TE KAAHU O TUAWHENUA

Issue 5 August 2008

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ISSN 1176-8096 (Print)
ISSN 1178-3400 (Electronic)

Landcare Research
Manaaki Whenua

Overview and updates in brief

Progress on our podocarp tree (e.g., rimu) and kererū restoration projects is updated in this 5th issue of *Te Kaahu o Tuawhenua*. Given that some of our research projects will soon end it is also timely to give a brief overview of how our science funding works. In the first instance we need to identify desirable outcomes from the research. This is usually done by the users of research results – not the researchers themselves. In our case the Tūhoe Tuawhenua Trust, as a research user, identified podocarp and kererū restoration as a desired outcome. We then built a case for specific research to achieve that outcome and applied for funding. We were successful in getting funding from the Foundation for Research, Science and Technology. The specific research projects are then undertaken and produce, for example, reports and publications. These reports and publications are reviewed by others who assess them as part of a quality checking process. Our project has got to the stage of producing such reports and publications and most of these are listed in this issue. It is important at this stage to discuss our research results with people. We then need to implement our research findings to achieve the intended outcome. For this reason the Trust has applied for funding from the Ministry of Agriculture and Forestry – and we will soon see if that was successful. The MAF-funded project would begin to plant rimu to achieve the outcome of rimu restoration in logged-over forests. As you can see there are clear roles for the Trust and researchers in developing an ongoing programme of research.

PROJECT UPDATE:

IDENTIFYING OUTCOMES WITH THE TRUST

Each year the Trust and researchers get together to discuss where additional research may fit the Trust's strategic directions and desired outcomes. The next such hui is on the 28th June.

PODOCARP RESTORATION

Recently we have been assessing podocarp seedling numbers in the unlogged forests on Trust lands to compare with seedling numbers in the logged forest.

KERERŪ RESTORATION

Recently some of the results of our research on Mātauranga kererū o Tūhoe were published in the New Zealand Journal of Ecology. You can find the article at: http://www.newzealandecology.org/nzje/. It is the second article in the 2008 issue.

FUNDING

We will soon (14th July) find out if our major block of funding from the Foundation for Research, Science and Technology will continue past September 2008.

Flowering and fruiting in Tuawhenua forests

WHO'S INVOLVED?

Tuawhenua Trust: Jim Doherty
Manaaki Whenua: Sarah Richardson, Peter Bellingham, Neil Fitzgerald
University of Canterbury: Dave Kelly

This year, many of the trees in Tuawhenua forests produced huge amounts of fruit and the ground underneath tawa, hīnau, rewarewa, kahika and mataī trees was covered in fruits and seeds. However, in some years, these trees produce almost no seeds, so what was so special about this summer?

Many New Zealand tree species only flower and fruit in some years and, as far as we can tell, the amount of fruit is related to the climate during the previous year. For example, in South Island mountain beech (tawhai) forests the trees flower heavily the year after a hot summer. The only time this doesn't happen is when two hot summers happen in a row, because the trees need a year off before they can flower again.

We would like to know whether hot summers are also the cause of flowering and fruiting in Tuawhenua forests. Does every tree species respond in the same way to warm summers or do different trees react to temperature at other times of the year?

There are three reasons why we would like to know more about flowering. First, because these seeds are the essential starting point for new trees in Tuawhenua forests. Second, because the fruits are a valuable food source especially for pigs, kererū and kākā. Lastly, because rats and mice can become more abundant after a heavy seeding year and this is bad news for the forest birds. Unfortunately, rats and mice like eating seeds, especially species such as tawhai and rimu that are just the right size. Seeds are a great source of energy and they make the perfect meal for a mouse or a rat. When they are well fed rodent numbers increase quickly and so if the forest is full of fruiting trees, the chances are high that rat and mouse numbers will increase. Generally, this isn't a good thing, especially as rats are known to eat birds' eggs and small chicks out of nests.

In terms of managing Tuawhenua forests, if we knew that next year was going to be a seeding year, we could start trapping rats and mice straight away before their numbers got too high.

We are measuring seedfall in Tuawhenua forests near Hopeone in the Tauranga Valley. We are using permanent seed traps underneath a range of tree species such as rimu, mataī, toromiro, tawa and tawari. The seed traps are emptied regularly, the seeds are sorted from the leaf litter and into different species, and finally counted and weighed. There is a climate station near the seed traps so we can start to work out how temperature and rainfall affects the amount of seed produced by each species.

Neil Fitzgerald

Top inset: Toromiro fruit. Main photo: Kaikomako in fruit, Tarapōunamu.

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What have we been doing this summer on the podocarp project?

WHO'S INVOLVED?

