



Sampling towers collect data during field trials of aerial spray drift.

Advanced technologies expand our knowledge of spray deposition

Turbulence created by the 'roughness' of the forest canopy top is an important factor in calculating aerial spray deposition.

The widely used AGDISP™ spray drift model uses broad assumptions to factor in this information when calculating spray drift and deposition of pesticides aerially released for forest protection and pest eradication purposes. AGDISP™, initially created by the US Forest Service, is undergoing further development at Scion in collaboration with the US Forest Service and others.

Dr Tara Strand, Scion Research Leader for Pest Management, explains that the AGDISP™ model is possibly overestimating drift in some circumstances due to an underestimation of spray deposition at canopy top. The canopy top is likely to be 'grabbing' more aerosol droplets than calculated within the model. Until recently, this hypothesis could not easily be tested because deployable field-ready technology was not available.

Thanks to the use of the advanced backscatter LiDAR technology and sensitive instruments that measure temperature, wind velocity and turbulence

an international team of scientists has been able to collect data that will be used to evaluate the accuracy of these calculations and scientifically advance our understanding of canopy-top induced turbulence.

The team comprises Scion's Pest Management Team and scientists from the US Forest Service, University of South Carolina and Lincoln Agritech Ltd. They converged on Scion in April to conduct a series of field trials to test their hypothesis and are now analysing the large amounts of data (a terabyte) acquired during the trial.

The analyses will lead to changes within the AGDISP™ model that will improve its calculation of drift and deposition. Results will also lead to further understanding of turbulence at the canopy top, which also has applications in seed dispersal, such as the spread of wildings, unpredictable fire behaviour, and the spread of fungal spores and other pathogens.

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The forest industry's social licence requires proactive effort and investment

In this edition of *Scion Connections* we feature several examples of research related to the forest industry's social licence to operate. Securing and keeping a social licence to operate takes dedicated effort and engagement with local communities, iwi and the wider public.

Those that set legislation, sign-up to international conventions and administer regional and district plans are key stakeholders too because they prescribe many of the parameters within which social licence is to be achieved.

'Social licence' generally refers to a local community's acceptance or approval of a company's project or ongoing presence in an area¹. It is a prerequisite to the use of many technologies and implementation of economic development initiatives. Securing and maintaining a social licence occurs both outside of and as part of formal permitting or regulatory processes. Indeed, experience shows this work needs to be front-footed in good faith with communities and iwi before formal submissions are made, hearings occur or technologies are used in the field. Building mutual understanding and trust - or social capital - by researchers and industry requires plenty of time for dialogue, active listening and responding to queries and concerns.

The forest industry has a wide range of 'live' social licence challenges. These challenges include the ability to use genetic modification and new breeding technologies, the application of unmanned aerial vehicles (drones) to forest management, the health and safety of forestry workers, sediment and log 'trash' entering waterways after harvesting, the legality of logs entering supply chains, the use of chemicals such as herbicides for forest weed control, methyl bromide for log fumigation and Chromated Copper Arsenate (CCA) for wood preservation, and building standards.

Not surprisingly, Scion has considerable research dedicated to understanding the factors influencing (and likely to influence) community and key stakeholders' perception and acceptance of technologies and practices such as those given above.

The significance and degree of difficulty in securing and retaining social licence is growing. In a recent address to the Association of Scientists entitled *Trusting the*

*scientist*², the Prime Minister's Chief Science Advisor Professor Sir Peter Gluckman expounded on some of the reasons why this is so for science:

We live in what is sometimes called a post-trust society ... With today's almost boundless access to news about science, claims and counterclaims can be confusing. Trust in science can be undermined by seeing too many breakthroughs debunked, too many conflicting arguments and sadly too many stories about bad science and scientific misconduct. Yet on the other hand, there has never been a more vocal public call for, and need for, active scientific expertise in addressing societal challenges, developing societal consensus and creating good public policy.

The need for trust and verification of performance applies equally to businesses and industry sectors. It is manifested in the increasing need for traceability in supply chains, third party certification of management practices, and tighter market access protocols. Addressing social licence adds cost, occasionally generates better margins and assures the right to participate. However, left unattended or only partially addressed, social licence issues quickly become very expensive to rectify as dairy farmers and oil and gas drillers are discovering; and the forest industry is experiencing with new genetic technologies and remedying public mistrust of building standards following problems with leaky homes.

