large fruiting trees of old growth forest, will be included early in the revegetation effort. Thus, the diversity and temporal delivery of fruit and blossom resources will be maximised under this plan as will the range of food types. This means that Ecological Optimisation will henceforth become a central goal for MRT.

There are three categories of species that are treated as separate groupings for the Nursery Plan namely: [1]Pioneer, [2]Mature Phase and [3]Gap Phase. The following list covers only woody plants >3m height. All plants are to be produced at PB3 size prior to planting out. The described output is proposed to commence as an annualised effort from 2012 for Pioneer and Mature Phase categories and from 2015 for the Gap Phase category.

Pioneer species are to be produced at 10400 PB3 per annum so that on a 2.5x2.5m planting grid - requiring 1600/ha - they should cover 6.5ha in any one year to primarily service the pasture conversion component of the planting effort.

Species	Number	Biotope
<i>Melicytus ramiflorus</i>	900	Interior Hill Forest
<i>Melicope ternata</i>	900	IHF
<i>Myrsine australis</i>	900	IHF
<i>Pittosporum eugenioides</i>	900	IHF
<i>Kunzea ericoides</i>	800	IHF
<i>Pittosporum tenuifolium</i>	900	IHF
<i>Pseudopanax arboreus</i>	900	IHF
<i>Pseudopanax lessonii</i>	800	IHF/MF
<i>Epileta arborescens</i>	500	IHF
<i>Pittosporum crassifolium</i>	500	Maritime Forest

<i>Coprosma repens</i>	500	MF
<i>Myoporum laetum</i>	500	MF
<i>Plagianthus regius</i>	200	Swamp Forest
<i>Coprosma robusta</i>	800	SF/IHF
<i>Cordyline australis</i>	200	SF
<i>Phormium tenax</i>	200	SF

This list therefore involves an annual goal for **pasture conversion** of ca. **.5ha** for IHF, **1ha** for MF and **.5ha** for SF - depending on the deployment of species, some of which can be used in more than one Biotope.

Mature Phase species are to be produced at **3200 PB3** per annum so that at a **5x5m** planting grid - requiring **400/ha** - they should cover **8ha** per annum to primarily service the **ecosystem enrichment** and **ecological optimisation** effort. However, although these species are mainly intended for planting among pre-existing pioneer stands, some of those on the list are sufficiently hardy to be planted in the open to augment the pasture conversion effort when needed. Where this occurs it will be done on the understanding that it is not the best long-term mode of deployment for these species. It will thus be done only to account for **shortfalls** in the Pioneer species for pasture conversion. However, where it is periodically deemed necessary to do this, the intended **8ha/ha** coverage for planting into pre-existing pioneer stands can be maintained for the Mature Phase complement of plants by modest **upward** adjustments of **planting distances**. Abundant Mature Phase species are to be propagated in greater numbers than those less common for obvious reasons - with a continuum between those poles to reflect **relative abundance** in nature.

Species	Number	Biotope
<i>Beilschmiedia tarairi</i>	400	IHF
<i>Podocarpus totara</i>	400	IHF
<i>Vitex lucens</i>	400	IHF
<i>Metrosideros excelsa</i>	200	MF
<i>Corynocarpus laevigatus</i>	100	IHF/MF
<i>Dysoxylum spectabile</i>	100	IHF
<i>Pouteria costata</i>	100	IHF/MF
<i>Litsea calicaris</i>	100	IHF
<i>Nestegis lanceolata</i>	100	IHF
<i>Hedycarya arborea</i>	100	IHF
<i>Sophora microphylla</i>	100	IHF
<i>Nestegis apetala*</i>	100	MF
<i>Streblus banksii*</i>	100	MF
<i>Syzygium maire</i>	100	SF
<i>Dacrycarpus dacrydioides</i>	100	SF
<i>Prumnopitys taxifolia</i>	100	IHF
<i>Alectryon excelsus</i>	75	IHF
<i>Prumnopitys ferruginea</i>	50	IHF
<i>Rhopalostylis sapida</i>	50	IHF/MF
<i>Nestegis montana</i>	25	IHF
<i>Beilschmiedia tawa</i>	25	IHF
<i>Metrosideros robusta</i>	25	IHF
<i>Nestegis cunninghamii</i>	25	IHF
<i>Dacrydium cupressinum</i>	25	IHF
<i>Waimannia silvicola</i>	25	IHF

