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connections

Issue Three I March 2012

Scion plays part in the water quality picture

A modified zeolite product developed by Scion has been used to treat potentially toxic algal blooms in Rotorua lakes. The product, marketed by Blue Pacific Minerals under the trade name "Aqual P", is one of many tools being used by the Bay of Plenty Regional Council as part of their lake clean-up efforts.

Zeolite is a highly absorbent volcanic mineral that is commonly used for applications like cat litter and chemical spills. Scion's technology modifies the zeolite with a benign polymer that increases the mineral's ability to absorb phosphorus and other nutrients. The product is applied to the lake surface and mops up phosphorous as it sinks. It eventually settles on the bottom to act as a sediment cap, locking in the nutrients on the lake floor.

The Bay of Plenty Regional Council used Aqual P this summer to treat a toxic blue-green algae bloom in Rotorua's Lake Okaro. Algal blooms can occur in nutrient rich lakes when temperatures rise, posing a potential health risk to any animals or humans that come in contact with the water.

The Regional Council applied an Aqual P slurry to the lake from a helicopter, in an effort to reduce the nutrients in the water and starve the algae. Initial results are promising with algal levels reducing to much lower levels within 2-3 weeks. Monitoring of the lake will continue until late autumn.

A similar approach used by the Regional Council to treat Lake Rotoiti in February 2011 was successful in averting an algal bloom threat. Council staff and residents observed a rapid improvement in water quality following the Aqual P treatment, and the algal bloom did not become a serious health issue.

The Regional Council's Lake Operation Manager Andy Bruere says these treatments are part of a wider management plan for the Rotorua lakes, which include tree planting, wetland restoration and working with land owners to reduce nutrient run-off.

"Aqual P has proven useful for short term remediation where there is a need to control blooms in small lakes or bays before they become a longer-term problem," he explains.

Scion started research on the ionic properties of locally mined zeolite in 2004 and two years later teamed up with Blue Pacific Minerals to develop the technology. Lake trials were conducted from 2006 onwards by the Bay of Plenty Regional Council, supported by researchers from the University of Waikato and NIWA. All results have been positive with no harmful environmental impacts.

The Aqual P technology has now been licensed to Blue Pacific Minerals, a privately owned mineral processing company based in Tokoroa. The exclusive licence is for the manufacture, sale and global distribution of modified zeolite. This research was conducted as part of Scion's ecotoxicology programme which has grown from the treatment of forest industry waste streams.

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> Maori bring new forestry perspective

Maori own some $2b of forestry assets and are set to have a substantially larger role and influence in the future of New Zealand forestry.

Scion recognises the absolute importance of building high quality, long-term partnerships with Maori. Last year we conducted several hui with a range of iwi to develop our Te Papa Tipu Maori Science and Innovation Plan. The plan has four goals:

1. Work together to grow co-investment for Maori-led initiatives in forestry and related businesses;

2. Build dynamic, long-term partnerships with iwi/Maori who have significant interests and/or potential in forestry;

3. Improve knowledge and technology transfer to iwi/Maori enterprises to support their development of forestry and related enterprises; and,

4. Increase Maori capabilities and capacity to enable faster innovation by Maori in the forest industry.

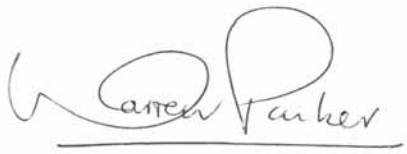
I am delighted that we are making good progress on the action plans in all four areas including the formation of Nga Rangitira ropu (or Maori Strategy Advisory Panel) and Hangarau ropu (Maori Technical Advisory group). The former advises the Scion Board and Executive on gaps in our Science and Innovation Framework pertaining to Maori and how implementation of our research can be enhanced with respect to Maori needs. The latter provides us advice on the operational aspects of our research including that matauranga Maori is appropriately incorporated, tikanga is observed and the correct engagement with local hapu occurs.