Paradoxically funding for social licence research remains limited and tough to secure, whether from government or business. The new funding (\$2.2 million) announced in Budget 2015 to provide additional support to the Science in Society initiative "A Nation of Curious Minds - He Whenua Hihiri i te Mahara" is welcome but not sufficient to effectively address matters such as those I have listed above. Industry will need to do more too.

As always your feedback and comments to me on social licence to operate or to the person listed under any of the topics in this edition of *Scion Connections* is most welcome.



Warren Parker, Chief Executive

Want to know more? Contact Dr Warren Parker at warren.parker@scionresearch.com

¹ Owen, J., Kemp, D. (2013). Social licence and mining: A critical perspective. *Resources Policy*, 38(10), 29-35; accessed at <http://www.sciencedirect.com/science/article/pii/S0301420712000529>, 27 May 2015.

² Gluckman, P. (2015). *Trusting the scientist*. Accessed at http://www.pmcsa.org.nz/wp-content/uploads/NZAS-Speech_Trusting-the-scientist.pdf, 27 May 2015.

The human factor of forest safety

Human factors scientist Brionny Hooper helps individuals perform to the best of their ability while compensating for their natural limitations.

A recent addition to Scion's Human Factors Team, Brionny examines the interactions that occur between humans and their environment, in complex high-risk industries like forestry.

She is working with key industry stakeholders to develop safety and performance initiatives that will benefit both workers and industry alike. As Brionny explains, human factors is an applied multidisciplinary science that looks at ways to optimise performance, maximise longer-term productivity and minimise the potential for errors, all without compromising worker safety and well-being. This increased capability places Scion in a good position to support the New Zealand forest industry achieve its safety and productivity goals.

"Industry can learn a lot from human factors research," says Brionny. "One of the primary lessons is that safety is achieved by improvement rather than constraints."

"People don't intend to make errors. If we can enhance their ability to respond, monitor, anticipate and learn in a high risk environment - we can save lives. It is incredibly important work because our workers are still ultimately responsible for the success and safety of forestry operations."

Brionny has experience applying human factors and safety systems principles in a



Human factors scientist Brionny Hooper is based at Scion's Christchurch office.

number of inherently hazardous industries, including the military, aviation, oil and gas, utilities, mining, road and rail transport. Throughout this time, she learned the impact of applied science.

"While highly controlled lab studies may produce scientifically robust findings, these are not often operationally relevant for industry stakeholders."

"I've been able to apply practical solutions to minimise safety risks, promote improved health and well-being, and optimise performance and culture. Several of these solutions have included integrated multilevel compilation and analysis of accident databases, and the development of comprehensive incident management systems."

Scion has allocated core funding to address the physiological and psychological challenges in motor manual harvesting, in addition to a comprehensive review of human factors initiatives and research priorities in allied industries (aviation, oil and gas, mining). The findings of this research will be used to develop a research strategy in alliance with industry. Systemic and structural risks across the value chain that may affect optimisation or worker health and well-being in forests, will also be investigated.

An immediate avenue of research for Brionny will be to identify benchmarks for workforce improvement initiatives to establish credibility and presence for industry stakeholders. As mechanisation of the forestry industry continues, understanding and integration of human factors will be essential for successful change adoption and management in this area.

For further information

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Advanced technologies expand our knowledge of spray deposition

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"Aerosol deposition is influenced by meteorology, turbulence and the roughness of the surface as well as the physical properties of the aerosols themselves, and where, when and how they are applied," says Tara.

"Understanding how aerosol spray moves in the air is critical for risk assessment and ensuring the right amount of chemical is applied. It also helps us further our knowledge of aerosol behaviour in complex environments such as forests, urban areas and ports.

"These advanced technologies have enabled us to capture the vertical profile of an aerial spray drift cloud and study, in more detail, the effects of canopy turbulence."

The team used Dr April Hiscox's (University

of South Carolina) LiDAR instrument to measure the aerosol droplet cloud as it drifted over a 10-m tall sampling tower, and obtained data on cloud height and size. This is a novel method for estimating deposition at the canopy top and will be evaluated as a possible replacement for standard, labour intense, deposition study methods.

The sampling tower was deployed with eight smaller towers with sampling devices, sourced from the US Forest Service and Scion, to capture spray droplet deposition at different heights. Another 10-m tower was equipped with five wind sensors and eight temperature sensors to measure changes by the second or less.

"The need for drift reduction constrains chemical control applications. Improving deposition and drift estimates will reduce treatment costs while maintaining high environmental standards," explains Tara.

"Based on our results, we aim to develop a new algorithm for the AGDISP™ model.