<i>Fuchsia excorticata</i>	25	IHF
<i>Metrosideros bartlettii</i> *	25	IHF
<i>Knightia excelsa</i>	25	IHF
<i>Elaeocarpus dentatus</i>	25	IHF
<i>Elaeocarpus hookerianus</i> *	25	SF
<i>Laurelia novae-zelandiae</i>	25	SF
<i>Pennantia corymbosa</i>	25	SF
<i>Streblus heterophyllus</i>	25	SF
<i>Agathis australis</i>	25	IHF
<i>Phyllocladus trichomanoides</i>	25	IHF
<i>Halocarpus kirkii</i>	25	IHF

The four species asterisked require translocation permits and the rationales for those requests will be discussed later in this document.

Gap Phase species are to be produced at 2400 PB3 per annum but with a three years lag before they are added to the above species complement (in 2015). This is proposed for two reasons – the first being to allow for a staged growth of the Nursery output to ensure that the systems in place are not overwhelmed by a potentially very large total number of plants in 2012 – the second being that many of the species on the following list are highly invasive gap specialists that might otherwise pose problems to the earlier Mature Phase plantings if they were to be installed too soon. The listed species in this Gap category are typically hardy to exposure so that they should be used primarily to augment the pasture conversion effort on a 2.5x2.5m grid at 1600/ha. This means that when the Gap Phase plants are added to the above Pioneer complement they will allow for an extra 1.5ha/pa pasture conversion. When this is added to the 6.5ha pasture conversion facilitated by the listed Pioneer species, the total pasture conversion potential from 2015 will increase to 8ha per annum. Thus, from 2015 the goal of converting half of the total plantable area of Motutapu (1200ha) to forest in a 75 year period (one lifetime) at a rate of 8ha per annum = 600ha will be entrained. At that point all of the 3200/pa Mature Phase plants could then be committed solely to enrichment planting in existing Pioneer stands.

Species	Number	Biotope
<i>Macropiper excelsum</i>	100	IHF/MF
<i>Geniostoma rupestre</i>	100	IHF/MF
<i>Aristolelia serrata</i>	100	IHF/SF
<i>Toronia toru</i>	100	IHF
<i>Schefflera digitata</i>	100	IHF
<i>Myrsine salicina</i>	100	IHF
<i>Coprosma arborea</i>	100	IHF
<i>C. macrocarpa</i>	100	MF
<i>C. areolata</i>	100	IHF
<i>C. lucida</i>	100	IHF
<i>C. propinqua</i>	100	SF
<i>C. crassifolia</i>	100	MF
<i>C. grandifolia</i>	100	IHF
<i>Brachyglottis repanda</i>	100	IHF
<i>Pittosporum umbellatum</i> *	100	IHF
<i>Olecris rani</i>	100	IHF
<i>Hesperia populnea</i>	100	IHF
<i>Psidium panax crassifolius</i>	100	IHF

<i>Carpodetus serratus</i>	100	IHF
<i>Melicope simplex</i>	100	IHF/SF
<i>Melicytus novae-zelandiae</i>	100	MF
<i>Griselinia lucida</i>	100	IHF/MF
<i>Brachyglottis kirkii</i>	100	IHF
<i>Lophomyrtus bullata</i>	100	IHF

Translocation Permits:

Permitting will be sought from DoC to translocate five plant species to Motutapu, to assist with the restoration effort. These require additional consideration due to the need to source their seed from beyond the Isthmus/Inner Gulf Region. These species are needed on Motutapu to service the following three objectives:

1. **Provision of Sanctuary to endangered species.**
2. **Assistance with Weed Suppression from long-lived species.**
3. **Ecological Optimisation of fauna requirements for fruit and/or blossom.**

Such translocations will be of a similar order to those currently facilitated for fauna introductions to island ecosystems albeit with far greater due given to the constraints of provenance in this case.

