Scion
connections

SCION forests · products · innovation

SCION CONNECTIONS NEWSLETTER ISSUE 14 | DECEMBER 2014

The hand held scanner provides highly detailed 3D data of individual trees within a stand where GPS is unavailable.

Mobile scanner game changer for forestry management

NEW

A small, lightweight mobile laser scanning device is proving a boon for forestry resource management.

Successful trials of the ZEB1 hand held scanner by Scion's Forest Systems staff has demonstrated the means to accurately locate and measure the lower stems of individual trees in more detail than is possible using aerial LiDAR (Light Detection and Radar).

The ZEB1, developed by UK-based company 3D Laser Mapping, has the ability to scan and provide spatial locations for individual trees within a stand where GPS is not available. When comparing this to current terrestrial laser scanning technology, Research Leader Dave Pont says the device is a game changer for the forestry industry.

"The device is lightweight - less than one kilogram – and scans quickly while the operator is 'on the go' allowing an inventory plot to be completed in a fraction of the time it takes for a conventional terrestrial scan to be done," explains Dave.

"In the forest, trees are obscured by terrain and other trees, and conventional tripod mounted units need to take multiple scans to compensate for this. The ZEB1 scans continuously as you move, providing a single, highly detailed point cloud from the external surface of the scanned objects. Being hand held, it can also be used on rough terrain or anywhere that is accessible and safe for the operator. The device's portability and continuous scanning overcomes the issue of other trees obscuring the field of view."

The novel SLAM, or Simultaneous Localisation and Mapping, technology

(Continued on page 5)

Contents

New investment in wood processing spotlights future security of log supply

Across the country new investment is either confirmed or signalled for upgrading processing mills and manufacturing plants. This is good news for the forest industry and essential to realising the New Zealand Wood Council's (WoodCo) '$12 billion by 2022' export goal. Processing more logs onshore, at least 70% compared to the present 45-50%, is a key element in achieving this target. The upgrade and expansion announcements do not mean it is plain sailing for mills to catch-up on deferred maintenance and capex investment, however it does confirm that solid wood and pulp processors see a good future in New Zealand and their belief they can be internationally competitive.

In the central North Island, Rotorua-based Red Stag has confirmed they will construct a state-of-the-art super mill which will double log input to 1.2+ million cubic metres per year and increase output from 450,000 to 700,000 million cubic metres per year. Nearby, Oji Holdings, who with their 40% co-investor the Innovation Network Corporation of Japan (INCJ) have acquired Carter Holt Harvey's Kinleith and Tasman (Kawerau) mills, are expected to undertake a mill modernisation programme that will increase their need for wood fibre.

Developments at Kawerau include Sequal Lumber's installation of geothermal drying kilns, which will enable them to double their mill output. Closed former mill sites are also being reappraised, for example, the Tachikawa mill site in Rotorua has been purchased by investors with plans to re-establish a sawmill. In Taupo, Pacific T&R's new high-tech plant to produce terpenes and rosin from radiata pine stumps is due for commissioning in early 2015; and new firm Carbon Producers Limited is being established to make carbon activated products from forest biomass and other plant sources. The latter examples will allow value to be recovered from more of the forest biomass.

Elsewhere, Pan Pac Forest Products Limited (Pan Pac) purchased the former Southern Cross Forest Products Limited (in receivership) sawmilling and drying assets at Milburn and Milton in November. Following upgrading of both sites, full production is expected from April 2015, regenerating local jobs. Regional mills in Taranaki, Auckland and Northland are also modernising their plant to improve efficiency and worker safety, and lift product quality and diversity. Other investors are exploring how they can utilise New Zealand's renewable forest resource, relative abundance of clean energy and water, trade agreements and stable political situation.

These developments highlight the importance of replanting existing forests and farm woodlots, and establishing new forests. New Zealand's future wood supply curve is well-known (Figure 1) and shows that while the harvest has scope to increase to 33-35 million cubic metres over the next decade (last year the harvest was a record 30 million cubic metres), more log supply will be required from the late 2020s.

