SCION™

FORESTS ▪ PRODUCTS ▪ INNOVATION

2022 ANNUAL REPORT

In April 2022 we turned 75. This year we salute the past while we look to the future. Those early forestry scientists were pioneers. They created plantation forests for sustainable wood supply. They learned how to grow and protect trees in the best possible way. They learned how to use wood and fibre in the best possible way. Now we are learning how trees and plants can be used to create new materials and energy. We are learning about land use options and how to replace non-renewable resources. And we are learning how to balance standing forest benefits with economic demands. Together with tangata whenua – Ngāti Hurungaterangi, Ngāti Taeotu and Ngāti Te Kahu – we are working on mutually beneficial goals. We are committed to building genuine partnerships with Māori in science and innovation.

SCION™
FORESTS ■ PRODUCTS ■ INNOVATION

2022 ANNUAL REPORT

Presented to the House of Representatives pursuant to section 44 of the Public Finance Act 1989.

This annual report meets our reporting responsibilities under the Crown Research Institutes Act 1992 for the year ended 30 June 2022.

The report is available in digital format at
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Scion over the years

1898

Whakarewarewa Nursery established: Shortly after the Crown aquired land from Ngāti Hurungaterangi, Ngāti Taeotu and Ngāti Te Kahu, the Whakarewarewa Nursery was established, essentially the land upon which Scion sits today. More than 60 exotic species were planted to determine which species grew best in New Zealand conditions.

1947

A government-owned forest experiment station: Scientific research commenced on the present campus under the auspices of the New Zealand Forest Service.

1949

The research station was officially named the Forest Research Institute (FRI). The institute became an internationally recognised leader in plantation forestry science. The Sirex wasp wiped out a third of all pine trees in the Central North Island in the late 1940s. Researchers worked to tackle the wasp problem, focusing on plant health, climate, soils, tree spacing in the forest and forestry management.

1984

1984-1992: An era of intensive science reform (and overall economic reform) with a reduction in government funding of research and the introduction of a 'user-pays' system. This new, contestable funding mechanism affected all research institutes.

1987

The Forest Service ceased to exist. The FRI became part of the new Ministry of Forestry.

1992

Ten Crown Research Institutes created. The major government research providers (DSIR, MAF technology, FRI and the Meteorological Service) were reorganised into 10 stand-alone CRIs. FRI did not survive this reorganisation process intact. The bulk of the Forest and Wildlands Ecosystem staff were separated off and became part of what was eventually named Landcare Research New Zealand, while the rest became New Zealand Forest Research Institute.

As a CRI, the revised New Zealand Forest Research Institute came into being on 1 July. The new CRI was strongly Rotorua-based and highly focused on plantation growing and processing, along with environmental and sustainability issues relating to commercial activity. As it was now a stand-alone company, the New Zealand Forest Research Institute needed to provide for its own corporate support and development, in an increasingly commercial environment.

2005

Forest Research Institute rebranded to become Scion. The trading name Scion was adopted to reflect the growth of research programmes to include the development of new materials and energy from renewable resources and waste streams. A scion is a cutting from one plant, grafted onto another and is where new growth occurs. Similarly, by bringing ideas together here at Scion, we are creating new opportunities for a circular biobased economy.

2021

Scion officially opens Te Whare Nui o Tuteata, which means the great house of Tuteata. This name was gifted by Ngāti Hurungaterangi, Ngāti Taeotu and Ngāti Te Kahu. The hapū also gifted the kōwhaiwhai patterns used in this building, which come from the wharenui of Hurungaterangi in Ngāpuna.

2022

A kawenata (Memorandum of Understanding) signed in August formally established and recorded the enduring partnership between Ngāti Hurungaterangi, Ngāti Taeotu, Ngāti Te Kahu and Scion.

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A new kaupapa started this year that focuses on new and unique approaches to Māori-led indigenous land and forestry systems. **Page 12**

A pair of boots were made with leather tanned using Scion's pine bark tannin demonstrating the high-quality finish achieved. **Page 20**

The Timber Design Centre was launched to activate greater use of engineered timber in multi-rise buildings. **Page 24**

The Extreme Fire Research Programme ended successfully delivering new knowledge, methods and tools for managing extreme wildfires. **Page 32**

About us

Operating revenue

$58.7m

Last year: $61.1m

Total comprehensive income

$0.9m

Last year: $4.9m

Return on equity

0.8%

Last year: 9.3%

Full-time equivalent staff

330

291 Rotorua
2 Wellington
37 Christchurch
(includes fixed-term, student and postdoctoral staff)

Peer-reviewed journal articles

201

107.09 H-index factor (5-year rolling average)

Commissioned reports to users

288

Our core purpose

To drive innovation and growth from New Zealand's forestry, wood product and wood-derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

Our vision

Prosperity from trees – Mai i te ngahere oranga

Our mission

Enhancing New Zealand's prosperity, well-being and environment through trees – Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Trees are remarkable, renewable resources. Planted as forests, and used in products and materials, trees have a powerful potential to be at the heart of a low-carbon, biobased future New Zealand.

Scion's *Strategy to 2030* sets out three research impact areas that focus our expertise to deliver on our aspirations for New Zealand and support the Government's goals.

Our research impact areas are:

Forests to biobased products. Development of products, processes, manufacturing, trees, other biomaterials and healthy, resilient forests to replace petrochemicals and non-sustainable materials.

Forests to timber products. Development of products, manufacturing, high-value trees and healthy, resilient forests that capture an increasing share of the global high-end market for timber.

Forests and landscapes. To grow healthy, resilient forests that are planted primarily for their standing-forest benefits.

Chair and Chief Executive overview

Back to the future

When institutions have birthdays, people are celebrated, successes relived, achievements recounted and the future imagined.

Over the past 75 years, thousands of talented and highly skilled Scion scientists, technicians and support staff have created a body of knowledge and technology prowess that has shaped the development of New Zealand's sustainably managed exotic forests and forest product industries.

Today, Scion looks out to 2050 with a strategy targeting New Zealand's carbon zero goals and the transition to a circular bioeconomy. Beyond that our aspirations for the next 75 years lie in contributing to enriching next generation's lives through continuing to enhance New Zealand's prosperity, well-being and environment through trees.

The establishment, management and resilience of our exotic forests remain a core focus of Scion. Our role in New Zealand's future is vital in enabling the circular bioeconomy opportunity through trees.

Roll back a century and the importance of trees to New Zealand's prosperity was recognised. In 1913, in response to dwindling stocks of native timber-producing trees and the need to protect forests, a Royal Commission on Forestry was established. One of its recommendations was large-scale planting of "eucalypts for durability and pines for building timber" with reference to the Californian Monterey pine (*Pinus radiata*). The rest is history as they say and resulted in a forestry industry that is New Zealand's third largest primary industry export earner worth $6 billion a year and employing more than 35,000 people.

Looking ahead, forestry and the research and innovation it has fostered have much to offer in tackling this century's crisis – climate change.

The establishment, management and resilience of our exotic forests remain a core focus of Scion. Our role in New Zealand's future is vital in enabling the circular bioeconomy opportunity through trees. We have experience in that. In our 2002 annual report we featured a section on 'biomaterial futures' and talked about a new economy. Over the two decades since then, we have gained a place among world leaders in promoting and demonstrating a circular bioeconomy approach in our science and innovation. Maintaining that place is critical to fulfilling our strategy.

The path to deliver Scion's *Strategy to 2030* was cemented in the past year with a big effort put into completion of roadmaps for each of our 11 research portfolios. The direction these are taking is exciting, including two newly established Māori-focussed, Māori-led portfolios - 'Restoration, protection and mauri o Te Waonui a Tāne' and 'Distinct value of indigenous wood products'.

These 11 roadmaps are presented in our new Statement of Corporate Intent. The SCI also indicates our revenue investment across our three impact areas showing more in our 'Forests to timber products' area relative to the others. This share is to be expected given our legacy and our core purpose, however, we intend to retain and grow investment in all areas in line with government and community expectations.

Our research activities are delivering outcomes and leading to impact across all three impact areas. In the past year, despite operational challenges stemming from COVID-19 disruptions, we have much to be proud of.

We have continued our journey of building enduring relationships with, and

delivering value to, iwi entities across the country and in particular with Ngāti Hurungaterangi, Ngāti Taeotu and Ngāti Te Kahu who hold mana over the whenua that Scion is located on.

In December 2021, the five-year Extreme Fire Research Programme ended successfully, on the eve of 30 years of fire research conducted at Scion. The programme delivered a new fire spread theory for managing risk, new tools for fire response and targeted protection plans for indigenous forests.

On the same theme, we developed and successfully trialled a means of monitoring forestry slash piles for risk of spontaneous combustion.

