ScionConnections

SCION NEWSLETTER ■ ISSUE 22 ■ DECEMBER 2016

Calling all citizen scientists

A smartphone app has been developed to give the public a new way to report sightings of eucalyptus pests.

A new tool for biosecurity response

New Zealand's economy is reliant on the health of our primary industries. That is one reason why we take biosecurity so seriously - it just takes one breach to wreak havoc. How we manage the pests that have slipped through the net is another challenge altogether.

The ability to respond effectively to an incursion is dependent on finding it quickly, having good information about where it's located and the likely rate and direction of spread. The response is informed by surveillance, and often involves the time consuming and labour intensive work from teams of people, methodically searching large areas.

Dr Brian Richardson, Scion Principal Scientist, says "Effective surveillance is critical. If we know the exact distribution of a pest and its likely rate of spread we can more efficiently allocate resources in the response. But large scale surveillance needs a lot of eyes and ears on the ground which can be a real challenge.

"We're always looking for new technologies and methods that will help improve surveillance efficiency. One improvement in biosecurity surveillance could be citizen science."

Citizen science can work wonders – why not in biosecurity?

The logic behind citizen science is simple. By giving the public a channel to report information straight from the source, you can exponentially increase the amount of eyes on the ground. When it comes to pest surveillance, trying a citizen science approach makes sense.

Citizen science has already been used successfully in a range of fields including ecology, astronomy, and medicine. At its best, the sheer scale of data contributed from volunteers enables observations to occur over large geographic areas, faster and at much lower cost than professional teams.

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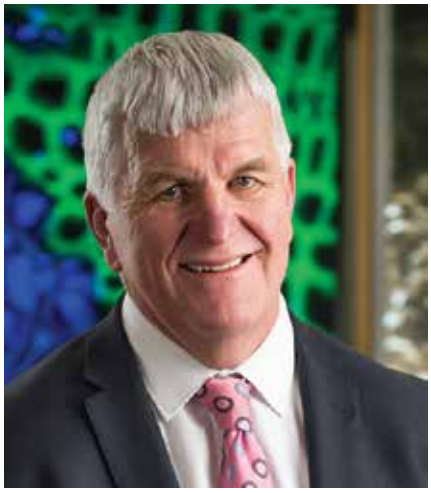
Lessons from the 1990s vital for next expansion in forest plantings



Dr Warren Parker, Chief Executive.

Planting more trees is one of the most cost effective mechanisms for New Zealand to meet its COP21 Paris Climate Agreement target and generate many environmental and regional co-benefits. Indeed, the Minister for Climate Change Issues Hon Paula Bennett has stated "Forestry is so important because it's currently our most important source of domestic emission removals. It can deliver at scale and is likely to cost less than purchasing international emissions reductions"[1] .

At this stage, New Zealand's Nationally Determined Contribution (NDC) is to reduce emissions by 30% below 2005 levels (or 11% below 1990). Under the Paris Climate Agreement, this NDC may 'ratchet-up' at the five yearly reviews in order to hold the increase in the global average temperature to below 2°C above pre-industrial levels by 2050.

While New Zealand's NDC target might appear modest compared to some countries, it will be a 'stretch' because of our national greenhouse gas emissions profile, the age structure of our plantation forests, recent land-use change to higher emission enterprises and lack of tree planting. Combined, the latter factors mean the removal rate of carbon from forests due to harvesting will exceed the amount stored from the early- to mid-2020s. As well, reducing emissions from pastoral agriculture is not straight forward.

All of this means, a lot more talk about the potential to plant 1 million hectares of new forests over the next 13 years. Planting rates therefore will need to ramp up to 1990s levels, which peaked in 1995 with almost 100,000 hectares of new forest established.

Planting more trees will also help to alleviate a critical issue facing wood processors and manufacturers – security of long-term log supply.

While this is great for forestry it is important to apply the lessons of the 1990s, which are distilled as:

- Pick your planting sites wisely – consider topography, ease of harvesting, and distance to main road infrastructure.

This is an exciting time for the forest industry. As the world adjusts to a low carbon renewable future, it will lead to an increase in the global demand for products from trees.