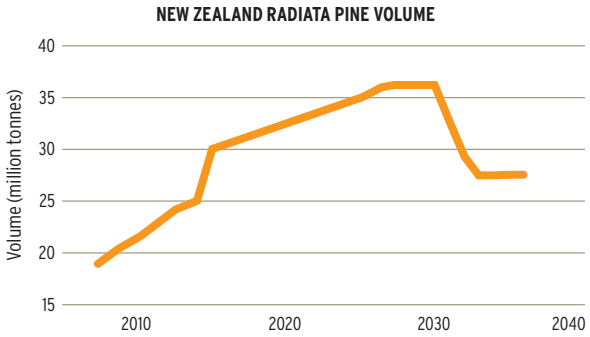


Figure 1. *Wood supply insecurity is a big concern for wood processors. New Zealand harvest volumes showing steep decline in log supply late 2020's.* (Source: MPI)

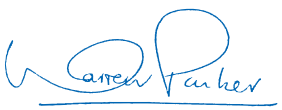
Increasing the security of future log supply has many positive corollary benefits. Tree planting and forest silviculture generates employment; contributes to reduced nutrient leaching and increased biodiversity; and, in light of new global efforts to address the threats posed by climate change, will help lower New Zealand's greenhouse gas emissions.

Learnings from the 1990s planting boom indicate we need to think carefully about where forests are planted (e.g. future harvesting and transport costs, likely future wind and fire risk), the optimum tree genetics and establishment methods for a site, the use and integration of other species with commercial value (e.g. co-crops such as manuka and ginseng), and payments for a wider range of forest ecosystem services (e.g. payments for carbon storage and/or purchase nitrogen discharge allowances).

Establishment costs can be assisted through payments for carbon, Afforestation Grants and other commercial arrangements, but also through consideration of alternative forest systems with, for example, shorter rotations and higher planting rates.

Scion is heavily engaged with forest growers and mill owners in developing the knowledge and technology necessary to secure a future supply of wood, wood fibre and other forest biomass that will meet processor and market requirements. The stimulus provided by new investment in wood processing and value-added manufacturing using materials from forests bodes well for the forest industry's ongoing significant and multi-faceted contribution to the New Zealand economy.

I welcome any comments you might have on this topic or on any of the other articles featured in this edition of *Scion Connections*. On behalf of the Scion Board and staff, we extend our best wishes to you, your family and friends for Christmas and a fruitful 2015 year.



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

Scion's biodegradation facility measures and quantifies the aerobic composting of materials.

Setting standards for a safer environment

Without standards our lives would be chaotic. Developing and revising standards is a continual process at Scion as new technologies and products become available, with many of our scientists actively engaged in national and international standards committees for such things as wood preservatives, biodegradability, packaging, freshwater and biosecurity measures.

Scion is an advisory partner for the Knowledge Based Bio-based Products Pre-Standardisation (KBBPPS), an EU funded programme of research. In this capacity we are helping to develop, revise and harmonise standards to endorse claims of renewable components or biodegradability for such things as bio-based solvents, plastics, packaging and lubricants.

Biopolymer scientist Dr Martin Markotsis (pictured above) has been testing the biodegradability of bio-based lubricants in freshwater environments using Scion's biodegradation facility. This purpose-built facility measures and quantifies aerobic composting of materials under controlled conditions, and whether additives and coatings impede or accelerate composting.

...This work has also given rise to the Open-bio programme which got underway last November. Open-bio builds on the findings of the standards work to open international bio-based markets by promoting sustainability and end of life options such as biodegradability, composting and recycling...

"Standards are based on rigorous and robust scientific testing," says Martin. "Although the KBBPPS is not a regulatory body, it does propose standards to the EU and European Committee for Standardisation, and products may soon have to be clearly labelled as to which standards they comply with, or display some form of licensed logo. Knowing a product meets certain requirements will help reduce trade barriers and boost public confidence and acceptance of bio-based products."

The new test methods will provide a faster turnaround in product testing for industry.

This work has also given rise to the Open-bio programme which got underway last November. Open-bio builds on the findings of the standards work to open international bio-based markets by promoting sustainability and end of life options such as biodegradability, composting and recycling.

New test methods give faster results

Establishing and reviewing standards can take an enormous amount of time, none more so than for determining the durability of new wood products. Some of these products are expected to last for decades.

...''We have already developed tests for framing end use as part of our ongoing New Zealand standards and development work''...

