



Forging partnerships for a successful future

“The contribution of Māori business to New Zealand’s prosperity is one of the most exciting opportunities of our generation.”¹

The Government through the Crown-Economic Growth Partnership, He Kai Kei Aku Ringa, has noted the potential of Māori owned assets to add at least another \$2.6 billion to the New Zealand economy above business as usual by 2040². In shaping Scion’s Māori Plan in 2013, we supported this outcome as part of our mission. In addition, we included a more personal statement “To enable each Māori land-owner to benefit from the economic, environmental and cultural development of their assets.”³

Achieving these aims is in the interest of both Māori stakeholders and all New Zealanders, since many of the economic

challenges and opportunities facing Māori are similar to those facing the rest of New Zealand. The Māori and New Zealand economies are mostly based in the regions and derived from use of land, water and sea-based assets. Sustainable development of biological assets directly for commercial utilisation, or protecting our environment, society and heritage lies at the heart of New Zealand’s value proposition.

At Scion, we modified our approach to working with Māori in 2012/13, built around a philosophical change. Again quoting Matt Pritchard (ibid), “It’s time that we moved past seeing Māori business as a stand-alone sector of the economy, controlling a separate large asset base, and had the courage to turn to Māori culture to understand what it has to add to New Zealand’s success on a world stage.”

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¹ Matt Pritchard. Mainstream Solutions from Māori Culture. Boardroom June/July 2015 www.iod.org.nz

² He kai kei aku ringa Māori economic development panel November 2012.

³ Scion’s Te Papa Tipu Māori Plan (<http://www.scionresearch.com/scion-maori-plan>)

Integrated land use holds key to regional development

The Government has completed four Regional Growth Studies - East Coast, Northland, Bay of Plenty and Manawatu-Whanganui. These regions all have significant areas of forestry, which is an important source of local employment. However, there are big differences between the regions in the extent and competitiveness of wood processing mills, transport and other infrastructure. These assets and capabilities are essential to adding more value and jobs from forestry. It is salient too, that Māori own significant land (and forests) in these regions. They are key partners and investors in forest industry development initiatives.

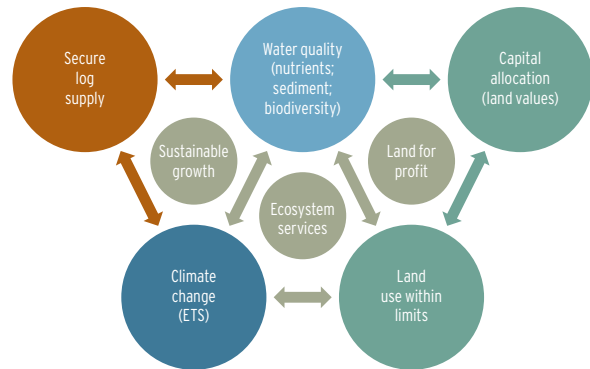
While log supply in these regions is assured for the next decade or so, few new plantings and deforestation in recent years are increasing concern about the availability of logs after 2030 to meet current, and new, processors' needs.

Alongside forestry development, regional leaders are thinking about how to manage their land and water resources within tighter environmental limits, and how to meet the challenges posed by climate change. The latter includes New Zealand's commitment to reduce greenhouse gas emissions in 2050 by 50% from 1990 levels and an "intended nationally determined contribution (INDC)" under the new post-2020 International Climate Change Agreement. This agreement is being discussed in Paris as we go to print and aims to achieve a 30% reduction below 2005 levels by 2030 (equivalent to an 11% reduction on 1990 levels).

With this in mind, you quickly appreciate designing regional development plans that will grow household incomes and well-being with a smaller environmental footprint is not a trivial task. Previous regional initiatives; the aforementioned resource and climate constraints; and changing markets all point to the need for a more integrated, cross-sectoral and collaborative approach to regional development than in the past. With traditional rivalry between industries and districts this is easier said than done. It is great, therefore, to see this new approach being fostered in the Bay of Plenty Regional Growth Study Action Plan under the "Bay of Connections" umbrella.