Impacts for industry will be significant, especially for eradication programmes in urban areas where any off-target drift can have very serious implications. Further understanding of deposition and drift improves industry's capabilities to aerially apply pesticides on-target in both pest management and eradication applications."

This project will produce three peer-reviewed papers for the scientific audience. Results will be disseminated to industry directly through presentations and a technical note and indirectly through the insertion of the algorithm in AGDISP™. Immediate uptake is expected as this model is used during eradication programmes to quantify efficacy of the application and off-target drift.

For further information

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Global science

Working together and sharing knowledge helps scientists from around the globe solve some of the many and complex challenges facing today's communities, and discover ways to achieve a more sustainable bio-based economy.

Over the years, Scion's scientists have developed an extensive network of international and national collaborations that share the common goal of extending our scientific knowledge and developing innovative technologies to enhance the quality of our environment, and reduce the toll on our planet's resources.

Some of our wide-reaching projects and capabilities include:

Validating bioadhesives' green credentials

Bio-based adhesives and resins for use in wood-based panels have a much lower environmental footprint, and are more socially acceptable, than their traditional formaldehyde-based counterparts. Dr Warren Grigsby has been developing adhesives from natural sources, such as tree bark, that have been shown to have a 22% lower environmental impact over their entire lifecycle than conventional adhesives (see *Scion Connections*, issue 11, March 2014).

Wood is a sustainable and dependable resource. Even more rewarding is that the manufacturing of bioadhesives uses parts of the tree that would otherwise go to waste while also reducing the use of fossil resources and greenhouse gas emissions. Lignin's structure, abundance and low cost offer good potential to replace petrochemicals in bioadhesives.



Drs Shin-ichiro Tohmura (left), Warren Grigsby and Kohta Miyamoto enjoying the cherry blossom in Tsukuba.

Warren recently spent three weeks in Tsukuba, the 'science city' of Japan, on a Japan Society for Promotion of Science Invitational Fellowship. Part of his time there was spent working with colleagues at Forest & Forest Products Research Institute (FFPRI) on a collaborative project to assess the emissions produced from wood panels using bioadhesives. The emissions from individual adhesive components of forestry and agricultural processing residues, such as lignin, were also assessed.

“One of the hurdles for the wood processing industry to overcome is the acceptance of bioadhesives as a reliable replacement for traditional formaldehyde-based adhesives.”

“This fellowship gave me the opportunity to tap into the institute's ability to look at volatile emissions,” explains Warren. “We assessed volatile organic compounds that were emitted during the hot press manufacturing of hardwood plywood panels using bioadhesives, and the subsequent panel emissions released over seven days. The results clearly showed that our bioadhesives have very low formaldehyde emissions, which were lower than wood, and that lignin and tannin use contributed to this. We intend

to implement these outcomes here at Scion using our new olfactory capabilities.

“One of the hurdles for the wood processing industry to overcome is the acceptance of bioadhesives as a reliable replacement for traditional formaldehyde-based adhesives. Assessing their environmental impact helps us to validate their green credentials and support their uptake by manufacturers. It also reinforces the industry's licence to operate.”

For further information

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Transforming properties of lignin in softwoods

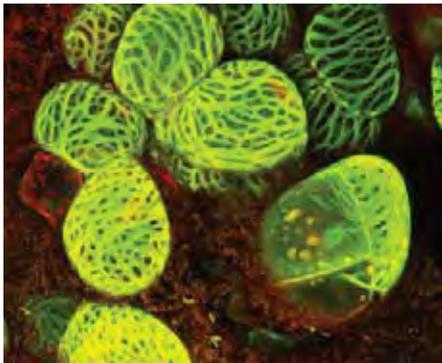
Radiata pine that is easier to process into pulp and biofuel is one step closer thanks to a team of Scion biotechnologists working in collaboration with the University of Wisconsin-Madison.

Easier-to-process softwood brings economic and environmental benefits. Needing less energy, the pre-treatment process will be faster, more efficient and less wasteful, yielding improved feedstock for pulp, paper and biofuel industries. Led by Dr Armin Wagner, the team recently published its work in the *Proceedings of the National Academy of Sciences*¹ proving the concept

¹ Wagner, A., Tobimatsu, Y., Phillips, L., Flint, H., Geddes, B., Lu, F., & Ralph, J. (2015). Syringyl lignin production in conifers: Proof of concept in a Pine tracheary element system. *Proceedings of the National Academy of Sciences*, 112(19), 6218-6223.

that it is possible to change the makeup of lignin polymers in softwoods.