Tuawhenua Trust: Jim Doherty, Brenda Tahi
Ruatāhuna/Ngāputahi: Richard White, Katiana Tamiana, Rory Doherty
Manaaki Whenua: Rob Allen, Sarah Richardson, Fiona Carswell, Chris Morse, Karen Boot

We have been busy this year on the podocarp project, collecting new information to answer the question "Are there enough podocarp seedlings in Tuawhenua forests to replace the adult trees that are there now?"

There are two things that we need to know in order to answer our question:

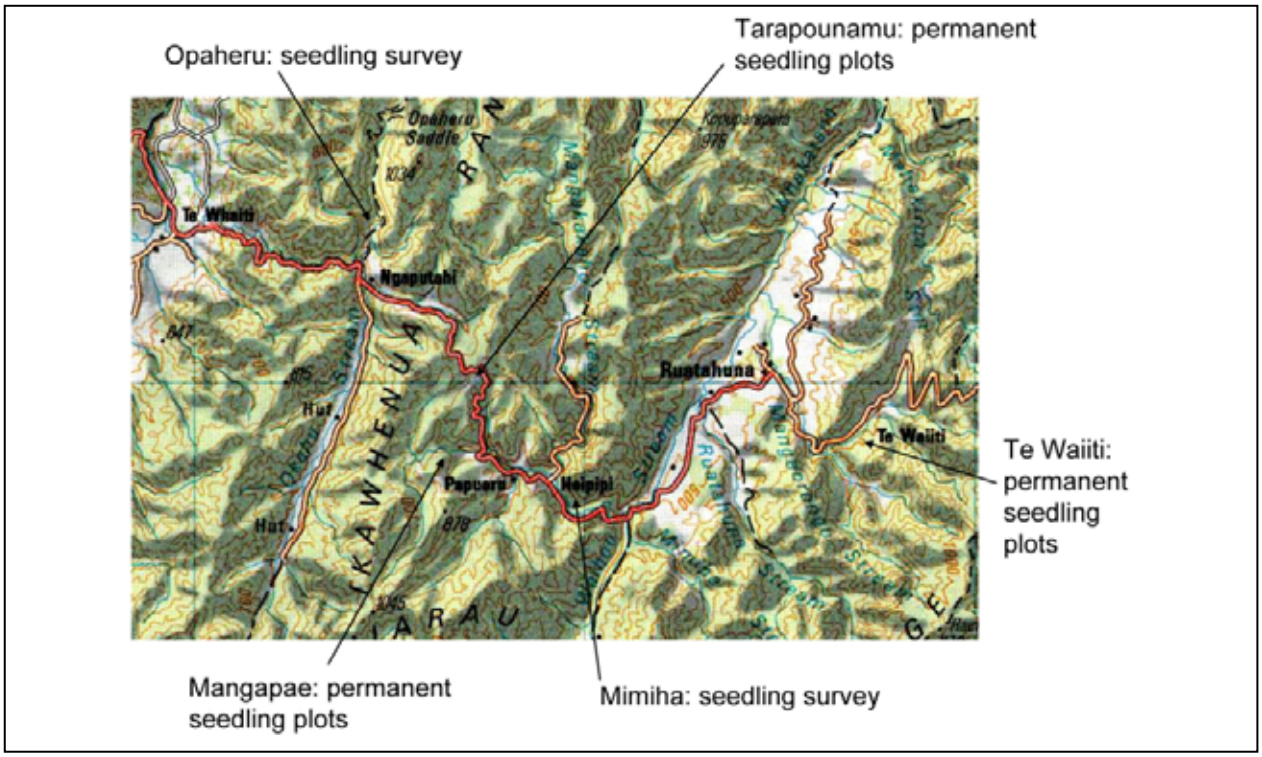
- How many seedlings are there in the forest?
- How fast are those seedlings growing and how often do they die?

We can use this information to calculate how many seedlings and young trees will be in the forests in the future.

HOW MANY SEEDLINGS ARE THERE?

Fiona has already answered this question for the logged forests around Ruatāhuna (see *Te Kaahu* Issue 2) but we would like to compare the numbers in logged forests with those in unlogged forests. In April 2008, we visited two unlogged blocks of forests and measured plots to estimate the number of seedlings. We worked in the Ōpāheru at Ngāpūtahi and around the Mimiha bridge (see map).

We put a grid of points over each block with the points about 300 m apart. We went to each point and laid out a circle-shaped plot and counted the seedlings within it. By and large, there were very few seedlings in the plots, which is what we expected. The most common podocarp was toromiro, which is what Fiona found in unlogged forest, but there were also quite a few rimu seedlings. Matai, kahika and tōtara were rare. On each plot, we measured the amount of light coming in because Fiona's work has shown that light is important to seedling growth. We collected a small soil sample that we will analyse for nutrients. Finally, we collected one seedling and one sapling of each species and we hope to count the annual growth rings in their stem wood to estimate how fast they were growing and how old they were.



