

'ORA NGAHERE, MAURI ORA'

PODOCARP RESTORATION ON TUAWHENUA LANDS

Tuhoe Tuawhenua Trust



**Sustainable
Farming Fund**
Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

PODOCARP RESTORATION ON TUAWHENUA LANDS

Ora ngahere, mauri ora!¹

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Cover image: Young toromiro, Paripari Flats, Tuawhenua - as we want to see it everywhere in the Tuawhenua (Tuhoe Tuawhenua Trust Image Collection)²

¹ Can be translated as: "The essence of life and wellbeing comes from the vitality of the forest".

² All photographs unless otherwise indicated are from the Tuhoe Tuawhenua Trust Image Collection

Tena koutou!

This report contains the record and findings of SFF Project 08-060 undertaken by the Tuhoe Tuawhenua Trust from 2009-2012. Our project sought to test a new kind of management approach for the Tuawhenua forests that involves restoring the composition of our tawa forests left from past logging of podocarps back to mixed stands of tawa and podocarps.

The project became a long journey of learning - trying different approaches, researching the work of others, seeking the knowledge and advice of experts, recording and analysing results and data, canvassing the views of practitioners and industry players, and endlessly querying and challenging - the findings, the status quo, the results, the rules, the advice given to us. All of this so that we might deepen our understanding of our forest beyond the norm, and that we might strike a vein of thinking that would cast new light on management of a mixed modified indigenous forest such as ours.

Throughout the project we were driven by principles that seek a management approach that is productive and responsible in economic and environmental terms, and that returns to us the kind of forest our ancestors of yore treasured and enjoyed. This project has made all the difference. It gave us time, resources and support to work out what to do and how to do it, and it gave us opportunities to engage and enlighten the Tuawhenua people on what's happening and how we can make a better future.

We simply thank here all that have supported and been involved in this project: MAF Sustainable Farming Fund for their funding and assistance for the project; Landcare Research for being our long-term research partner and for their contribution in the coupe research and their advice throughout the project on all aspects of podocarp restoration and indigenous forest management; Scion for encouragement and advice on podocarp restoration and forest management; MAF Indigenous Forestry section for their guidance in forest management and harvest permits; the Bay of Plenty Regional Council for their advice and support in environmental matters, land use and harvest planning.

We also thank DOC for advice and guidance at different points in project and Te Wharekura o Huiarau for working with us on the nursery component of our project. We acknowledge the foresight and efforts of past managers and staff of the

Tuawhenua Trust who launched this project. It has proven to be a crucial part of our learning and development in responsibly managing the forests of the Tuawhenua.

Nga mihi hoki ki nga hapu o Ruatahuna - Ngati Manunui, Ngati Tawhaki, Ngai te Riu, Ngati Kuri, Te Urewera - na koutou te kaupapa nei i tautoko i oti ai nga mahi, i puta ai te ihu o Te Tuawhenua i roto i enei tu momo mahi. Na reira, tena koutou, tena koutou, tena tatau katoa!!

Nga Kaitiaki o Te Tuawhenua

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EXECUTIVE SUMMARY

Introduction

The Tuhoe Tuawhenua Trust administers a large tract of land about Ruatahuna, an isolated and disadvantaged community, which is central to the identity and wellbeing of the hapu of Ruatahuna and the tribe of Ngai Tuhoe. The Trust seeks a future for the Tuawhenua lands where the people and land are ‘settled’, in harmony, and thriving. The trust seeks to restore podocarps to its previously logged forests whilst at the same time create jobs for Ruatahuna peoples and contribute to a commercial base for the trust through a indigenous forestry venture focused in the first stages on tawa. The trust seeks to keep control of such an operation rather than enter into joint venture, and needed the opportunity to test the feasibility of tawa extraction, and develop the methodologies for podocarp restoration integrated with a tawa harvest operation.

The Sustainable Farming Fund of MAF provided funding for a project to test these matters, and research partner Landcare Research completed a research component and provided overall advice for the project. The project was conducted over nearly 4 years from winter 2009 and involved three components – podocarps restoration, canopy manipulation and tawa feasibility study. The project involved a range of stakeholders, government agencies and local hapu and organisations.

Podocarp Restoration

This part of the project involved transplanting out of naturally occurring seedlings in the first stages, and releasing seedlings and saplings in later stages. Over 4000 plants were dealt with: a total of 3830 seedlings were transplanted, 455 seedlings were released and 270 poles and saplings were released. In nearly all patches of transplanting or releasing the predominant podocarp species was rimu, followed by toromiro or kahikatea then matai. In a few patches, toromiro was the predominant species. Matai seedlings were less commonly found than the others species. Kahikatea seedlings were commonly found to be regenerating successfully so were not used often in the transplanting programme.

In about half of our restoration locations, most seedlings were transplanted into shaded or partly-shaded areas. For a number of our locations, however, the majority of seedlings to poles were situated in open areas. For most of our seedlings plots 80-90% measured less than 100cm, as this was our preferred size for transplanting. Overall the survival rate was good with 80-90% where transplants were mostly not in the open, and 40-60% where a proportion of transplants were in the open. Clearly, survival rates were affected by lack of shade for the transplants.

Overall, the podocarp restoration component of this project assisted us to:

- develop a cost-effective and appropriate way to source seedlings
- develop techniques for best transplanting and maintaining seedlings
- understand how crucial data management will be to future management of our forests

- begin development of the systems and competence required for forest data management
- understand the need for and costs of ongoing maintenance of seedlings over the long term

The podocarp restoration also made a major contribution to a key outcome for us from this project – the engagement of our people in Ruatahuna. Four hapu were involved in podocarp restoration on their lands that are under our Trust, so that they too have learnt about transplanting, releasing and data collection and now have their own understanding of and interest in the management of Tuawhenua forests.

Canopy Manipulation

Two coupes were created in November 2009 and the growth and survival of the podocarp seedlings over 15cm tall and growth of edge trees will be monitored over future years. Our key learning from this exercise is that the gap of 20-30 m² is an open space in which transplanted podocarps struggle to survive. We know that we can increase the rate of survival by wrenching and or hardening-off before planting out seedlings, so are comfortable that this risk can be mitigated in our future forest management, but an additional cost will be incurred.

Otherwise, we have set in this part of our project the base for monitoring the change in light conditions and closing of the canopy gap, the growth of planted and naturally-occurring podocarp seedlings, and the growth or damage to canopy-edge trees. We also have a site where the tawa canopy was opened to create smaller gaps, and in which podocarps were planted in 2011. This site will also be monitored over time for comparison with the larger coupe sites. It will take some years before conclusive results will be obtained, but we are able to refer to results gained from studies in other forests in the meantime.

Conclusion

As outlined in the relevant sections of this report, we were blessed through this project to learn a lot about podocarp restoration and canopy manipulation. In summary, we found that we could:

- mount a programme of podocarp restoration using seedlings from our own lands
- make podocarp restoration an integral part of tawa harvest where it is undertaken in small coupes

All our learnings, however, are tempered by a number of issues that pose risks to the overall commercial and/or ecological viability of our forest management proposition. These issues include:

- an holistic model for management of our forests
- research and evaluation on podocarp restoration, forestry management, economics and commercial viability, markets and products, biodiversity, cultural and community development, industry networks and context.

Through this project we have learnt enough about our forest management approach of podocarp restoration to be able to implement an operation. We will plant podocarps into

the gaps created by the small coupes and few-tree group removal as part of a tawa extraction programme. We will continue to research all aspects of our forest management approach, from resource assessment to podocarp restoration and timber markets.

PART I: INTRODUCTION



Te marua o Ruatahuna – the Ruatahuna valley. The photo is taken from the southern end of the valley looking out towards Whakatane and the Bay of Plenty. These are the headwaters of the Whakatane River which forms and flows north through the middle of the Ruatahuna valley. The Tuawhenua lands are in general the bush-clad area surrounding the Ruatahuna valley and neighbouring valleys.

(Photo courtesy of GNS Science).

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1 The Tuhoe Tuawhenua Trust was formed in 1987, after a long legal battle by Hikawera Te Kurapa and others of Ruatāhuna to quash the amalgamated title and to return the lands of the Tuawhenua to their original hapu title. Most of the bush blocks of the lands about Ruatāhuna are under the Tūhoe Tuawhenua Trust, which has 25 blocks in total, covering about 9000 hectares in area.

2 It has been a long road for the Trust since its establishment. There were no trust funds for the Trust to administer, and the lands are, in general, native bush blocks, where about 30% of the forest was logged in the 1950s and 1960s. Opportunities for development are limited, due to the nature of the land and regulations that constrain development in this region.

3 Despite these limitations the Trust is active in working towards its main aims to ensure that the lands are retained in the ownership of the people of the Tuawhenua, that the lands and forests are protected and restored as appropriate and that the lands and forest generate economic benefit for the current and future generations in a sustainable manner. Our activities include: research, feasibility studies and business development, commercial operations, conservation and biodiversity programmes, communications and support, and trust administration and management.

Ruatahuna: Te Manawa o Te Ika

4 The people of the Tuawhenua lands are the hapu of Ruatahuna who have a number of marae strung out along the Ruatahuna valley and the upper reaches of the Whakatane River. Ruatahuna's population is between 350-400 people, most of whom are of the Tuhoe tribe.

