NORTHLAND TŌTARA WORKING GROUP

NEWSLETTER 2020

NORTHLAND TOTARA WORKING GROUP

Tāne's Tree Trust — Native Trees for the Future

Northland Regional Council

SCION — Forests • Products • Innovation

New Zealand Farm Forestry Association

NZ Landcare Trust

Reconnecting Northland — Whenua ora, wai ora, tangata ora

BUSINESS CASE FOR A NORTHLAND TŌTARA INDUSTRY

TIP project harvests demonstrated sustainable continuous-cover-forest management practices can be done with farm-tōtara in Northland.

The Tōtara Industry Pilot (TIP) project confirms a viable business case for farm-totara industry.

The two-year Northland Tōtara Industry Project has demonstrated that sustainable management of naturally regenerating tōtara, with low-impact selective harvests, can be successfully undertaken within existing stands of farm-tōtara on private land in Te Taitokerau. This approach is in stark contrast to clear-fell plantation forestry models. Multiple environmental, social, and cultural benefits could come from integrating such native forestry with other land uses in the region. This is the vision and motivation of the project partners - Tāne's Tree Trust, Scion, Te Taitokerau Māori Forestry Inc., Te Uru Rākau/ Ministry for Primary Industries, and Northland Inc.

"Kei te tohunga te whakaaro"

The carver brings the wood to life

The project report will soon be posted on the project's website: https://www. totaraindustry.co.nz/

It is not a case of planting and waiting for 80 years; a resource of 'second-growth' tōtara trees already exists on private and Māori land in Northland, with far more extensive areas of younger regeneration currently growing. Consequently, a sustainable tōtara industry could start now, with scope for significant long-term growth prospects, which will encourage the planting of more native forest on private land.

The opportunity

The TIP project estimates the total value to New Zealand after ten years is between $5.1 million revenue pa (in the most conservative scenario) and $37.7 million revenue pa (for the most optimistic and value-added scenario).

The project harvested around 300m^3 of tōtara sawlogs from three farms in the Far North. The logs from the second harvest (200 m^3) were processed at Northpine in Waipu and the timber is being sold via JSC Timbers. This practical pilot enabled a financial model to be tested and confirms a viable business opportunity for the region. Stakeholder engagement revealed high levels of interest in the project and support for the development of European-styled native forestry

200m³ of Farm-tōtara logs were milled at Northpine in Waipu.

models as an alternative land use option to clear-fell radiata-pine regimes. However, it also identified some remaining risks, knowledge gaps and potential issues for a fledgling industry.

These include the accuracy of the regional resource estimate, regulatory hindrances (e.g., cost of permitting and export prohibition), some logistical/technical issues (e.g., peeling bark, etc.), market development requirements, and the need to co-ordinate sustainable management of the collective supply.

Tōtara is an iconic and revered tree species in Aotearoa New Zealand, therefore, wananga on cultural aspects associated with any future industry are also proposed.

Next steps

Because the real appeal of this native forestry opportunity is probably as much about the promising environmental, social and cultural values and outcomes, it will be critical to ensure any industry is structured to deliver that full potential for current and future generations. To that end, it is critical that the most suitable entity (e.g., a co-op or social enterprise) is determined and detailed business plans are developed.

Tāne's Tree Trust, via the Northland Tōtara Working Group (NTWG), will support the continued development of this Northland tōtara initiative, and the next phase of the TIP project.

All interested landowners and stakeholders should register on the Northland Tōtara Working Group database.

Join NTWG online – Membership is free!

Or contact: Paul Quinlan, phone: 09 4050 052 or email: pdq@pqla.co.nz

NEW PROJECT

Remeasurement of the tōtara silviculture plots

Te Uru Rākau's (TUR) Partnership Funding will fund Tāne's Tree Trust to remeasure a network of 60 Permanent Sample Plots (PSPs) set up by the Northland Tōtara Working Group (NTWG) in regenerating tōtara-dominant forests. This will help confirm growth-rates and productivity of the species in managed stands (i.e., where thinning has been carried out) and unmanaged stands where no silviculture has been applied. This information is needed to refine forest management prescriptions, update growth and carbon-modelling, and to determine appropriate sustainable harvest rates for forests located in the Northland region.