Map showing where we worked.

Left: Tahae (Jim) puts a tag on a toromiro seedling near Te Waiiti. Right: Chris measures the height of a seedling in one of our Tarapōunamu plots.

HOW FAST ARE THE SEEDLINGS GROWING AND HOW DO SEEDLINGS DIE?

In order to become a tree a seedling has to grow, but it doesn't have to grow quickly and it doesn't have to grow every year. The trick is that taking the slow lane and only growing in some years means that, in order to eventually make it to a tree, a seedling has to be able to survive on the forest floor where it's usually dark, where it can get covered in branches and leaves, and where deer and pigs can easily eat it or trample it. The forest floor is a dangerous place to be a seedling!

We would like to know how fast podocarp seedlings can grow under the best conditions, but also how slowly they can grow and still survive in the worst conditions. Both of these situations might be suitable for podocarps to eventually form a tree, but they would take very different amounts of time.

The environment around Ruatāhuna is hugely variable. The amount of light reaching the forest floor ranges from virtually dark to completely open. The soils vary in their fertility, being extremely low on ridges and very high in gullies and on river terraces. Lastly, the climate gets colder with increasing elevation. Podocarp seedling growth rates and survival probably vary with all of these things and we need to get some understanding of that in order to ask whether there will be podocarp trees in the future.

Last November, a team of us selected 20 sites around Te Waiiti, up the Mangapae and at Tarapōunamu (see

A tagged seedling – we used twist ties to attach metal tags to individual seedlings. Each metal tag has a number on so we can identify this seedling in the future.

The four corners of each plot are marked with red and white Permolat while the corners are marked on the ground using metal pegs, Permolat and flagging tape.

map) where we will study seedling growth and mortality. These three sites are at low elevation (Te Waiiti), mid-elevation (the Mangapae) and high elevation (Tarapōunamu). At each of these three sites we tried to find patches of podocarp seedlings that were on ridges, stream terraces, slopes and in gullies so as to get a range of soils at each elevation. We hope that across all our plots we will find variation in light that will allow us to measure how podocarps respond to light.

We marked permanent plots at each site and tagged every seedling in each plot. The plots have been marked using red and white Permolat on trees (see picture) and white Permolat on metal rods in the ground (see picture). Each seedling has a metal tag attached using a twist tie (see picture). We measured the height of every seedling. These plots will be in place for many years so we need to mark them well so we can find them again. Next year we would like to measure the environments in these plots: the light reaching the forest floor; the nutrients in the soil; and the climate, using small climate sensors. In the future, we will return and measure how much the seedlings have grown and how many have died so that we can find out how growth and survival vary with elevation (climate), soils and light.

AND FINALLY…

One of the things we would like to know about is how well Tuawhenua tree seedlings cope with frost damage. If frosts become less common in the future then species like tawa may become much more abundant because they won't be suffering from frost damage after each winter. It's difficult to measure frost tolerance in the forest but it's easy to do it in a lab. In April, we collected seeds of 14 common tree species which we are growing on here at Lincoln. When these seedlings are about 30 cm tall we will experimentally freeze them and measure how they respond.

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Na mātauranga kererū o Tūhoe

WHO'S INVOLVED?

Tuawhenua Trust: Brenda Tahi, James Doherty
Ruatāhuna/Ruatoki: Spady Kutia, Motoi Taputu
Manaaki Whenua: Phil Lyver

Mātauranga provided by Tuawhenua kaumātua in interviews conducted between 2004 and 2007 allowed us to describe the change in kererū abundance over the last century in the central Te Urewera region. Using this information we were also able to review the techniques used by the people to monitor the changes in kererū numbers. Kaumātua were also encouraged to provide accounts addressing the reasons why they thought the kererū had declined.

DECLINE OF KERERŪ IN TE UREWERA

Kaumātua indicated they would begin to assess annual kererū abundance as the birds began to flock prior to the toromiro fruiting period (April–May). Some reported their own grandparents discussing flocks of kererū during this period as numbering in the hundreds, and even thousands at the beginning of the 1900s. Up until around 1950, kererū were considered to be hugely abundant in the Ruatāhuna and Ruatoki regions of Te Urewera, although one kaumātua began to observe declines as early as 1930. A reduction in kererū numbers was even more noticeable to him after he returned from the Second World War in 1945 (see Figure 1).

Many of the kaumātua reported a dramatic widespread decline in kererū after the 1950s, although birds were still reasonably abundant in the region through into the 1960s. Throughout the 1970s the decline in kererū abundance became increasingly noticeable to the community as harvest levels could not be maintained, and by the 1990s it was realised that in the current environment it was unlikely that the kererū population could be maintained in the long term.