- a. *Nestegis apetala* – This species has its nearest occurrence some 50km from Motutapu on Hauturu. Coastal Maire is a long-lived plant of mature phase Maritime Forest substage and as such is needed to assist with the Weed Suppression of *Rhamnus* in particular. It will do this more efficiently than shorter-lived equivalents in that Biotope, such as Karo, because it will ensure that less forest is in gap phase and available for weed colonisation over time. The species also requires Sanctuary on Motutapu given that its populations are declining - due to human agency and rat predation - and that an untoward event in one of its remnant strongholds could destroy a large fraction of the total survivors. In terms of Ecological Optimisation it produces fruit earlier in the season than most in MF so spreading the availability of food to frugivorous bird residents in particular.
- b. *Streblus banksii* – This species has its nearest occurrence as a non-reproductive female singleton on Tarakihi Is some 20km from Motutapu. Again it is a long-lived plant of the mature phase Maritime Forest substage and thus is also needed to assist with the Weed Suppression of *Rhamnus* in particular. Given its status as a singleton, it will soon be extinct in the Inner Gulf unless Sanctuary is provided to it on Motutapu. In terms of Ecological Optimisation it produces fruit in the mid-season in MF, but earlier than Tawapou, so spreading the temporal availability of food to birds resident therein. Milkwood has suffered population declines to now very low numbers also due to both human agency and rat predation in island ecosystems. Further, it has the additional limitation of dioecy so that when remnant populations decline to very low numbers reproduction becomes first problematic and then impossible.
- c. *Pittosporum umbellatum* – This species has its nearest occurrence on Rotoroa Is some 20km from Motutapu also as a singleton. Haekaro is needed primarily as a mid-winter nectar source for honeyeaters and in particular for the endangered Hihi. It has already been translocated to Tiritiri on this basis and is similarly required on Motutapu to serve that purpose under the Ecological Optimisation objective.

- d. *Elaeocarpus hookerianus* - This species had its nearest occurrences some 30km from Motutapu at Brookby and Papatoetoe on the Isthmus Mainland where it now appears to be extinct due to its habitat being preferred for agriculture. The lowland ecotype of this species in northern New Zealand itself faces **extinction** given that the remnant populations in the Northland-Waikato-Waitakere-GBI regions are almost invariably singletons, and that it is not self-fertile due to proterandry, so that it should be provided with **Sanctuary** on Motutapu. The species is a **Swamp Forest specialist** that is **long-lived** so contributing to its capacity for **Weed Suppression** in its, typically more open, swamp habitat. Together with its sister species Hinau, it provides the highest quality carbohydrate fruit in the NZ lowland woody flora. However, the fruit of Pokaka is half the size of that of Hinau and therefore **more widely available** to a range of smaller birds such as **Saddleback** under the **Ecological Optimisation** objective. For these reasons Pokaka amply meets all three of the translocation objectives listed above.
- e. *Metrosideros bartlettii* - This species has its nearest occurrence some 300km from Motutapu in the Cape Reinga region of the Far North. It is facing population **collapse** there due to **possum browse** (from an already tiny remnant of 31 adult individuals in 2000 to some 20 individuals now). Motutapu represents possibly the only viable **Sanctuary** for this large and striking forest tree in the public estate because, unlike most of the adjacent Northland/Auckland mainland, the island has very high average **temperatures** that put it in the same climatic zone as Cape Reinga. This means that Bartlett's Rata is more likely to find the high temperatures necessary to its flowering and **reproduction** on Motutapu in the context that such activity is largely absent for the species where it has been planted on the **cooler Mainland**. As well as being **possum free**, Motutapu is also sufficiently large to provide a **sheltered Interior Hill Forest Biotope** that matches the habitat of this non-maritime species in the Far North. If given sanctuary on Motutapu this species would provide nectar from a pohutukawa-like flower but at an **earlier** time in the season - **November** - than pohutukawa, so spreading the temporal delivery to honeyeaters of such food under the **Ecological Optimisation** objective. It is only distantly related to Pohutukawa and Rata with minimal danger of hybridisation. The species is **long-lived** so contributing to **Weed Suppression**.

Genetic Refuge, Integrity and Diversity:

For all of the **translocation** species described the focus would be on securing seed from the **nearest viable** (ie. reproductive) populations to Motutapu and also from a minimum of the **three** most **proximate** dispersed sources to ensure both **genetic integrity and diversity**.