5 Ruatahuna is known as Te Kohanga o Tuhoe – the place of origin of the early tribes of the Tuhoe people, a centre from which these tribes populated and settled the wider Urewera region. Ruatahuna has also been a place where early tribes enjoyed the bounty offered by the forests and streams of the region, and in latter centuries have taken refuge there from attack by warring tribes and the colonial military. Ruatahuna holds a wider significance too, for it lies at Te Manawa o Te Ika-a-Maui – the heart of Maui's fish – the North Island of Aotearoa.³



³ For more on Ruatahuna origins and significance, see pp 3-5, 'Te Manawa o Te Ika', Volume 1: A History of the Mana of Ruatahuna from Early Origins to Contact and Conflict with the Crown, Tuawhenua Research Team, October 2003

Mature rimu tower above tawa canopy near Paripari cliffs.



The Future for the Tuawhenua

6 This Trust is honoured to be responsible for these lands because of their significance for the Ruatahuna people, for the Tuhoe tribe as a whole, and indeed for the nation. The Trust's tumanako or aspiration for the medium term is "Kua ora ake ano te iwi me te whenua...The people and the land are thriving" where:

- The great podocarps of our ngahere are regenerating to former glory
- Our special bird-life is flourishing
- The whenua, ngahere and awa contribute to our sustenance and good health as a people
- The land and resources are managed in a sustainable way over the long term for the enjoyment and benefit of future generations
- Our people know about, care for and make good use of the land and resources of the Tuawhenua.

7 Given the current state of our land and forests, we anticipate that it will take at least 10-20 years to make some real progress towards Te Tumanako o te Tuawhenua, and we are organising now for how we will achieve this. In the longer term of 150-200 years, we aspire to have our lands and forests in a state where the special ecosystems of the Tuawhenua are sustained in a balanced manner. We accept the challenge to face the size and complexity of the assessments, decision-making and planning that is required to reach this end.

Issues for Our Forest and Community

8 Forest (ngahere) restoration is a stated goal of our trust, for a number of reasons. Firstly, our ngahere is a major source of history, culture, spirituality and wellbeing for our people. For the people of Ruatahuna, existence in the past and today is bound up inextricably with the nature of the ngahere, what it stands for and what it provides. Thus, it is not just a matter of resources or food, it is one of identity.

9 Unfortunately, the nature of our forest has changed and continues to change. Our kereru, so central to traditional Tuhoe culture, no longer abound; at times our bush stands silent and bereft of even our smaller birds; many of our great podocarps have been

logged; without their shelter the tawa under-storey has been damaged and broken; many of our rata, stripped of leaf, stand dying or have fallen; and our traps often catch rats and cats rather than possums.

10 At the same time, Ruatahuna as a community has been undergoing major changes. Since the closure of the local timber mill in the early 1970s, Ruatahuna has had no ongoing local industry to sustain the economy and welfare of its people. Consequently, much of the Ruatahuna community have become welfare dependent and survive on very low incomes. Ruatahuna people have however sought to improve their lot with enterprises in tourism and horticulture established in the 1970s and 1980s, and in latter years, infrastructural works in water and roading being taken up by local contractors. Unfortunately these pockets of enterprise have proven difficult to sustain and the economic reality for most families in Ruatahuna is either welfare or just part-time and intermittent employment.

11 These matters are of major concern for us as trustees of the lands that traditionally have been the spiritual inspiration and the economic sustenance of our people. It is in this context that the Trust has set goals for forest restoration and economic development for the lands of the Tuawhenua - how can we use our timber resources to create work in Ruatahuna and provide some return for owners whilst at the same time protect and restore the special nature of our forests. From our experience it seems that forestry and forest restoration simply cannot go together. This is why we have spent some time researching and planning what we want and need to do.

Lessons from Past “Forest Management”

12 Whilst we are keen to generate some industry in Ruatahuna we are also keenly aware of the history. During the forestry of the last century, logs were sold for just a royalty, and were paid out to owners at the time leaving no legacy for current and future generations. Although Ruatahuna people benefitted from jobs created in the logging and milling industries, these jobs were in relative terms, short-lived. Most of those employed had secure jobs for at most ten years.

13 The people of Ruatahuna saw forestry as part of a broader development strategy. The forest would be cleared to bring land into pasture, just like everyone else had done in high country across the nation. But not to be so in Ruatahuna, where forestry was restricted for soil conservation and scenic reasons. The land could not be cleared but logging of most of the podocarps was allowed, leaving the ngahere as simply cutover.

14 Different approaches to a forestry operation have been tried since the milling days. In the 1980s the Steering Committee for these lands tried out the recovery of dead and down rimu but this never came to fruition as an ongoing operation. The native timber option was revisited about 10 years ago by the Tuhoe Tuawhenua Trust with an assessment of the harvestable timber on a few of our land blocks. The trust, under direction by the owners, was focused on ‘dead and down’ only for a limited period but the logging company they courted at the time as a partner wanted a forestry license to include live trees over a period of up to 50 years! The relationship turned sour and once bitten we are now twice shy.

15 Thus we find it hard to trust operators in the timber industry as partners, but we need some of their skills and market knowledge. We are still exploring options on the best approach but we are leaning towards an approach that is about starting small and doing most if not all of the operation ourselves. We believe this approach is not only consistent with the Tuhoe principle of mana motuhake (unending power or control), but it also allows us to ensure it is done in a way that ensures the forest is restored and

protected for future generations. Further, by building and controlling our own forestry operation we believe we will also be able to realise more value and economic opportunity for our trust and our owners.

The Quest Begins

16 We believe we need to have a good understanding of how our ngahere lives and changes before we even think of intervening again in our forest ecosystem. We have worked with Landcare Research to research podocarp regeneration in our forests and found that regeneration was not occurring at an adequate rate for restoring or sustaining our forest in either logged or unlogged areas. A key factor impacting on regeneration appears to be the tawa that forms the under-storey for most of our podocarp forest. Essentially nothing much grows under tawa but tawa.

17 As we see it then, our forest will never be the same again if we leave it as it is - tawa is becoming more dominant and the podocarps will never reign again as our great trees. Herein is the genesis of our intent to manage our forests in a way that is not only commercially and ecologically sustainable, but in a manner that restores what we once had in our forests. In setting this intent, we took on a major challenge - we are not experts in any of these matters - commercial indigenous forestry, sustainable ecological management or species restoration - but we are not deterred. We know our forests well, we believe in our ability to learn, we have some experience in forestry and business management, and most of all, we have been fortunate to be able to gain support from a number of authorities for the purposes of research and feasibility studies.

18 In this case, we successfully sought support from MAF Sustainable Farming Fund for a project that brought together the key issues for us in the future of our forest management:

- our aim for the restoration of our podocarps
- the need to manipulate the tawa canopy in order to 'make room' for more podocarps in our forest
- the need to make good use of tawa extracted from our forest on a commercially sustainable basis
- our aim to ensure that all of this is achieved on an ecologically sustainable basis.

19 We are immensely grateful to the MAF Sustainable Farming Fund and the staff for their funding, advice, guidance and patience throughout the course of this 3-year project. We are also indebted to Landcare Research for their particular contribution to this project and all that we do for management of our forests.

20 We turn now to how we developed, planned and delivered this project - SFF Project 08-060...

Project Rationale

21 Although this project has a specific significance for the Tuawhenua people and the Tuhoe Tuawhenua Trust, its rationale lay in a broader context. Historical logging has left some podocarp-tawa forests found in the central North Island in a degraded state, which in turn has diminished opportunities for future social, cultural and economic benefit for the forest owners. Such is the case for the Tuawhenua forest, the Trust and the Tuawhenua people.

22 In our forest, the podocarps have been logged out of a tawa matrix over extensive areas. One-third of our forest comprising 3000 hectares were logged last century, but as explained, we now seek to restore our forests to a balanced and productive state. As in the distant past, we seek for our forest to provide for the Tuawhenua people. In the future we see a number of commercial activities including eco-tourism, honey production and timber extraction on a sustainable basis. This in turn will provide resources to assist in the development of the Tuawhenua people and help the Trust to fulfill its kaitiakitanga responsibilities and to restore and improve our indigenous forest. Thus any venture in this context would not only be about meeting environmental and economic expectations, but would also be important for our spiritual and cultural well-being.

23 Very few demonstrations exist of how to restore such degraded forests. Collaborative research conducted by the Trust and Landcare Research has shown there is little podocarp regeneration in logged forests and that tawa trees and ferns currently dominate the forest canopy and forest understorey, respectively.⁴ We built our project on the premise that an opportunity may exist for commercial gain through extraction of tawa while providing the appropriate conditions for podocarp restoration. Although the demonstration would take place on our forests, we considered that other owners of tawa forest would also benefit from guidance on how these forests can be managed for sustainable extraction and podocarp restoration.

24 Further we were particularly interested in the podocarp species because they are a special feature in the tawa-podocarp forests of our region and the forest feels bereft without them, and also because they are of particular value to the Tuhoe people. The rimu and kahikatea are the great trees of the ngahere, the toromiro is a key food source for kereru and other birds, and the totara is a special timber source. It is not as if we do not value the tawa – this species too is crucial to our ngahere as a food source for our birds, especially the pigeon during the summer months.