INDICATORS USED BY KAUMĀTUA TO MONITOR KERERŪ IN TE UREWERA

A range of audible, visual and harvest-based indicators such as decreasing flock size, less noise from kererū in the forest canopy, and steep decline in harvests since 1950 were used by kaumātua to assess kererū abundance (see Table 1). However, the decline in numbers has meant many of these indicators have been used for over 35–40 years. Declines in the kererū population were most noticeable for hunters through a reduction in total numbers harvested each season and an increase in the amount of time it took to harvest a hoko (tally of 20 birds). Prior to 1960, marae hunting parties of two or three men could easily harvest 500–1000 kererū over 2–5 days. After 1970, kererū numbers had declined to a point that hunters would return with 10 birds for 3–4 hours' effort, and this could only be achieved with the use of firearms and by targeting the best times of the day for harvest. Now just harvesting a few kererū in a day can be difficult.

WHAT HAS CAUSED THE DECLINE IN KERERŪ?

Some kaumātua felt that Crown authorities had ridden over Tūhoe *mana* (authority) over the kererū by creating laws and enforcing protection orders that made the harvest of kererū illegal. They believed the resulting decline in traditional Tūhoe observances and practices had moved Tane Mahuta to revoke the mauri (life force or essence) of the kererū, so that it was unavailable to the people. In addition, kaumātua understood that if the kererū was

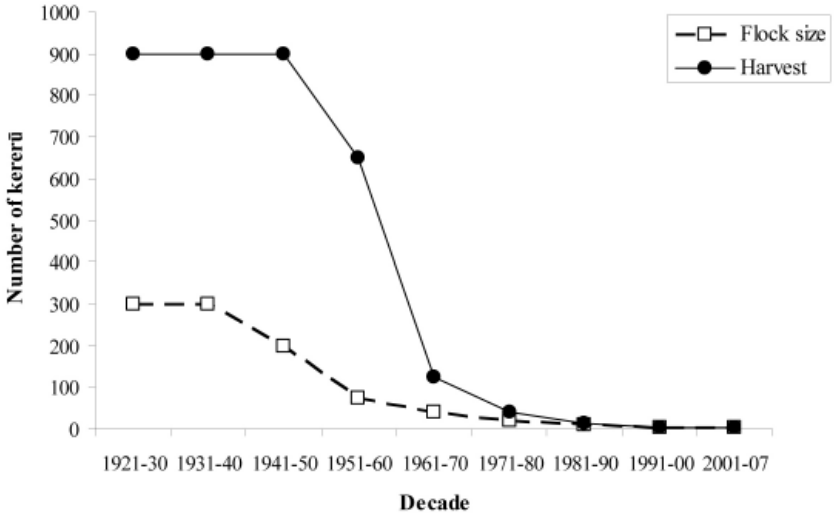

Figure 1: Decline in median kererū flock size and number of kererū harvested per marae each year in Te Urewera over the last 90 years.

Table 1: Indicators used by kaumātua to monitor kererū population decline in Te Urewera over the last 100 years.

Period	Cultural indicators of kererū abundance
Pre-1950	Small flocks of kererū (20–50 birds) merging into large mega-flocks (100–500 birds) over period of weeks prior to feeding on toromiro Flocks passing overhead would shade the sun Rumbling sound as kererū flock passed overhead Continous "rustling" sound in the forest caused by kererū flock in canopy Branches of toromiro would break as flocks of kererū landed to feed Kererū would alight on the hunter if flock landed in vicinity of where he was hidden Feathers and down used for korowai and pillow/mattress filling Kererū harvested on a marae basis A "hoko" (20 birds) of kererū easy to harvest
1950–60	Large-scale flocking phenomenon prior to feeding on toromiro no longer observed Continous rustling sound of flock in canopy Feathers and down used for korowai and pillow/mattress filling Kererū harvested on a marae basis A hoko of kererū easy to harvest in one trip
1960–70	Large flocks of kererū no longer observed Continous rustling sound of flock in canopy Feathers and down used for korowai and pillow/mattress filling Kererū harvested on a marae basis A hoko of kererū difficult to harvest in one trip
1970–80	Large flocks of kererū no longer observed Hunters required to wait for kererū to arrive at toromiro trees Kererū harvested on an individual basis Not possible to harvest a hoko of kererū in one trip
1980–90	Hunters required to wait for kererū to arrive at toromiro trees Kererū harvested on an individual basis Not possible to harvest a hoko of kererū in one trip Harvest and eating of kererū limited to special occasions
1990–2007	Kererū not present in toromiro trees for entire fruiting season Few kererū observed in the forest during the year Kererū harvested on an individual basis Not possible to harvest a hoko of kererū in one trip Harvest and eating of kererū limited to special occasions