The giant willow aphid programme concluded with excellent results. Monitoring showed that the biocontrol agent, an introduced wasp, had established widely reducing damaging giant willow aphid populations.

With timber still a novelty in mid to high-rise buildings, the time was right to push interest in engineered timber construction to action. Hence the Timber Design Centre was launched in March with Scion among its backers.

Adorning our homes and buildings is a big part of the construction and furnishings sector and Scion has exposure in this space too. Indeed, the New Zealand Pavilion at the World Expo featured bespoke Trubridge pendant lights made from a biomaterial formulated at Scion.

Such biomaterials research contributes to the journey to lessen plastics pollution. Scion was proud, in March this year, to launch a roadmap towards sustainable plastics use in New Zealand.

All good roadmaps need to be followed by early adopters and enthusiasts. If they're looking for sturdy boots, they can look forward to shoes made from hides tanned with pine bark tannins developed at Scion.

And so, we arrive back at the pine tree – a renewable resource with much potential still to unleash. This report is just a snapshot into the relevant and remarkable research undertaken by our clever people.

Our knowledge and expertise were rewarded in the year with invitations to join several government advisory groups addressing big issues facing New Zealand.

During the year we completed the organisational realignment, which now sets our sights clearly on pursuing our Strategy to 2030.

Playing a meaningful role in these important forums is to be expected of a Crown Research Institute with evidence-based information pertinent to the problems to be solved. Our strategy ultimately serves New Zealand and its people, and we are totally committed to attaining our goals.

To advance our strategy and make good progress with our bioeconomy-related R&D, we have budgeted for revenue growth in the year ahead. During the year we had continued to engage thoughtfully with the Ministry of Business, Innovation and Employment, our owners' representative, for a sustainable long-term funding mechanism to deliver our strategy. Although no solution was forthcoming, we have now been encouraged to pursue sustainable funding for our research through opportunities presented in the Government's Climate Emergency Response Fund for forestry and bioeconomy sectors and the Emissions Reduction Plan.

The 2021-22 year resulted in revenue of $58.7 million, which exceeded our budgeted target by $0.9 million. We continued to see business disruption as a result of COVID-19 and cost escalations, yet despite this we achieved a profit after tax of $0.4 million. We expect similar challenges in the coming financial year as the global pandemic continues.

The year was another tough year for Scion's people working under the constraints imposed by the pandemic and the Government's pay restraints. We are very proud of the individuals and teams, from science and functional groups, who continued to deliver under pressure to meet milestones and programme targets. During the year we completed the organisational realignment, which now sets our sights clearly on pursuing our *Strategy to 2030*. Our sincere thanks are extended to all staff for their commitment, perseverance and hard work in these challenging times.

We also express our thanks to our customers and partners for their support and contribution to Scion throughout the year.

Finally, we acknowledge the work of everyone before us. Seventy-five years ago, they created the foundations and the layers towards what is today an institute of international standing. We are proud to stand tall on the shoulders of those pioneers and make our contributions to Scion's continuing journey of science and innovation in harmony with nature.

Dr Helen Anderson QSO
Chair

Dr Julian Elder
Chief Executive

Our strategy

Our 2050 aspirations for New Zealand

Serving New Zealand's 2050 goals

- 10-fold increase in GDP from forests and manufacturing
- Zero carbon emissions
- All erodible land planted in permanent forests
- Zero water quality issues from land use
- Sustainable communities and economies in all regions
- High OECD household net wealth ranking
- Much improved living standards.

Strategy to 2030

Scion goals to 2030

Right tree, right place, right purpose

Helping New Zealand transition to a circular bioeconomy

3 Impact areas

Forests to biobased products	Forests to timber products	Forests and landscapes
High-value biorefineries	Trees to high-volume wood products	Establishing indigenous forests
Bioproducts and packaging	Trees to high-value wood products	Restoration, protection and mauri o Te Waonui a Tāne
Distributed and circular manufacturing	Distinct value indigenous wood products	Designing forests – Mahi tahi whaihua
Integrated bioenergy	New value digital forest and wood sector	

11 Portfolios

Research pathways

Interconnected research programmes delivering short-, mid- and long-term outcomes

Partnering and co-innovating with Māori

Creating pathways for Te Ao Māori-focussed research

During 2021-22, roadmaps for Scion's 11 portfolios were developed, including two newly established portfolios with strong Te Ao Māori pathways. These roadmaps took shape following intensive engagement with various Māori partners, industry and government stakeholders and Scion staff.

The two portfolios that have strong Te Ao Māori pathways are:

Restoration, protection and mauri o Te Waonui a Tāne

- Kia Ora Te Waonui a Tāne | Ecological well-being – together with Māori partners, developing a set of projects that value Te Ao Māori worldviews and enrich Aotearoa ngahere ecosystems. Developing Māori-centred research that enables capacity, capability and leadership in ngahere research, science and innovation.
- Whakamaru ngahere | Protect and restore indigenous forests – methods, protocols, tools and research to respond to abiotic and biotic threats to ngahere.

Distinct value of indigenous wood products

- New, scalable indigenous forest-to-wood product paradigms.
- Reinforcing distributive intergenerational economics.
- Launch a 'wood with meaning' indigenous wood products futures lab.

The roadmaps can be found in our *Statement of Corporate Intent 2022-25*.

Te Rātā Whakamaru – *The sheltering rātā*

Scion partnered with Rotoiti 15 Trust in a three-year science-based project to monitor the spread of myrtle rust disease in the Bay of Plenty. The 'Myrtle Rust Jobs for Resistance' programme - Te Rātā Whakamaru - is a three-year project funded by the Department of Conservation - Te Papa Atawhai, Jobs for Nature fund.

The project will allow for the development of knowledge in myrtle rust, reporting on tree health and identifying if any trees are resistant to the disease. Consistent with the Jobs for Nature fund objectives to revitalise communities through nature-based employment, nine new full-time science recruits started work with Rotoiti 15 and Scion in April 2022.

Arapeta Tahana from Rotoiti 15 Trust said he and his fellow trustees are committed to providing opportunities for the taiao, culture and people.

"This is logical for us to invest in our own people. To increase capacity for learning for our whenua (land) while protecting our ngahere (forests). This is not the sort of work you can outsource," said Arapeta.

Scion and Rotoiti 15 Trust at Te Waiiti Marae, Lake Rotoiti, for the whakatau for Te Tira Rātā (Jobs for Resistance work team).

"The goal is to provide jobs and build capability within the Bay of Plenty to protect the ngahere against myrtle rust," he explained. "We are committed to not only understanding the impact of myrtle rust within our environment, but to connect and understand our environment better."

https://tinyurl.com/mws9dhhz

Vision Mātauranga

Scion's continued commitment to invest in our staff's capability and capacity saw four Vision Mātauranga workshops held at our Rotorua and Christchurch campuses in May and June.

The workshops improved staff understanding and knowledge of the principles of Vision Mātauranga to enable opportunities for staff to more confidently identify, develop and pursue Vision Mātauranga approaches to enhance Scion's science and research programmes. Sixty-eight staff from both the science and corporate areas of Scion participated in the externally presented workshops. To ensure that we build our organisational capability in this area, Vision Mātauranga workshops will be incorporated into Scion's cultural competency framework.

Development of critical capabilities within Scion will enable Scion and Te Ao Māori to achieve mutually beneficial outcomes.

Modelling land use change alternatives

A long running research programme funded by the NZ Agricultural Greenhouse Gas Research Centre (NZAGRC) is in its seventh year and due for completion in June 2023. The objective of the programme – 'Takahuri Whenua: The changing land' – is to develop GHG mitigation and land use change scenarios for the Māori agricultural sector.

Science leader of the programme Dr Tanira Kingi, Emeritus Scientist at Scion, says interest in the programme is high given the impending impacts on the agricultural sector from proposed carbon pricing system and freshwater regional plans coming into effect in 2025.

The NZAGRC describes Takahuri Whenua as "a major project partnering with three Māori land collectives to support their ambitions to transition their farms and forests to a high-value, low-emissions bioeconomy within their tribal rohe".

The programme involves GHG mitigation and land use modelling on 18 case-study farms owned by Māori land authorities across three collectives with six farms in each.

Takahuri Whenua will produce a decision-support framework that integrates a range of existing tools and models and presents the mitigation and land use change scenarios in a variety of formats including in spatial layers. A key part of the framework is the discussion with the farm's governance and management leaders to clarify priorities, values and long-term objectives and then to explore future scenarios.

Tanira says while the information is technical and complex the research team has devised effective ways to present case farm reports in workshop settings, which improves the farm's governance and management teams' capability to use the information for better planning and decision-making.

Researchers from other organisations involved in the programme come from AgFirst, Fruition Horticulture and Groundtruth Ltd.