Research Base

25 Research by Landcare Research on our lands and in collaboration with the Trust has provided a strategic, fundamental understanding of podocarp regeneration and management of tawa-podocarp forests. A number of areas have been covered that contributed to the design of this project:

- The influence of historical rimu harvest on soil biota and fertility⁵

⁴ Carswell et al, 2007

⁵ Wardle et al, 2008

- The conditions under which podocarp seedlings could be planted to successfully restore the forests, which suggests that some manipulation of the tawa canopy is necessary⁶
- The impacts of exotic species on forest regeneration and the need to manage their impacts accordingly⁷
- The distribution and abundance of tree seedlings⁸
- Mātauranga showed a massive decline of a key fruit (seed) disperser⁹
- The significant variation in soil fertility and plant species composition with topography¹⁰

Project Objectives & Outcomes

26 Our objectives in this project were multifaceted across a number of levels. Of national interest, our project serves as a wider demonstration to forest owners on how forests cutover in an exploitative manner can be managed to restore podocarps and to gain potential income from tawa harvest. At a global level, obligations such as the Montreal Process¹¹ and market access are increasingly requiring such management practices. In addition, it is an important contribution to resource management by indigenous peoples (e.g. as recognized in Forest Stewardship Council certification).

27 At an iwi, regional and local level, the project aimed to contribute to outcomes in ecological management and economic, social and cultural development in a number of ways by:

- Managing the Tuawhenua forests in an ecologically responsible manner
- Increasing the abundance of podocarps on Tuawhenua lands, given their cultural significance to Tuhoe people
- Providing job opportunities for Ruatahuna people, to stimulate the Ruatahuna economy and to help our people avoid benefit dependence
- Demonstrating how a forest can be managed for gain and providing for its people without exploitation
- Empowering the Tuawhenua our people to take a wider leading role in forest management regionally and for their iwi
- Providing learning opportunities for Tuawhenua people and to start to develop Ruatahuna's (and by extension, Tuhoe's) own environmental and forest management capability
- Enhancing environmental and aesthetic values for the benefit and enjoyment of local communities as well as domestic and international visitors to the region.

⁶ Te Kaahu o Tuawhenua 2007; Allen and Doherty 2005, pp13–15.

⁷ Allen and Lee, 2006

⁸ Carswell et al 2007

⁹ Lyver et al, 2008

¹⁰ Richardson et al, 2008

¹¹ A national forest reporting protocol

Project Design and Delivery

28 The podocarp restoration project consisted of two parts:

- A podocarp restoration programme, which involved planting and/or releasing over 4000 podocarp seedlings, saplings and poles
- A canopy manipulation exercise, which involved testing our ability to manipulate tawa, retain stable stands and enhance regeneration

29 The methodology for each part of the project is described in the respective sections in this report. Suffice to provide an outline here against the timeline for the project over three years from 2009 to 2011, with extension into 2012.

	Year 1	Year 2	Year 3	Extension
Ending	Winter 2009	Winter 2010	Winter 2011	Autumn 2012
Podocarp Restoration	Over 500 seedlings transplanted at 3 sites Nursery established	Over 1500 seedlings transplanted on 3 sites	Over 1500 seedlings transplanted on 4 sites; saplings & seedlings also released	Monitoring and data analysis Report
Canopy Manipulation		Canopy Manipulation at Hukanui Transplanting of podocarps into canopy gap	Canopy Manipulation at Tahora Transplanting of podocarps into canopy gap Monitoring	Analysis and report
Project Management	Communications & Accountability Project management, evaluation & final report			

Stakeholder Support & Engagement

30 A range of stakeholders were engaged in this project and provided support in a number of ways. MAF Sustainable Farming Fund provided the support for this project overall. Landcare Research provided time, effort and invaluable advice throughout the entire project. MAF Rotorua advised on permits and forest planning, whilst MAF Christchurch dealt with the process for sustainable forest management planning. The Bay of Plenty Regional Council also advised on matters for forest planning and land use.

31 Advice came from many quarters in the course of the project, including members of the New Zealand Farm Forestry Association (John and Ro Wardle), DOC Rotorua, millers and loggers involved in the project, potential markets consulted in the project

32 Locally, Te Wharekura o Huiarau provided the location of the nursery in the early stages of the project, and the hapu of Te Urewera, Ngati Tawhaki, Ngati Manunui, Ngati Kuri and Ngai te Riu were involved in a number of aspects of the project.

33 The project involved regular communications and promotion:

- Articles for our publication Te Kaahu o Tuawhenua which is published by Landcare Research and is sent to stakeholders, government agencies, researchers, iwi organisations and beneficiaries
- An article for Indigena, magazine for indigenous forest interests
- Articles in our trust's bi-monthly newsletter for Ruatahuna
- Reports to the local monthly tribal meeting, which engages all the hapu and organisations of Ruatahuna

34 The project was also designed in a way to contribute to development in the community by:

- Providing contract and project jobs to hapu and individuals in Ruatahuna
- Promoting the intent and rationale for podocarp restoration
- Engaging a number of hapu actively in podocarp restoration: This approach is key to hapu taking care over the very long term of the podocarp seedlings as they grow. Essentially we believe that if they are directly involved then they will take responsibility for their protection. We are also finding that the project has generally lifted the awareness about and desire for podocarp regeneration on the trust and other lands of Ruatahuna.
- Lifting understanding about tawa management, including harvesting, and the feasibility of indigenous forestry opportunities

Conclusion

35 This report sets out our story for the project SFF 08-060. It is presented in five parts:

- Part I: Introduction, covering a background on the Tuhoe Tuawhenua Trust and SFF project 08-060
- Part II: Podocarp Restoration, which covers that part of the project that focussed on planting and and/or releasing of podocarp seedlings and saplings
- Part III: Canopy Manipulation, which traces the exercise in creating gaps in the tawa canopy and the planting of podocarp seedlings into those gaps
- Part IV: Conclusion, covering our main learnings and issues for future consideration.

PART II: PODOCARP RESTORATION



Beau Riini, Raniera Te Kurapa and Raymond Te Kurapa of Te Urewera hapu tagging seedlings for transplanting in the podocarp restoration programme. This site is for podocarp restoration is at Otekura on Apithana T2 block, which was planted out in the winter of 2010.

Engagement

36 The project involved a number of groups and activities: the Tūhoe Tuawhenua Trust who provided a project manager, appropriate administrative support, and communications; Landcare Research who provided ecological expertise; hapu of Ruatahuna – Ngati Manunui, Ngati Tawhaki, Ngai Te Riu/Ngati Kuri and Te Urewera – who provided project workers to find, plant and release podocarp seedlings on their lands; and our local school, Te Wharekura o Huiarau who in the early stages provided the site for our nursery and some of the school youth to be involved in the nursery and planting activities.

Our Initial Approach

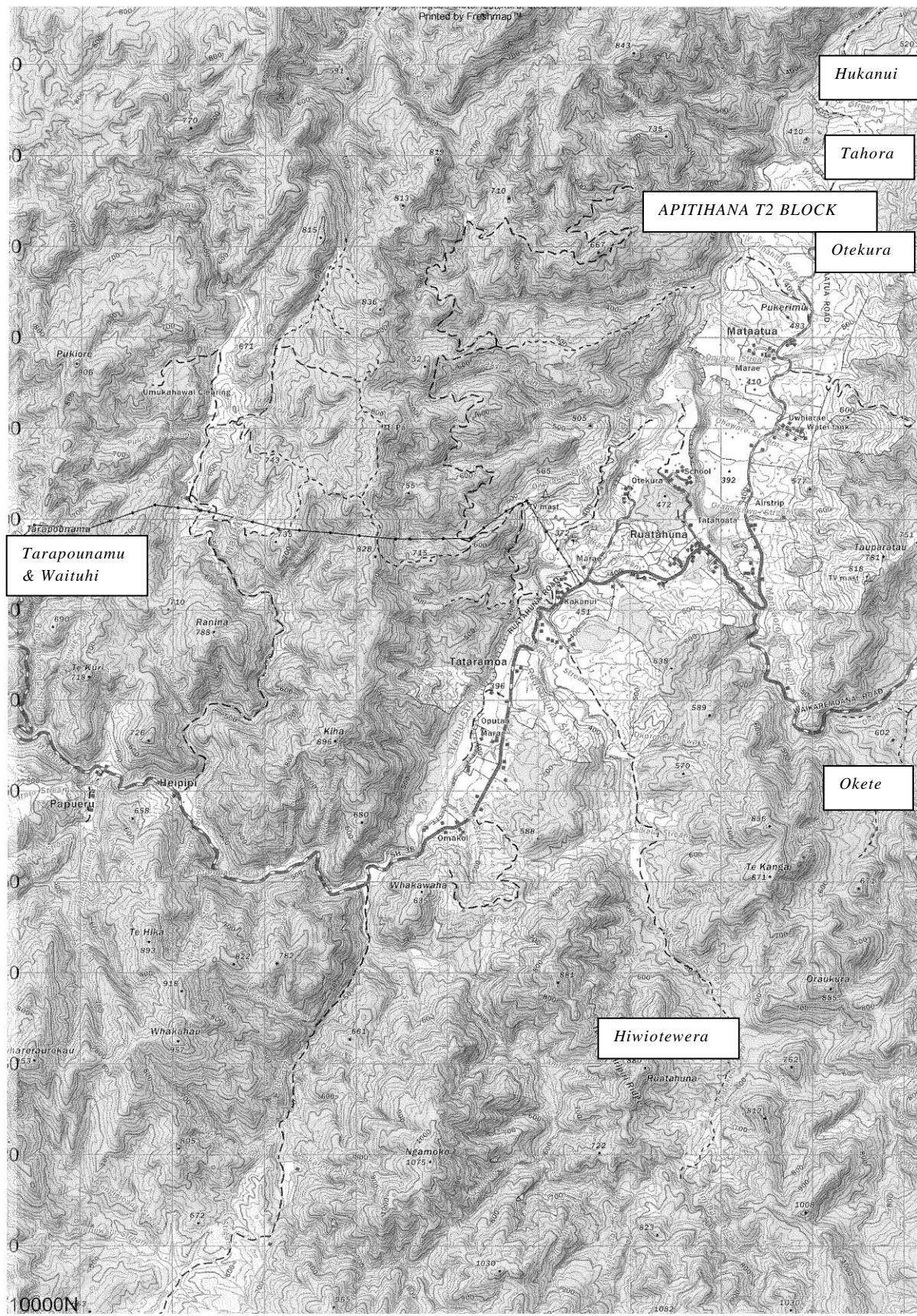
37 Although originally we had considered sourcing our stock from a native plant nursery, we decided instead to use seedlings found naturally in each block, in order to maintain Tuawhenua provenance in our forest. In our terms, we were maintaining the whakapapa of our ngahere. Sourcing the seedlings locally also gave us the opportunity to engage hapu in contracts for finding and transplanting. Cost-wise our approach was also probably cheaper than sourcing stock from a nursery.