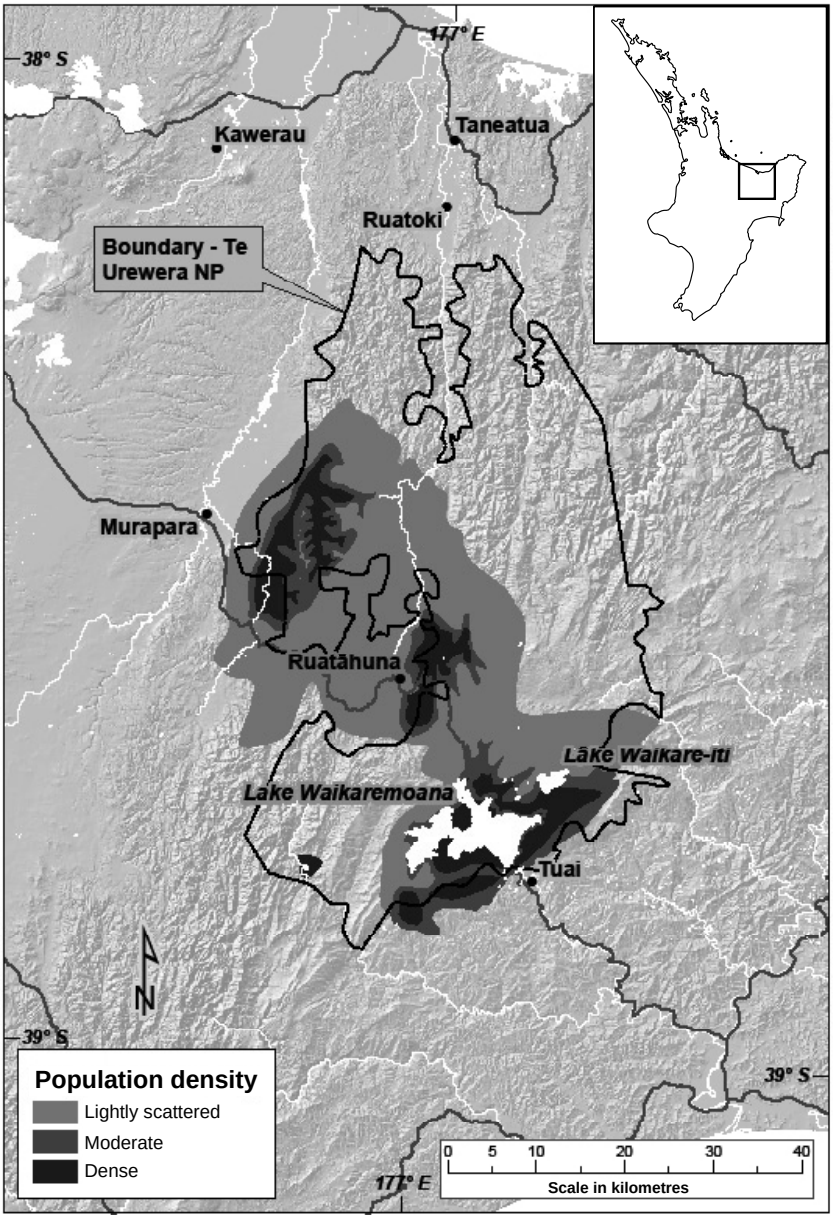

Figure 2: Tūhoe communities Ruatāhuna and Ruatoki, in relation to possum density and distribution in and around Te Urewera National Park in 1955 (from Pracy archive, Landcare Research Library).

not harvested by humans, Tane Mahuta would sense that the bird was no longer required or valued and would not replenish it. It was widely considered that the return of mana over the kererū, land and forest to Tūhoe would be instrumental in the process to restore kererū to Te Urewera.

Kaumātua identified competition and predation by rats (*Rattus* spp.), stoats (*Mustela erminea*), possums (*Trichosurus vulpecula*) and feral cats (*Felis cattus*), and the cutting of podocarps between 1954 and 1970, as factors having the largest cumulative impact on kererū in the region. It was reported that possums first appeared in the central Te Urewera region during the 1920s, becoming prominent by the late 1940s and early 1950s, and increasing significantly after 1960 (see Figure 2). The burgeoning possum population was thought to have had a devastating effect on kererū numbers through direct competition for preferred food species, such as the toromiro, hīnau and tawa. A survey of possums in the central Te Urewera region in the 1950s indicated expanding ranges and densities approaching carrying capacity in some areas around Ruatāhuna (Figure 2) – which coincide with community observations of major kererū population declines. These observed declines in kererū also coincided with the initiation of logging of the big podocarps, including toromiro, in the region.

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Honeybee decline and implications for indigenous flora

WHO'S INVOLVED?