The programme's second phase involves the farm entities coming together within their collectives to explore joint strategies. From October 2022 to April 2023 when the programme enters its final phase, the three collectives will work together to identify opportunities to scale up their network across the regions, explore value chains for alternative land use products and develop multi-collective joint strategies to help identify potential partners and funding avenues.

https://tinyurl.com/3chzxh39

Showcasing the talent of tamariki and rangatahi

Scion proudly supported the inaugural Te Tūkohu Ngāwhā Science Fair hosted by Te Arawa Lakes Trust and the Bay of Plenty Regional Council.

Invited Scion judge, Katerina Pihera-Ridge (Portfolio Leader – Restoration, protection and mauri o Te Waonui a Tāne) seized the opportunity to contribute to the kaupapa of biodiversity, biosecurity, wai Māori and mātauranga Māori by creating a Scion award.

Katerina says, "Our young people are tomorrow's leaders. They will be our new emerging scientists, technologists and indigenous practitioners. With Māori under-represented in the sciences, opportunities that start early and are

founded on Māori values are very important".

The Ngā Huarahi ki Te Ao Award was designed by Katerina to recognise innovation and sustainability through a mātauranga Māori lens.

"The taonga creation is grounded in traditional ecological knowledge held within the 1000-year-old tōtara combined with Scion's contemporary full colour technology *Pinus radiata*, laser etched with poutama designs as a tohu and signal of knowledge potential. The three coloured plumes represent prized raukura feathers or ngā kete e toru, symbolic baskets of knowledge; ascending poutama staircase to higher learning; embracing the traditional and contemporary knowledge pathways needed to address sustainability and the changes in our natural world," said Katerina.

The award recipient will have a day with a scientist at Scion and see some of the exciting science pathways as well as share their own research exhibit with staff. They will also receive a taonga made at Scion with local carver Grant Marunui (Ngāti Hurungaterangi, Ngāti Te Kahu, Ngāti Rangiteaorere, Ngāti Rongomai, Ngāti Manawa).

Te Tūkohu Ngāwhā attracted 80 exhibits submitted by year 5-13 students attending schools across the Te Arawa rohe. Held in Rotorua, the fair was open to the public for three days starting 30 June 2022.

Scion sees this event as a capability incubator for rangatahi to present their exhibits focused on mātauranga Māori and western science approaches to tackle environmental issues facing Aotearoa. It is also a highly hands-on collaboration that will strengthen local relationships and partnerships within Te Arawa (rohe) schools, rangatahi and community through science capacity and capability.

Alex Malcolm from Mokoia Intermediate won the Ngā Huarahi ki Te Ao Innovation and Sustainability Award and the Ngā Karu Atua Supreme Award for his catfish pest project. With him are Mariana Te Rangi, Te Arawa Lakes Trust Biosecurity Coordinator; Katerina Pihera-Ridge, Scion; and William Anaru, Te Arawa Lakes Trust Operations Manager.

Proud supreme and category winners with organisers and judges.

https://tinyurl.com/yckvstw6

Ngāti Hine Forestry Trust: *He Ringa Ahuwhenua, He Hanga Mahi Indigenous Forestry Strategy Development*

A new kaupapa started this year that focuses on new and unique approaches to Māori-led indigenous land and forestry systems.

Led by Ngāti Hine Forestry Trust and supported by Scion, the project is funded through the Te Uru Rākau (New Zealand Forest Service) One Billion Trees initiative. This project aims to develop a transition strategy to shift from exotic pine to an indigenous forest system through rangahau and research, wānanga and indigenous forestry trial sites.

Rangahau planning hui at Motatau Marae, hosted by Ngāti Hine Forestry Trust in May 2022.

This project is significant because it not only considers a kaupapa Māori approach, it is unique to Ngāti Hine mātauranga through a rangahau philosophy that incorporates Te tū o Ngāti Hine, kaitiakitanga, mahi tahi and He Whenua Hua, He Tangata Ora.

Scion and other partners provide examples of trial design and other technical knowledge from our science experience and expertise. Those examples and knowledge are then used to co-design the final trial design with understanding the critical inputs, importance and availability of plant species and rākau taketake types, and their prevalence in the past, present and future. All this work will be confirmed at trial sites selected within the Ngāti Hine rohe/estate.

Collaborating for impact

Scion's reach is wide and deep. Internationally we are part of more than a dozen formal, long collaborations and interactions in around 50 science programmes around the globe. Plus, our national reach is just as broad and important.

Through these multi-disciplinary collaborations and networks our scientists are at the forefront of the latest thinking, novel approaches and technological advances. Maintaining and building on these linkages is essential for Scion to remain innovative and competitive in domestic and global markets. Our presence and influence in key networks are well earned as shown in the examples below.

On a mission to save iconic trees

Within 'New Zealand's Biological Heritage National Science Challenge' is a research programme called *Ngā Rākau Taketake – Saving our iconic trees from kauri dieback and myrtle rust*.

A handful of Scion scientists are involved in the programme joining many others from various organisations and groups on their collaborative mission to protect our treasured species from disease. Among those is Scion social scientist Simon Wegner who co-leads one of the research themes in the Ngā Rākau Taketake programme.

The Risk Assessment and Ecosystem Impacts theme seeks to understand the ecosystems at risk and the impacts of diseases to support mana whenua, communities, agencies and other researchers to prioritise their efforts and make better management decisions.

With co-leader Dr Luitgard Schwendenmann from the University of Auckland, the team has taken a holistic view of ecosystems. This view recognises that harm to kauri and myrtle species will have substantial consequences for associated species, for wider ecosystem functions and for the people who interact with and value these ecosystems for social, cultural and economic reasons.

Because there are significant gaps in knowledge, and many impacts will take decades to become apparent, Simon says the focus is on characterising kauri and myrtle ecosystems, identifying what is at risk and establishing baselines against which to measure long-term change.

Scion is one of many contributors to the programme, and everyone involved feels very privileged to be part of it.

https://tinyurl.com/2cjb5yc8

Putting design at the heart of research

A multi-disciplinary collaboration has brought transformative concepts and technologies to life.

The 'Additive manufacturing and 3D and/or 4D printing of bio-composites' spearhead project, within the Science for Technological Innovation National Science Challenge, has had co-leader Scion's Dr Florian Graichen regularly buzzing with excitement.

On a mission to support solutions for some of New Zealand's grand challenges, the spearhead team took a design-led approach to early-stage research by putting the end users' interests upfront.

This approach involved cross-disciplinary academics and practitioners working closely with design students from Victoria University of Wellington School of Design Innovation and designers from industry. During collaborative sessions, the spearhead reimagined products of the future that would use biomaterials and printing techniques developed by the research team.

The potential product areas are vast and the applications remarkable, from prosthetics to furniture and much more.

Imagine a sunshade that responds to the angle of the sun, like flower petals do when they follow the sun's rays, or a cornea made from electrospun collagen that can be transplanted onto a human eye. These are examples of actual projects.

"We're dealing with natural materials that are smart and can transform with environmental triggers. With designers alongside our scientists, they can see the possibilities are limitless. In fact, it is the designer's imagination that is the limit," said Florian.

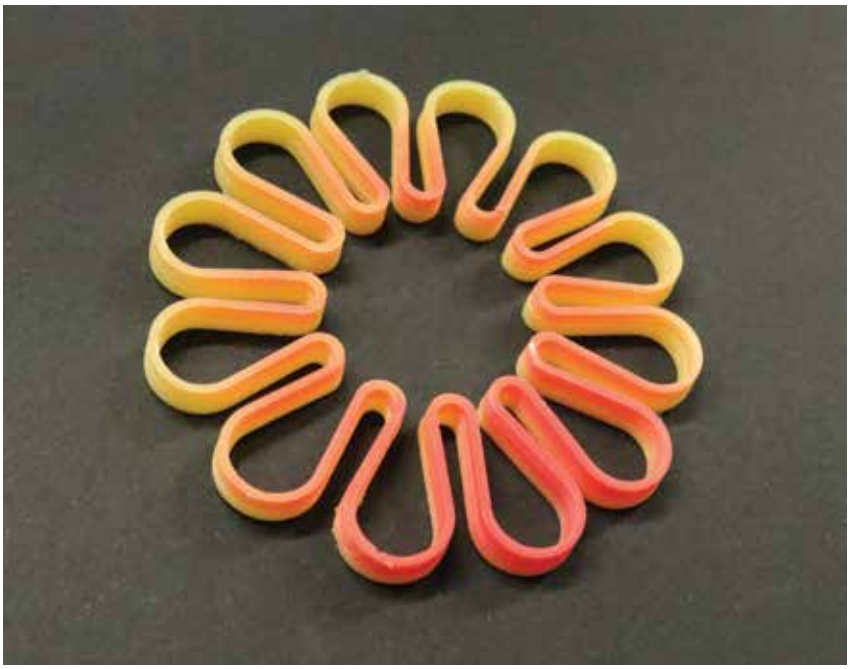
The strength of the collaboration lies in the talent within the team. Professor Kim Pickering, University of Waikato, has been co-leading the spearhead with Florian. The team has involved researchers from AgResearch, GNS, Massey University, Victoria University Wellington, AUT, Auckland University in addition to the University of Waikato and Scion plus industry partners.