Up until now, when processing sustainable harvest permits and plans under the Forests Act, TUR have often had to use regional growth models for tōtara from Wellington and Nelson areas. These have resulted in very low allowable annual harvest rates of less than 0.5m³/ha/yr. Yet, total productivity of young regenerating tōtara forests in Northland can exceed 5m³/ha/yr. This project will help confirm a Northland regional growth model.

The PSPs, established from 2007, were last remeasured in 2012 (see the NTWG 2013 newsletter). At that time, a newly developed thinning schedule (based on a size/density chart or Stand Density Index) was applied to a selection of the NTWG plots (See Tāne's Tree Trust Handbook article: 11.3). This was used to determine the effect of intensity of thinning on mortality and diameter growth. Remeasurement will check how good that prescription is. This work will occur over the next 18 months and a full project report due out by June 2022.

Contact Paul Quinlan at Tane's Tree Trust for further information about this project: pdq@pqla.co.nz.

HARVESTING TŌTARA FOLIAGE FOR ESSENTIAL OIL

Left: Pruned tōtara foliage was distilled into essential oil and tested for useful properties.

Right: Stephan Heubeck records the harvest time and foliage yield from a tōtara sapling pruning operation.

The Sustainable Farming Fund currently supports a 3-year collaborative project on Productive Riparian Buffers (PRB). The project is exploring which species can be usefully grown along waterways, in stock-excluded riparian buffer zones that are not usually considered a productive part of the farming system – while ensuring they still benefit the environment!

The DairyNZ - NIWA led project is built around two North Island catchment stakeholder groups (Waitangi and Waihou-Piako). Its governance team includes representatives from the farmer groups, regional councils, and the Poplar and Willow Trust. The project is now in its second year, and we're starting to see some interesting results.

Initially, the project reviewed a wide range of productive options, including ideas for herbaceous feed and silage crops, fuel and bioenergy, tree fodder, timber, fibre (e.g., flax), honey production, fruits and nuts, essential oils or medicinal products. The review report is available from our project webpage www.dairynz.co.nz/environment/waterways/productive-riparian-buffers/, which will be updated as we go.

Tōtara was identified as one of the most interesting options for PRB because of its versatility - with potential for timber, essential oil extraction, pharmaceutical extracts and even bioenergy. This means there is potential for a "cascade" of uses, for example, using the by-products of pruning/thinning for oil production, while maintaining the tree for timber in the long term. And, of course, it is an opportunity to weave more native forest into the farm.

The Northland Tōtara Working Group assisted with field trials in November last year on a dairy farm in Kaeo, Northland, which has extensive stands of tōtara along riparian margins and its hill slopes. The practicalities of harvesting foliage from a range of tree sizes and ages (saplings, poles and harvest-sized trees) were tested and the labour requirements (time) and foliage yield (weight of biomass) were compared to better understand how and where synergies between tōtara silvicultural care (i.e., pruning, thinning, and residue management in timber production) and a potential new business – tōtara essential oil extraction – could be maximised. To this end foliage harvesting was trialled in three distinct test plots:

1) **Saplings** - A 0.01 ha area with young tōtara saplings up to 3.5 m tall and a stocking rate of 2,300 stems/ha. (N.B. - These saplings were of naturally regenerated origin but approximate a 10-year-old planted stand ready for its first form prune).
2) **Tōtara poles** - A 0.01 ha area of tōtara poles with an average diameter of 14.3 cm and a stocking rate of 3,600 stems/ha, which was thinned down to 1,200 stems/ha. This was intended to simulate final thinning ~30 years prior to a potential start of any timber harvesting.
3) **Semi-mature tree** - A single 38-year-old edge tree was felled to simulate foliage harvest being carried out in association with timber harvest.

Form-pruning was carried out manually, using loppers, a pruning saw and a forestry ladder. Thinning and felling were done with a chainsaw with foliage cut from the branches with garden shears.