38 Thus, the initial stages of the project in 2009 began with learning about how to lift and transplant podocarp seedlings. Then the first lots of podocarp seedlings were found locally and transplanted out at three sites – Apitihana, Hiwiotewera and Tarapounamu. The focus at the time was on reaching the required seedling numbers rather than covering a particular area. The seedlings were planted out roughly at 2m x 2m spacing in accessible areas identified as suitable for ‘plantings’.

39 Some of the seedlings were potted and grown on in a nursery at Te Wharekura o Huiarua, our local school. Dozens of seedlings were collected from the bush, potted up and grown on in the nursery. The exercise was productive – fine seedlings were prepared for transplanting out, the community was engaged and interested in the project (particularly because we also produced vegetable and flower seedlings for home gardens) and the school had the opportunity to learn a lot about podocarps and nursery management. Unfortunately we found the nursery too expensive to maintain and we also found that the ngahere itself is, of course, a natural nursery. We just had to find the seedlings and find out how to transplant them successfully!

40 In 2010, a similar approach was taken for further transplanting at the same sites, and the coupes formed from the canopy manipulation (see Part III of this report) were also filled with podocarp seedlings. Further detail on our approach to the transplanting programme in 2009-10 is set out in field guidance notes in Appendix II. In summary, we simply found clumps of podocarp seedlings of less than a metre high, and dug them up in winter and within a day or two transplanted into their new sites. These sites in general were accessible areas at Tarapounamu, Hiwiotewera, and Otekura (Apitihana T2 block). We also transplanted seedlings into the gaps created by the canopy manipulation exercise at Hukanui.

41 We researched how to transplant podocarp seedlings, through literature and by talking to experts from Landcare Research, as well as our own. About 700 seedlings were transplanted out across the three sites in this first winter (2009), most of which were rimu, followed with another 1800 seedlings across the three sites in the winter of 2010.





Rimu seedlings lined out in the nursery at Te Wharekura o Huiarau.



Motoi Taputu, project manager, shows a visitor some of the work completed in the development of the nursery and surrounding gardens

42 Monitoring of the growth and condition of the seedlings was undertaken in the spring 2010 and 2011.

Our Revised Approach

43 By the end of the 2010 year we had identified two key issues with our programme. At that point after transplanting about 800-850 seedlings in each block, we thought that the accessible supply of naturally occurring seedlings in the blocks we were working on would not have been enough to complete the seedling numbers for winter 2011 transplanting. Furthermore, a number of the seedlings planted in open areas had not survived.

44 Thus, we considered that although we had intervened in the bush in a way that was improving regeneration in most cases, in other cases, we may have been destructive. We realised then that we needed to rethink our approach and to gain more advice on podocarp restoration.

45 In obtaining more advice, it was clear to us that no-one categorically knows enough about podocarp regeneration to give us a really clear plan on what to do. Thus our project was still experimental to some extent.

46 We decided to change our approach and focus on:

- releasing past-transplanted seedlings
- thinning and transplanting naturally-occurring seedlings
- releasing naturally-occurring seedlings, saplings and poles

47 The revised approach, applied in the winter of 2011, consisted of the actions and raised issues as set out in the following table:

Element	Detail	Issues/Queries
<i>Releasing the seedlings we have planted</i>	<ul style="list-style-type: none">• Clear around the seedling• Remove kaponga leaves, actual kaponga or some shrubs to increase light – but not too much	<ul style="list-style-type: none">• How much light should we provide?• Matter of judgement to create a light well without exposing the seedling to frost or other elements
<i>Thin naturally occurring seedlings</i>	<ul style="list-style-type: none">• Thinning can be combined with the releasing of seedling as the seedlings are often found in clumps• Thinnings in OK condition can be transplanted to ideal spots nearby	<ul style="list-style-type: none">• What's an ideal spot to do this in? Will just have to try different spots• Is thinning take a clump and move it out altogether or is it to separate out the seedlings and spread them out?• We can only try the different approaches
<i>Release naturally occurring seedlings & saplings</i>	<ul style="list-style-type: none">• Find seedlings and saplings• Release to encourage growth• Mark and measure	<ul style="list-style-type: none">• How much light to provide?• Other considerations?• Different for different species?



Miro seedlings obtained from within our bush for planting out (Otekura 2010)



A rimu seedling tagged and planted out at Otekura in 2010.

48 In 2011, over 1500 seedlings were thinned or transplanted, and over 700 seedlings or saplings were released. In this season, we also began our programme in another part of the Tuawhenua region, thus engaging other hapu of Ruatahuna, Ngai Te Riu and Ngati Kuri.

49 The details of the programme completed over the three years are set out in the table below.

Location	Seedlings Transplanted	Seedlings Released	Poles & Saplings Released	Totals
Apitihana				
2009	180			180
2010	560			560
2011	350	175	50	575
Hiwiotewera				
2009	200			200
2010	600			600
2011	520	20	30	570
Tarapounamu				
2009	250			250
2010	520			520
2011	530	200	100	830
Okete				
2011	120	60	90	270
Totals				
2009	630	0	0	630
2010	1680	0	0	1680
2011	1520	455	270	2245
Overall Total	3,830	455	270	4555

LEARNINGS & OUTCOMES

Introduction

51 We consider the learnings and outcomes of the podocarp restoration component of our project in a number of ways. Firstly we look at the results of our podocarp restoration – species, sizes and condition of the seedlings to saplings dealt with in this project. We also consider survival rates from the transplantings. Then we review our key learnings and the outcomes that can be attributed to this exercise.

Results

Species

52 In most of our plantings, the majority of seedlings are rimu. As can be seen from the table below the proportion of rimu is most commonly over 70%. In some plots, toromiro seedlings predominate or are the next most common, and totara may also feature. In general, matai seedlings were only found in numbers at Okete, and kahikatea were not sought after for this project as we found this species is already regenerating in abundance.

Plot	Year Planted	Type	Rimu	Toromiro	Matai	Kahikatea	Totara	Total
Waitawa	2009	Seedlings	73%	14%	0%	9%	3%	100%
HukanuiCoupes	2010	Seedlings	84%	2%	0%	15%	0%	100%
Otekura	2010	Seedlings	56%	34%	1%	4%	5%	100%
Otekura (Uru Rimu)	2011	Seedlings	96%	3%	0%	0%	1%	100%
Otekura (Uru Rimu)	2011	Saplings & Poles	99%	0%	0%	1%	1%	100%
Otekura (Miro Patch)	2011	Seedlings	2%	98%	0%	0%	0%	100%
Te Tahora Logging Site	2011	Seedlings	25%	69%	0%	5%	0%	100%
Hiwotewera	2010	Seedlings	41%	8%	3%	16%	31%	100%
Hiwotewera	2011	Seedlings	47%	51%	1%	0%	0%	100%
Hiwotewera	2011	Saplings & Poles	79%	16%	4%	0%	0%	100%
Tarapounamu & Waituhi	2009-10	Seedlings	75%	18%	0%	0%	7%	100%
Tarapounamu & Waituhi	2011	Seedlings	53%	31%	1%	0%	15%	100%



Monitoring was an important part of our method, although it presented its challenges! Landcare Research assisted and advised throughout our project. Here in 2011, Dr Rob Allen and Dr Fiona Carswell of Landcare Research encourage us with some of the good growth we found in the Otekura seedlings that had been planted the year before.