- Think about the end markets for the trees including proximity to a wood processing site or port – transport costs to mill or port are an important determinant of net returns to the land owner. Where distances are large and slopes are steep it may be better to plant forests for carbon storage (see page 6 "would a carbon forest work on my farm?") and other purposes.
- Choose the correct silviculture regime – Scion's latest research indicates that having the right final stocking of trees is critical to maximising the volume recovered at harvest and therefore to forest profitability.
- Select the best possible genetics for the site location and climate expected for the locality over the next 20-40 years. Consider local changes in weather, such as increased drought or exposure to strong winds.
- Understand the policies, tax and other rules impacting forestry, in particular the Emissions Trading Scheme (ETS). Forests that qualify under the ETS can earn carbon credits – currently around $18 per tonne CO_2 equivalent and expected and projected to increase towards $50/t plus from 2013. Carbon payments can ease the cashflow challenges for forestry. The present review of the ETS is about half way though and based on Minister Bennett's comments is expected to provide increased policy stability and be more attractive to foresters.

Finally, it is important to get up-to-date, robust advice – much has been learnt by forest owners and researchers since the 1990s and markets are evolving quickly as a low emission, renewable and bio-based economy gains traction.

This is an exciting time for the forest industry. As the world adjusts to a low carbon renewable future, it will lead to an increase in the global demand for products from trees. By learning from the valuable lessons of the 1990s we can ensure the full potential of forestry's substantial contribution to New Zealand's future prosperity is realised.

I welcome your comments on this topic or any of the other articles in this edition of *Scion Connections* and would like to take this opportunity to wish you a happy Christmas and New Year.

WANT TO KNOW MORE?
Contact Dr Warren Parker at warren.parker@scionresearch.com

[1] Speech to the Climate Change and Business Conference, 11 October 2016.

Dr Florian Graichen (second from left) speaking at I-SUP 2016.

Speaking on an international stage

Scion staff have been on the road presenting our work to new markets.

Thanks to the wonders of globalisation, there's a whole world of opportunities for our research outputs. To make our research as useful as possible, our teams have been out presenting to new audiences about the ground-breaking research we carry out.

Bioproducts on tour in Europe

Europe is one of the world's biggest markets for bioplastics and biopolymers. When the opportunity to speak at several European bioplastic events arose, Florian Graichen, Science Leader – Biopolymers and Chemicals, got on a plane to promote Scion's biomaterials work including award winning biobased adhesive technology Ligate™.

"By working closely with international partners, we're able to take our products to a bigger market and increase their impact, helping us to keep New Zealand bioplastics at the forefront. It's a competitive business, but Scion is a unique partner because we have in-house expertise on everything from genetics to manufacturing of bioproducts," says Florian.

We can use our situation to our benefit, by working closely with established processing plants in New Zealand. "We're working with manufacturers here, who have allowed us to use the equipment they rely on every day, to bring our products to tonne scale. For a new partner, knowing a product can be made in this amount is significant and the possibility of not needing new infrastructure to do that makes our proposition much more attractive."

Packaging research on display

Tappi is America's largest corrugated box expo and the perfect place for Materials Scientist Saad Hussain to connect with people who could benefit from his research. Saad was one of a small number of technical experts presenting at Tappi and he used the time to profile his research on improving the lifetime of boxes.

Dr Saad Hussain presenting packaging research.

Saad says, "We're focused on research that will have practical applications. So it was great to get out there and see so many box makers interested in what we're doing.

"Creep is an issue that happens to every box and it costs the industry billions of dollars. Food is packaged for a long time – some fruit is stored in boxes for up to a year, and frozen food for up to two years. In that time some boxes will fail, but we have a facility that can start to solve the problem.

Our WHITE (Weight, Humidity Intervals, Temperature and Experimentation) Room testing facilities is the biggest independent testing facility of its kind in the world. Saad says "By making stronger boxes which last longer, they'll get used more and that helps us grow the forest based bioeconomy".

Forestry, climate change and China

John Moore was one of several Scion staff members to attend and present at the IUFRO Asia Oceania Regional Congress, in Beijing. IUFRO is the International Union of Forest Research Organisations - the main global network for forest scientists. In parallel with the congress Division 8, of IUFRO held its first congress, with the theme of "Forest environment under changing climate and societies".