Similarly, for the **entire list** of plants presented here every effort would be made to secure seed from the **three** most **proximate** dispersed sources to again ensure **genetic integrity and diversity**. This would mean, for example, that in the case of Tawapou - which remains extant on Motutapu - seed would best be collected from three individuals, one on Motutapu, one on Waiheke and one on Pakatoa. In the case of White Maire - which is now locally extinct on Motutapu - seed would best be collected from an individual on Waiheke, one in the Hunuas and one in the Waitakeres. In the case of Black Maire - which is now locally extinct in the Inner Gulf - seed would best be collected from an individual in each of the remaining populations on the Isthmus Mainland at Whatipu, Anawhata and Riverhead.

Genetic refuge should be provided on Motutapu for *Pittosporum eugenioides* and *P. tenuifolium* in particular. The native provenances of both species in the Isthmus/Inner Gulf region are now surrounded by widely-planted conspecifics from elsewhere in New Zealand. For example, Tarata, is planted by both private and public agencies in the Auckland region as its Nelson-Marlborough

provenance. Thus both species should be taken to Motutapu as the native regional provenance, with any examples of inappropriately provenanced plants already on the island removed, to facilitate a genetic refuge there for them.

Weed Suppression:

As foreshadowed above in the translocation species discussion, the reasoning behind the use of **long-lived** species for **weed suppression** is related to their ability to provide a consistent canopy cover for long periods of time and thus to limit the area of **gaps** available for weed colonisation. In the case of the pressing need for *Rhamnus* suppression on maritime cliffs, for example, if MRT were to only plant **short-lived** species such as Karo, Ngaio, Taupata and Heupara on the steep margins of Motutapu, with an average longevity of ca. 50 years, and assuming a mixed age structure, and assuming an area of 250ha for that habitat - then $G=a/l$ (where G = the area in gap phase per annum, a = the total planted area, l = average longevity of the planted individuals). In this situation **5ha** would be in **gap phase** with high light and available for *Rhamnus* colonisation in any one year.

The alternate scenario is that instead of the pioneers, MRT would be able to plant a diverse forest of **old-growth cliff specialists** that includes Coastal Maire, Pohutukawa, Tawapou and Milkwood with average longevities of ca. 250 years. In this case using the above model there would only be **1ha** per annum in **gap phase**, thus **saving** the time and resources that would otherwise have been spent controlling weed invasion for an additional **4ha** per annum if only shorter-lived early-mid successional species had been planted. Viewed another way, and assuming the situation where MRT was able to plant the entire maritime 250ha in one year - so that all planted individuals grew and subsequently died as a perfectly co-ordinated cohort - then the pioneers would produce a massive gap over the entire area **50 years** after the planting occurred. By contrast, the old-growth species would all vacate the 250 ha much later at **year 250**. This means that in the period of time over which DoC would have had to control *Rhamnus* **five times** over the entire 250ha if **shorter-lived** species had been used - the Department would have only had to control it **once** with plantings dominated by the Mature Phase species. One could argue against this by saying that the native species will also be attempting to regenerate in the gaps. However, in the case where there is a dominant invader like *Rhamnus* or *Privet*, this is an unlikely proposition.

This rationale also applies in **all** the other forest **Biotopes**, and for **all** Mature Phase species, to be used in the revegetation effort on Motutapu and for all potential **weed** species. Thus, the emphasis on producing a Mature Phase forest dominated by long-lived species across the whole island, as well as being best for the fauna, is also in the view of MRT best for **Weed Suppression**.

Planting Sequence:

Where possible planted Pioneer stands should be allowed **five years** to establish prior to the installation of the Mature Phase plantings in their understoreys. This would allow the Pioneer stands to gain sufficient size to provide adequate **shelter** to the MP species, as well as an adequate period to allow for pasture **grass suppression**. Both these effects are likely to enhance the performance of the MP plants in their early stages of growth. Achievement of this objective would be straightforward because for the first years of the new planting regime the MP plantings would best be deployed in the **60ha** of **pre-existing** planted Pioneer forest. Thus the **lag** produced by assignment of MP plantings to the already established Pioneer stands in the first years of this programme would give sufficient time for the subsequent Pioneer plantings to become **well grown** before MP species were inter-planted amongst them.