Bioactives scientist Dr Tripti Singh (pictured below) was invited to speak to the American Wood Protection Association (AWPA) recently about Scion's work with leaky building problems and test methodologies in the wood framing class.

"The AWPA sets the American wood standards and is trying to introduce a framing test method for their Class 2 category for wood product evaluation – similar to our Hazard Class H1.2. We have already developed tests for framing end use as part of our ongoing New Zealand standards and development work," she says.

"The forest industry relies on test methodologies that can provide rapid proof of durability. Following our recent review of the protocols for assessing wood preservatives, the Australasian Wood Preservation Committee has now amended the Protocols for *Assessment of Wood Preservatives* to include three new test methods.

"These were found to be reliable and faster than some existing ones. The new 'I' frame sample test for Hazard Class 1.2 has been included in addition to the current frame cavity test, plus the Ground Proximity Test and the Embedded Test for Hazard Class 3. The amendments are now out with industry for review.

"These new test methods will provide a faster turnaround in product testing for industry which also means a faster turnaround for investors and response time for changes to preservation standards. We are also working with industry to develop other technical documents such as *Standard Operating Procedures*."

For further information:
Contact Dr Martin Markotsis at *martin.markotsis@scionresearch.com* or Dr Tripti Singh at *tripti.singh@scionresearch.com*

Experimental block with different colour temperature LEDs.

City lights, bright nights

The world is more brightly lit now than ever before, spilling light pollution out into the night skies, with the glows on the horizon becoming progressively whiter and brighter.

Bright, energy saving LED lamps (light emitting diodes) are the new white when it comes to lighting. With their many advantages over incandescent lights, such as lower energy consumption, longer lifetime, robustness, smaller size and faster switching, LEDs are increasingly being used for municipal and industrial purposes.

…"Insects demonstrate different abilities to detect light depending on their vision, however most insects respond strongly to light in the blue and UV spectra"…

At first, entomologist Dr Steve Pawson wanted to find out what effect the harsh, white LED light was having on insects compared to the softer yellow hues of traditional high-pressure sodium lamps (HPS), and what this might mean for the forestry industry and log marshalling sites at ports. He then started getting enquiries from those in the food production industry who were experiencing an increasing number of unwelcome insect pests being drawn to their sites, and he realised the issue was much broader.

"Insects demonstrate different abilities to detect light depending on their vision, however most insects respond strongly to light in the blue and UV spectra," explains Steve. "And current white LED lights are based on monochromatic blue LEDs coated with a phosphor coating. The phosphor coating can be manipulated to produce a range of 'white' lights that are referred to by their colour temperature – the greater the proportion of blue light emitted, the higher the colour temperature.

"The growing trend for industries to change to more cost effective LED lighting could have a huge effect on how insects and animals respond and behave and could potentially alter ecosystem processes."

While the bright lights of the city's industrial sites may hold a strong attraction for insects, there is growing evidence to suggest their effects may be more widely spread among terrestrial animals. As Steve explains, behaviours that are influenced by vision could change creating a significant ecological impact both for individual species and the interaction between species, such as predator avoidance or prey detection, navigation, pollination or foraging.

…Steve and his team conducted a comparison between the effects of LED and HPS lighting at an industrial scale, using different colour temperatures of LED lights…

To investigate this further, Steve and his team conducted a comparison between

the effects of LED and HPS lighting at an industrial scale, using different colour temperatures of LED lights. This research was recently published by the Ecological Society of America.

Their results showed that LED lamps attracted 48% more flying insects on average than HPS lamps, irrespective of the colour temperature of the LEDs.

...As an example, the gypsy moth (*Lymantria dispar*) is more attracted to white lights than to light from HPS lamps. Gypsy moth is a voracious and invasive forest pest and the ecological ramifications of it establishing in new regions are severe...

"Our results imply that careful selection of LEDs on the basis of their colour temperature is not likely to influence the ecological impacts of a broad-scale shift to white LED lighting by industries," says Steve. "The nuisance value of attracting unwanted pest species needs to be carefully considered when choosing industrial lighting but more importantly,

the potential for white LEDs to increase phytosanitary and biosecurity risks that could snowball to other ecological impacts."