John coordinated a session on wind disturbance and sustainability under changing climates, with Barry Gardiner from INRA in France. John also presented on the potential impacts of future climate change and the risk of wind damage to radiata pine forests in New Zealand.

This event is one of many contacts between Scion and China, including the recent signing of a memorandum of understanding with the Chinese Academy of Agricultural Sciences. In early December, Scion hosted a delegation from the Chinese Academy of Forestry.

FOR FURTHER INFORMATION

On Ligate™ and biopolymers contact Dr Florian Graichen, at florian.graichen@scionresearch.com

On box lifetimes and packaging research contact Dr Saad Hussain, at saad.hussain@scionresearch.com

On wind disturbance risk to radiata pine forests contact Dr John Moore, at john.moore@scionresearch.com

Members of the Task 34 group enjoy a tour of Scion.

World class bioenergy experts

For one week in early November, Scion hosted the world's foremost bioenergy experts in Rotorua for the latest round of International Energy Association (IEA) Bioenergy meetings.

Bioenergy experts venture south

Hosting events under the IEA Bioenergy banner in Rotorua is a significant step for New Zealand. Although biofuels are a drop in the ocean of our fuel consumption - accounting for less than 0.1% of the annual 8.6 billion litres of fuel consumed here annually - bringing together bioenergy's most influential and intelligent minds shows we are in the major league on this issue.

IEA Bioenergy is an international organisation created to improve cooperation and information exchange between participating countries, with an aim to increase global uptake of bioenergy. It is where the world's leading scientists and policy makers can come together to work on tasks, or streams of work, that contribute to bioenergy research, development and usage around the world.

> Scion Science Leader and workshop organiser Paul Bennett says "It seems logical to get all the parties in the same room talking to one another, learning about the barriers to deployment of these fuels."

New Zealand is a member of IEA Bioenergy with a place on the executive committee, and staff from Scion represent New Zealand on Tasks 34 (Direct Thermochemical Liquefaction, Ferran de Miguel Mercader) and 39 (Commercialising Conventional and Advanced Liquid Biofuels from Biomass, Ian Suckling) with the other world leaders in those fields.

While the work of those tasks is very specific, the overall benefit is consistent – sharing information on joint projects. By virtue of being part of these tasks, we learn from other member countries that have gone further down the track in deploying bioenergy than New Zealand has.

Focussing on marine and aviation

Marine and aviation biofuels were the hot topic of the week. These sectors don't have the option of electric powered motors like cars – if they're going to reduce their reliance on fossil fuels – biofuel is one of few options available.

Rather than a traditional meeting of researchers, the IEA workshop on drop-in biofuels for international marine and aviation markets workshop brought together the different parties involved in the process. Officials from Boeing, Air NZ, Interislander, Ports of Auckland and Z Energy were among the speakers.

Scion Science Leader and workshop organiser Paul Bennett says, "It seems logical to get all the parties in the same room talking to one another, learning

about the barriers to deployment of these fuels. By having everyone there, we were able to get the whole picture of what's happening around the world and insights into what needs to happen here in New Zealand."

The driver for aviation drop-in biofuels is through the international market. In October 2016 the International Civil Aviation Organisation, which the New Zealand Civil Aviation Authority is a member of, announced an agreement to cap the global net CO_2 emissions from international aviation at 2020 levels.

Paul says, "Initially offsetting (such as afforestation) will be used to address the target but in the longer term using biofuels will be an enormous leap toward the aviation industry achieving their goal of carbon neutral growth from 2020".

The maritime sector is in a somewhat different predicament. Their heavier fuels emit sulphur, which affects air quality in ports and has become a real issue in some areas. Paul says, "There has been some international movement toward setting a limit on sulphur levels – and if that happens, it will have a huge effect here. If the ships leaving our ports carrying our exports don't meet the standards of the destination port, they won't be permitted to enter".