53 We were guided in our selection of seedlings by a number of factors. Initially, availability of seedlings drove our transplantings, where rimu were found most commonly, and toromiro were sometimes found in dense clumps. Then, our transplanting programme was driven to a greater extent by a number of specific objectives:

- To restore numbers of rimu in our ngahere since this was the main species harvested in logging of the 1950s and 1960s, it is an iconic species within our bush, and it holds commercial value in forestry terms.
- To increase the number of toromiro trees as a key food source for kereru, a revered species for Tuhoe.
- To increase numbers of matai and totara trees since seedlings of this species appear to be much less common than other podocarps and because these species hold particular cultural and commercial values.

Level of Shade

54 We assessed the level of shade over seedlings and as the table below shows, the level of shade ranges across the plots. Notably, the seedlings in the Hukanui coupes are mostly in the open, where as we shall see there was a relatively low survival rate.

Plot	Planted	Type	Open	Part-shade	Shaded	Total
Waitawa	2009	Seedling	2%	15%	83%	100%
HukanuiCoupes	2010	Seedling	92%	8%	0%	100%
Otekura	2010	Seedling	22%	36%	41%	100%
Otekura	2011	Saplings & Poles	13%	17%	70%	100%
Otekura (Uru Rimu)	2011	Seedlings	1%	7%	92%	100%
Otekura (Miro Patch)	2011	Seedlings	0%	0%	100%	100%
Te Tahora Logging Site	2011	Seedlings	8%	40%	53%	100%
Hiwotewera	2010	Seedling	43%	34%	23%	100%
Hiwotewera	2011	Seedling	43%	30%	27%	100%
Hiwotewera	2011	Saplings & Poles	42%	29%	29%	100%
Tarapounamu & Waituhi	2009-10	Seedlings	57%	19%	25%	100%
Tarapounamu & Waituhi	2011	Seedlings	54%	41%	4%	100%

We tried different levels of shade cover for our seedlings. This rimu seedling was planted on an open north facing bank in 2010 (at Otekura). It was probably one of the ones that died by the time we checked them in 2011.



Height

55 In most of our seedling plots over half of the seedlings measured between 25 and 75 cm, and 80-90% were less than 100 cm. This is no surprise as we selected our seedlings to be in this height range, because we found that taller seedlings were much less likely to survive transplanting without prior wrenching.

Height (cm)	Waitawa	Hukanui Coupes	Otekura	Otekura	Otekura Uru Rimu	Te Tahora Logging Site	Hiwotewera	Hiwotewera	Hiwotewera
<i>Planted</i>	2009	2010	2010	2011	2011	2011	2010	2011	2011
<i>Type</i>	<i>Seedling</i>	<i>Seedling</i>	<i>Seedling</i>	<i>Sapling</i>	<i>Seedling</i>	<i>Seedling</i>	<i>Seedling</i>	<i>Seedling</i>	<i>Sapling</i>
0-25	29%	20%	40%	1%	10%	10%	7%	24%	0%
26-50	30%	48%	40%	1%	40%	40%	42%	37%	0%
51-75	18%	18%	12%	6%	21%	20%	35%	19%	0%
76-100	14%	8%	6%	4%	10%	18%	9%	11%	0%
101-125	5%	5%	1%	11%	12%	7%	6%	6%	5%
126-150	3%	2%	0%	8%	4%	6%	0%	3%	6%
151-175	2%	0%	0%	10%	0%	0%	1%	0%	6%
176-200	0%	0%	0%	17%	1%	0%	0%	0%	10%
201-300	0%	0%	0%	32%	0%	0%	0%	0%	32%
301-400	0%	0%	0%	8%	0%	0%	0%	0%	25%
401-600	0%	0%	0%	2%	0%	0%	0%	0%	14%
Over 600	0%	0%	0%	1%	0%	0%	0%	0%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Survival Rates

56 Although all seedlings and saplings planted or released were assessed for condition, only some results have been included here for a number of reasons. Firstly, some results are not meaningful to present as they relate to the seedlings *found* in that year, which was sometimes significantly less than the number of seedlings originally planted. We had no way of knowing the condition of all the seedlings without actually locating them, although we suspect that many of the 'missing' plants had actually died. For example, at Otekura, 499 seedlings were planted out in 2010, but only about 280 plants were found in 2011. Similarly, of over 800 seedlings planted at Tarapounamu and Waituhi in 2009-10, only 600 were found in 2011. Of these none were recorded as dead, yet we have observed many of these seedlings had died by 2010. Sceondly, and significantly, a large proportion of the plantings were completed in 2011 so there is no monitoring data – this is simply a job for the future.

57 Thirdly, the technical job of obtaining, recording and managing masses became a real challenge for our field-workers and the Trust office. For instance, we found that our GPS equipment read inconsistently, or not accurately enough for this purpose; it took us time and a lot of learning to be able to download our data from the GPS and match it to data collected in the field; we measured seedlings in different ways; we did a lot of double-work with data; and we even managed to lose some data! Despite continuously improving our systems, and training in GPS use, we were bedevilled with issues in the data collection process. Some of the issues stemmed from a lack of skills and knowledge, some from using different contract teams for the data collection, and some from the utility of our equipment. No matter, we have learnt a lot about monitoring and data collection for the future!

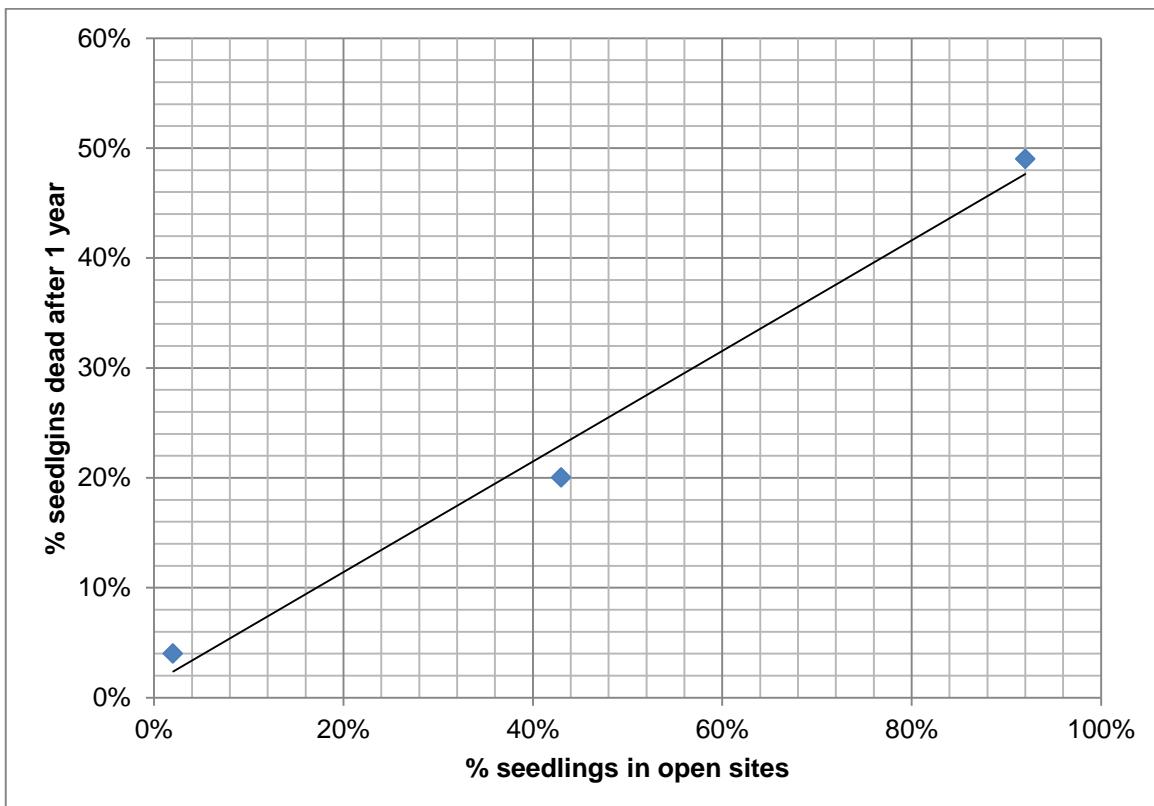


This rimu seedling is just not going to make it – dessicated out in the open on a slope at Otekura

58 The results below show the survival rate and condition of seedlings at just four of our plots. In the table, we have also included the percentage of seedlings that were planted in the open, as we found that this was a major factor impacting on survival. You can see that where few seedlings were planted in the open, as at Waitawa, the survival rate (Good and OK condition) was well over 80%, even after two years. We also noted that over time, such as at Waitawa, some 'OK' seedlings 'took root' and improved their condition, whilst some in poor condition simply died.