The inaugural meeting of Nga Rangitira ropu, whose members are Dr Apirana Mahuika (*Ngati Porou*); Roku Mihinui (*Ngati Wahiao/Tuhourangi*), James Wheeler (*Te Àtiawa, Ngati Whakaue*) and Scion's kaumatua George Mutu (*Ngati Whakaue*), occurred in February at our Rotorua Campus. We will be incorporating their advice into the update of our Statement of Corporate Intent which is now underway.

It is very positive this year to have the recently completed WoodCo Strategic Action Plan for the New Zealand forest industry and the Forest Owners' Association Science and Innovation Plan to help us set our science priorities and improve the impact of the work we do on forest industry performance right along the value chain.

We will also be seeking, as we did last year, a broad base of forest industry stakeholder input to the refresh of our strategy and SCI over the next two months. Part of this work will include a stock take on the progress we have made over the past 12 months. In that regard, any comments you would like to make to me on where we can improve or better direct our science, or about the science described in this edition of Connections, would be most welcome.

Hei kona ra



Warren Parker
Chief Executive

Scion's Dr Robert Lei (at left) explains waste management technologies to Maori Advisory Panel members: Roku Mihinui (centre) - Chief Executive Officer of Te Arawa Lakes Trust, and James Wheeler - Deputy Chair of the Federation of Maori Authories and Whakatu Incorporation.

> Scion imports atmospheric modelling skills

An atmospheric modelling specialist from the United States brings exciting new capability to forest protection research at Scion.

Dr Tara Strand has unique skills and experience that are valuable across many research projects aimed at supporting the forest industry. Such projects include fire behaviour modelling and smoke dispersion; pheromone dispersion; disease spread; and pesticide deposition and drift for pest control programmes.

When Tara accepted a job at Scion, little did she suspect that her first project would involve kiwifruit. Zespri is drawing on Scion's expertise in aerial spraying to support their ongoing battle with Psa (*Pseudomonas syringae pv. actinidiae*).

"Kiwifruit is a challenging crop to treat because the foliage canopy is in the form of a narrow, dense layer that makes penetration of spray difficult," Tara explains. "We are experimenting with using the turbulent wake of helicopters to force spray droplets through the canopy to improve overall coverage on the vines."

Tara's expertise in turbulent air movement combined with Scion's experience with aerial spray application is being applied in a series of spray trials for Zespri. Their aim is to optimise treatment methods for Psa in orchards.

The research involves using sonic anemometers, which are advanced instruments for recording wind movement in three dimensions. These instruments have recently been purchased by Scion and Lincoln Ventures Ltd for use in the collaborative research programme, "Protecting New Zealand's Environment from Pesticide Exposure", funded through the Ministry of Science and Innovation.

Tara's skills in turbulence and atmospheric science have been applied in a range of projects in the United States relating to air quality and carbon emissions. Her most recent work involved fire behaviour and smoke dispersion modelling for the US Forest Service.

Want to know more?
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Aerial spray capabilities

Scion offers a range of expertise to support aerial spray operations for pest management and eradication:

- *Spray modelling and risk assessment*
- *Measuring spray performance and off-site drift*
- *Operational planning*
- *Equipment evaluation*
- *Aircraft calibration services*
- *Training*

> Managing forests for healthy streams

The management of woody debris following harvesting operations is the focus of a study by Scion freshwater scientist, Brenda Baillie.

Brenda's PhD project involved a large catchment-scale study on the function of wood in New Zealand's stream ecosystems. Her research demonstrates how branches and logs play a vital role in keeping streams healthy and nurturing their aquatic inhabitants.

"Wood debris provides natural habitat, shelter and food for freshwater organisms," she explains. "Pools are formed by debris dams that build up around logs and fallen branches. These pools provide the depth and shade that are particularly important for larger fish species like banded kokopu and eels."

In areas where forests have been cleared, the removal of wood from streams is detrimental to aquatic life.