As an example, the gypsy moth (*Lymantria dispar*) is more attracted to white lights than to light from HPS lamps. Gypsy moth is a voracious and invasive forest pest and the ecological ramifications of it establishing in new regions are severe. Ships infested with egg masses laid by moths attracted to lights are a known pathway, and therefore a transition to white LEDs at, or near, ports may elevate the risk of egg masses being spread and establishing gypsy moth in new areas.

Where to from here?

Light pollution is recognised as a global threat to the conservation of biological diversity. This is likely to be magnified by the growing trend to use phosphor-coated LED lamps for industrial and municipal purposes.

According to Steve, it is imperative for us to fully understand the possible long term ramifications of white LED lights on ecological communities, populations and species and the associated implications for biosecurity. Further research is necessary to achieve this.

"A comprehensive assessment of overall impacts and knowledge about the influence of each region of the visible spectrum will allow lighting engineers to work with ecologists to focus future developments in lighting technology that balance the needs of illumination and energy efficiency while minimising ecological impacts".

For further information:
Contact Dr Steve Pawson at
steve.pawson@scionresearch.com

Mobile scanner game changer for forestry management

(Continued from page 1)

behind ZEB1 is based on sophisticated algorithms that generate a point cloud, or a set of 3D data points. These data can then be used to generate such things as 3D models or visualisation. In this instance, the prototype analysis method developed by our research team to extract information from the point cloud has provided valuable information about the lower stems of individual trees. On pruned trees it measures such things as pruned height, stem straightness, taper and lean. When combined with an aerial LiDAR assessment of the canopy, it may therefore be possible for inventory plots to be scanned and characterised in detail for management purposes, accurately, quickly and considerably more cost effectively than current methods.

..."We are also investigating its application in characterising productivity and genetics, scanning for post-harvest debris and in remote sensing tree health, plus its potential use in forestry activities such as scanning logs on skids and trucks"...

The device scans quickly while operator Rodrigo Osorio is 'on the go'.

For Dave and other research teams at Scion, the mobile device shows real potential to have practical applications in forestry and to facilitate research within Scion's *Growing Confidence in Forestry's Future* programme. Dave is currently working with the Informatics Team to further develop our in-house capability for processing the point cloud data.

"For example, it's possible the device could be used to capture the external shape of tree stems and the surrounding environment before harvest, then use our new destructive sampling technology to relate these data to the tree's internal wood qualities," says Dave.

"We are also investigating its application in characterising productivity and genetics, scanning for post-harvest debris and in remote sensing tree health, plus its potential use in forestry activities such as scanning logs on skids and trucks".

For further information:
Contact Dave Pont at
dave.pont@scionresearch.com

Dr Paul Bennett, Scion's new Science Leader for Clean Technologies.

New science leader fuels greener business opportunities

Investigating opportunities for the bioenergy sector in New Zealand is high on Dr Paul Bennett's list of priorities once he has familiarised himself with his new role at Scion, that of Science Leader for Clean Technologies.

Paul recently joined Scion's Rotorua campus from England having spent over 25 years working on a range of fuels, biofuels and bioenergy issues. He has worked as an independent consultant, for quasi-government organisations and for BP in roles which took him throughout the UK, Asia, South America and Africa developing new technologies and business opportunities for biofuels.

First on Paul's agenda at Scion was attending the International Energy Agency (IEA) Bioenergy executive committee meeting in Brussels in October, of which Scion is a member and funder on behalf of New Zealand.

…Increasing concerns around climate change, energy security and agricultural development is driving the rise of industrial biotechnology worldwide, indicating an increasing shift away from industrial practices that rely heavily on fossil fuels man-made chemicals and non-renewable materials…

"The key focus of the IEA Bioenergy is the promotion of bioenergy globally, the strengthening of national capabilities through international collaboration and accelerating the deployment of new technologies," says Paul.

Increasing concerns around climate change, energy security and agricultural development is driving the rise of industrial biotechnology worldwide, indicating an increasing shift away from industrial practices that rely heavily on fossil fuels, man-made chemicals and non-renewable materials. Scion's bioenergy and biofuels research aligns well with the IEA's objectives to enhance energy efficiency and increase the share of renewables in the mix, and supports the move towards a bio-based economy in New Zealand. Our scientists are investigating new economic opportunities in such things as industrial biorefining, bioenergies and bio-based substitutes for petroleum and other declining resources.