Plot	Planted	Monitored	% Open	Good	OK	Poor	Dead	Total
Waitawa	2009	2010	2%	61%	24%	11%	4%	100%
Waitawa	2009	2011	2%	68%	18%	4%	11%	100%
Hiwiotewera	2010	2011	43%	31%	23%	27%	20%	100%
Hukanui Coupes	2010	2011	92%	10%	27%	14%	49%	100%

59 Our transplanting into open places achieved much lower survival rates. At Hukanui, the site of the canopy manipulation which was open for just about all the seedlings, only 37% could be considered as 'OK' or 'good', with nearly half of the seedlings dying. The relationship between the 'open' planting site and 'dead' condition is graphed below. Roughly speaking, we find $y = 0.5x$ where y is the % of seedlings dead after one year, and % is the % seedlings in open sites.



60 Other factors we observed that affected survival included:

- transplanting technique: if seedlings were allowed to dry out or were planted roughly, or on a hot day, they were more likely to die
- pest animal damage: wild pig rooting of some areas killed some seedlings, and trampling or nibbling by farm stock and deer also affected seedling condition

61 We also found that some seedlings take a long time to establish, and where at first they appear dead, when later examined they have actually survived. Often the top leaves are desiccated, whilst a few bottom leaves will have regained a little green.

Learnings and Issues

62 This part of the project was to a large extent experimental – designed to test aspects of podocarp restoration and to provide opportunities for our trust and hapu to learn about the practical and management aspects of this kind on operation. We learnt a lot.

Transplanting

63 Firstly, we found that transplanting from our natural ‘bank’ of seedlings in our bush is cost-effective and fits with our desire to maintain Tuawhenua provenance for our podocarps. We know that where there are thousands of seedlings in a hectare, on average only about 20 or so trees will ever get to maturity. It makes good sense to us to simply thin them out and use the thinnings for transplanting.

64 However we are mindful of the need to assess the seedling bank resource and to manage it carefully. We observe that our podocarps often grow as ‘uru’ or groves, where naturally they develop as an even-aged stand to the sapling stage and then some grow further whilst others stunt and finally die. In our terms, we believe that the formation of an ‘uru’ is crucial to the podocarps being able to reach high up to a light well in the canopy, as the young trees support one another, seemingly acting together against competition and wind damage. The process is repeated at later stages too until only a few reach the maturity in the top canopy. With this in mind, we did not thin seedling clumps to less than 2mx 2m so that as they reach sapling stage, they are still able to form an ‘uru’.

65 Our approach to transplanting gave mixed results. We know now that podocarps do not like open sites if they come straight from the shelter in the bush. However, we also know that techniques such as wrenching and hardening-off, although not used in our project, will significantly increase the rate of survival. There are also a number of good practices that we developed to ensure transplanting success such as: never allowing the transplants to dry out; replanting as soon as possible after collection; keeping the tap root intact.

Data Collection

66 We learnt that data on our seedlings can be immensely useful but it is challenging and expensive to collect and manage. We developed basic systems to manage and analyse our data and, in the end, learnt how to collect it relatively efficiently. The key matters to address in this regard were:

- competence in the use of the GPS, so that data will not be lost or corrupted, and so that it can be downloaded efficiently to mapping and spreadsheet software for recording and analysis
- consistent data language and definitions in order to obtain reliable and meaningful data

- competence in data analysis and database management
- capacity – personnel time and focus – to complete data collection, management and analysis tasks.

67 We know we still have a lot to learn and develop in this area. In a wider context of for-ever sustainable management of our forests, the requirements in data management over decades and centuries are daunting – not just seedlings and saplings, but trees of all ages and those harvested too! Thus, we consider this competency as crucial to our Trust's ability to manage our forests effectively in the future.

Ongoing Maintenance

68 Whilst we are excited that we now have planted out or released at least 5000 young podocarps, we know that the task does not end here. The management job has only just begun. We learnt from Scion how plantings of podocarps in Whirinaki forest 30 years ago have been overgrown by kaponga and bush shrubbery – today they still stand at virtually the same heights at which they were planted. These plots were not maintained as the NZ Forest Service was disestablished, and no organisation took up the responsibility for ongoing maintenance. Whatever the case, as Scion advised, the costs of a maintenance programme which would involve releasing say every five years, are prohibitive. From our experience, it took about 4 man-days (costing about \$800) to release about 220 seedlings and saplings. Roughly then, the cost would be about \$3.50 per seedling or about \$18000 to release 5000 seedlings.



Scion took us to show what had happened to plots of podocarp plantings in the Whirinaki forest by the New Zealand Forest Service in the 1970s. Here Greg Steward and Dr David Bergin of Scion explain how the seedlings were smothered by kaponga and shrubbery. We know from this how important ongoing maintenance will be for our podocarp programme.

Conclusion

69 Overall, the podocarp restoration component of this project assisted us to:

- develop a cost-effective and appropriate way to source seedlings
- develop techniques for best transplanting and maintaining seedlings
- understand how crucial data management will be to future management of our forests
- begin development of the systems and competence required for forest data management
- understand the need for and costs of ongoing maintenance of seedlings over the long term

70 The podocarp restoration also made a major contribution to a key outcome for us from this project – the engagement of our people in Ruatahuna. Four hapu were involved in podocarp restoration on their lands that are under our Trust, so that they too have learnt about transplanting, releasing and data collection and now have their own understanding of and interest in the management of Tuawhenua forests.

71 At the end of this project, from this part, whilst we have learnt and gained a lot, we are left with further questions and issues to resolve in the future:

- What is our stock of seedlings and what are the best way to manage it for our objectives of podocarp restoration and commercial indigenous forestry?
- What data are required for informing podocarp restoration in our forest, how much will it cost to collect and manage and are these costs sustainable? Do we have a choice on this matter?
- What is the most cost-effective way to maintain planted seedlings, how much will this cost and are these costs sustainable? Do we have a choice on this matter?

72 We are also left with questions about the restoration of podocars in gaps created by manipulation of the tawa canopy, to which matter we now turn.

PART III:

CANOPY MANIPULATION

Introduction

73 This section has been largely prepared for this report by Dr Sarah Richardson of Landcare Research, as the work relating to this part of the project was undertaken by Landcare Research staff with our support. We have made some additions to Dr Richardson's report from our podocarp restoration findings.

74 Our project sought to trial coupe harvesting of tawa as a method for restoring podocarps while generating some income from small-scale timber production. The Forests Act specifies that initial forest composition and structure should be maintained after harvesting; whereas our Trust has an explicit goal however to shift composition away from stands of pure tawa left as a result of past podocarp logging towards stands of mixed tawa and podocarps. This concept of "restoration silviculture" was to be tested to learn whether podocarps can be restored in logged forests through tawa harvesting. Thus, the canopy manipulation exercise was designed to throw light on the question of: "Can coupe harvesting in tawa (*Beilschmiedia tawa*, Lauraceae; tawa) forest be used to encourage regeneration of long-lived, light-demanding podocarp seedlings and saplings?"

Methodology

75 Two coupes were created in November 2009 and Landcare Research and the Trust started monitoring in August 2010. We tagged all the podocarp seedling over 15cm tall and will monitor their growth and survival over the next few years. The naturally occurring podocarp seedling population in the coupes has been enhanced by the Trust through plantings. We counted tawa seedlings in a series of contiguous plots across the coupe and lastly, we will monitor the edge trees around the coupe

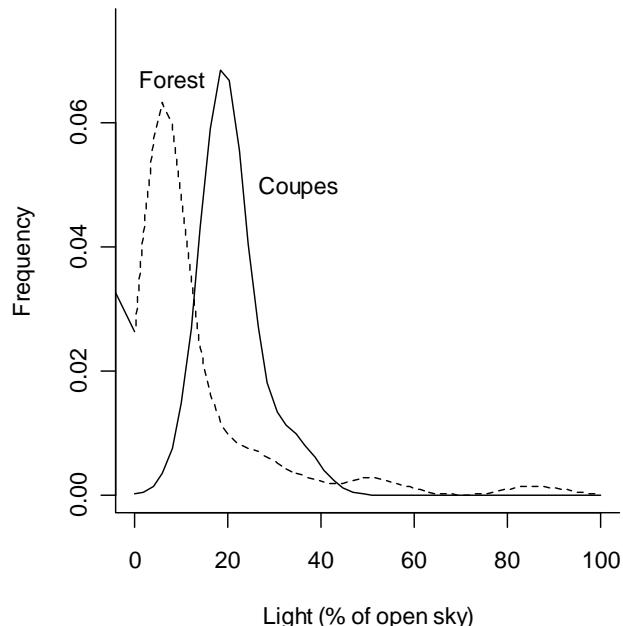
Coupe location and size

76 The first two coupes were close together and adjoining an area of pasture. Some pasture weeds (e.g., ragwort) established in the coupes as seeds were easily moved in by people and stock. Future coupes will be cut further from pasture margins to minimise weed spread and fenced as soon as possible to prevent stock moving seeds in.

77 Both coupes were ~30m in diameter (~700m²) and this increased the amount of light from 7% to 19% (Fig. 1). We know that rimu seedlings grow much faster in light over 10%¹² so we expect seedlings to grow faster in coupes. We will monitor the seedlings to test this. We would like to try coupes of different sizes to evaluate whether 30m is the best size, but the light data we have are encouraging. It is possible that the tawa trees around the coupe edges will grow over the coupes and reduce the light but we will only know this over the next few years as we monitor change in the coupes.