The 2014 National Policy Statement for Freshwater Management (NPS-FM) and the Emissions Trading Scheme (ETS) provide important legislative frameworks for regional growth initiatives. Both policies embody the concepts of ecosystem services (such as flood control, avoided erosion, sequestration of carbon and enhancement of biodiversity) and natural capital. The interdependence between the outcomes sought from the NPS-FM and the ETS, (see illustration) encourage the integration of land uses with complementary environmental impacts, such as forestry and pastoral farming, in order to achieve sustainable land management, better water quality and more resilience to extreme weather. The integration of land uses at various scales has obvious downstream implications for their respective industry value chains and thus regional development.

PUBLIC POLICY AND STRATEGY CONNECTIONS



To understand sector complementarity, a full value chain, multi-sectoral analysis is needed to quantify the benefits and costs of this approach. This broader systems framework is increasingly being used at Scion in our collaborations with regional councils, businesses, iwi and economic development agencies. Because a wide spectrum of science expertise is required from other sectors, including understanding land-owner decision-making behaviour, we are fostering new collaborations with other CRIs, universities and consultants. Recent work in comparing dairy and forestry value chains in central North Island has been particularly insightful on how policy incentives can drive sub-optimal economic and environmental outcomes and, equally, pathways for 'smarter growth' with better long-term use of natural resources and less greenhouse emissions.

Regional development is a microcosm of the challenges faced nationally and globally in achieving sustainable economic growth and improved social and cultural outcomes. I am sure the insights Scion is gaining from several of the growth study regions will be portable and will support an enlarged role for the forest industry in New Zealand's economic future.

I welcome your views on regional development and any of the other articles in this edition of *Scion Connections*. On behalf of the Scion Board and staff, I wish you, your families and colleagues our best wishes for Christmas and the New Year.

Dr Warren Parker,
Chief Executive



Want to know more?

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Hydro-tech toilets - reinventing how we do the business

Scion was recently awarded a grant of approximately \$400,000 from the Bill & Melinda Gates Foundation to reinvent the toilet using the hydrothermal processing expertise we have developed for the woodprocessing and municipal waste sectors.

Hydrothermal oxidation is one of the processes behind TERAX™, the unique and cost-saving technology to treat biowaste as a recyclable resource.

“Our task is to create a toilet that removes pathogens from human waste, is off the grid without connections to water, sewer, or electrical lines, costs less than five cents(US) to use per person a day, and recovers valuable resources such as clean water and energy.”

Research Leader for Clean Technologies, Dr Daniel Gapes, says Scion was asked to submit a late application for the Gates Foundation's Reinvent the Toilet Challenge following colleague John Andrew's presentation on the technology at the International Water Association's Leading Edge Technologies conference in Abu Dhabi, United Arab Emirates, in 2014. The challenge is now on for our Clean Technologies Team to design and build a prototype toilet by September 2016.

Scion's is one of 20 toilet design challenges underway across the globe in the next 12 months.

“Our task is to create a toilet that removes pathogens from human waste, is off the grid without connections to water, sewer, or electrical lines, costs less than five cents (US) to use per person a day, and recovers valuable resources such as clean water and energy,” says Daniel.

“We're very much at the start-up phase of this design. Our aim is to apply our hydrothermal oxidation, or wet oxidation,

technology on a much smaller and simplified scale. Basically, we're looking at packaging wet oxidation in a can.”

Hydrothermal oxidation uses high pressure, temperature and oxygen to break down, or 'pressure cook' biosolids into simpler organic compounds, releasing energy and chemicals.

“One of the first things we're doing is concocting a model human waste product to feed into our mini hydrothermal reactor, enabling easy initial concept testing,” says Daniel. “But we will be moving reasonably quickly to using 'the real deal', as working with human waste is what the challenge is all about.”

Daniel says simplicity is key to this project. “We want to design something that can be used by developing countries to improve sanitation. It's that piece of technology beneath the toilet doing the business.”

For further information

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Hydrothermal oxidation is one of the processes behind TERAX™ technology.

Forging partnerships for a successful future

(Continued from page 1)

The Scion plan has four pillars. The first two (Partnering and Increasing Scion's Capacity to Work with Māori) were to create a platform for greater mutual understanding and confidence in Scion staff to work with Māori and Māori entities. There is much in common between Māori and the focus for Scion. Forestry and science are both long-term activities that seek to create a more prosperous New Zealand for current and future generations. Partnering with Māori entities, other commercial enterprises and Government is the only way such long-term outcomes can be achieved. This also sits at the heart of the Scion operating model.