The sapling plot took one hour to harvest. For the essential oil extraction trial, 105 kg of high-quality foliage - around half the total pruned biomass - was recovered from the sapling stand. There were no dry branches, moss or lichen growth, which could reduce the quality of essential oil, so it was considered suitable for oil extraction without further sorting.

The tōtara pole plot took around 2.5 hrs to thin with a chainsaw, from 3,600 stems/ha to 1,200 stems/ha, but this was focussed on silviculture (i.e., thinning and pruning) for long-term timber production rather than efficient foliage harvest. Recovering the branch material from this stand was quite labour intensive, as only around half was suitable for essential oil

extraction. There were a lot of dry branches and twigs, and many branches were overgrown with lichen and moss. This 0.1 ha plot yielded 109 kg of usable foliage. The leftover branches also made the area more difficult to navigate, which suggests that biomass from pole stand thinning might be better for other applications, like bioenergy production.

For the semi-mature (~38-year-old) tree, harvest of the foliage was carried out by hand, using garden shears, loppers and a hand saw. The crown contained relatively few dead branches, and twigs were thickly covered in green leaves. However, there was a lot of lichen and moss, which took some time to separate. A total of 126 kg fresh matter (FM) of suitable foliage was recovered within 95 minutes, which we estimated to be less than a fifth of the total crown foliage and branch material by weight.

Table: 1 Efficiency of tōtara foliage harvesting by mean tree size

Plot/ stand type	Kg of Fresh Matter (FM) per labour unit minute
Saplings (~10yrs and 3.5m high)	0.875kg
Pole stand (14.3cm mean DBH)	0.641kg
Semi-mature – a small harvestable-sized tree (~38yrs)	0.663kg

The clear winner in terms of harvesting efficiency was the pruned sapling plot, as the harvested biomass is usable without much additional sorting. This raises the chances of being able to use machinery more effectively in the harvest process.

Although there were clear differences in the characteristics of the foliage from the different plots – and even noticeable variation in the appearance of foliage between trees – all the foliage was mixed into a single batch for an initial essential oil extraction trial. The foliage was shipped to a facility in Queenstown, where it was chipped before being batch-distilled using saturated steam (~100°C) - the same process used for lavender, mānuka and kānuka essential oil extraction.

The overall total essential oil yield of the tōtara biomass was 1 g/kg FM (0.1%). This is lower than for mānuka (0.2 - 0.6%) and kānuka (0.3 – 2.1%). Distillation of the tōtara biomass over 3 hours indicated that 90% of the distillation yield was achieved after 1 hour. This is slightly longer than typical distillation times required for kānuka but shorter than for mānuka. These results show tōtara foliage is relatively easy to work with, but not particularly high yielding in terms of essential oil production.

However, the essential tōtara oil produced was clear and bright, with a fresh pine/citrus aroma, and good physical blending properties. This indicates scope for use as a blending partner and carrier oil for perfume, cosmetics, and other lifestyle products. Furthermore, initial gas chromatography analysis of the tōtara essential oil also indicates unusual and potentially beneficial components – including a high concentration of Beta-caryophyllene. This is a terpene produced in high concentrations by only a handful of plants, including cannabis, and which is thought to have a variety of health benefits. Of course, more research is needed to properly evaluate the potential pharmaceutical and therapeutic properties of tōtara essential oil - however, this initial finding certainly indicates further investigation is warranted.

Overall, this trial work suggests that tōtara has promising potential for a cascade of multiple uses as part of productive riparian buffer areas on Northland farms. This should encourage the planting and strategic integration of more native forest into our rural production landscapes.

The full project report is available on request. For more information on this project contact:

Stephan Heubeck, NIWA Wastewater Energy Engineer. Email: Stephan.Heubeck@niwa.co.nz

Electra Kalaugher, DairyNZ Senior Land & Water Management Specialist. Email: Electra.Kalaugher@dairynz.co.nz

A tōtara pole stand (in a grazed paddock) was thinned and pruned for long-term timber production and the pruned foliage harvested for distillation into essential oil.