¹² Carswell et al, 2012

Figure 1: Light in forest around Ruatāhuna and inside coupes.
 Forest data come from a grid of 100 plots in unlogged forest around Ruatāhuna, and Coupes data come from measurements above seedlings in the two coupes. We measured light using hemispherical lenses and then modelled the amount of light reaching each point.



Podocarp seedling densities and sizes

78 We tagged and mapped podocarp seedlings in both coupes. Naturally-occurring podocarp seedling densities were very high in both the coupes (>30 podocarp seedlings in each coupe) and these were enhanced by plantings (>25 extra seedlings per coupe). Most of the seedlings were rimu or kahika and the plantings added whichever species was naturally in the minority (Table 1).

79 Podocarp seedling densities are now 886 per ha in Coupe 1 and 1300 per ha in Coupe 2. This is substantially higher than naturally occurring seedlings around Ruatāhuna (35–323 seedlings per ha for various podocarp species in logged forest around Ruatāhuna¹³

80 We have to expect some mortality of these seedlings given the disturbance around them and possible damage during logging, but the densities are so high that we expect plenty to survive and grow into saplings (more than 135cm tall) in these coupes.

Growth and survival of edge trees

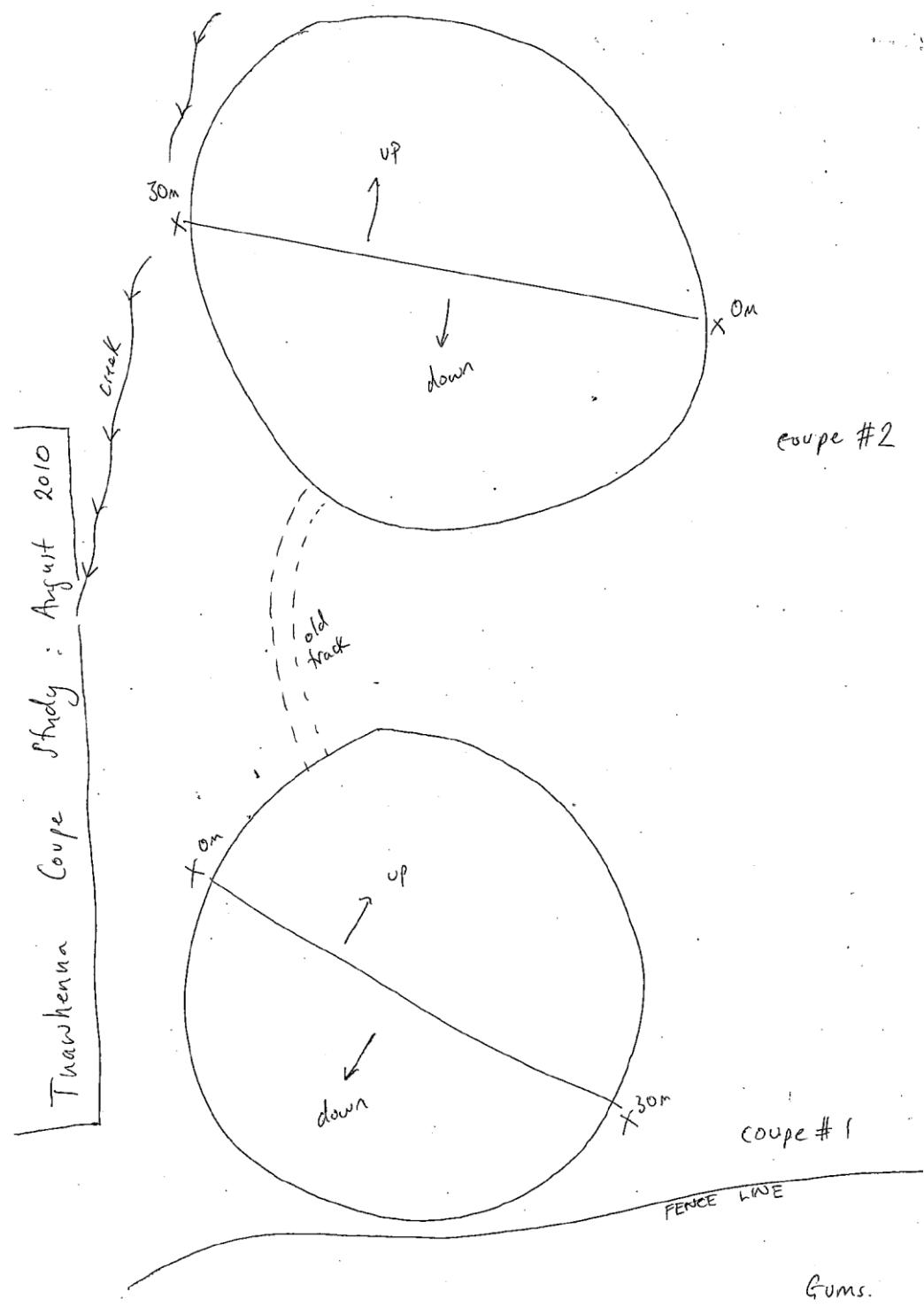
81 Forestry operations can accidentally damage trees around the edges of coupes and it has been claimed that these trees often die and deteriorate forest condition. We can test this claim by monitoring the growth and survival of edge trees around the two coupes and comparing this to trees in unlogged forest. We tagged 112 trees of 9 species around the coupe edges and in unlogged forest. We will monitor these trees to test whether harvesting damages and kills edge trees. Our work in beech forests in the South Island demonstrated that edge trees were no more likely to die than trees in unharvested forest, but growth of small trees did increase. These coupes will allow us to build on that South Island study and expand our knowledge to North Island tawa forest.

¹³ Carswell et al, 2007

Table 1: How many seedlings of each species in the two coupes, their origin and their size.

Coupe	Origin	Species	Number of seedlings	Mean height (cm)
1	Natural	Rimu	0	—
		Kahika	36	31
		Toromiro	1	78
	Planted	Matai	0	—
		Rimu	21	73
		Kahika	3	71
		Toromiro	1	64
		Matai	0	—
		TOTAL	62	
2	Natural	Rimu	12	126
		Kahika	24	41
		Toromiro	2	16
		Matai	23	35
	Planted	Rimu	24	57
		Kahika	6	60
		Toromiro	0	—
		Matai	0	—
		TOTAL	91	

Sketch map of the coupes for remeasurement



Conclusion

82 Our key learning so far from the canopy manipulation exercise is that the gap of 20-30 m² is an open space in which transplanted podocarps struggle to survive. We know that we can increase the rate of survival by wrenching and or hardening-off before planting out seedlings, so are comfortable that this risk can be mitigated in our future forest management, but an additional cost will be incurred

83 Otherwise, we have set in this part of our project the base for monitoring the change in light conditions and closing of the canopy gap, the growth of planted and naturally-occurring podocarp seedlings, and the growth or damage to canopy-edge trees. We also have a site¹⁴ where the tawa canopy was opened to create smaller gaps, and in which podocarps were planted in 2011. This site will also be monitored over time for comparison with the larger coupe sites. It will take some years before conclusive results will be obtained, but we are able to refer to results gained from studies in other forests in the meantime.

¹⁴ Te Tahora logging site

PART IV: CONCLUSION



What does the future of the Tuawhenua forests hold for our future generations? Whatever it is, we have to start now to build that future. This project is one of the building blocks for understanding how we will manage the forests of the Tuawhenua. Our mokopuna Wharekiri Tahi here in attendance at an expo about the matauranga (traditional knowledge) of our forests held in Ruatahuna by the Tuhoe Tuawhenua Trust (November 2011).

84 This section of our report brings together the key learnings from each component of our project – podocarp restoration and canopy manipulation - and sets out a number of issues that we consider need to be addressed in the future management of our forests. We conclude with our strategy, as formulated at this stage for the management of the Tuawhenua forests.

85 In summary, we found that we could:

- mount a programme of podocarp restoration using seedlings from our own lands
- make podocarp restoration an integral part of tawa harvest where it is undertaken in small coupes

86 All our learnings, however, are tempered by a number of issues that need further consideration. The first of these issues is the nature of the model to underpin our management of the Tuawhenua forests.

An Holistic Model for Management of the Tuawhenua Forests

87 During the course of this project we have developed our thinking on how we manage our forest as a whole, not just with regard to our objectives for podocarp restoration and indigenous forestry. We have referred back to a visit by our Chair, James Doherty, who with support from Landcare Research visited the Black Forest of Germany, to observe age-old methods of ‘ecological silviculture’ for maintaining the forest in a near-natural state. Additionally our research on changes in our ngahere and observation of changes in abundance of species such as podocars and kereru have signalled the need for us to do more for our special species. We decided we need a model for dealing with our forest that is not just about management but about development – taking it to be more than what it is today. We also need a model that dovetails our goals for biodiversity and restoration with economic opportunity for our people. Further, we go nowhere without the knowledge and guidance of our ancestors. Thus, we have now been inspired to develop a holistic and natural approach to the utilisation and restoration of our ngahere, which is based on our Tuhoetanga. The principles for this model that have emerged for us are:

- Holistic integrated approach: It’s not just about logging, it’s about supporting and working with the whole of the forest ecosystem to ensure it’s around for the next generations.
- Matauranga (knowledge and understanding): our old people worked with the forest in ways which respected and understood the mauri, its very essence, of all that resides there. This knowledge must form the foundation of our forest development approach. Further we believe we should only consider forestry and forest restoration when we understand our ngahere and how it lives, how it works as an ecosystem and how it is changing. Thus, strategy development and implementation for the Trust must be based on our research and knowledge about our ngahere
- Biodiversity matters: Some species of flora and fauna have a traditional cultural significance for our people and need to be restored or cared for. Some are critical for their role in the ecosystem such as birds in dispersal of seeds. Some are potentially critical for sustaining our people in economic, health or recreational ways.
- Natural forestry: any forestry activity to involve maintaining the natural composition and structure of our forest.