The third pillar is Communication. In April this year Scion, in conjunction with Te Puni Kokiri, Forest Owners Research

and Development Committee, the Ministry for Primary Industries, and Ministry for Business, Innovation and Employment undertook a forestry hui in Rotorua. The intent of this hui was to enable greater dialogue between Māori forestry entities and those engaged in delivering many of the research programmes that are being supported by the forestry levy and other investors. Examples included the 'Growing Confidence in Forestry's Future' programme, focused on increasing sustainable productivity of radiata pine; a new programme seeking to increase value from other exotic species such as Douglas-fir, eucalypts and cypresses (Specialty Wood Products Partnership); addressing threats to our forests including kauri dieback (Prosperity from Forests); and new models of industries and communities working together such as symbiosis models (Wood-Energy

Industrial Symbiosis). Scion is committed to continuing to partner with iwi and will be focusing on more regional hui to strengthen linkages between investors and researchers, to ensure these programmes remain responsive to needs and to be part of translating knowledge to those best able to use it.

This addresses the fourth pillar of our Māori plan. That is, continuing to shape and build programmes with all our partners, be they hapū or major corporations, who are either already active in the forestry value chain or who are seeking to be a part of building the future of forestry and its downstream product opportunities. It is only then that we can fully realise the involvement of Māori and their full spectrum of capabilities and knowledge in the New Zealand forest industry.

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Forest growers be prepared, El Niño's back in town!

El Niño is here and already making its presence felt. Recent fires that blazed through plantation forests in Waikakaho Valley, near Blenheim, are perhaps the first of the summer's casualties of what Scion's Research Leader and atmospheric dispersion specialist Dr Tara Strand calls "a textbook synoptic El Niño weather pattern for New Zealand."

El Niño is a natural occurrence that returns every 3-7 years, usually around winter or spring and diminishing late summer or autumn. Over this time, winds tend to be stronger and more frequent from the west in summer, bringing more rain to the west and drought to east coast areas.

Tara says, "Initially, weaker easterly trade winds bring stronger south-westerly flows, which lead to cooler temperatures and higher rainfall in the south and western parts of the South Island.

"At some point, parts of the South Island will switch from these wet south-westerlies to north-westerlies, which bring dry, hot winds and will put areas like Canterbury and Otago at risk for high fire danger. We are already seeing high fire danger in the Marlborough area because the moist south-westerlies are not reaching the northern end of the South Island.

"In the North Island, a pressure ridge builds over the northern regions, resulting in less rainfall in the Auckland, Northland and Gisborne/Hawke's Bay areas.

The hot, dry and windy conditions typical of an El Niño create the ideal environment for wildfires that are likely to burn more intensely with a greater potential for escape, therefore posing greater risk to property, natural resources and people.

"Historically, El Niño has brought severe drought to Hawke's Bay and Gisborne, and this year's event is shaping up to be similar in strength to those in 1982-83 and 1997-98. Both events saw severe fire dangers across large parts of the country

and major fires in Northland, the central North Island, Nelson and Otago."

The hot, dry and windy conditions typical of an El Niño create the ideal environment for wildfires that are likely to burn more intensely with a greater potential for escape, therefore posing greater risk to property, natural resources and people. On average, around 3,000 wildfires occur each year throughout the country, laying waste to about 6,500 hectares of rural land with considerable environmental and economic impacts. In comparison, over 45,000 hectares were burned during the El Niño event in 1982-83, in the central North Island alone.

Increased uptake of science and fire behaviour tools by New Zealand fire managers over the past 24 years is helping to reduce wildfire risk and protect life and property, and to build more resilient rural communities. Our Rural Fire Research Team provides the science and technical expertise in fire research to the rural fire sector, providing fire managers with a greater understanding of fire behaviour under various conditions and fuel types, and with a range of fire management tools.

This was demonstrated earlier this year when fire scientist Veronica Clifford served as technical specialist for the National Incident Management Team deployed to manage wildfires that swept through 600 hectares of forest at

Onamalutu, in Marlborough, and more recently during the Waikakaho fire. It's estimated about 450 hectares of forests were destroyed in the Waikakaho Valley wildfire, the majority of which was close to harvest. Veronica used the fire behaviour model Prometheus and the New Zealand Fire Behaviour Toolkit to provide fire weather forecasts, and fire behaviour and growth predictions for the Marlborough/Kaikoura Rural Fire Authority, which formed the basis of their operational decisions.