Together they have laid the groundwork

for new concepts and technologies developed in the lab. The potential for the innovations could be game changing in areas such medical applications, high performance sport, packaging, housing and waste reduction. These possibilities are further developed with industry input within targeted applications, such as next generation antennas for better wireless communication.

Scion's contribution to the spearhead laid the path in developing novel biopolymers, application of proteins, cellulose and lignin, combination of biobased materials and additive manufacturing, and processing of biobased fibres.

This spearhead project commenced in 2016 and ended in June 2022. It was funded through the Science for Technological Innovation National Science Challenge.



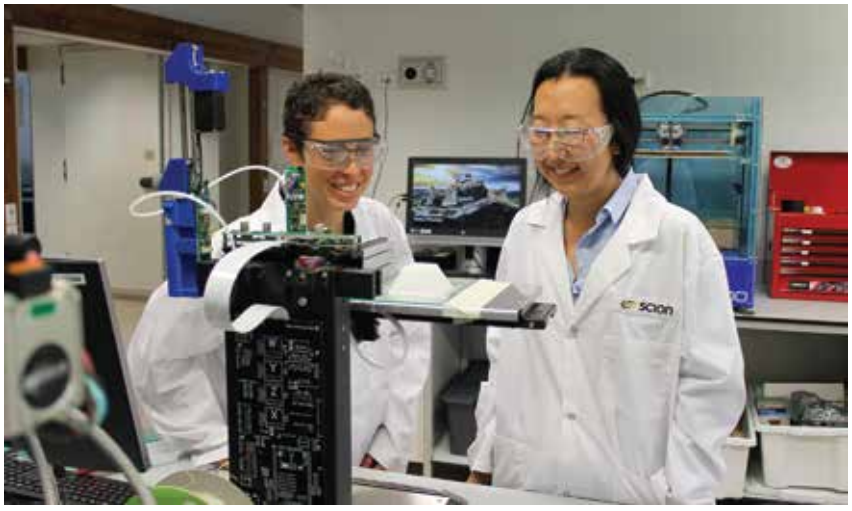
A 4D printed biomaterial changes colour when heat is applied.

https://tinyurl.com/2x7xvmxx

Using plant-based resources in new, smart materials

Scientific exchange between France and New Zealand has a long history, and Scion is no stranger to such collaborations and interactions.

The seeds of collaboration can grow in unexpected ways as a project with INRAe (the French National Research Institute for Agriculture, Food and Environment) shows.



Drs Claire Mayer-Laigle (left) and Marie Joo Le Guen.

Dr Claire Mayer-Laigle, an INRAe researcher from the Joint Research Unit in Montpellier, visited Scion in 2018 for a one-week exchange with her counterpart Dr Marie Joo Le Guen. Marie Joo was subsequently invited to present at Claire's laboratory. These successful interactions led to a joint conference presentation and joint research publication.

In 2020, Claire was awarded a prestigious Marie Skłodowska-Curie fellowship in partnership with Scion. The fellowship supports Claire to work at Scion on a three-year research programme exploring the use of plant material in 4D printing.

Claire explained that plant biomass, as a reservoir of functional compounds, could be used to replace oil-based materials and offer a promising avenue for reducing the environmental impact of plastic.

"The functional elements are buried within plant tissues but milling or grinding plant material to ultrafine powders could bring hidden qualities to the surface and allow plant material to be used in advanced 3D printing technologies. We specifically want to understand if we can use plant powder to bring new qualities that we can use to design smart materials for 4D printing - where printed material changes in reaction to environmental stimuli," said Claire.

This research combines INRAe's experience in milling plant biomass and Scion's knowledge of additive manufacturing.

"In Europe, Scion is renowned for its world class capability in biopolymer and biomass extrusion, characterisation and 3D/4D printing using biobased materials. Scion has the capabilities and expertise to characterise powder from biomass and bioproducts (solid-state NMR, confocal microscopy) which supplements the tools available in France. Together we can devise methodologies to develop advanced biobased materials," said Claire.

Over recent years, Scion has created a network on the 'additive manufacturing of biomaterials' comprising researchers passionate about developing the technology and fully committed to environmental issues. Though this programme, Scion aims to enlarge the network to other European institutes and strengthen collaboration.

The programme, which ends in 2024, has already resulted in an international conference presentation and the filing of a patent.

This research collaboration also strengthens the wider MOU agreement between INRAe and Science New Zealand, signed in June 2020.

https://tinyurl.com/2p973sb2

A load of rubbish - He putunga para

Schoolchildren around New Zealand are now able to learn the answers to queries about rubbish and recycling that might cross their minds, plus a lot more about the circular bioeconomy.

The answers lie in a science kit called *A load of rubbish – He putunga para*, which was launched in Rotorua in late June 2022 as the result of a unique collaboration.

Keen to educate New Zealanders about how to deal with waste in their daily life, Scion approached House of Science and supermarket company Countdown for help in creating a science resource to support teachers in teaching circular bioeconomy principles to school aged kids.

House of Science, a charitable trust that develops and distributes science kits to primary schools, has expertise in translating complex concepts into educational activities. Countdown, which is on a journey to make its own brand packaging 100 per cent reusable by 2025, provided sponsorship for development of the kit.

Taking around a year to develop and test, *A load of rubbish – He putunga para* is a bilingual (English and Māori) science kit designed for children in years 1-8. Activities in the kit apply scientific principles through which students learn how to identify and solve environmental problems and help them make informed choices on sustainable packaging materials and their end-of-use.

Even before the official launch, the kit was a great success. Thirteen kits have now been sponsored by various organisations, and they will reach more than 7,000 school children each year.

The project aligns with the Government's commitment to implementing circular economy concepts as part of the 2025 Plastics Declaration and 2050 zero-carbon economy vision. Scion's initiative in setting up the project also aligns with the Ministry for the Environment's national plastic action plan to improve teacher resources on plastics and help drive behaviour change.

Scion scientist and project leader Eva Gaugler says technology, mind-set and evidence-based behaviour changes are essential for the transition to a circular economy to be successful.

"This kit is a practical hands-on tool that will help teachers and students understand the basics of a circular economy that is about designing out waste and pollution, keeping products and materials in use and regenerating natural systems. It operates very differently to our current linear economy where many materials are only used once and then thrown out."

https://tinyurl.com/5fypdxj9

Joining complementary world-leading expertise

Scion's expertise, leadership and domestic and international networks in 3D/4D printing using plant material was behind a request to become a partner organisation in the DeMANS consortium.

DeMANS, which stands for design and manufacture of sustainable materials for additive manufacturing technologies, is an international and intersectoral project. It has an ambitious goal of world-class innovation in the design and additive manufacture of parts, components and devices using sustainable (bio)polymer materials.

The DeMANS project is exploring new opportunities for replacing traditional synthetic plastics with biomaterials in complex consumer products and aims to deliver a technology roadmap guiding Europe into a new era of biobased products and applications.

This consortium of seven academic and industrial organisations from three European and two southern hemisphere countries is part of the global race to reduce reliance on fossil fuel derived plastics.

Dr Marie Joo Le Guen, Research Group Leader Materials, Engineering and Manufacturing, joined other DeMANS partners at Trinity College Dublin in May 2022 where she presented on Scion's current research on additive manufacturing with biobased materials.

The DeMANS project is funded by the European Union and runs to 2025. Scientist exchanges and secondments are instrumental to how the network shares knowledge and expertise among partner organisations: Trinity College Dublin, University Hospital Würzburg, Natural Resources Institute Finland, Logitech Ireland Services Limited, WAZP, University of Wollongong and Scion.

In return for Scion's contribution to the project, DeMANS adds to skill development, offers exposure to new international research and product development and widens the career perspectives of staff involved. Project results will be disseminated to relevant scientific, industry and governmental agencies worldwide to advance the largely unexplored field of sustainable material additive manufacturing.

As the programme continues, Scion will host secondments from the EU partners to facilitate relationship building and knowledge transfer with New Zealand partners and implement distributed, domestic bioproduct manufacturing.

A value chain compass adds to sustainable production

Scion seeks innovative ways to value-chain development for a new bioeconomy, including Māori-centred approaches, and a recently completed collaborative project contributed to Scion's vision.