Tōtara saplings were form-pruned for future timber production purposes, and the pruned foliage was harvested for distillation into essential oil.

MEDICINAL TŌTARA?

Paul Quinlan

Tōtara boosts mānuka

"A schoolgirl scientist has discovered the anti-bacterial properties of mānuka honey can be boosted more than 200 per cent by combining it with an extract from the tōtara tree."

As first reported by the Northern Advocate.

As a final-year Kerikeri high school student, Sophia Fotheringham was joint overall winner of the top prize of the 2019 Top Energy sponsored Far North Science & Technology Fair. The project compared the anti-bacterial properties of oil extracts from mānuka, kānuka and tōtara with a surprising result.

Anti-bacterial properties of mānuka extracts are well-established as is the antibacterial, anti-inflammatory and antioxidant properties of Totarol™ - an extract from the heartwood of tōtara. Sophia's experiment showed antibacterial properties in her extracts from all three species. However, perhaps the most significant finding was when the mānuka and tōtara oils were combined. The mixed mānuka-tōtara oil appears to have a synergetic effect, which was 232% more effective than mānuka alone.

In a time of increasing antibiotic resistance and the need for effective alternatives, the result of Sophia's experiment suggests further research into all the properties of tōtara is warranted.

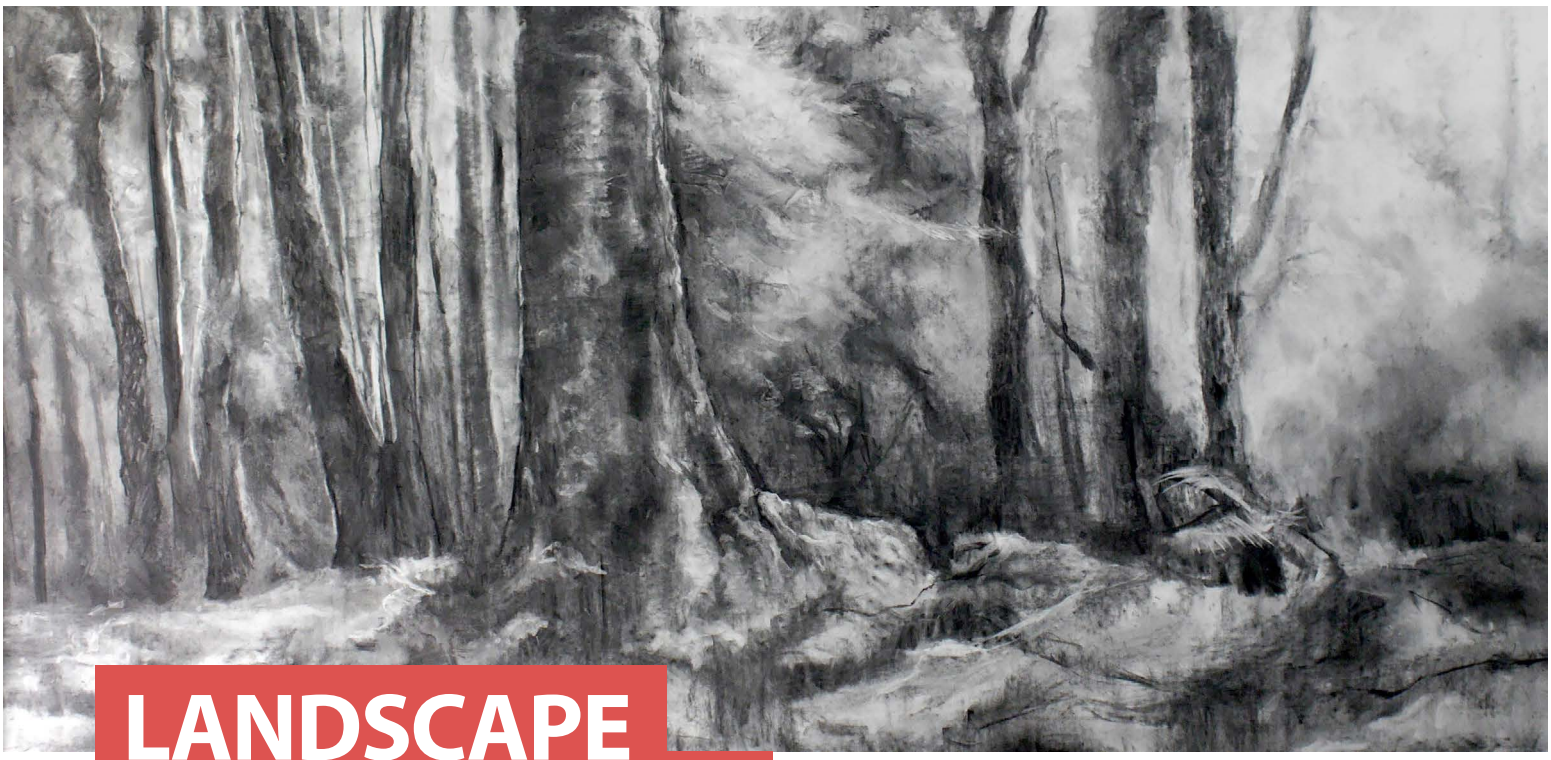
Totarol is a powder extracted from tōtara heartwood and used in health and cosmetic products.