"Lignin is a complex polymer that provides strength and structure in trees," said Armin. "In softwoods, like conifers, the lignin contains guaiacyl (G) units while hardwood lignin also contains syringyl (S) units. Lignin made up of G units is more condensed and difficult to degrade than lignin that also contains S units. This, together with the higher levels of lignin found in softwoods, makes trees like radiata pine more complicated and expensive to process than hardwoods.



Softwood pine tracheary elements (TEs) from cells engineered to produce hardwood-type lignin. Photo: Lloyd Donaldson, Scion, and Matt Wisniewski, GLBRC.

"We have shown it is possible to engineer cells of *Pinus radiata* to produce S lignin units. This suggests it's possible to engineer softwoods, such as radiata pine, to produce easier to process hardwood-like lignin while retaining their outstanding fibre properties."

...the pre-treatment process will be faster, more efficient and less wasteful, yielding improved feedstock for pulp, paper and biofuel industries.

Metabolic engineering allows plant breeders to introduce a single, clearly identified desirable trait into a population where it is not normally or readily available. The materials used in this work were obtained from naturally occurring organisms such as bacteria, fungi and plants.

The corresponding author is renowned lignin expert John Ralph from the University of Wisconsin-Madison, Professor of Biochemistry and Plants Leader at the Great Lakes Bioenergy Research Centre. John has a long association with Scion and has collaborated on numerous projects.

For further information

Contact Dr Glenn Thorlby at glenn.thorlby@scionresearch.com

Adding value to industrial by-products

Using bacteria to produce bioplastics and other high value products from wood residue, in the context of a biorefinery, is an area of research Dr Christophe Collet will be focussing on at Scion. Christophe recently joined Scion as research leader for industrial biotechnology.

"Scion's industrial fermentation platform allows us to work with companies to test approaches to modifying and adding value to industrial by-products."

"My background has focused on product development, specifically in areas where value can be added to industrial by-products," says Christophe.

"Once a product or process has been developed at lab-scale, for example, recovering plasma proteins for pharmaceuticals or producing recombinant enzymes for commercial purposes such as in forensics, we undertake further development at pilot scale before the new process is ready for commercialisation."

Christophe has worked on a variety of industrial projects from converting dairy

sidestream into biofuels; developing enzymes to improve the DNA extraction from animals and bacteria; recovering plasma proteins for pharmaceutical use; and the fermentation of industrial gases into biofuels and chemicals.

Originally from Switzerland, Christophe gained his PhD in environmental science and engineering from the renowned Swiss Federal Institute of Technology in Lausanne (EPFL). Since 2004, he has been based in New Zealand working for start-up company ZyGEM Corporation Ltd, where he helped develop high value products for use in research, forensic and molecular diagnostics; protein biologics manufacturer ICPBio Ltd; and steel mill flue gas bioprocessing company LanzaTech Ltd, before joining Scion.

"Scion's industrial fermentation platform is unique in New Zealand. It allows us to work with companies to test approaches to modifying and adding value to industrial by-products. We can conduct experiments from 1L to 100L scale, allowing sufficient quantities for downstream processing into a final product, and facilitating the scale-up and technology transfer of industrial biotechnologies."

For further information

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Dr Christophe Collet in Scion's PC2 fermentation laboratory.



Dr Carel Bezuidenhout.

Oiling the supply chain wheels

Shaping supply chains into value chains is something Dr Carel Bezuidenhout and his team excel in.



Carel is Scion's Science Leader for Value Chain Optimisation, a small dedicated team of systems' analysts who specialise in ironing out the complexities of supply chains, analysing market opportunities and making operations run more efficiently. Or, as Carel terms it, fine-combing the details and connecting the dots.

Although it's early days for the team, they have already begun to analyse data that describe product flow and stockpiling to quantify the forestry supply chain's degree of leanness and agility.

"A supply chain is about making money by producing, moving and marketing products," says Carel. "On the other hand, a value chain is more about alignments where companies with similar business models synergise and innovate to create unique win-win opportunities.

"Our team has a strong mathematical modelling background, but the real key to driving value chain optimisation lies in creating teams with the right skills across Scion's broad range of disciplines, and appreciating the different business realities along the supply chain. A considerable amount of value chain

research involves understanding the people who make the decisions along the supply chain."

Although it's early days for the team, they have already begun to analyse data that describe product flow and stockpiling to quantify the forestry supply chain's degree of leanness and agility. As Carel explains, this should fit the business models and the nature of the markets, otherwise the supply chain may not be fit for purpose.