The information is being used to identify "trigger points" for high fire risk activities, such as roadside mowing and access to forestry and recreation areas, that can be included in strategic and tactical fire management plans.

"By taking into account weather conditions, the lie of the land and vegetation, and the way they interact, we can go a long way to predicting the behaviour of most fires," says Veronica. "I used up-to-date weather forecasts for the area and other information to predict what the fire was likely to do over the next 12-hour period. Then I briefed management and the fire crews at twice daily shift changes."

This year, the team has also been evaluating the weather data and fire danger indices used in the development of fire management plans for the Nelson and Marlborough regions. The information is being used to identify "trigger points" for



Fire scientist Veronica Clifford provided technical advice to fire crews at the Onamalutu and Waikakaho Valley wildfires.

high fire risk activities, such as roadside mowing and access to forestry and recreation areas that can be included in strategic and tactical fire management plans.

Science Leader for Forest Protection Lindsay Bulman says fire is just one of the issues for forest growers likely to be exacerbated by El Niño conditions.

"Strong winds can cause catastrophic damage to planted forests, so it's best to delay activities over this period that normally increase wind exposure to trees, such as thinning and felling.

"Increased drought also stresses the trees, making them more vulnerable to

insect and pathogen attacks. Diplodia whorl canker could be a problem this summer - and can cause up to 30% tree loss. Infection usually occurs through wounds, particularly from pruning, so it's best to avoid pruning over summer if expecting drought conditions."

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Forests and people: investing in a sustainable future

The key message Tim Barnard, Team Manager for Forest Systems, brought home from the XIV World Forestry Congress this year was how critical it is becoming to expand planted forests worldwide.

Tim and other members of the Forest Systems Team attended the week long congress, held every six years by the Food and Agriculture Organisation (FAO) of the United Nations. This year's event was in Durban, South Africa - the first congress to be held in Africa - with over 400 speakers and attracting some 4000 delegates.

With the world's population expected to reach around 9.3 billion by 2040, it will essentially take the resources of two Earths to support our current levels of consumption.

"The congress brings together academics, researchers, international forestry leaders, indigenous groups and delegations on a range of forestry issues at a global level," says Tim. "However we seem to share a common concern that the growing threat of climate change has dramatically increased the importance of forests."

With the world's population expected to reach around 9.3 billion by 2040, it will essentially take the resources of two Earths to support our current levels of consumption¹.

"The bioeconomy holds the key to our future sustainability, with forestry being a major contributor," he says. "Certainly, if we are to build a sustainable bioeconomy by 2050 we need a lot more trees in the ground now. There's a big push worldwide to expand planted forests and reduce our reliance on fossil fuels. This will take the pressure off indigenous forests around the world, protecting our ecosystems and biodiversity."

"As scientists, we first need to establish best practice for the design of planted forests and land-use options or new forest systems to ensure communities are not disenfranchised."

Tim says New Zealand is uniquely placed to become an international leader in the development of a vibrant bioeconomy, fuelled by productive planted forests. Planted forests will make a major contribution to the prosperity of the national and regional economies, as well as to the quality of life for New Zealanders through the provision of valuable ecosystem services.

"As scientists, we first need to establish best practice for the design of planted forests and land-use options or new forest systems to ensure communities are not disenfranchised. It will be really important to empower small, local communities to be productive, and provide them with economic, social and environmental security."

This message was reinforced by Principal Scientist Dr Tim Payn.

"The congress was a meeting place of focused and very motivated people who all appreciated the strength of the relationship that exists between forests and people and their communities. And how important that interaction is.

"The FAO launched a series of 13 papers at the congress that highlighted the current global trends in forestry. Those papers, including the paper² we contributed to on global trends in planted forests,

clearly shows that while the rate of global deforestation is slowing, so too is the rate of expansion of planted forests. Globally, we need to reverse this latter trend if we are to meet the growing demand for forest products and services, and relieve the pressure on natural forests caused by the growing global population and a rapidly changing climate.