The 'Rewarding sustainable practices' project sat within the Our Land and Water National Science Challenge with Scion contributing expertise in value chain and Te Ao Māori direction.

The purpose of the project was to help New Zealand exporters add more value for their agri-food products and reward good practises that created the extra value. The project was phase three of a larger research programme.

Researchers from the Agribusiness and Economics Research Unit (AERU) and Scion, together with independent researcher John Reid, tested a list of common characteristics with four emerging value chains. Their work produced a final set of nine characteristics of successful food and fibre value chains.

Reina Tamepo, Scion lead for this project, and colleague Sylvia Tapuke said Scion played a key part in developing the compass to provide a Māori-centred way of communicating AERU's results for our Māori agri-partners.

"We played a role in shifting the identification of nine attributes of value-add from a linear scale to a more holistic approach.

"The centre of the value chain compass is the chain's collective values. The collective values are held in common by the partners along the chain – from producers to consumers. These shared values act as a binding attribute in sustaining strong, successful value chains, encouraging collaboration along the chain and creating value for the consumer," explained Reina.

That central insight was first developed by AERU's research officer, Dr Tiffany McIntyre, in her PhD thesis. The Value Chain Compass builds on that work. Reina and Sylvia arranged for the compass to be presented to the Māori Agribusiness Team at the Ministry for Primary Industries, and Professor Paul Dalziel (AERU Deputy Director) also presented it to a workshop at E Tipu: The Boma Agri Summit in June 2022.

"According to Tiffany, the compass offers multiple pathways for agribusinesses to innovate new value chains or transform supply chains to value chains," summed up Sylvia.

The research team is now preparing on-line resources for the agri-food sector based on this work.

https://tinyurl.com/ymw4ytv2

Our research goals

Our new science operating model was implemented towards the end of the 2020-21 financial year. During 2021-22, we developed our roadmaps to impact for our 11 new portfolios and defined 36 research programmes that will deliver short-, mid- and long-term outcomes aligned to our Strategy to 2030. These roadmaps and research programmes are presented in our recently published *Statement of Corporate Intent 2022-2025*.

All programmes have been established and deliverables identified for coming years. We will report progress on these deliverables in our 2023 annual report.

Research highlights

We're developing tomorrow's products from today's trees to contribute to a biobased future.

We're finding cutting-edge ways of building with timber here and around the world.

We're protecting and nurturing the forests that you love.

Roadmap to zero – for plastic

A March 2022 Scion-authored report titled *Making zero the hero* provided a roadmap towards sustainable plastics use in New Zealand. The 'zero' refers to eliminating plastics waste – rather than plastics use.

As a minor-player in the global plastics sector, the New Zealand industry is import-reliant and often produces products and goods destined for export.

There are environmental, economic and social benefits of driving towards a new plastics economy. The questions now are how the domestic plastics industry will be involved and how will they partner with others to enable this transition.

The report highlighted an already high commitment from industry, but support from central and local government is needed in the form of clear and coordinated policy, regulation, incentives, and much better nationwide recycling systems.

The report focuses on re-using and recycling the plastics we mostly use now and stopping them from escaping into the environment.

Financial support for this project was received from the Waste Minimisation Fund, which is administered by the Ministry for the Environment.

The roadmap summarises short-, medium- and long-term initiatives to transition New Zealand's plastic industry to a circular economy and highlights the inter-dependent elements needed for a circular future for New Zealand's plastics, namely: infrastructure development, supply-chain evolvement, diffusion and maturity.

The report's authors worked with industry partners to identify the challenges, barriers and opportunities to understand how global plastic supply

chains are part of New Zealand's transition to a new plastics economy.

Making zero the hero follows the 2019 report on the New Zealand plastics problem by the Prime Minister's chief science advisor, Professor Dame Juliet Gerrard, which lamented the lack of data on which to base a strategy.

The report is referenced in the *ANZPAC Plastic Pact Roadmap to 2025*, targeting solutions for the entire Australia, New Zealand and the Pacific Islands region. Key players are connected to give effect to a shared vision of a circular economy for plastic and link into the Ellen MacArthur Foundation's global plastics pact network.

Implementing new plastics economy systems in our economy will boost the resilience of our businesses to match global supply chain transitions and global sustainability trends and enable them to remain and become more competitive.

Funders
Ministry for the Environment

Collaborators
Plastics NZ, Packaging New Zealand and WasteMINZ

More information
https://tinyurl.com/2p8393nz

Scion's work on Making zero the hero *built on* Rethinking Plastics *and provided improved data. It clearly shows the scale of the data gaps, considering material flows through all parts of the economy, and illustrates the actions needed to improve our systems. This roadmap, along with the wider collective action underway within the New Zealand plastics ecosystem, provides a clear pathway to a better future for plastics in Aotearoa.*

Rachel Barker, CEO Plastics NZ

The demonstration boots modelled by organic chemist Dr Hilary Corkran.

These boots were tanned with pine bark

New Zealand currently imports all its leather tanning agents, and around 85 per cent of these contain chromium - a heavy metal toxic to humans and the environment.

The opportunity was open to exploring sustainable New Zealand-made tanning alternatives. Scion did not have to look far to find a local source. The domestic radiata pine industry produces two million tonnes of pine bark a year, most of which goes to waste. When trees are felled for export, the bark is removed for biosecurity reasons with just a fraction of the bark produced used – and even then, for mainly low-value applications such as garden mulch.

Starting from proof-of-concept lab scale trials, the project team quickly moved on to pilot plant trials at Callaghan Innovation with 160 kg of bark generating 12 kg of pine bark tannins, which was enough for tanning hides in collaboration with the Leather and Shoe Research Association of NZ and Tasman Tanning.

A demonstration pair of leather work boots were made with leather tanned using Scion's pine bark tannin. As a proof of concept, the boots reveal the high quality of the produced leather in a finished product and will serve as a show piece when engaging with leather producers and users. Further, they demonstrate the potential to initiate a new bioproduct value chain in New Zealand, ranging from forestry to luxury leather products.

With most of the 2.4 million annual animal hides (a by-product of the beef industry) exported for others to finish, a return to domestically made products will reduce our dependence on imports and create new higher-value export opportunities. It is a sustainable way of invigorating local manufacturing and contributing to New Zealand's 2050 sustainability aspirations.

Funders
Ministry of Business, Innovation and Employment

Collaborators
Leather and Shoe Research Association of NZ (LASRA), Tasman Tanning, McKinlays Footwear

More information
https://tinyurl.com/2kajrvm7

The Leather and Shoe Research Association has been helping Scion investigate the use of pine bark tannin as a tanning agent for leather. Initial trials using an ethanol extracted pine bark tannin were very encouraging, producing beautiful leathers with very high performance. At this early stage, a New Zealand tanning company was very interested in the concept and keen to follow up on its potential as there is no current supplier worldwide. There has been significant commercial interest in the tannin work so far, leading to a number of enquiries and a new impetus to complete trials and identify the ideal candidate tannin for commercial leather production and compete with alternatives such as mimosa, chestnut or quebracho.

Geoff Holmes, Director, New Zealand Leather and Shoe Research Association

Bioenergy thought leadership helps shape national policy

During 2021, the Government published consultation documents that provide a clearer picture of the role of bioenergy in New Zealand's future. These documents outline possible approaches to phasing out fossil fuels in process heat and creation of a sustainable biofuels mandate.

These developments follow from the Scion-led Biofuels Roadmap study which informed and stimulated debate on the large-scale production and use of liquid biofuels in New Zealand. Underlying these consultation documents are research, technology and thought-leadership provided by Scion's scientists and engineers.

In April 2021, the Government announced that a ban on new coal boilers used in manufacturing and production (process heat) will come into effect by 31 December 2021 together with a phase out of existing coal boilers by 2037. Woody biomass-derived fuel is a logical replacement for coal.

The final policy design for the Sustainable Biofuels Mandate was released by the Government in December 2021. The objective of the mandate was to enable a just transition to a zero carbon and climate-resilient economy and society through increasing the supply and use of green fuels for transport, particularly for hard to abate transport modes.

In May this year the Government announced Aotearoa New Zealand's first Emissions Reduction Plan which sets out policies and strategies to decarbonise every sector of the economy, including the energy and industry sectors. Central to that is desire to move to a thriving circular economy and bioeconomy. Accelerating a sustainable and secure supply and uptake of bioenergy in Aotearoa is at the heart of Scion's Integrated Bioenergy Portfolio.

Budget 2022 included several initiatives targeted at new economic opportunities in the forestry sector. Among them was $91 million to increase biomass supply and stimulate private sector investment to alleviate projected bioenergy shortages through Crown planting 10,000 ha of short rotation energy forest and targeted research and development.