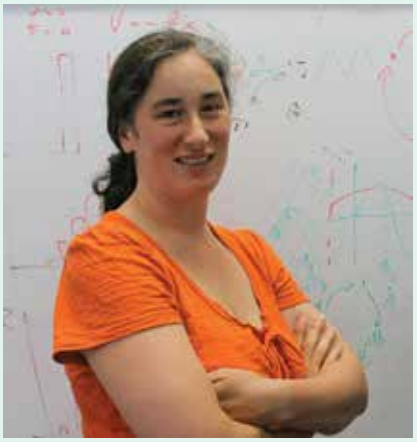
…A more productive use of sustainable resources, by-products and residuals will be beneficial to both industry and environment alike…

A recent funding boost by MBIE will see Paul and his team investigate potential synergies across the bioenergy sector that, through appropriate use of waste streams from some companies, could release biomass for use as an input to other companies or for application in new products. A more productive use of sustainable resources, by-products and residuals will be beneficial to both industry and environment alike.

In this Industrial Symbiosis Project Paul explains, "we will be looking at three case studies, in particular the Kawerau Industrial cluster where there is the potential for industries to use geothermal energy and release biomass for other purposes.

"The outcome of this research could help establish New Zealand as a showcase for a smarter, cleaner and greener way of doing business".

For further information:
Contact Dr Paul Bennett at *paul.bennett@scionresearch.com*



Dr Katharine Challis.

Marsden Fund boosts research into molecular motors

Scion's Dr Katharine Challis has been awarded a Marsden Fast Start grant to explore how tiny molecular motors use energy (refer *Scion Connections*, Issue 10 December 2013)

Katharine, a theoretical physicist working in our bioenergy and biofuels team, says that the 'motors' within biological systems (including cells) are far more efficient than industrial processes and finding out how these nano-motors work may have major implications for the future of bioenergy.

"We live and move because the molecular motors in our cells convert energy from one form to another. The fascinating thing is that these nanoscale motors operate very differently from large-scale motors found in your car or in industrial processes, and they are amazingly efficient. We want to know how their unrivalled efficiencies are achieved," she says.

Fundamental understanding of biological energy conversion could provide clues for developing new highly-efficient industrial energy technologies. The $300,000 grant will be used by Katharine to develop a new comprehensive and universal theory especially for nanoscale molecular motors. She will be working with her former Science Leader Dr Michael Jack who is now at the University of Otago. Both wrote papers on the topic published by the American Physical Society last year.

For further information
Contact Katharine Challis at
katharine.challis@scionresearch.com

Dr Roger Newman, excellence in science

(1 March 1949 – 26 July 2014)

In recognition of his lifetime dedication to science, particularly in the areas of nuclear magnetic radiation (NMR) and spectroscopy, Dr Roger Newman has been posthumously awarded Scion's Science Excellence prize for 2014.

Roger's ground-breaking work into the structure and biosynthesis of cellulose, and its role in the longitudinal shrinkage of wood has made a huge contribution to the science community. Longitudinal shrinkage is a prime culprit in causing dimensional instability in timber, a major problem with radiata pine during drying and in service. While broadly associated with compression wood, the patterns of occurrence and severity of longitudinal shrinkage had, until recently, long remained a puzzle for wood scientists.

Roger made other highly meritorious achievements throughout his long science career and a fitting tribute to his commitment and dedication to his chosen field was published in *Cellulose* journal (December 2014, Volume 21, Issue 6, pp 3861-3863).

Roger had been working at Scion since 2004 as a Principal Scientist in the area of bio-based materials.

For further information
Contact Dr Stefan Hill at
stefan.hill@scionresearch.com

Drs Carol Rolando (left) and Nari Williams.

Contributions to science and communication recognised

Scion's Red Needle Cast (RNC) and Weed Management research teams were rewarded for their contributions to the forestry sector at the New Zealand Forest Owners Association Conference held in October.

Project Technical Leader Dr Nari Williams, who accepted the Science of International Quality Award on behalf of the RNC pathology team, says the award acknowledges the enormous efforts that the team puts in behind the scenes.

"This award recognises the foundation work in epidemiology, trade risk and disease response to RNC leading to three papers being published earlier this year. While the science team of Margaret Dick, Ian Hood, Judy Gardner, Peter Scott, Lindsay Bulman, Beccy Ganley, Rebecca McDougal, Carol Rolando and I were specifically named, it also recognises the inputs into monitoring, assay development, diagnostics, trials and lab work, and to our improving communications with the industry and technical steering committee over the last six plus years."