"This presents a great opportunity for New Zealand. We are already contributing to the global forest resource, and through our 'Growing Confidence in Forestry's Future' programme we have the scope to increase productivity of our existing, and of new planted forest estates.

"We need to be confident in our forestry as the demand for trees will continue."

For further information

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¹ 2012 Living Planet Report www.wwf.panda.org

² www.sciencedirect.com/science/article/pii/S0378112715003473

Associate Minister for Primary Industries Jo Goodhew, who attended the Congress, took the opportunity to launch the 'Sustainable Management of New Zealand's Forests: New Zealand's Third Country Report on the Montreal Process Criteria and Indicators' at a side event during the World Forestry Congress. The report showcases New Zealand's progress towards sustainable forest management.

<http://archive.mpi.govt.nz/forestry/forestry-in-nz/international-forestry/montreal-process>





Precious indigenous plant begins new future

A native plant nursed back from the brink of extinction by Scion nursery staff was returned to iwi at an official ceremony in September. The rare white-flowered ngutukākā (kakabeak) was last seen growing in the wild in the 1950s near Wairoa on the North Island's East Coast and was considered extinct. A chance discovery of a bag of seeds stored in a member of the public's garden shed led to the plant's recovery.

"We've been working with iwi, the Department of Conservation, Landcare Research, and the Ngutukākā Recovery Group to preserve these native plants, safeguarding their survival for future generations," says Dr Brian Richardson, General Manager Forest Science. "Over the last four years our nursery staff have grown white ngutukākā from seed, applying their propagation expertise and increasing the likelihood of these plants surviving in their natural environment."

Through genetic testing, the plant's origins were traced back to the Wairoa region. Project Leader Karen Te Kani says, "The white ngutukākā is considered precious taonga to East Coast iwi. About 100 plants have been gifted back to Ngāti Kohatu and Ngāti Hinehika iwi to be planted on their ancestral land.

"A block of land surrounding Te Reinga marae at Wairoa has been fenced off to keep pests out, and we will also be guiding iwi on how best to ensure the plants survival."

Ngutukākā is New Zealand's most widely recognised endangered plant and was one of the earliest to receive conservation attention with DOC preparing a formal recovery plan in 1993. Plants are particularly at risk from browsing livestock and introduced forest pests such as rabbits and goats as well as deer and snails. Introduced invasive plant species such as buddleia and gorse also compete for the same forest environment.

For further information

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The complexity of predicting wind damage

Predicting how wind moves over forested landscapes can be challenging, according to Research Leader Dr John Moore. John recently attended a three day workshop at INRA* in France, on the mathematical modelling of wind damage in forests.

"The workshop was an opportunity to assess the knowledge that currently exists about the damage winds cause to forests, particularly in Europe where it's a major problem and one that's likely to worsen under future climate change. The more we know, the better we can manage and prepare for."

Predicting wind damage is a complicated process. Wind speed and direction change as the wind flows across a landscape and are also modified by the forest itself. Other elements such as the mechanics of wind-tree interactions, and the impacts of various management regimes on wind damage, add to the complexity.

"The amount of information we have on factors that affect risk is increasing, and will be further boosted with the use of new remote sensing technologies. These data are being incorporated into existing mathematical models.



"One of the key challenges remains our understanding of wind flow over forested landscapes. Knowing the pattern of wind over forests during storms is important in helping us understand the factors that contribute to wind damage and, therefore, how best to reduce the risk. It is also important for other aspects of forest management including pollen dispersal, spray management, wilding pine spread and fire risk.

"This workshop gave us all a chance to identify the knowledge gaps we need to address in future research, and a chance to see what other scientists are doing in this area and what can be applied here in New Zealand. I also came away with opportunities for future collaborations in the area of wind effects on growth and wood properties."

* INRA is the French National Institute for Agricultural Research.

For further information

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Unlocking curious minds

Young minds are curious minds and respond well to stimulation and challenge. Scion's biotechnology scientists are stepping up to that challenge after receiving a \$20,000 grant from the Government's Unlocking Curious Minds fund for a new project to encourage students from low decile schools in the Rotorua area develop a keen interest in science.

"Low decile schools often don't have access to a lot of resources in science," says Project Leader for Education and Outreach Andrew Dunningham. "And if kids are not engaged in science by the age of about 12 to 14 years, it's likely they never will be. We want to excite and interest these kids in science, get them to see the links between science and the values they have, whether personal or cultural, and to understand how science can be used to solve some of the world's problems.