Manaaki Whenua: Julia Wilson-Davey, Linda Newstrom-Lloyd
Crop & Food Research: Brad Howlett

The effects of introduced pollinating insects, particularly honey bees, on the pollination of native plants is not very well known in New Zealand but is in the process of being studied by Crop and Food Research, Manaaki Whenua and others. Data collected from beekeepers and scientific studies show that honeybees visit the flowers of 224 species of native plants for nectar and/or pollen. These include trees, shrubs, vines and herbaceous species.

Worldwide, bees are the most important insect group pollinating plants. In New Zealand flies, moths and butterflies play a significant role in plant pollination, in addition to bees. The impact of the introduction of honeybees, and bumble bees, on native ecosystems is complex due to different flower preferences and different behaviour relative to native pollinators, particularly native bees.

Honeybees and bumble bees are social and live in colonies. They are much larger than native bees and collect more nectar and pollen. Because of their size and the warmth generated in the social nests they are active at cooler temperatures and can start foraging earlier in the day than native bees. In contrast to the introduced bees, native bees are solitary and form individual nests; however, they are gregarious and are normally found grouped together.

Under natural conditions they nest in the earth in a very wide range of soil substrates from sand through to clay, with many species having preferences for different soil types. The nests are about 20–60 cm below the surface and here they construct cells and lay eggs. Adult bees are usually active through December and January and can collect pollen and nectar from a range of native and exotic plant species. They can even be found foraging on a range of crops thus pollinating them. Unlike honeybees native bees do not produce honey. While native bees are capable of stinging they will only do so under extreme circumstances, e.g. if they are being crushed. Their sting is also much weaker than a honeybee sting.

Other factors that need to be

Richard Toft

Native bee visits manuka flower

considered when investigating the impact of honeybees on the pollination of native plants include the plant's flower structure and larger-scale habitat disturbance. Honeybees may improve the pollination and fruit or seed set of a plant because they can carry a lot of pollen on their densely hairy bodies. However, the type and size of the flower is important. If the plant has small delicate flowers evolved for pollination by small flies a visit by a honey bee may prove to be destructive and have a negative impact on pollination. Another possible negative effect of honeybee visitation could be the displacement of native pollinating insects. This could be by collecting nectar and pollen before native insects are active because they can stand cooler morning temperatures, or by actively 'defending' food sources and chasing off other insects. It is hard to prove displacement of native pollinating insects by introduced bees because presently not enough field data have been collected and it is very difficult to design appropriate experiments. In addition, the absence of native pollinating insects in an area where there are a lot of honeybees could be due to habitat loss and disturbance rather than their presence.

At present we are not certain how the decline of honeybees will affect the pollination of native plants. The answer to this question is complex and requires more research, as indicated above. Other relevant fields of research include the amount of nectar and pollen produced by native flowers, the effectiveness of insect pollinators (native and introduced), and quantifying competition between them.

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Te Wharekura o Huiarau: Ruatāhuna Project

RESTORATION OF PODOCARP:

This project involves the planting of seedlings to restore podocarps in the forests.

PURPOSE

To develop a curriculum (that aligns with NCEA) in the secondary school, under the Restoration of Podocarps project.

1. Establish a curriculum committee under the Board of Trustees
2. Hold an open day at the Kura for both students and parents, inviting Manaaki Whenua and Bio-discovery.

Sarah Richardson

WHAT DO WE WANT TO DO

1. We want to research the background to this project
2. We want to look at this project as a case study
3. Why this area was selected
4. Background to the area looking at relief, climate, geological and soils make-up
5. Look at what types of trees are growing in the study area
6. What is happening to certain species of podocarps
7. Research the thoughts of local bushmen about why some trees are not thriving like they used to

QUESTIONS TO ASK

1. Which trees are important to Ruatāhuna?
2. Why are they important?
3. What can we do to preserve our trees?
4. Is tawa responsible for the decline of other species?

SOME LONG-TERM OUTCOMES

1. Publication of brochures describing each podocarp type
2. Research activities looking closely at the trees, birds, insects
3. Skills: Mapping, GPS, GIS, horticulture, research fieldwork, bushcraft, woodcraft
4. School production depicting the story of Hinepukohurangi and Te Maunga

Sarah Richardson

Sarah Richardson

OUTCOMES OF THIS DISCUSSION

1. Curriculum committee set up. Look at involving more people at a later date
2. Present discussion to school staff – **Staff agreed as a school to participate in the restoration project**