Taken collectively, the policy directions set in place over the past 12 months signal a very strong desire by the New Zealand Government that bioenergy, especially from forestry-based sources, has a critical role to play in powering the future economy of New Zealand. The role of Scion as a trusted adviser in this energy transition is highly evident.

Funders
Strategic Science Investment Fund

Collaborators
Air New Zealand, Fonterra, Genesis Energy, Sequal Lumber, Z Energy

Z Energy has consistently advocated for the use of biofuels and welcomed the announcement from the Government that New Zealand's Sustainable Biofuels Mandate will be in place by 1 April 2023. Biofuels are an important step on the journey to help New Zealand decarbonise the transport sector.

Biofuels can be readily 'dropped into' the existing liquid fuel supply chain and are a long-term solution for transport use cases that cannot easily decarbonise, particularly aviation and shipping. Z Energy has been appreciative of the wealth of knowledge, expertise and drive that Scion has brought to the sustainable aviation fuel (SAF) initiatives that we have collaborated on.

We would not have been able to form such a comprehensive view of the potential for SAF production in New Zealand without the team at Scion. Our working relationship with Scion goes back to 2015, when we participated in the workshops that led to Scion's Biofuels Roadmap.

Chris Durno, Head of Strategy, Z Energy Ltd

Scion biomaterials light up EXPO 2020 Dubai

The New Zealand pavilion at the World Expo in Dubai was adorned with David Trubridge Navicula pendant lights, made from plywood. But one of those lights was made from a biomaterial formulation developed by Scion.

The New Zealand Pavilion showcased some of the best local culture, innovation and creativity. The pavilion theme was "Care for People and Place", inspired by the ethos of kaitiakitanga, the connection and responsibility between people and the natural world. It was a message that resonated with a sustainable, values-based approach to material and product development.

Backed by 12 years of collaboration, Trubridge and Scion combined their expertise in creating a unique biomaterial. The Navicula pendant light featured a composite of sustainable biobased plastics and pāua shells developed by Scion scientists, with an iridescent sparkle.

Trubridge says the main objective of working with Scion is to show what's possible, and hopefully as the commercial environment changes, to make it more attractive for companies to take up the baton to move away from oil-based plastics.

Scion's mission and vision is transitioning New Zealand from a linear to a circular bioeconomy. Biobased products like these lamps helps demonstrate what is possible from renewable natural materials.

The transition to a circular bioeconomy will never be completed without taking people on the journey. Therefore, working with artists, designers, teachers or educators allows Scion to bring our innovative biomaterials and bioproducts to life.

Funders
New Zealand Trade and Enterprise, Strategic Science Investment Fund

Collaborators
David Trubridge

More information
https://tinyurl.com/4w9htjaj

> *I love the paua navicular pendant light they developed because it's so different – the light shines through and the colour works well. We always said that it's important to get a surface texture, as we didn't want it to have a glossy shine that made it look like plastic. Scion achieved a perfect rough texture – it works really well, it's quite different to our plywood lights and I like that.*
>
> David Trubridge, designer

When it comes to carbon, redwood can outshine radiata pine

Redwood occupies just one per cent of New Zealand's planted forests. A recent Scion computer modelling study predicted that redwood can sequester double the amount of carbon per hectare, compared with radiata pine in some parts of New Zealand.

New Zealand may not meet carbon reduction commitments this century unless it plants tree species that grow rapidly over long lifespans. Redwood is a candidate for permanent forests, but the species has specific environmental requirements that need to be characterised to provide forest growers with confidence around where best to plant this species.

Using data from Scion's Permanent Sample Plot database, maps (technically known as productivity surfaces) were developed that describe growth and carbon sequestration for both radiata pine and redwood over the entire country.

Spatial predictions of carbon sequestration were averaged to a regional level for both species. These regional predictions could form the basis for more accurate carbon look-up tables for this species as part of the New Zealand Emissions Trading Scheme.

By age 40, the estimated average carbon for redwood in some North Island areas exceeded that of radiata pine for stands growing at medium to high density. Predictions of carbon at age 40 for redwood were high within some Bay of Plenty and Waikato locations where they reached 4,000 tonnes CO_2/ha, nearly double that attained by radiata pine.

Radiata pine was superior for carbon storage on colder and drier sites – including almost all the South Island.

The redwood productivity surfaces have been used by commercial forest growers and landowners to plan planting and management regimes.

The New Zealand Redwood Company reported that the study stimulated many enquiries and a significant increase in advance nursery orders.

An increase in planting rates of well-managed redwood in the right locations can help New Zealand reach carbon emission reduction commitments, particularly between 2050-2100.

Funders
Strategic Science Investment Fund

Collaborators
Environmental Statistics Ltd

More information
https://tinyurl.com/4v494r8b

> *For a long time, few customers would order trees in advance of planting season. We are more than 12 months out from the 2023 planting season and already have orders for more trees than we have ever produced. We have limited capacity to supply more but I expect we will get orders for many more by the winter of 2023 and already have strong interest for 2024.*
>
> Simon Rapley, New Zealand Redwood Company

Dr Michael Watt, a principal scientist at Scion, led the study.

Helping to drive greater use of timber in the design and construction of all building projects as this example shows.

Timber Design Centre to create future where timber construction leads the way

Envisioning a future where timber is used more widely in mid to high rise buildings and contributes to carbon neutral targets, is an exciting opportunity in building design. The tools to make this a reality are now coming together with the Timber Design Centre, launched in March 2022.

The centre's work programme will be co-designed with a wide range of people involved in the building construction process including developers, designers, council planners and consenters, architects, engineers, builders, building owners, students and researchers.

The centre is an initiative between Te Uru Rākau – New Zealand Forest Service and a consortium comprising Scion, the Wood Processors and Manufacturers Association, New Zealand Timber Design Society and BRANZ.

The greater use of timber in construction provides an opportunity for the sector to support the Government's commitment to be carbon-neutral by 2050, while realising the broader economic and well-being benefits of including wood products in multi-storied buildings.

New Zealand's built environment accounts for about 20 per cent of the country's carbon footprint owing to the emission of greenhouse gasses over the full life cycle of buildings. This includes embodied emissions of building materials and products.

The time is right for New Zealand to have a dedicated timber knowledge centre that provides advice and guidance on timber construction. Over recent years, the interest in engineered timber construction has increased significantly and the Timber Design Centre will help ensure that clients, designers, contractors and authorities have all the information they need to build efficiently in timber.

Funders

Te Uru Rākau - New Zealand Forest Service

Collaborators

Wood Processers and Manufacturers Association of New Zealand, New Zealand Timber Design Society, BRANZ

More information

https://tinyurl.com/yc5a95p8

Specialty Wood Products Partnership comes to an end

The Specialty Wood Products Research Partnership (SWP) was a seven-year research programme that concluded in June 2022.

The aim of SWP was to develop a high-value specialty wood products industry from alternative species to radiata pine. The research programme focussed on Douglas-fir, eucalyptus and cypresses.

The SWP partnership developed investment cases for specialty forestry species and communicated these to potential forestry and wood processing investors and Te Uru Rākau. From these investment cases, the potential to increase earnings within a five-year timeframe (from 2027) is at least $80 million per annum.

The main drivers behind this programme were reducing sectoral risk, creating products for new markets and spurring regional development. Forestry relies heavily on radiata pine, which leaves the industry vulnerable to fluctuations in demand and at risk from a potentially devastating pest or disease outbreak.

The SWP partnership was developed to create a broader range of higher-value, better-performing timber products matched to specialty markets. A further aim was to encourage new forestry resources and processing in regions within economic range of processing plants and export ports.

By accurately matching tree species with growing site, linked to regional processing capacity and infrastructure, this programme has delivered valuable information to increase investor confidence in specialty timber species. Investment cases for specialty species, growing and processing catchments, have been identified in several regions and communicated to key stakeholders (including regional and central government), incentivising increasing planting of specialty tree species.

Screening for wood properties that meet or exceed technical expectations for stiffness, natural durability, stability and colour have led to development of high-value wood products. These products can create opportunities for a diversified wood products supply.

Key processing challenges have been overcome (e.g. segregation of poor-quality logs, growth strain, collapse/internal checking) or options have been identified to improve the economics of processing by at least 20 per cent.

Funders

Ministry for Business, Innovation and Employment, Forest Growers Levy Trust, New Zealand Farm Forestry Association, industry and Strategic Science Investment Fund

Collaborators

University of Canterbury, Marlborough Research Centre

In 2021, a field test was set up at Scion's Rotorua campus to test flat panel durability of the heartwood of Cupressus lusitanica, C. ovensii *and Douglas-fir with and without heat modification (at 230°C) along with a number of control samples.*

Scion has been a key research provider to the SWP programme for the last seven years in areas including timber durability, engineered wood product performance, tree breeding and pest and disease management. This has been a strong relationship between both FGR and the industry partners.