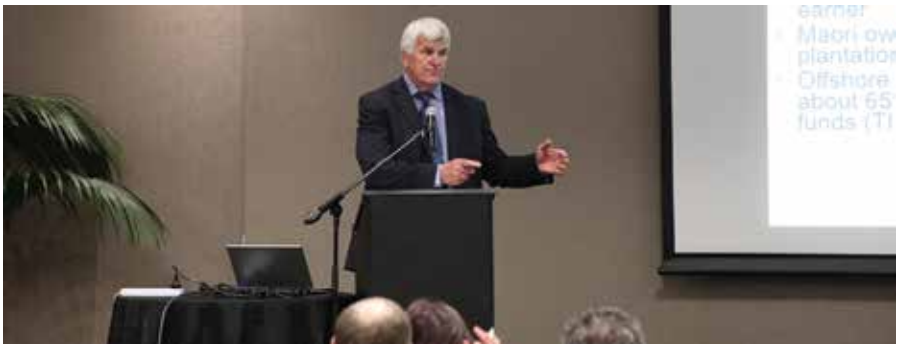
Paul says the industry pressure is mounting, and we need to stay at the forefront of science on this issue. "It's not a question of whether or not we pursue biofuels, it's how we do it in the best way for New Zealand".

Plotting our future in biofuels

Second generation biofuels have come a long way. Researchers at Scion are working on a bioenergy roadmap to plot out the course for biofuels to enter our market. The IEA Bioenergy forums can help us to determine which biofuels would work best here, based on what other countries are doing. After all, doing nothing is not an option for us.

New Zealand's export economy relies on fuel for aircraft and ships to get goods and tourists in and out of the country. Right now, maritime and aviation industries are dependent on fossil fuels, but they are international industries looking for a change. If we're not ready to respond with options, the future could get a lot smaller for New Zealand.

FOR FURTHER INFORMATION
contact Dr Paul Bennett at paul.bennett@scionresearch.com



Dr Warren Parker opens the workshop on aviation and marine biofuels.

Calling all citizen scientists

(Continued from page 1)

The application for pest surveillance is simple. Brian says, "Knowing where the pest is, and its rate of spread, is essential for effective decision making. If you get that wrong, the eradication attempt is lost. You won't succeed. If you have good information, you can make decisions about where to deploy resources according to priority, where to put restriction zones and what controls to implement. Everything comes from the knowledge of where the pest is. If engaging an army of volunteers enhances the rate and volume of useful data - that would be tremendously beneficial".

In November 2016, Scion working with the Ministry for Primary Industries (MPI), the Forest Owners' Association (FOA), Lincoln University, and NatureWatch NZ, launched a smartphone app to test whether a citizen science approach could work for reporting sightings of the eucalyptus variegated beetle.

Testing the waters

Paropsisterna variicollis, known as the eucalyptus variegated beetle, was first reported in the Hawke's Bay in March 2016. Brian and his team seized the opportunity to test whether a citizen science approach would enhance surveillance. With funding from MPI and the FOA the 'NZ Eucalyptus Pests' smartphone app was created.

The app is built on the NatureWatch NZ platform, a popular online social media site for New Zealanders to upload and identify photographs (and sounds) of plants, and animals, and fungi. NatureWatch NZ is part of the global iNaturalist network operating from the California Academy of Sciences.

The 'NZ Eucalyptus Pests' app works in a similar fashion. Anyone who has downloaded the app can photograph and report possible beetle sightings. These photos are uploaded to NatureWatch NZ for initial identification and confirmed sightings are then assessed by MPI staff. The exact coordinates of observations are visible to authorised MPI and Scion staff but remain publicly obscured by 10 km on NatureWatch NZ.

If enough robust information is gathered, MPI and forest owners will be more informed for effective decisions on appropriate management controls.

The beauty of the app is its simplicity, it has been built to be easily customised to other pests. The possibilities are endless. Brian says, "If this goes well, we could possibly use this app structure for reporting symptoms of disease in foliage, other pests, weeds - you just have to imagine it really".

NZ Eucalyptus Pests app available now!

The beetle has been found in the Hawke's Bay and surrounds but your help is needed to know its spread.

The 'NZ Eucalyptus Pests' app can be downloaded free, from the Apple and Google Play stores.