Nari also took home the Contribution to a Science Team Award for her work in leading the 'Healthy Trees, Healthy Future' programme on *Phytophthora* research.

Research Leader Carol Rolando accepted the Communication and Sector Engagement Award on behalf of the Weed Management Team, including Loretta Garret, Mike Watt and Brenda Baillie, in recognition for their excellence in science communications and focus on delivering high quality science with operational relevance.

For further information
Contact Dr Nari Williams at
nari.williams@scionresearch.com
Dr Carol Rolando at
carol.rolando@scionresearch.com

Upcoming events

New Zealand Flax (Harakeke) Forum

Waiariki Institute of Technology, Rotorua

8.30am – 5pm, Friday 20 February 2015
Cost: $25

This forum will present research and development about the innovative and commercial uses of harakeke (New Zealand flax) and extensive work done on planting during the past decade. Topics include: species selection, plantations, industrial processing, muka (traditional fibre preparation), innovation, composites, natural skincare and other uses. Open to the public, in particular small business developers, researchers and scientists.

Hosted by Biopolymer Network Ltd, and supported by Scion and Callaghan Innovation. To register, visit www.biopolymernetwork.com

13th Annual FOA/MPI Forest Biosecurity Workshop

Rimu Room, Scion, Rotorua

24 - 25 February 2015

The introduction of the "Log Levy" has provided the mandate to extend the FOA forest health surveillance to include all of New Zealand's commercial plantation forests. Growing international concern about the prevalence of biosecurity threats associated with trade and travel has seen the introduction of new remote sensing technologies and molecular-based diagnostic tools for detection and identification of biological invaders. The workshop will review what the Forest Biosecurity Committee is doing in partnership with MPI to provide improved surveillance and greater confidence to MPI and New Zealand's trading partners that our export products do not pose a biosecurity threat. The workshop is open to all interested parties but attendance limited to the first 100 to register. For further details go to www.nzfoa.org.nz/events

Scion holiday dates

Scion will be closed from 5pm, Friday 19 December and will re-open on Monday 5 January 2015.

The Scion Board and staff would like to extend to all our clients and colleagues our very best wishes for the festive season, and we look forward to working with you again in the new year.

The field guide to controlling needle disease

Shelterbelts, woodlots and commercial plantations throughout the country often suffer from one or more of the foliage diseases dothistroma needle blight, cyclaneusma needle blight, physiological needle blight (PNB) or red needle cast (RNC). Seasonal development of these diseases differs between diseases, locations, seasons and years with many factors contributing to outbreaks.

Control of needle disease is dependent on the correct identification of the disease. To help forest growers identify a needle disease with confidence and implement the appropriate control measures, Forest Protection Science Leader Lindsay Bulman and Technician Judy Gardner recently produced the field guide, *Field assessment, control and identification of common foliage diseases of pine in New Zealand*.

The field guide explains how to correctly estimate the amount of current infection in the tree crown, the number of trees that should be assessed in the stand during a ground based inspection, and how to account for the various microclimates within the stand. It also provides detailed diagnoses for each species and gives recommended control options for each disease.

The field guide is available to download from our website www.scionresearch.com or email publications@scionresearch.com

Subscribe to Scion Connections ...

... and receive our latest news every three months in the post or direct to your inbox. Visit **www.scionresearch.com/scion-connections** to subscribe for the electronic version or email **publications@scionresearch.com** to order your hard copy – please put "*Scion Connections*" in the subject line.

We'd love to receive your feedback on *Scion Connections*. Tell us what you think by emailing **publications@scionresearch.com**

ISSN 2230 - 6137 *(print)* ISSN 2230 - 6145 *(online)*

Scion Connections is published quarterly, and is also available online at **www.scionresearch.com/scion-connections**

If you'd rather receive this newsletter via email, or wish to change your address details please email **publications@scionresearch.com**

SCION
forests · products · innovation

49 Sala Street,
Private Bag 3020,
Rotorua 3046, New Zealand
Telephone: +64 7 343 5899
Facsimile: +64 7 348 0952
www.scionresearch.com