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Update on Trust activities

Project	Current status
Kererū Matauranga Project	1. Missed the Ngā pae o te māramatanga funding for further research and interviews on the kererū 2. Discussion for the development of learning resources for Kura, Kohanga, wānanga 3. Waikaremoana Hapū restoration very keen to participate in further research projects with the Tuawhenua Trust
Sustainable Management Fund	1. Environmental benefits from the development of weed and pest control strategies 2. Application declined (oversubscription of applications)
Sustainable Farming Fund	1. First phase of the application successful 2. Second phase…
Ngati Tawhaki Trust	1. Assisting with the development of the trust for the purpose of managing a Ruatāhuna kiwi project on the Waituhi block 2. Assisting with an application to Enterprising Communities for development of an operational base
Blackberry eradication programme	1. Community project for the eradication of blackberry 2. Participants: Ruatāhuna farm, Tuawhenua Trust, Environment BOP, Whakatane District Council, WINZ 3. Training required and offered by EBOP, Robert Black contractors (weed eradication throughout the eastern bay) has offered to train on site over a period of 2 weeks
Timber recovery	1. Identified skilled tree-felling contractors 2. Sawmilling operation 3. Ruatāhuna Marae, Ruatāhuna PTE, Kura 4. Wood turning
Resource development	1. Discussion with Kura re: resources for the primary level, using archival material from the Trust 2. Opportunity for level 1 & 2 credits in environmental studies for secondary students 3. Opportunity for a Taskforce Green project (subsidised work) with 4 workers, 2 developing learning resources (writer, illustrator), 2 working in the nursery with the planting and transplanting of podocarps 4. Discussion with publishing houses to increase the circulation of resources

Next moves:
1. Reapply in the next funding round with revamped proposal a) Marilyn Brewin willing to assist with proposal. 2. Access research material from trust archives for learning resource development a) Contacted publishing houses for the possible publication of children books at different levels b) In discussion with Kura to implement Taskforce Green programme to develop resources and aids for kererū matauranga 3. Set up interviews with kaumātua in Waikaremoana, possibly more kaumātua throughout Tūhoe
1. Reapply to the Sustainable Management Fund for 2009 2. Review the reasons for the declining of the application with Sustainable Management Fund
1. Commitment from Te Wharekura o Huiarau to pilot a small nursery of rimu as a joint project in the Restoration of Podocarps project 2. Whanau Tuakana interested in all aspects of the project including field trips to the developed sites of replanted rimu
1. Trust seeking guardianship agreement for the Waituhi block for the duration of the project? For the long term? 2. Might be able to duplicate this type of project on other blocks developing/using owners and beneficiaries as the workforce, management
1. Negotiate with farm for subsidy, equipment for a workforce of 5 workers: 3 workers under the Taskforce Green programme and 2 workers under investment work programme to become permanent 2. Waiting GROWSAFE® training with ITO provider in Awakeri 3. Blackberry eradication throughout Tuawhenua lands visible on old bully tracks (Maiora T thru' to Te hiwi o Te Wera
1. Encourage ownership so project remains on track if funding is not secured 2. Make contact with local sawmilling operations 3. Marae considering renovating be encouraged to consider using windfall tawa as contribution to the renovation finance package (able to use value of timber and add as contribution to total project) 4. As a part of the Kura Technology programme, the community will be encouraging the establishment of a wood-turning project (marae equipment: chairs, tables)
1. Access archival material 1. Arrange curriculum hui with Manaaki Whenua staff, Kura staff, writers 1. Submit application for subsidies from Work and Income New Zealand (WINZ)

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Researchers visit kura

I te ra 23 o Noema o te tau 2007 i tau mai wetahi tohunga putaiao i runga i te karanga a tetahi kamupene, ko Manaaki whenua. I pohiritia e wetahi o matau, nga tauira o Te Wharekura o Huiarau i Mataatua marae, ara i Ruatahuna. Mutu ana te pohiri i heke mai nga tohunga ki to matau kura. Na, toko rima aua tohunga i ahumai nga topito o te ao. Tetahi o aua tohunga no Ingarangi, tetahi no Kuhawaea me wetahi atu wahi o nga moutere kua wareware ne i au no hea. Ko tetahi o aua tohunga, he tohunga Bio Discovery Medicine. Tana mahi he rangahau i wetahi rongoa mai te naghere puta noa i Aotearoa. Ki taku titiro, waimarie matau, nga tauira o tenei kura, te mea hoki i roto i wa ratau kauhau i mau i au wetahi korero e pa ana ki nga paihamu. Kai te kaikainga e te paihamu wa matau Kiwi, manu taketake o te Ngahere o Tuhoe. He kauhau whakahirahira wenei moku na te mea kua mau i au enei o wa ratau pukenga, matauranga. Kei i au tonu te wa, e hoki mai ai au ki te wa kainga, ki te kawe i enei matauranga, pukenga hei whai mahi maku, hei awhina hoki i te iwi.

Kaare e mutu nga mihi i konei mo taua tohunga.

Kati ra e kare ma tena koutou, tena koutou kia ora tatau katoa...