To learn more about the eucalyptus variegated beetle see: www.mpi.govt.nz/protection-and-response/responding/alerts/eucalyptus-variegated-beetle/

FOR FURTHER INFORMATION
contact Dr Brian Richardson at brian.richardson@scionresearch.com

Research with an impact

The UN Weather Agency has confirmed that 2011-2015 was the hottest five year period on record. Now more than ever, we have good reason to work closely with industry to deliver research that will have a big impact and prepare New Zealand's forestry and wood product industries for the realities of climate change in our future.

Preparing for extreme fires

Scion is teaming up with fire experts from the United States, Australia and across New Zealand to learn more about extreme fire.

Extreme fire can occur within any wildfire. It spreads rapidly and is unpredictable, making it especially dangerous and difficult to supress. New Zealand experiences approximately 3000 fires annually, wreaking over $200 million worth of direct and indirect damages, like lost property and productivity. As our summers continue to heat up and dry out, we can expect to see more extreme fire activity. The team has been awarded $8.75 million over five years, from MBIE's Endeavour Fund to carry out this work with US Forest Service Missoula Fire Science Laboratory, University of New South Wales, San Jose State University, US Forest Service Pacific Northwest Laboratory, University of Canterbury and Lincoln University.

Senior Fire Scientist Grant Pearce says, "By understanding what causes extreme fire and when it might happen, we can give fire managers new information about what they're dealing with. They'll be able to use that information to make decisions about where to send resources and how to manage fire fighter safety".

Communities, the natural ecosystem and primary industries will also benefit from research findings that can be applied to fire mitigation and preparation activities.

Climate change and forestry research review: making the most of what we've learned

Forestry is being hailed as one of the primary ways New Zealand will offset greenhouse gas emissions in the future. With all this attention, now is a good time to take stock, know what research we can arm the forestry industry with and identify where gaps in knowledge lie.

Andrew Dunningham and his team have been awarded $250,000 from the, MPI Sustainable Land Management and Climate Change (SLMACC) Research Programme to do just that.

Andrew says, "This is a great chance to really demonstrate the value and impact of the existing research to the industry and the public and to showcase forestry as an option to mitigate for climate change".

Would a carbon forest work on my farm?

That is the question that Scion Senior Scientist Steve Wakelin is trying to help New Zealanders answer with $230,000 from MPI's SLMACC fund.

Planting a forest is a long term commitment and can be a hard sell for land managers who are unsure of the benefits. Steve's team will be working on a raft of measures that will help land managers evaluate small scale carbon forestry as an option and compare it to other land uses, such as dairy or sheep and beef farming.

Steve says, "Our goal is to help people make informed decisions. The work we're going to do will help landowners assess what's best for their land".

Creating biobased high performance plastics

Imagine that your next electronic device contained plastic material made in New Zealand from renewable materials. Now imagine that plastic was created by feeding a small army of microorganisms that produce the polyester.

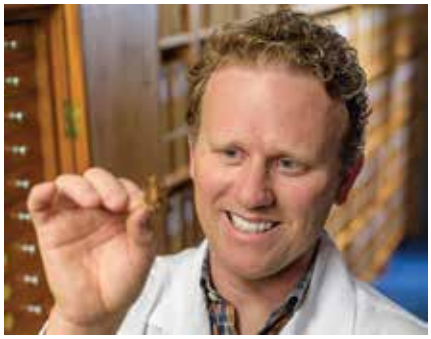
The *Bioinspired Aromatic Polyesters* project has been awarded $1 million over two years from the MBIE Endeavour Fund to develop the microorganisms that mass produce aromatic polyesters. The non-fossil fuel origin of these new aromatic polyesters make for a 'green' plastic material sustainably produced from wood.

These high performance, hard wearing bioplastic products can be used in everything from high-value electronics to sporting goods. Our success could lead to a new high performance bioplastics industry for New Zealand.

Make wood not love

Studying reproduction in radiata pine is no small challenge. Trees take between 6 to 8 years to reach reproductive maturity and producing research results can take over a decade. But this research is much needed. Elsewhere in the world, foresters have been using genetically engineered (GE) trees to boost their productivity. Sterile trees will help to address the social and environmental concerns about growing GE trees in New Zealand.