"On one hand we have lean operators who try to reduce all forms of wastage. They operate in a commodity market with a high turnover and small margins, so the focus is often on volume and consistency. At the other end are some manufacturers that need a greater choice in timber because they make a range of products for different markets and need to adapt to suit market demand.

"The best way to measure how well a supply chain is working is by evaluating the size and fluctuations of the stockpiles. There are always going to be fluctuations due to the variability in log prices, market demand and upstream variability, but it's how well that variability is managed that makes the difference."

Although the drive is towards increasing domestic processing, log exports form a substantial component of the forestry

industry. The various port and shipping logistics activities happen independently of each other, and often no single entity assumes responsibility for streamlining port activities as a whole.

The Log Price Outlook is a unique initiative in the New Zealand forestry industry that asks log traders and others to think about what is likely to happen to log prices over the coming months, and to vote confidentially online.

According to Carel, there is significant scope to benchmark and simulate port activities in order to ensure operations are world class. Likewise, there are opportunities for individual log exporters to evaluate the efficiency of their multi-port operations. The VCO team has already initiated work in this area.

Log Price Outlook

Carel also introduced a Log Price Opinion Index earlier this year to gauge a better idea of future log prices. This three-monthly web-based survey provides a speculative log price forecast based on informed opinions. This is a unique initiative in the New Zealand forestry industry that asks log traders and others within the industry to think about what is likely to happen to log prices over the coming months, and to vote confidentially online. The team collate and graph this information and share it with those who participated.

This information adds to the wealth of data the team is gathering about performance, markets, networks and concerns from industry stakeholders throughout the supply chain, ranging from growers to traders and manufacturers, to be modelled and re-shaped into fit for purpose value chains.

For further information

and to participate in the Log Price Outlook contact Dr Carel Bezuidenhout on carel.bezuidenhout@scionresearch.com



Forest health lab meets international standards

The work Scion's Forest Health Reference Laboratory does is of international standard and has recently achieved IANZ Certificate of Accreditation to mark this status.

The newly gained International Organisation for Standardisation/ International Electrotechnical Commission (ISO/IEC) 17025:2005 for Biological Testing accreditation provides recognition that the lab is meeting internationally accepted standards of quality, performance, technical expertise and competence.

"Achieving accreditation is something to be proud of," says laboratory coordinator Debra Bly. "We are the only accredited lab at Scion, and one of the few in the country accredited for fungal and insect identifications.

"We identify fungi and insects from trees for the Ministry for Primary Industries (MPI), the NZ Forest Owners Association and the general public. MPI itself is accredited and requires its sub-contractors to be accredited. Having confidence in results is important when you are making decisions about biosecurity.

"Getting accreditation has taken five years. The amount of work needed was daunting at first and would not have been possible without the buy-in and support of the whole Forest Protection Team.

"The next step is to extend this way of working into other areas in the lab."

Dr Beccy Ganley, Research Leader Pathology and Forest Protection, speaks highly of the team. "They have worked incredibly hard to get this accreditation, I'm proud of their effort and the rigorous standards they've implemented to get there. We have noticed a lot more of the work MPI is funding these days requires ISO accreditation, and we expect this is going to increase further."

IANZ is part of the Testing Laboratory Registration Council, an autonomous Crown entity established in 1972, and is New Zealand's premier accreditation body.

For further information

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New coating increases paperboard packaging life

Ensuring products reach the consumer in the best possible shape is an ongoing challenge for the chilled goods supply chain, where paperboard packaging is constantly exposed to fluctuating humidity, causing it to absorb moisture and eventually fail. This results in costly product losses.

Scion's packaging team hopes it's got the problem all wrapped up with a new high moisture barrier coating that increases the lifetime of paperboard packaging in humid conditions. Applied over the ink, the coating also provides a high level of gloss that protects package branding and offers good scuff resistance, maintaining the visual impact of a product right through to the end user.

"Package failure in the chilled goods supply chain is a big issue," says Lou Sherman, Research Leader for Packaging. "It's difficult to measure exactly what percentage of product is lost due to package failure, but it's enough for moisture barrier performance to be on most exporters' wish list of packaging requirements."



Key to its success is that the coating is applied using the industry-standard flexographic printing process and enables multiple thin layers of coating to be applied, which reduces both the total volume of coating required and the costs incurred.