Marco Lausberg, SWP Programme Manager, Forest Growers Research Ltd

Machine learning whispers tissue culture secrets

Planting one billion trees starts with producing a billion trees. Advanced tissue culture techniques help us multiply up the best trees by the tens of thousands.

Exotic forestry species and indigenous tree species need to be produced at scale if New Zealand is to meet its zero carbon commitments. Ensuring a high rate of germination success is crucial to reduce plant costs for landowners and improve the efficiency of propagation.

Using next generation technology including machine learning tools for germination success prediction, Scion is transforming the way somatic embryos are matured, selected and germinated. Somatic embryos are formed from plant cells that are not normally involved in the development of embryos, i.e. ordinary plant tissue.

Machine learning is a type of artificial intelligence that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so. Machine learning algorithms use historical data as input to predict new output values.

An algorithm developed by Scion quantifies the morphological (shape) characteristics of embryos and uses these measurements to predict germination success. This work has helped advance scientific knowledge of radiata pine embryo development.

Typically, laboratory technicians select embryos based on observed morphological features that affect germination success. The developed algorithm is a more precise predictor of germination success since it automatically measures significantly more morphological features than can be detected by the human eye. The algorithm was tested on nearly 500 radiata pine somatic embryos and achieved a high degree of prediction of germination success.

Based on the machine learning workflow, embryos that score below a certain threshold can be eliminated from the production process and only the most viable embryos allowed to continue.

These insights will ultimately be embedded as part of a new system that will be able to segregate embryos without human intervention. The aim is propagation of best tree genotypes at scale and at a competitive cost.

This work is part of the seven-year 'Tissue Culture for 21st Century Forests' programme funded by industry and MBIE. The programme aims to make dramatic improvements in the delivery of genetic gain and future biotechnology developments into tree stock.

Funders

Forest Growers Levy Trust, Ministry of Business, Innovation and Employment, Strategic Science Investment Fund

Collaborators

Georgia Tech University (USA), Natural Resources Institute Finland (Luke)

Automatic annotation of somatic embryo using deep learning.

> *What was initially seen as a small part of the tissue culture programme at Forest Growers Research has become a very significant and important outcome and of itself has the potential to increase precision and productivity for existing processes as well as the new process we are striving to develop.*
>
> Russell Burton, Programme Manager for the Tissue Culture for 21st Century Forests programme

Timber Engineering Laboratory stands the test of time

For over 70 years, Scion's Timber Engineering Laboratory has been trusted to deliver materials, product, technology innovation and performance testing for the construction industry. The work has provided the platform for the New Zealand timber industry and has opened the way for radiata pine to be exported for overseas use.

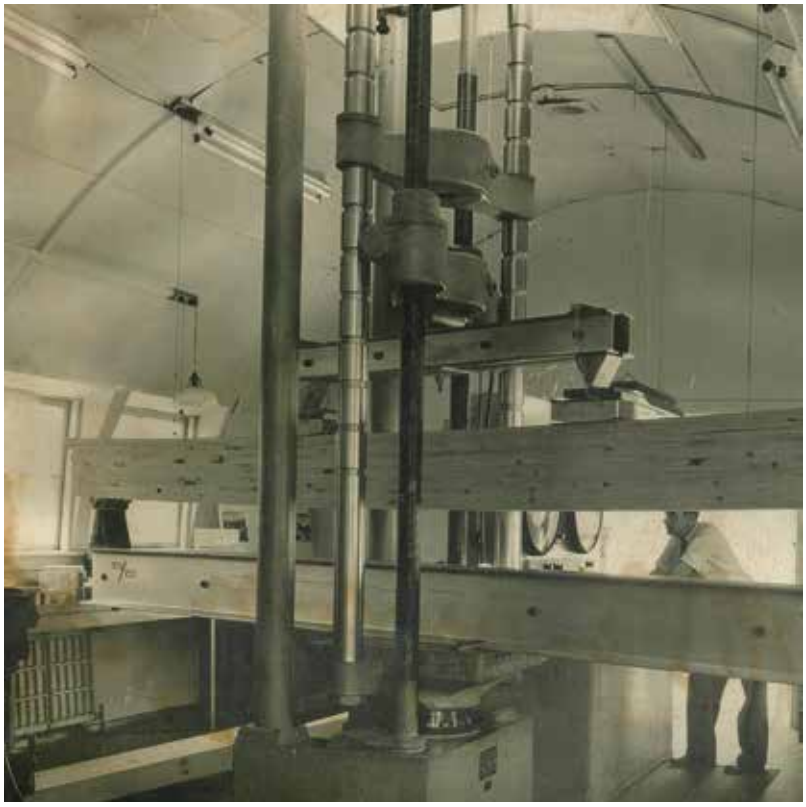
The original laboratory was in one of the ex-Army Quonset huts with the roof lifted to fit the test machine. The Baldwin test machine, purchased in 1955, still does the heavy lifting for the timber engineering lab - albeit with a control system upgrade to computer control.

Before a timber product or fastening system can be used in construction in New Zealand it is likely to have been tested here first. Scion's timber engineering staff have been a trusted source of technical information for New Zealand timber and construction standards. Expertise has been provided on the design of engineered timber structures, domestic housing, grading methods, glulam, finger-jointed timber, fibre cement, plywood, structural jointing and fastening systems.

The primary outcome for Scion's timber engineering clients is that our independent test results enable them to enter the market with high confidence.

Mechanical testing of timber properties in New Zealand began in the 1930s with most of the testing taking place at the University of Canterbury and Auckland University. Testing began in Rotorua in the early 1950s.

By and large, the specialised testing machinery in use today has stood the test of time. An Avery-Denison impact tester built in Leeds England has the words 'War Issue' stamped on it indicating that the machine even pre-dates the establishment of the Forest Experiment Station in Rotorua 75 years ago.



1955 Baldwin universal test machine in the original Quonset huts, with the laminated beam loaded via the window. The Baldwin is still operating.

Scion's role in verifying high-performing wood products helps ease the way for wood construction, which ultimately aligns with New Zealand's Wood First policies.

Funders
Industry and Scion

Gamma Bracing Technologies Ltd has carried out many P21 structural bracing tests over the past seven years at the Scion test facility in Rotorua. The testing facility is top quality and the team are very professional and great to deal with. Their service is excellent and competitive, with good advice and prompt reporting that is highly respected within the building industry.

Geoff Tully, Director, Gamma Bracing Technologies Ltd

Slash pile probes seek the heat

Spontaneous ignition of a forestry slash pile fire can cost forest companies up to $200,000 or more, so the development of a probe tool to monitor temperatures before piles catch fire is a game changer.

Skid sites are locations within a forest where felled trees are processed before being loaded onto trucks. Processing tree stems into logs generates woody debris (sawdust, broken branches and logs, needles and cut-off ends of logs) at the skid site. To keep the site tidy, this material is pushed into piles or over the edge of a slope.

Usually these piles decompose over time. Occasionally, decomposition results in the debris pile reaching very high temperatures and spontaneously igniting.

Concerned about a repeat of slash pile fires, and with no way of knowing which piles were hot, Wenita Forest Products Ltd (an Otago based timber producer) sought assistance from Scion.

Scion's Rural Fire Research Team and inFact Ltd developed a slash pile temperature monitoring system that can send real-time temperatures from skid sites to forest managers.

Temperature probes are pushed into the slash piles and connected to the satellite transmitter. The slash pile temperature can be monitored from a smart phone or computer.

Slash pile probes were deployed in Wenita's forests to 15 slash pile sites and the temperatures were monitored by Wenita staff for the risk of spontaneous combustion. The probes detected six very hot piles with the hottest internal pile temperature in excess of 90 degrees C with a high risk of spontaneous combustion. These high-risk piles were then opened and cooled safely.

Following the successful trial with Wenita, the Scion team is investigating opportunities to work with a commercial partner to develop the system into a market-ready product.

The economic, environmental and social impacts of wildfires are huge and any technology that reduces the risk is highly beneficial.

Funders
Ministry of Business, Innovation and Employment

Collaborators
Wenita Forest Products Ltd, InFact Ltd

More information
https://tinyurl.com/mss33ysa

The probes have been extremely useful and they're easy to use.

These probes mean the suspicious slash piles can be monitored anytime from almost anywhere, which is brilliant. We don't have to drive out to check the piles all the time.

John Kerr, Forester at Wenita

Speeding up propagation and establishment of indigenous trees

The commercial scale production and establishment of indigenous tree species is becoming a reality as tree species propagated in small paper pots survive and thrive. However, not all sites are favourable for tree establishment so it is critical to know if paper pots can be used to plant trees in harsher environments.