Comprehensiveness:

The full complement of 75 species contained in this Nursery Plan is very close to all possible large woody species that are ecologically relevant and useful for the Motutapu ecological restoration and revegetation programmes. Those few that are missing include *Coriaria arborea* (toxic), *Pisonia brunoniana* (danger to birds), *Mida salicifolia* (root parasite), *Leprospermum scoparium* (fire promoter and harsh understorey) and *Nothofagus truncata* (sensitivity to root rot). Since Motutapu has insufficient elevation for the Montane Forest Biotope, Mature Phase species preferring that habitat in northern New Zealand - *Ixerba brexioides*, *Quintinia serrata*, *Griselinea littoralis*, *Monoao colensoi*, *Lepidothamnus intermedius* and *Metrosideros umbellata* – have been excluded.

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Common plants for translocation to four Hauraki Gulf Islands

Key

- T = to be translocated
- E = extant (recorded within last 20 years)
- (V) = very low numbers to be planted <20
- (L) = low numbers to be planted 20-100
- (M) = Medium numbers to be planted 100-1000
- (H) = High numbers to be planted >1000
- (p) = present in pollen record
- k = usually only associated with kauri forest so suitable for larger islands only

The criteria used to decide which native species to include for translocation to each island are as follows:

1. The species is not currently present on the island
2. The species will be within its known natural distribution
3. The species has been recorded at some time within the Inner Gulf Islands ecological district or adjacent coastal mainland as defined in fig. 1 attached or
4. The species has been recorded in the fossil record from the island or
5. The species has been recorded in a pollen core from the island or an adjacent island and
6. The potential exists for appropriate habitat on the island

Species	Motutapu	Motuihe	Tiritiri-Matangi	Motuora
Forest trees and shrubs				
Botanical name				
<i>Agathis australis</i>	E	T (L) (p)	T (L)	T (L)
<i>Alectryon exelsus</i>	E	T (M)	E	T (M)
<i>Alseuosmia banksii</i>				
<i>Alseuosmia macrophylla</i>	T (M)	T (M)	T (M)	T (M)

RELEASED UNDER

Species	Motutapu	Motulhe	Tiritiri Matangi	Motuora
<i>Aristotelia serrata</i>	Wineberry	T (L)	T (L)	T (L)
<i>Beilschmiedia tarairi</i>	Tarairi	E	E	T (H)
<i>Beilschmeidia tawa</i>	Tawa	T (M)	T (M)	T (M)
<i>Beilschmiedia taylora</i>	Tawaroa	T (M)	E	T (M)
<i>Brachyglottis kirkii</i>	Kirk's daisy	T (M)	E	
<i>Brachyglottis repanda</i>	Rangiora	T (M)	E	E
<i>Carpodetus serratus</i>	putaputaweta	T (L)	E	T (L)
<i>Coprosma arborea</i>	Tree coprosma	E	E	T (M)
<i>Coprosma areolata</i>	Thin-leaved coprosma	T (M)	E	T (M)
<i>Coprosma crassifolia</i>				
<i>Coprosma grandifolia</i>	Large-leaved coprosma	T (M)	E	T (M)
<i>Coprosma lucida</i>	Shining karamu	E	T (M)	T (M)
<i>Coprosma macrocarpa</i>	Coastal karamu	T (H)	E	E
<i>Coprosma propinqua</i>	Mingimingi	E	E	T (L)
<i>Coprosma rhamnoides</i>	Twiggy coprosma	T (M)	E	E
<i>Coprosma spathulata</i>	k	T (L)	T (L)	T (L)
<i>Corokia buddleioides</i>	Korokio k	T (L)		
<i>Cyathodes juniperina</i>	Prickly mingimingi	T (M)	E	T (L)
<i>Dacrydium dacrydioides</i>	Kahikatea	T (M) (p)	E	T (V)
<i>Dacrydium cupressinum</i>	Rimu	T (M) (p)	T (L)	T (V)
<i>Dracophyllum latifolium</i>	Neinei k	T (L)		
<i>Elaeocarpus dentatus</i>	Hinau	T (L) (p)	T (L)	T (L)
<i>Freycinetia banksii</i>	Kiekie	T (L) (p)	T (L)	T (L)
<i>Fuchsia excortica</i>	Tree fuchsia	T (L)	T (M)	T (L)
<i>Griselinia lucida</i>	Puka	T (L)	T (L)	T (L)
<i>Halocarpus kirkii</i>	Monoao	T		
<i>Hebe macrocarpa</i>	Hebe	T (M)	T (M)	E
<i>Hedycarya arborea</i>	Pigeonwood	E	E	T (M)
<i>Hoheria populnea</i>	Lacebark	T (H)	E	E
<i>Lagarostrobos colensoi</i>	Silver pine	T		
<i>Laurelia novae-zelandiae</i>	Pukatea	T (L) (p)		
<i>Leionema nudum</i>	Mairehau k	T (L)	T (L)	T (M)
<i>Leucopogon fasciculatus</i>	Mingimingi	T (M) (p)	E	T (M)
<i>Libertia ixioides</i>	Mikoiko	T (L)	T (L)	T (L)