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Sarah Richardson

Iti rearea teitei kahikatea ka taea

Mei au, ka rite ki te rearea, ahakoa iti, ka taea.
Ina koia te whanui o nga mahi me nga kaupapa hei ako
ki nga akonga o TKKM o Huiarau, mehemea ratau
ka mau motuhake ki te taonga maioha a nga matua tipuna
ki te wao nui a Taane.

Students of Te Wharekura o Huiarau will experience first hand what guardianship of the Te Urewera forest means.

One of Te Tuawhenua Trust's major kaupapa in development involves Manaaki Whenua working with teachers and students to study regeneration of the podocarp forests that once covered the bulk of land administered by Te Tuawhenua Trust.

Part of the Trust's work is the education and training of youth to care, maintain, nurture and rejuvenate its forest, which has always provided Tūhoe with shelter, food and medicine.

This will also mean work for the staff and Board of Te Kura Kaupapa Māori o Huiarau to develop the school curriculum with long-term vocational options for students in conservation, pest control, animal husbandry, and timber recovery, to name a few. When completed it is envisaged that Te Kura Kaupapa Māori o Huiarau will be in a position to lead this project through many of the Tūhoe schools.

There is also significant opportunity for the use of research and anecdotal information to progress in to the development of interactive digital resources based on the kererū and its environment, which is uniquely Tūhoe.

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List of publications from Tuawhenua forests

Did you know that we have written heaps of articles now about Tuawhenua forests? These are listed below. If you want a copy of any of them please get in touch with Doris.

NEWSPAPER ARTICLES

"Bringing light to seedlings". Paul Mulrooney. Dominion Post. 8 August 2007.

POPULAR ARTICLES

Allen RB, Doherty JE 2005. Restoring the Tuhoe forests. Indigena (December): 13–16.

Doherty J, Lyver P 2008. Native foods of the kereru: a Tuhoe perspective. Indigena (May): 4–6.

Lyver PO'B, Doherty J, Tahi B 2008. Tūhoe Tuawhenua traditional knowledge of kererū in Te Urewera. Indigena (February): 23–25.

Wardle DA, Wiser SK, Allen RB, Doherty J 2007. Ecological impact of single tree removal in native forest. Indigena (November): 7–8.

CONTRACT REPORTS

Richardson SJ, Carswell FE, Wiser SK, Allen RB, Doherty J 2005. Restoration silviculture. Unpublished Landcare Research Contract Report LC0405/141, prepared for the Ministry of Agriculture and Forestry. 33 p.

List of publications from Tuawhenua forests continued...

Richardson SJ, Carswell FE, Wilmshurst JM, Wiser SK, Allen RB 2007. Summary of science knowledge to assist the Tūhoe Tuawhenua Trust manage the issues concerning Ngahere o Te Tuawhenua. Unpublished report produced for the Tūhoe Tuawhenua Trust.

ARTICLES IN BOOKS

Moller H, Lyver PO'B 2008. Using traditional ecological knowledge for improved sustainability: case studies from four customary wildlife harvests by Māori in New Zealand. Conservation International (In press).

ARTICLES IN SCIENTIFIC JOURNALS

Carswell FE, Doherty J, Allen RB, Brignall-Theyer ME, Richardson SJ, Wiser SK. Effects of light and removal of below-ground competition on seedlings from a New Zealand conifer–angiosperm forest. Canadian Journal of Forest Research (Submitted).

Carswell FE, Richardson SJ, Doherty J, Allen RB, Wiser SK 2007. Where do conifers regenerate after selective harvest?: A case study from a New Zealand conifer–angiosperm forest. Forest Ecology and Management 253: 138–147.

Lyver PO'B, Taputu TM, Kutia ST, Tahi B 2008 Tūhoe Tuawhenua mātauranga of kererū (*Hemiphaga novaseelandiae novaseelandiae*) in Te Urewera. New Zealand Journal of Ecology 32: 7–17.

Lyver PO'B, Jones C, Doherty J. Integration of science and Tuhoe Tuawhenua Matauranga for kereru restoration in New Zealand. Ecology and Society (Submitted).

Richardson SJ, Allen RB, Doherty JE 2008. Shifts in leaf N:P ratio during resorption reflect soil P in temperate rainforest. Functional Ecology (In press).

Wardle DA, Wiser SK, Allen RB, Doherty JE, Bonner KI, Williamson WM 2008. Aboveground and belowground effects of single-tree removals in New Zealand rain forest. Ecology 89: 1232–1245.

We have also published four previous issues of *Te Kaahu o Tuawhenua*. If you want copies please ask Doris.

Editors: Fiona Carswell, Rob Allen
Layout: Anouk Wanrooy
Thanks to: Christine Bezar

Published by: Manaaki Whenua, Landcare Research, PO Box 40, Lincoln 7640, New Zealand

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Facsimile: +64 3 321 9998

www.landcareresearch.co.nz