"We know that longfin eel numbers are in decline due to over fishing and loss of habitat. Depletion of wood is a contributing factor, as it provides deeper pools with cover. Many native fish species are similarly affected," Brenda says.

While forests are good for streams, difficulties can arise during harvest. When too much slash is left in stream channels, it harms the ecosystem and creates risk of debris moving downstream during heavy rain.

Brenda insists that keeping streams free of wood is not the answer.

"Forest and resource managers can make better use of wood in streams to reduce flooding risks and enhance New Zealand's stream environments," she says.

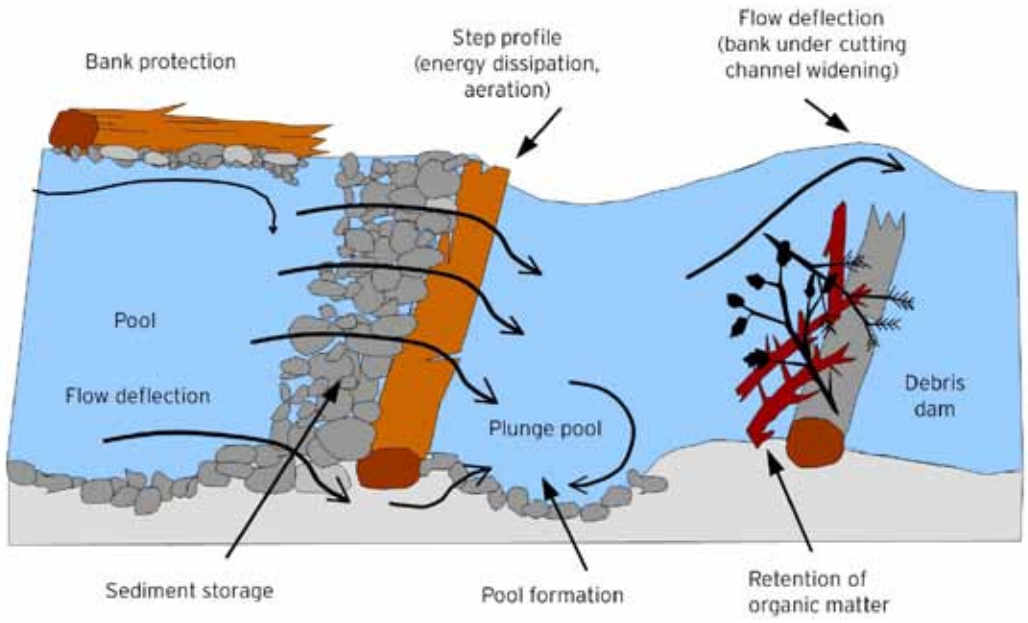
She recommends that large, stable pieces of wood are left in smaller sized streams, providing a win-win for both the stream and the forestry companies.

"Logs and large branches left in streams provide shade and habitat for aquatic organisms and form the basis of natural debris dams. They are also less likely to move downstream during high flows."

Recommendations arising from Brenda's PhD study have been incorporated into slash management plans for forestry companies and regional councils. Her research also made a valuable contribution to the proposed National Environmental Standard for Plantation Forestry.

Hancock Forest Management (NZ) Ltd assisted with Brenda's research and began incorporating her results early on. Environmental Manager Sally Strang says that this project is a rare example of an academic PhD study that has immediate practical application.

"Management of harvesting woody debris in streams has been the subject of a lot of discussion over the



The role of woody debris in providing habitat for aquatic organisms is better understood through research by freshwater scientist, Brenda Baillie.

years, both within forestry companies and with our regulators. We've debated over whether harvesting wood should be fully or partially removed and, if the latter, what portion do you remove - the small material or the large?" Sally explains.

"We need to manage our operations to maintain the aquatic health of streams in our forests, and also to manage the risk of woody debris mobilising in floods. Brenda's work has helped to put some sound science behind the decisions that we make in the field, and for our regulators when they're developing rules and consent conditions."