This $1 million project will test new biotech-based methods to produce sterile conifers using the early and densely flowering model conifer species *Pinus densiflora*. This will speed up the testing process and allow testing at a rate not possible using commercially important conifers like *Pinus radiata*. Controlling reproduction would also mean that sterile trees could be safely field-tested, with no risk of spread. The success of the project could enable forests with shorter rotation times, greater wood volume, improved quality and no wilding pines – potentially adding $6.5 billion to New Zealand's GDP by 2051.



FOA award winner Dr Steve Pawson.

Awarding excellence

Scion staff have had a busy awards season. Here's a full wrap up of the individuals who took out awards in their fields.

Congratulations to Mike Watt, winner of our Roger Newman Science Excellence Award. The research being led by Mike has already had a big impact for industry. His findings showed that the average New Zealand radiata forest is understocked and the learnings are already being applied by forest managers.

Brionny Hooper was the recipient of a newly-created Forest Owners Association award for young scientists. The FOA recognised Brionny for her relationship building at all levels after only 18 months in the forest industry.

Steve Pawson was also recognised by the FOA for his excellent communication and engagement with industry. Steve is known for championing citizen science, and worked closely with developers on the NZ Eucalypt Pest smartphone app.

Value Chain Optimisation researcher Ginny Christians has been named the New Zealand Chartered Institute of Logistics and Transport's Young Achiever of the Year. Ginny's award recognises exemplary involvement in the operation or development of transport and/or logistics in New Zealand.

FOR FURTHER INFORMATION contact Dr Michael Watt, Research Leader, Forest Industry Informatics at michael.watt@scionresearch.com

Brionny Hooper, Scientist, Forest Systems at brionny.hooper@scionresearch.com

Dr Steve Pawson, Research Leader, Forest Protection at steve.pawson@scionresearch.com

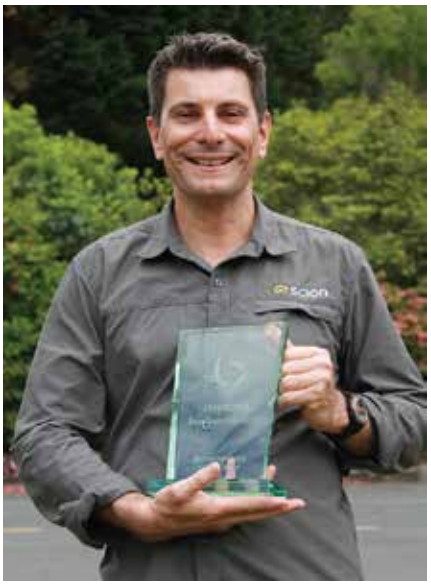
Ginny Christians, Researcher, Value Chain Optimisation at ginny.christians@scionresearch.com

Accolades all around for 'green' glue

Scion's environmentally-friendly bioadhesives technology Ligate™ has been earning accolades all over.

The Scion bioadhesives team, led by Warren Grigsby, have developed a 100 percent biobased adhesive and resin technology for engineered wood products.

It was awarded Biotechnology of the Year by NZBIO, won a judges commendation for renewable innovation at the NZ Sustainable Business Network awards and was a finalist for the Innovation in Sustainability and Clean-Tech category at the NZ Innovation Awards.

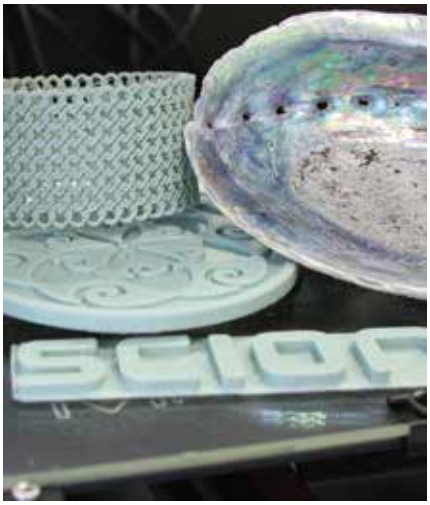


Dr Warren Grigsby and the NZBIO Award.

On winning the NZBIO Biotechnology of the Year award, Warren said "We are thrilled to receive this award. It's a great acknowledgement for our team. We have spent several years developing these adhesives and resins and it's great to get this recognition as we move toward commercialising Ligate™ technology".