THIS OFFICIAL INFORMATION ACT

RELEASED UNDER

Species	Kawaka	Motutapu	Motuihe	Tiritiri Matangi	Motuora
<i>Libocedrus plumosa</i>		T (L)	T (L) (p)		
<i>Litsea californis</i>	Mangeao	E	E	T (M)	T (L)
<i>Lophomyrtus toulata</i>	Ramarama	T (L)			
<i>Melicope simplex</i>	Poataniwha	T (L)			
<i>Melicytus macrophyllus</i>		T			
<i>Metrosideros robusta</i>	Northern rata	T (M)	T (L)	T (L)	
<i>Myrsine salicina</i>	Toro	T			
<i>Nestegis cunninghamii</i>	Black maire	E	T (L)	T (L)	
<i>Nestegis lanceolata</i>	White maire	E	T (L)	T (L)	T (L)
<i>Nestegis montana</i>	Narrow leaved maire	T			
<i>Nothofagus truncata</i>	Hair beech	T (M)	T (L) (p)		
<i>Olearia albida</i>		T (L)			
<i>Olearia furfuracea</i>	Akepiro	E	T (M)	E	E
<i>Olearia rani</i>	Heketara	T (L)	T (L)	T (L)	T (L)
<i>Ozothamnus leptophyllus</i>	Tauhinu	T (L)	T (L)	E	T (L)
<i>Pennantia corymbosa</i>	Kaikomako	T	T (L)	T (L)	
<i>Phyllocladus trichomanoides</i>	Tanekaha	E ^k	T (M) (p)	T (L)	
<i>Pittosporum eugenoides</i>	Lemonwood	E ^k	T (M)	T (L)	
<i>Pittosporum cornifolium</i>	Perching pittosporum	T	T (L)	T (L)	T (L)
<i>Pittosporum tenuifolium</i>	Kohuhu	E	E	E	T (L)
<i>Plagianthus divaricatus</i>	Makaka	E (M)	T (L)		
<i>Plagianthus regius</i>	Manatu	T			
<i>Pouteria costata</i>	Tawapou	E	E	E	T (M)
<i>Podocarpus totara</i>	Totara	E	T (M)	E	E
<i>Pomaderris kumeraho</i>	Kumarahou	E	T (L)	E	T (L)
<i>Pumnopitys ferruginia</i>	Miro	E	T (L) (p)	T (L)	T (V)
<i>Pumnopitys taxifolia</i>	Matai	E	T (L) (p)	T (L)	T (V)
<i>Pseudopanax crassifolius</i>	Lancewood	E	T (L)	T (L)	T (L)
<i>Quintinia serrata</i>	Tawheowheo		T (L) (p)		
<i>Rhabdothamnus solandri</i>	NZ gloxinia	T (H)	T (H)	E	T (M)
<i>Rhopalostylus sapida</i>	Nikau	E (M)	T (M) (p)	T (M)	T (M)
<i>Schefflera digitata</i>	Pate	E	T (L)	E	T (M)
<i>Solanum aviculare</i>	Poroporo	E	E	T	T (L)
<i>Streblus heterophyllus</i>	Small-leaved milk tree	T (L)	T (L)	E	T (L)