Brenda's thesis, completed through the University of Waikato, is entitled: "The physical and biological function of wood in New Zealand's forested stream ecosystems."

"Brenda's work has helped to put some sound science behind the decisions that we make in the field, and for our regulators when they're developing rules and consent conditions."

Want to know more?

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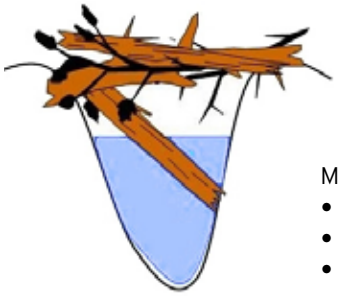
> Logging slash in streams

Retaining large stable pieces of wood that do not impede flow provides benefits to invertebrates and fish, similar to native forest streams.



Mainly above the channel:
- gives shade
- controls temperature
- lowers risk of movement downstream
- creates habitat

Mainly in the channel:
- impedes flow
- increases temperature
- decreases oxygen
- increases algal growth
- increases sedimentation
- impacts on biota
- risks movement downstream

> Kauri makes economic return

A growth model developed by indigenous forestry specialist, Greg Steward, shows that New Zealand kauri (*Agathis australis*) has surprisingly good potential as a productive commercial species.

Greg has completed a Masters Degree that involved compiling historic and recent growth data from kauri plantations around New Zealand. His modelling results show that kauri compares favourably with exotic tree species in terms of wood quality, growth rates and return on investment.

"We now have solid evidence that a 50-60 year rotation of planted kauri can yield a rate of return on good sites that is comparable with Douglas-fir and radiata pine," Greg explains. "This could go higher with research into improved genetics and silviculture."

Greg says the main impediment to kauri plantations has been the perception that natives will never pay. His research is starting to change people's minds.

"Forestry planners and investors need hard data, not anecdotal evidence. This model provides data on a native species for the first time. It opens the door to a new way of thinking about planted forests in New Zealand."

The kauri growth model has been developed as a web-based calculator by Future Forests Research (FFR). This tool will be available for FFR members to use for planning and managing planted kauri for specific outcomes. Scion is undertaking similar work with other native species, such as totara.

Want to know more about kauri?

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> Forests in a changing climate

Visiting scientist, Dr Bruce Nicoll from Forest Research UK, says native tree species could be complementary with exotics as forestry adapts to changing conditions worldwide.

"In the UK, we are moving towards diversified forestry species, away from large even-aged spruce plantations," he says. "Diversification will give us more opportunities to create forests that meet a range of needs and are resilient to a changing climate."

As Programme Group Manager for the Centre for Forestry and Climate Change, Bruce is helping to spearhead changes in the way forests are managed to balance public and economic interests.

"Whether or not people believe in climate change, there is a growing need to manage the risks caused by extreme weather events. This means that protecting people and infrastructure has become a major consideration in all land use decisions. In many cases, especially in Scotland, restoring native woodlands is the most suitable option where soil conservation issues have become important."

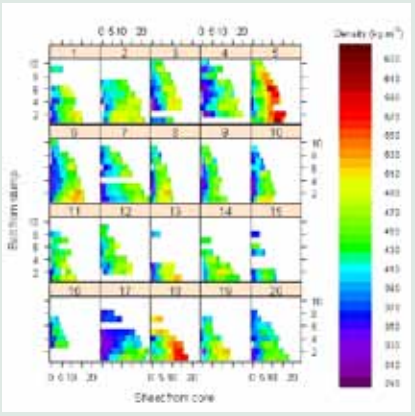
Bruce says that political pressures are lending momentum to the ecosystem services approach where multiple forest values can be taken into account.

"All of these drivers are opening up options for different kinds of forestry models. What we are finding is that the mechanisms being proposed for climate change adaptation, make good economic and political sense as well."