Made from natural sources, such as forestry and agricultural side streams, the adhesives and resins technology is petrochemical-free, has very low formaldehyde emissions and can be made and used in existing manufacturing operations.

FOR FURTHER INFORMATION contact Dr Warren Grigsby, Research Leader Biopolymer and Chemicals at warren.grigsby@scionresearch.com



Pāua Power on a screen near you

The crew from television series Rural Delivery visited our Rotorua campus to film an episode on our 3D printed bio-plastic containing pāua shells.

The episode covers the journey from inception to production. It all began when Scion researchers approached the pāua aquaculture farm OceaNZ Blue, keen to investigate the properties of pāua shells. For OceaNZ Blue, sustainable aquaculture practice is an important part of their brand and company ethos. Teaming up with Scion to develop a value-added product or process for their pāua shells aligned with their vision.

Pāua shell is a 'side stream' of the food industry and currently sold off cheaply to overseas processors who convert them into decorative veneers, powders for cosmetics and homeopathy treatments. Some of these products are then exported back to New Zealand.

Biomass side-streams, like pāua shells, are often overlooked. As by-products, they are sustainable resources and offer new economic opportunities for industry. Scion is continuously advancing the fundamental research to convert primary industry side-streams into value-added products that contribute to, and reinforce, a sustainable bioeconomy.

TV One aired the Pāua Power episode on 3 December – it is available online through the TVNZ on demand service.

FOR FURTHER INFORMATION contact Dr Marie Joo Le Guen, Biopolymer and Chemicals Scientist at mariejoo.leguen@scionresearch.com

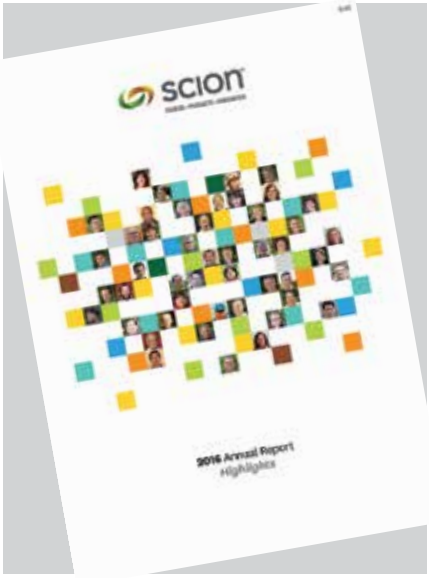
Annual report available now

Our 2016 annual report is now available. The report showcases a very successful year in creating science impact and financial performance.

Chief Executive Warren Parker says during the year Scion delivered savings of more than an estimated $20 million to businesses through its unique science problem-solving capabilities.

"The ability of our scientists to solve technical problems in an advanced manufacturing plant one day, and next day discover globally unique intellectual property in one of our laboratories, is enormously valuable to our customers and New Zealand," said Dr Parker.

Scion's complete Annual Report can be downloaded from www.scionresearch.com/annualreports



CEO retires

After almost six years at the helm and more than 20 years in senior executive roles, CEO Dr Warren Parker has announced his retirement.

"It has been a privilege to lead Scion through a positive period of change including implementing the CRI Taskforce reforms and strengthening industry, iwi and international relationships.

"The science at Scion uniquely applies across the value chain, is internationally competitive and underpins an increasingly strong technology commercialisation pipeline that will support the growth of New Zealand's bioeconomy. It is an appropriate time for me to hand over to a new leader to take Scion through its next phase of growth and impact," said Dr Parker.

The focus for Dr Parker is now on directorships, grandchildren and checking off his 'bucket list'.

Dr Parker will stay on as CEO until a replacement is found in 2017.

Introducing our new logo

In October we launched our new logo, which better connects with our business strategy and organisational values. It portrays a dynamic sense of innovation and creativity, harmony and collaboration between us and our partners and customers. At a more subtle level the logo represents the emergence of a stylised shoot (scion) with the colour palette inspired by nature. The logo shape also depicts the concepts of circular economies and the bioeconomy.

Meri Kirihimete

Our offices will close for the year at 5pm on Wednesday December 21 and re-open on 9 January.

The Scion Board and staff would like to wish all our clients, partners and colleagues the very best for the festive season. We look forward to working with you again in 2017.

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