"We have developed an inquiry-based learning model over the years that generates interest in the students, and improves their learning outcomes. This project will expose students to new science and have scientists explain it to them. They'll be able to discuss and debate the role of biotechnology now and in the future. They'll also get the chance to participate in a range of activities on campus, such as demonstrations, presentations and discussions, and to visit some of our labs and facilities."

Unlocking Curious Minds is part of the national 'A Nation of Curious Minds - He Whenua Hihiri i te Mahara' strategy to upskill New Zealanders, by encouraging young, 'harder to reach' students to engage with science and technology, and actively pursue higher value careers.

For further information

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Dr Tanira Kingi

New research leader to evaluate diversification of land use

An extensive background in agricultural systems, land economics and forestry makes Dr Tanira Kingi (Ngāti Whakaue / Te Arawa) a valuable addition to our Value Chain Optimisation Team. Tanira joined Scion in July as research leader in primary industry systems, having previously spent five years at AgResearch in a number of roles from science advisor, senior scientist and portfolio leader.

Tanira will be working across a number of key research areas, including projects that focus on optimising production systems and land use, but also limiting environmental impacts including greenhouse gas emissions and reducing nutrient leaching into waterways.

"My main focus will be from a land economics perspective. I'll be working with the VCO Team and other economists to evaluate options for land-use change and diversification. We'll be developing

tools and models to both optimise land use and integrate alternative land uses including forestry.

"I'm working at Scion in a part-time capacity; the rest of my time is spent on boards and I'm a consultant to the agricultural industry. Much of this work complements projects that I have with Scion, for example, advising Māori land entities to develop integrated land-use options on under-utilised land. I have been actively working with Māori landowners for over 20 years now, so look forward to building on these relationships in my capacity as research leader at Scion."

Tanira is a member of the oversight group for the Our Land & Water National Science Challenge and co-leads two projects as

well as being advisor to the challenge on the Vision Mātauranga component.

In recent years, Tanira has been developing policy frameworks with regional councils to reduce nutrient leaching into waterways. He is currently an advisor to the Bay of Plenty Regional Council and chairs a number of groups established under the council. He is currently working with the council and Rotorua Lakes Council to establish the governance structure for the regulatory rules, farmer support and economic development programmes for the Lake Rotorua catchment.

For further information

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TERAX™ wins national award for innovation

Terax Ltd 2013, a joint partnership between Scion and Rotorua Lakes Council, received the New Zealand Innovation Council's Innovation Award for Sustainability and Cleantech in October this year, for the company's novel TERAX™ technology.

The Innovation Awards recognise high growth New Zealand organisations that have invested in developing innovative new products, services and ventures.

"It was a really pleasant surprise to win up against so many strong finalists, and the award is a great endorsement of the hard work put in by a lot of people over the last few years," says Acting General Manager for Terax Ltd 2013, Rob Lei.

TERAX™ technology was developed to treat biowaste as a recyclable resource. The unique, cost-saving technology reduces wastewater, eliminates organic solids and recovers useful components such as nitrogen, phosphorus and carbon for recycling. Currently, the vast majority of municipal organic waste ends up as landfill, incurring high transport costs and generating large volumes of methane and toxic run-off that have flow-on impacts to the environment.

A TERAX™ demonstration plant is currently under consideration by the Rotorua Lakes Council. It is estimated the plant will save the council about 20% in waste treatment costs over the life of the project, compared to their current technology.

Upcoming event

Forest Genetics for Productivity Conference: the next generation.
14-18 March 2016. Rotorua Energy Events Centre, Rotorua.

The five-day conference includes a full day field trip, partner programme and a post-conference tour to the South Island, finishing in Queenstown.

This conference is for academics, scientists, geneticists and silvicultural scientists interested in genetics, national, regional and international governmental organisations and industry stakeholders, as well as geneticists from sectors outside forestry.

This conference will be led by several international speakers who are renowned in their field. It is part of the International Union of Forest Research Organization's (IUFRO) calendar of events, and includes the Australian Forest Genetics Conference. Registrations are now open.

www.fgpc2016.nz/fgp16

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