Bruce is collaborating with Scion on research associated with climate change and forestry, with particular focus on steepland forestry and erosion. His visit to New Zealand is part of the TRANZFOR international exchange programme supported by the European Union and the Ministry of Science and Innovation in New Zealand.

> Wood properties in technicolour

Pictures can say 1000 words, so they are great for explaining the complex world of mathematical modelling. With US collaborators, Scion scientist Dr Christine Todoroki has created colour maps of wood properties within 20 individual Douglas-fir trees. The maps show that density and stiffness change both up and across each tree. Models of within-tree wood properties will allow manufacturers to choose the most appropriate logs for production of materials such as laminated veneers and structural plywood.



See Todoroki, C. L., Lowell, E. C., Dykstra, D., & Briggs, D. G. (2012). Maps and models of density and stiffness within individual Douglas-fir trees. *New Zealand Journal of Forestry Science*, 42, 1-13 for more detail on this novel approach. www.scionresearch.com/nzjfs

> Scion forms Vietnamese connection

The Vietnamese pulp and paper company, Tan Mai Corporation, has signed a memorandum of understanding (MoU) with Scion. The MoU covers opportunities for Scion to provide forestry management advice, tools and training, including assistance with managing seed material.

Tan Mai Corporation is the largest newsprint manufacturer and second largest paper supplier in Vietnam. The corporation aims to expand its market share by investing in planted forests to increase wood supply. Tan Mai Corporation specifically requested Scion's support for the development of these forestry plantations in Vietnam.

New Zealand Trade and Enterprise helped to facilitate this initiative because Vietnam is a growing export market for New Zealand diary, wood and other products.

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> Why every bug matters

Natural forests are declining at a rate of about 13 million hectares per year globally, taking many different species with them. As planted forests supply more of our wood and fibre needs, they also play a role in providing habitat for insect, plant and animal species. But why is it important to retain species diversity?

An article co-authored by Scion Principal Scientist, Ecki Brockerhoff, shows that biodiversity can pay dividends. The article describes how increased biodiversity can lead to higher rates of pollination, reduced pest populations, increased productivity, and greater resilience in forest and agroforest ecosystems. The key role for science is to better understand the effects of different ecosystem-management options on biodiversity and to better communicate the results to policy makers.

The paper entitled "Forest Biodiversity and the Delivery of Ecosystem Goods and Services: Translating Science into Policy" recently appeared in *BioScience*, an American journal that discusses global issues relating to life sciences. To obtain a copy see the publication website (www.jstor.org) or contact eckehard.brockerhoff@scionresearch.com

› Watch us on YouTube

Scion has produced a selection of short videos that capture some of our latest research projects. These are loaded to the Scion YouTube channel and include:

- TERAX™: Hydrothermal deconstruction at pilot scale
- Nutrient recovery: useful products from the TERAX™ pilot plant
- Transforming kiwifruit waste into biospifes
- New indigenous forest resources in New Zealand.

We have also uploaded presentations from a recent Climate Change webinar that was held at Scion. The webinar presenters examined the effects of climate change on extreme weather, wind damage, forest fires and production.

View the videos at www.youtube.com/scionresearch

› GIS conference

Scion is hosting a Forestry Geographical Information Systems (GIS) Conference on Wednesday 18 April 2012 at Waiariki Institute of Technology in Rotorua.

Topics include: Cable harvesting, LiDAR, ArcGIS v10.1, GIS for the Emissions Trading Scheme, Climate change, and Environmental data sets.

For more information, visit www.scionresearch.com/gis-conference-2012

› Forest Biosecurity and Protection Annual Report 2011

Scion has released a summary of research from our Forest Biosecurity and Protection programme.

The 2011 Annual Science Report includes highlights of research over the past year aimed at protecting forests and forest product exports from damage caused by insect pests, diseases, weeds and fire.

Our new research programme places particular emphasis on managing needle diseases of radiata pine in New Zealand.

For a free copy of the report see www.scionresearch.com or contact publications@scionresearch.com.

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