- Development not just management: Intervention is not only acceptable but desirable. If we don't do something our forest will change so much that we will lose special species in our forests for future generations
- Small scale is not only OK it is desirable: Small scale allows us to manage any forestry operation ourselves. It also allows us and pushes us to realising more value from the harvest. In turn this approach reduces the incentive for us to harvest more than what we need to sustain our operation.
- Future generations: We are not here just for the benefit of this generation, we must be also be mindful of the needs of future generations.

88 Whilst this model becomes the kaupapa or foundation of our forest management we know that we start with an actual operation that over time can work to integrate all of these imperatives. This is our next tangible step, to begin harvest operations under the sustainable forest management plan, and then to dove-tail in the programmes for podocarp restoration and other biodiversity issues. This holistic approach will always be a challenge as there will be competing imperatives, but clarity on our kaupapa has been a major milestone for us to reach as it gives us the touchstone to return to every time we may become unsure.

Research & Evaluation

89 The second main issue for us to consider is the need for us to gain a profound understanding of what we are aiming to do. We know this will take ongoing research and evaluation across a range of areas.

90 Throughout the course of this project, a range of questions emerged as areas for research and evaluation in the future, including:

- Podocarp restoration:
 - What is our stock of seedlings and what are the best way to manage it for our objectives of podocarp restoration and commercial indigenous forestry?
 - What data are required for informing podocarp restoration in our forest, how much will it cost to collect and manage and are these costs sustainable? Do we have a choice on this matter?
 - What is the most cost-effective way to maintain planted seedlings, how much will this cost and are these costs sustainable? Do we have a choice on this matter?
 - What are the ideal coupe sizes in tawa canopy for podocarp planting? What and how much maintenance is required?
- Forestry management
 - How much tawa vs podocarp do we actually have on the ground and where?
 - What's the structure of the forest for the species we are interested in, and how can we change it to get the future state we are wanting
 - What monitoring plots are needed and where for us to get this information.
 - At what point would we consider the forest has reached the desirable state for tawa vs podocarp densities? What rate of planting of podocarp seedlings will get us to that state and over what period of time?

- Do podocarps grow naturally up in breaks formed in tawa forest? Can we find this has happened in the Urewera?
 - What's the gross annual increment for tawa in our area since we had to use info obtained from other areas to get an estimate for here?
 - What's the reasonable basis for calculating the net increment?
 - Would increment change with harvesting activity and if so, to what extent?
 - Overall, what are some new options for the sustainable management and utilisation of mixed and modified indigenous forest?
- Economics and commercial viability
 - Operational analysis - tree to log; log to sawn; sawn to finished and sold - all stages need careful job and cost/revenue analysis
 - What about total economic analysis of the whole forest? Are our interventions improving or reducing the economic value and at what rate/impact?
 - What are other options do we have for the use of the land currently in indigenous forest?
 - How do we assess land use option for our lands – in terms of returns that are commercial, cultural, ecological or environmental, or some or all of these? How do our goals for podocarp restoration and indigenous forestry fit with a framework based on these criteria?
- Markets & Products
 - These need much more development and research. What's the extent of current tawa markets – domestic and global? How and to what extent could the tawa markets be developed? What potential export opportunities exist?
 - What new or (renewed) products could be developed using tawa?
 - Where should we position the Trust's tawa? What brand values do we hold for our tawa?
 - Who else might be interested and would benefit from the development of tawa markets and products? Is this a kaupapa for Maori forest owners to pursue?
 - What's in the value chain for tawa products? What are the issues and value accretions at each stage?
 - How can we realise the value-add dream of Ruatahuna?
 - What about by-products and waste – what can be done with them to lift the economic viability of a tawa venture?
- Biodiversity
 - What changes to bird life, etc would come from our forest enhancement and harvest.
 - How could we combine our forest management with our biodiversity goals and programmes
- Cultural and Community Development

- Traditionally, tree felling and timber use were governed by a range of practices, including karakia and the state of tapu. How do we integrate our tikanga (customs and practices) into the operations for this venture?
- What benefits accrue to our community from our venture and how important is this in the scheme of things?
- Industry Networks and Context
 - How should indigenous forest owners work together? How should we be involved?
 - What policy development would impact on our forest development and how should we be involved?

Conclusion

91 Through this project we have learnt enough about our forest management approach of podocarp restoration to be able to implement an operation integrated with a programme of tawa harvest.

92 We will continue to research all aspects of our forest management approach, from resource assessment to podocarp restoration and timber markets. We thank all that have been involved in our project – from MAF as funders, to Landcare Research and the Bay of Plenty Regional Council as advisors and partners, to our hapu of Ruatahuna, and always the whenua and ngahere of the Tuawhenua

Ora ngahere, mauri ora!

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APPENDIX II:

GUIDE TO PODOCARP SEEDLING COLLECTION & PLANTING

<i>Task</i>	<i>Guidance</i>
<i>Finding</i>	<p>A patch must have more than 10 before seedlings can be taken At least two must remain (as we assume that half of what's left will die); but it is best to leave more than two if possible.</p> <p>Where there are at least three trees of the species at a height of 5 metres or more, then all seedlings underneath or close by can be taken as the mature ones will take the space. Just leave some on the edge.</p> <p>The preferred target species are rimu, toromiro, matai and totara. Kahikatea are already plentiful and will only be used if others are in short supply and we need to make up numbers.</p> <p>Good places to look for these species are terraces and ridges, especially those with some clearing, pulling tracks and short spurs. Tawhero areas also seem to be ideal. If needed kahikatea will be in damp or swampy places.</p> <p>The best size seedling is about knee-high (50 cm) as this can be easily dug up. A mix of larger and smaller seedlings is also OK but no taller than waist-high (about 1 metre). Smaller seedlings are ideal in that they transplant better; but larger seedlings are also sought as they are more likely to succeed in replacing lost adults</p> <p>Seedlings need to be as healthy as possible – preferably with lots of leaves, green and healthy, strong single stem, no lichen or disease.</p>
<i>Collection</i>	<p>There is a trick to digging and lifting the plants with minimum stress to the plant. Collectors need to be trained.</p> <p>Dig around the plant away from the roots; to as deep as possible, at least to the depth of the spade</p> <p>Do not break the tap root and try to lift the seedling with the dirt around it</p> <p>Place into the bag or container for transport and pack some soil around the roots</p> <p>Keep the plants out of the sun and away from heat.</p> <p>Don't store the plants for long – we must minimise the time between digging them up and planting them.</p> <p>Water the roots and soil if the plants are held for longer than a day; if they dry out in any way; and/or if the planting days or sites are dry</p> <p>Seedlings are best stored in the bush in a cool, sheltered and shaded place as this is the best place and saves unnecessary transporting.</p>
<i>Planting</i>	<p>Choose planting sites that have nursery shrubs such as mako, manuka, etc. Some can be tested in kaponga areas. Gaps and edges are good places but not in full sunshine or dry areas.</p>

<i>Task</i>	<i>Guidance</i>
	Dig at least one spade-depth deep and loosen soil well, ready for planting Place seedling into the hole with tap-root pointing down and firm soil around the roots. Mark each seedling with a ribbon.
<i>Equipment</i>	Spades Sharpening files (forest roots will rapidly dull the blade) Large plastic sacks or containers Backpack or shoulder bag for carrying sacks of seedlings Ribbon for marking trees
<i>Data Collection</i>	Use sheets provided to record data and record the following for each seedling Site - Hukanui (H), Te Hiwiotewera (HW), Tarapounamu (T) GPS position - E & N co-ordinates Species - rimu, toromiro, matai, totara, kaihikatea Shade level - no shade; open (N); part-shade (P); shaded (S) Seedling number Height in cm Date measured Condition - good (G); OK; dead (D)
<i>Releasing</i>	Look above the seedling/sapling/pole. Make a light 'well' so that the plant will be able to see the sky but will still be sheltered on the sides. This may involve just cutting away kaponga leaves. It may involve cutting branches or whole trees. Avoid cutting precious trees – common trees like kaponga, tawhero and tawa are OK. Use your judgment. Ensure dead kaponga leaves and other litter are not covering up seedlings Remove plants nearby (within one metre) especially kaponga as their roots choke the seedlings/poles. Cut kaponga off at the ground or it will just grow again. Be conservative and don't cut too much away at once – you can always cut some more away another year, but you can't put back what you cut away. If the plant is too exposed it may suffer from frost or drying out, so not too much exposure at once.

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