OFFICIAL

INFORMATION ACT

RELEASED UNDER OFFICIAL INFORMATION ACT

Species	Swamp maire	Motutapu	Motuihe	Tiritiri Matangi	Motuora
<i>Syzygium maire</i>	Swamp maire	E	T (L) (p)		
<i>Toronia toru</i>	Toru	T	T (L) (p)	T (L)	
<i>Weinmannia siphocla</i>	Towai	T	T (L) (p)		
Climbers					
<i>Clematis paniculata</i>	Clematis	T (L)	T (L)	E	E
<i>Metrosideros diffusa</i>	White climbing rata	T (L)	T (L)	T (L)	T (L)
<i>Metrosideros fulgens</i>	Orange rata vine	T (M)	T (M)	T (M)	T (M)
<i>Metrosideros perforata</i>	Small-leaved rata	T (M)	T (M)	T (M)	T (M)
<i>Muehlenbeckia australis</i>	Pokukhue	E	E	E	T (L)
<i>Parsonsia heterophylla</i>	NZ passion vine	T (L)	E	E	T (L)
<i>Passiflora tetrandra</i>	Native passion vine	T (L)	T (L)	T (M)	T (L)
<i>Ripogonum scandens</i>	Supplejack	E (L)	T (L)	E	T (L)
<i>Rubus australis</i>	Swamp lawyer	T (L)	T (L)	E	T (L)
<i>Rubus cissoides</i>	Bush lawyer	T (L)	E	T (L)	T (L)
Herbaceous species					
<i>Calystegia tuguriorum</i>	Powhiwi	E			T (L)
<i>Einadia triandra</i>	Pigweed	T (L)	T (L)	E	T (L)
<i>Einadia trigonos subsp. trigonos</i>	Pigweed	T (L)	T (L)	E	T (L)
<i>Epilobium rotundifolium</i>		T (M)			
<i>Linum monogynum</i>	NZ linen flax	E	T (L)	E	T (L)
<i>Peperomia urvilleana</i>		E	E	E	T (L)
<i>Selliera radicans</i>	Selliera	E	E	E	T (L)
<i>Tetragonia trigyna</i>	Beach spinach	E	T (L)	E	T (L)
Coastal monocots					
<i>Astelia banksii</i>		T	T	E	E
<i>Astelia grandis</i>		T			
<i>Astelia solandri</i>	Perching lily	T	T	T	
<i>Astelia trinervia</i>		T	T		
<i>Austrostipa stipoides</i>	Coastal needle tussock	E	T	E	T

RELEASED UNDER THE OFFICIAL INFORMATION ACT

Species	Motutapu	Motuihe	Tiritiri Matangi	Motuora
<i>Carex virginata</i>	E		E	E
<i>Eleocharis acuta</i>	T	E	E	
<i>Ficinia nodosa</i>	T	E	E	E
<i>Isachne globosa</i>	T		E	
<i>Isolepis cernua</i>	T	E	E	E
<i>Juncus edgariae</i> (syn. <i>J. sphaerolobus</i>)	T	E	E	E
<i>Juncus maritimus</i> var. <i>austroalensis</i>	T			
<i>Juncus pallidus</i>	E			E
<i>Juncus prismatocarpus</i>	T		E	
<i>Juncus sarophorus</i>	T		E	E
<i>Juncus usitatus</i>	T	E	E	
<i>Lachnagrostis billardierei</i>	T	E		
<i>Lemna minor</i>	T	E		
<i>Machaerina sinclairii</i>	T			
<i>Schoenoplectus tabernaemontani</i>	T	E		
<i>Triglochin striata</i>	T	E	E	E

Threatened plants for translocation to Hauraki Gulf Islands

Botanical name	Common name	Threat Status	Motutapu	Motuihe	Tiritiri Matangi	Motuora	Potential seed source
<i>Anemanthele lessoniana</i>	Gossamer grass	de	T				
<i>Austrofestuca littoralis</i>	Sand tussock	de				T	Pakiri beach
<i>Calystegia marginata</i>	Small flowered white bindweed	nu				T	Ti Point
<i>Centipedia minima</i> subsp. <i>minima</i>	Sneezeweed	nc		T			Kawau Island, Little Barrier Island
<i>Coprosma acerosa</i>	Sand coprosma	de		T		T	Te Arai beach
<i>Cianthus puniceus</i>	Kakabeak	nc		T		T	ARC Botanical gardens (Moturemu source)
<i>Dactylanthus taylorii</i>	Wood rose	nv	T	T (R)		T	Little Barrier Island, Coromandel
<i>Desmoschoenus spiralis</i>	Pingao	re				T	Mahurangi West, Mahurangi
<i>Euphorbia glauca</i>	Shore spurge	de		T (R)		T	Brownys Island, Little Barrier Islal
<i>Fuchsia procumbens</i>	Creeping fuchsia	nu	T				
<i>Ileostylus micranthus</i>	Green mistletoe	nt		T (R)		T	Mahurangi west, Waiwanda