The coating technology has been successfully tested at Karlstad University in Sweden at pilot scale, and trialled on a commercial flexible printing press in New Zealand. **Scion's new printing press makes it possible to conduct further trials in-house, with packaging performance able to be tested in our purpose-built coolroom box compression creep facility, which simulates conditions in the chilled supply chain.** These facilities are available for commercial testing.

For further information

Contact Lou Sherman at lou.sherman@scionresearch.com



Ecosystems services forum 2015

Integrating forestry in the landscape with other primary sectors was the theme behind this year's Forest Ecosystem Services Forum, held in Wellington on 19 May. The forum considered the roles that planted forests play in other key primary sectors, such as creating a business portfolio on farms, reducing bank erosion and sedimentation, providing shade and shelter for livestock, and protecting the marine environment.

A broad section of the forestry industry was represented among the 56 attendees, as well as local and national government, research organisations and iwi.

The line-up of international and national speakers discussed a range of topics including research trends in Europe and the US, and advances in accounting for, and valuing, forest ecosystem services. An iwi perspective was also provided by Tui Warmenhoven of Ngati Porou. Ms Warmenhoven is based in the Waiapu catchment of Gisborne, an area of the country's east coast that is considering forestry as a means to recover from the economic and social impacts of severe erosion.

Participants also shared their ideas on how best to make the most of trees for other primary industries; what the landscape could look like with more trees and how best to conceptualise this future landscape; and the value afforestation in carefully selected locations could be to New Zealand in terms of jobs, energy, landscape integrity, water quality and social well-being.

Presentations are available on the Scion website www.scionresearch.com/fes-forum2015

For further information

Contact Dr Richard Yao at richard.yao@scionresearch.com

Upcoming events

MapNet. 28 - 30 October 2015,
Scion, Rotorua

The 10th anniversary of MapNet will be hosted by Scion and Livestock Improvement Corporation (LIC). MapNet is a collective of New Zealand-based researchers from organisations involved in gene mapping.

A key driver for MapNet is the co-ordination of scientists from disparate sectors working with common technologies to foster the development of multidisciplinary and cross-sector teams.

Further information will be made available once details are finalised. For more information, please contact natalie.graham@scionresearch.com



**Forest Genetics
for Productivity Conference**
The next generation

14-18 MARCH 2016 | ROTORUA | NEW ZEALAND

Scion is proud to host an IUFRO Division 2 (Physiology and Genetics) conference in 2016. The five-day conference includes a full day field trip, partner programme and a post-conference tour to the South Island, which finishes in Queenstown.

Research topics for the conference are:

- Breeding productive and resilient forests
- Finding the synergies in genotype, environment and silviculture
- Genomics and phenomics.

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

Anyone who is interested in open dialogue on how to maximise productivity as well as those interested in the application of new technologies, particular genomics and remote sensing, to the development of genetically improved trees, should attend.

For more information go to www.fgpc2016.nz

Forestry research partnership to build high-value wood exports

Scion's support to industry's diverse species programme has been boosted by Government investment of \$5 million over the next seven years in a research partnership to create high-performance speciality wood products from trees other than radiata pine.

The partnership will be led by industry company Future Forests Research Ltd (FFR) in collaboration with Scion, the University of Canterbury (UoC) and the NZ Dryland Forests Initiative (NZDFI), beginning this July.

Scion's Science Leader for Forest Genetics Dr Heidi Dungey says this partnership will strengthen the way research organisations and industry work together to achieve outcomes for New Zealand.

"The aim is to develop high-value, high-performing wood products from forest species that complement radiata pine, such as Douglas-fir, eucalypts and cypresses.

"The Ministry of Business, Innovation and Employment (MBIE) was impressed with the programme noting that it had a focus on high-value exports and helped mitigate risk through species diversification. Scion has already made considerable progress in seed-to-product research for species

such as eucalypts, Douglas-fir and cypresses," said Heidi.

This partnership is unique in that it takes a value-chain approach and will cover everything from growing different species, right through to high-tech processing of them says Alison Slade, Acting Programme Manager for FFR.

"Often with partnerships, there will be a focus on either the growing aspect or the manufacturing process, and this partnership is quite special because it covers it all," said Alison.

Total investment in the programme over seven years is \$13.8 million. Funding through MBIE's Research Partnerships Programme is \$710,000 per year and will be equally matched by industry. An additional \$550,000 per year will be provided through Scion Core Funding. The University of Canterbury is also providing in-kind support to the programme.

The science leaders of the programme are Heidi Dungey and Doug Gaunt (Scion), Paul Millen (NZDFI) and Clemens Altaner (University of Canterbury).

For further information

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