Heartwood from fallen tōtara trees is already the source of an organically certified extract used for human and animal health products for its antimicrobial effects. The trademarked product is a powder called Totarol™, from Wairarapa-based company Mende Biotech Ltd, is being used in products such as toothpastes, anti-acne creams, and cosmetics. However, it is also being tested for animal health applications such as an organic mastitis treatment in dairy cows.

Totarol is purported to have anti-inflammatory, antimicrobial and antigenic properties – "It speeds up the way the body heals the tissues". For more information visit http://www.totarol.com

Totarol is a high-value product worth up to $1700 a kilogram but is only used in minute quantities – often as an ingredient comprising 0.2% of a health-care product. But the scope for more applications, including the potential to boost anti-microbial properties of mānuka honey suggests colossal market interests could be developed.

For the grower of tōtara forests, further research into the properties of this native tree species may unlock more surprises and values far beyond just the timber.



LANDSCAPE CONNECTIONS

Above: An untitled 'work-in-progress' drawing of a tōtara stand in Manawatu, by Naga Tsutsumi was a test of his tōtara charcoal.

Below: "Decision making" – by Naga Tsutsumi in tōtara charcoal.

Paul Quinlan

Artist makes 'truly local' tōtara charcoal

The preference to use tōtara for whakairo – traditional and contemporary Maori carving, is well known. But what about other fine arts in Aotearoa? One artist, inspired by his local grove of tōtara trees, has been 'obsessed with making a truly NZ drawing charcoal'. For Naga Tsutsumi, an artist in Palmerston North, a deep and authentic connection to the trees and place is important. Using materials and mediums from overseas didn't feel right. Naga wanted to draw tōtara trees with tōtara charcoal, and on tōtara paper. A grant from the Earle Creativity and Development Trust has enabled him to do so.

This involved an extensive scientific process of trialling, recording and testing of results. He found that charcoal from the heartwood of the trunk is different from charcoal from small branches. The former is more consistent and has a suitable matt black colour. After more than 50 tests, Naga has settled on a preferred kiln-firing procedure – with temperatures reaching 640 - 680°C. While not as smooth or easy to use as charcoal from willow trees, and despite being a little hard and powdery, Naga Tsutsumi is proud to have made 'a truly local tōtara drawing charcoal'. The series of charcoal drawings is now being exhibited as 'Long Distance Travel to Manawatu'. We think the results speak for themselves.

Unfortunately, due to an accident, the making of paper from tōtara fibres could not be trialled within the project timeframe. While harakeke (NZ Flax) paper is commonly available, Naga felt it was not so suitable for tōtara charcoal and says harakeke paper itself is an artwork and is too beautiful to draw on. So, as far as we know, making paper from tōtara remains an untried endeavour.