RELEASED UNDER

Botanical name	Common name	Threat Status	Motutapu	Motuihe	Tiritiri Matangi	Motuora	Potential seed source
<i>Korthalsella salicornioides</i>	Dwarf mistletoe	nu					
<i>Lepidium flexicaule</i>	Coastal cress	nv		T		T	
<i>Lepidium oleraceum</i>	Cook's scurvy grass	nv		T		T	ARC Botanical Gardens (GBI source)
<i>Picris burbidgeae</i>	Native oxtongue	ne				T	Casnell Island, Mokohinau Islands, Hen & Chickens Islands
<i>Pimelia arenaria</i>	Sand daphne	de		T (R)			
<i>Pimelia longifolia</i>	Long leaved pimelea	dd					
<i>Pimelia tomentosa</i>		nv		T		T	Goat Island, Waiheke, Great Barrier
<i>Pisonia brunoniana</i>	Parapara	re				T	Mahurangi, Mangawhai
<i>Pomaderris phyllicifolia</i> var. <i>ericifolia</i>	Tauhinu	de		T	E	T	Tiritiri Matangi
<i>Rorippa divaricata</i>	NZ watercress	nv		T		T	Fanal Island
<i>Senecio scaberulus</i>	Native fireweed	nc		T (R)		T	Goat Island, Noises Islands, Pon Island
<i>Sicyos aff. australis</i>	Mawhai	nu		T (R)		T	Waiheke Island, Little Barrier Island
<i>Strebilus banksii</i>	Large leaved milk tree	re				T	Waiheke, Tawharanui, Mahurangi
<i>Tetragonia tetragonioides</i>	NZ spinach	nu				T	Rangitoto, Casnell Island
<i>Tupeia antarctica</i>	Green mistletoe	de		T		T	Fanal Island

THE OFFICIAL INFORMATION ACT

Criteria for inclusion:
 Species currently classified as threatened or uncommon (as above) which have been recorded in the Inner-Gulf Islands Ecological District or adjacent coastal mainland

Key

- T = to be translocated
- E = extant (recently recorded)
- (R) = historical record for the island exists

Threat Status
 nc = Nationally critical (91 spp.)

re = Nationally endangered (45 spp.)
nu = Nationally vulnerable (44 spp.)
de = Declining (83 spp.)
re = Recovering (6 spp.)
rl = Relict (20 spp.)
nu = Naturally uncommon (542 spp.)
nt = Non-threatened

(from de Lange P J et al. 2009. Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* Vol. 47: 61-96).

References

- Buchanan J. 1876. On the botany of Kawau Island: Physical features and causes influencing distribution of species. *Transactions and Proceedings of the New Zealand Institute* Vol (9): 503-527.
- Cameron E K & De Lange P. 2006. Vegetation and vascular flora of southern Ponui Island, Hauraki Gulf- a return visit. 16/10/05. *Auckland Botanical Society Journal*, 61 (1): 3-14.
- Cameron E K. 1998. Bot Soc trips to The Noises (Hauraki Gulf) and an updated species list. *Auckland Botanical Society Journal* 53(1): 25-35.
- De Lange P J & Crowcroft G M 1999. The Vascular Flora of Motuihe Island Recreation Reserve. *Auckland Botanical Society Journal* 54(2):19-30.
- Esler A. E. 1980. Botanical features of Motutapu, Motuihe, and Motukorea, Hauraki Gulf, New Zealand. *New Zealand Journal of Botany* Vol (18): 15-36.
- Esler A E. 1978. Botanical features of Tiritiri Island, Hauraki Gulf, New Zealand. *N.Z. Journal of Botany* Vol (16): 207-226.
- Gardner R. 1996. Botanical Society field trip to Brown's Island (Motukorea), August 18 1996. *Auckland Botanical Society Journal*, 51, 2, 1996.
- Kirk T. 1878. Notes on the Botany of Waiheke, Rangitoto, and other islands in the Hauraki Gulf. *Transactions of the New Zealand Institute* Vol (11): 444-454.
- Wilcox M, Spence A & White P. 2002. Botanical features of Whakanewha Regional Park Waiheke Island. *Auckland Botanical Society Journal* 57(1): 34-46.

RELEASED UNDER THE OFFICIAL INFORMATION ACT

RELEASED UNDER THE OFFICIAL INFORMATION ACT