Only small volumes of wood are required to make tōtara drawing charcoal, so it is unlikely a market lays waiting here. But these artworks quite literally illustrate the principle that knowing, respecting and working with our local native trees and forests, whether as timber, medicine or for fine art, inevitably leads to a sense of personal and cultural connection.

"I feel more connected to the NZ Landscape".

Naga Tsutsumi

For more information visit Naga Tsutsumi's website.
And, for a video of him and this series of work click here.

REGENERATIVE FORESTRY

There is potential to use tōtara as 'productive riparian buffers' on farms and manage them for timber and non-timber products as well as environmental enhancement.

Paul Quinlan

- Northland's opportunity -

Recently, a web series called "Our Regenerative Future", was hosted by Pure Advantage, and focussed on regenerative agriculture. However, and probably inevitably, the scope widened to include a session on 'Regenerative Forestry for New Zealand".

Dame Anne Salmond was one of the distinguished guest panellists in that session and in the final concluding one. In that forum, she set out an inspirational vision for forestry in Aotearoa – mixed species, mixed ages, no clear-felling, 'nature-based' management. From a different but equally compelling angle, business commentator Rod Oram stressed the vital importance of "working with nature" and taking a whole eco-systems approach. The need for change and action is generally accepted. However, the paths are not always obvious or easy – except perhaps one...

As we search for appropriate forestry models and practices, we should not overlook what is slowly growing up in the scrub around us (often on land that has been cleared in the past). In nearly every region around the country locally appropriate native species can be found regenerating naturally – hinting at an underlying pulse of resilience. Learning how to encourage, support and foster this natural regeneration process is not only important for biodiversity reasons, but it also brings the best opportunity to create the type of desirable 'regenerative forestry' mentioned above.

We should be encouraged to pursue this direction, based on the success of visionary practitioners like John and Rosalie Wardle who sustainably manage their regenerating black beech and radiata pine forests at Woodside in Oxford, by applying continuous-cover-forestry (CCF), 'Target-diameter-harvesting', and 'near-natural' forestry principles. Likewise, CCF has been successfully demonstrated in silver beech forests in Southland and red and silver beech forests in Westland, and now with farm-tōtara in Northland.

In this context, the Tōtara Industry Pilot project represents an attempt to 'work with nature' and work with what we have, to regenerate and create a locally appropriate native forest resource – for multiple values - not just carbon, or timber or conservation. Because the full potential of a forest is to do all these things and more.

Regenerating tōtara presents a practical opportunity for regenerative forestry in Northland. Nature is doing her part; we just need to do ours.

Tāne's Tree Trust have long promoted the advantages of CCF for native and exotic forestry. The 2008 publication **Continuous Cover Forestry** - A handbook for the Management of New Zealand Forests, by Ian Barton, can be obtained via the Tāne's Tree Trust website.

NORTHLAND TŌTARA WORKING GROUP

Background

The Northland Tōtara Working Group (NTWG) was formed in 2005 to explore the potential to manage naturally regenerated tōtara on farmland for timber and environmental benefits. The group is convened and managed within Tāne's Tree Trust.

The NTWG has five objectives:

- To quantify the resource of naturally regenerating tōtara
- To establish demonstration trials, evaluating a range of thinning and pruning options
- To determine wood qualities and uses of farm-grown trees
- To investigate the feasibility of developing a supply chain
- To identify and overcome hindrances to sustainable management of naturally regenerating tōtara.

Check out our NTWG page on the Tāne's Tree Trust web-site (here), and, to ensure you are on the mailing list for updates, please join the NTWG – online membership is free!

NTWG – Remember to join! It's Free!

Make sure you stay on the mailing list – register on the NTWG database (membership). Click here.

Who should join? – Everyone with an interest in growing, managing, processing, researching, buying or using farm-tōtara throughout New Zealand.

For more information, contact:

Tāne's Tree Trust: www.tanestrees.org.nz
or email Paul Quinlan: pdq@pqla.co.nz

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