The goal of the Government to establish 300,000 ha of indigenous forests by 2035 is a contribution to the global effort to slow the rate of climate change, increase our forested areas and restore native biodiversity.

To meet these aspirations, the pressure is on nurseries to increase their production capacity and deliver high-quality plant-stock into the marketplace that can be relied on for cost-effective establishment in a range of growing conditions.

Funded by Te Uru Rākau – New Zealand Forest Service and in partnership with the Bay of Plenty Regional Council, Tipu Wai Trust and Treeline Native Nursery, Scion helped to establish six trials around Rotorua to determine if container type affected the survival of over 30 indigenous forest species.

The sites, established between 2020 and 2021, were of varying quality so that our scientists could determine the impact container type has when conditions are variable. By doing so, we could be confident in our support for container types and volumes that can help overcome the consequences, even where site quality is poor.

Tree survival in the industry standard polythene planter bags (1200 cm³ PB2) was found to provide no additional advantage to survival when compared to the smaller and much more sustainable 700 ml paper pot. In terms of plant survival, PB2 bags outperformed the paper pots on only the poorest establishment sites.

There are several economic benefits to reducing container size, such as reduced potting media costs, fewer trays and space within the nursery, as well as more efficient transportation and more efficient planting. Also, use of paper pots brings an environmental benefit by reducing plastic waste.

Using Scion's recommendations, nurseries have the confidence that 12 common species, grown in 700 ml paper pots should establish well under a range of growing sites. Even smaller pots were equally successful for some species (5 cm diameter paper pots). Partners will benefit from easier, faster, and cheaper planting. The country also benefits as more trees are established, enhancing indigenous biodiversity and increasing carbon sequestration.

Funders
Te Uru Rākau – New Zealand Forest Service

Collaborators
Bay of Plenty Regional Council, Tipu Wai Trust and Treeline Native Nursery, Ngāti Whare

An akeake seedling with a robust root structure grown using paper pot technologies.

Early success in biological control of giant willow aphid

A biological control agent for giant willow aphid that has been released in New Zealand is showing excellent results at the programme end.

Giant willow aphid (*Tuberolachnus salignus*), or GWA, was first reported in New Zealand in 2013. The aphids feed on willow sap, damaging and occasionally killing the trees. They also secrete copious amounts of honeydew, which attracts insects such as honeybees and pest wasps. Honey made from the honeydew is granular and cannot be extracted from the comb, and bees are at risk of being killed by the wasps.

Scion scientists' discovery of a parasitoid wasp in California that preys on GWA brought the possibility of management using biological control (natural enemies) one step closer.

Following three years of containment and host specificity testing at Scion together with public consultation, releases of the parasitoid wasp occurred in autumn of 2020 and 2021 by Scion, project partners, and concerned property and business owners.

Excellent coverage of New Zealand was accomplished, and after the first year of releases extensive surveys indicated that the parasitoid had established widely and was multiplying and spreading as much as 100 km per year.

The early impact of the wasp on GWA populations was monitored at five North Island sites following the initial releases. The proportion of aphid-free trees at these sites increased from 30 per cent at initial release to 86 per cent two years later.

The parasitoid wasp is continuing to be found in new areas and GWA becoming more difficult to locate. This work directly benefits beekeepers, river managers, soil conservationists and farmers. Indirectly, the general public will also benefit, for example, from riverbanks remaining less prone to erosion, fewer pest wasps and less sticky, sooty mould in public spaces.

Funders
Ministry for Primary Industries, Strategic Science Investment Fund and many co-funders

Collaborators
> 20 organisations in New Zealand and oversees representing industry, regional councils and researchers

More information
https://tinyurl.com/2p8un4d7

I am hugely impressed with the work and dedication of Stephanie and her team at Scion for finding and successfully releasing a biological control for GWA. As a farmer relying on willows to secure our hill country, as the then Chair of the NZ Poplar & Willow Research Trust and in more recent times the Chair of Apiculture NZ, the GWA was a real concern on many fronts. So to now have a proven parasitoid wasp preying on these damaging pests is extremely welcome.

Bruce Wills, Farmer, prior Chair of the NZ Poplar & Willow Research Trust, Chair of Apiculture NZ

Parasitoid wasps and a ladybird beetle feeding on honeydew under a giant willow aphid colony.

Freshwater ecosystem services

Freshwater ecosystem services are benefits provided by waterbodies to people and the environment. Working with the Waikato Regional Council, a team of Scion scientists, in collaboration with other research providers, have been assessing freshwater ecosystem services in the Waikato region. The services include drinking water, agricultural use, power generation and recreation to name a few.

Values associated with these services contribute to human well-being but are not fully accounted for in monetary terms. Sometimes, financial returns are the main driver of land use decisions, which in tune could limit the range of these services.

The aim of this long-term project, which began in 2015, is to ensure that freshwater ecosystem services associated with waterbodies in the region are recognised, sustained and enhanced for their contributions to human well-being.

The first two phases of this project involved an assessment of a sample of waterbodies - rivers, streams, lakes and wetlands and geothermal reservoirs across the region to quantify ecosystem services as well as their values. In Phase 3, more waterbodies in the Ohinemuri catchment were assessed. In Phase 4, the impacts of land use change on water availability, an ecosystem service, was evaluated in a large section of the Waikato River catchment over a 17-year period. The study shows how land use change could be linked to changes in ecosystem services, specifically, water flow and yield and water for hydropower generation.

Knowledge from this project contributes to the council's state of the environment reporting on what the community enjoys from these waterbodies, what services are being lost or at risk of being lost. This type of information could guide policies on protection, restoration and investment on natural capital in the region. There is also potential for this information to inform the implementation of the Government's One Billion Trees initiative.

Funders
Ministry of Business, Innovation and Employment, Waikato Regional Council

Collaborators
Waikato Regional Council

Lack of data and knowledge can undermine stewardship of natural resources. For example, it is difficult to account for the range of benefits that waterbodies provide. Lack of knowledge for some environmental pressure points could cause poorly designed policies or irreversible loss of some benefits. But now, stewardship of our waterbodies can be focused because this project has contributed valuable information, a clear regional picture of freshwater resources and the range of benefits they provide – what we have and value, what we are losing or at risk of losing.

Femi Olubode, Economist, Waikato Regional Council

Extreme Fire Programme phase one wraps up

Five years of Scion's extreme fire research came to an end in December 2021, changing the way knowledge is shared for quick response, discovering the underlying theory behind extreme fire spread, developing tools for firefighters and a fire for land management training course. The programme built on Scion's 30-year fire research programme and deep knowledge of forest ecology, forest management and atmospheric science.

In 2016, Scion warned that extreme fire was coming to New Zealand. That warning proved correct. Like many parts of the world, we have experienced extreme fire over the past five years. The annual average direct impact of rural fire on New Zealand's economy is over $67 million, with indirect costs estimated at two to three times this.

The programme has given us a new fire spread theory for predicting and reducing the extreme fire risk, decision support tools for response, new sensors and firefighting tools for mitigating extreme fire and Te Tira Whakamātaki (Māori Biosecurity Network) led a theme that produced targeted protection plans for indigenous forests.

National and international collaborations with more than 10 research and fire-fighting entities were established during the programme and were critical to its success.

Two research burns conducted in Canterbury were used to test the new fire spread theory in the field alongside fire fighters with researchers observing the fire spread and discussing preliminary data in the field.

Uptake of the knowledge, technologies, models and tools resulting from the programme was swift. This includes the NZ Fire Registry which is an integrated fire detection, fire growth and smoke prediction tool that has resulted in improved fire management responses, better public health warnings and evacuations.

New fire behaviour knowledge has been incorporated into firefighter training, which increases firefighter safety.

New sensor and firefighting technologies were taken up by the forestry sector. Database tools for monitoring fire danger trends have become an essential part of day-to-day fire management decision-making.

Funders
Ministry of Business, Innovation and Employment and industry

Collaborators
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, Lincoln University, The Nature Conservancy

More information
https://tinyurl.com/5f3jcme6

Monitoring an experimental burn of gorse at Rakaia Gorge in March 2020.

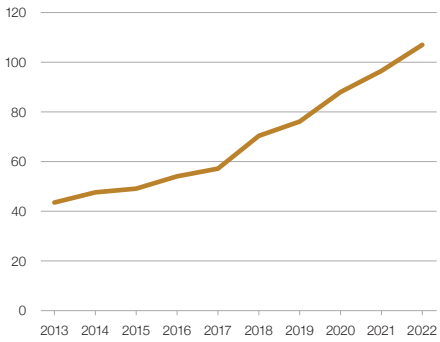
Sharing our work

Science papers and quality[1]

201 Peer-reviewed journal articles

107.09 H-index factor (5-year rolling average)

4.56 Journal impact factor for 2022 (no 5-year rolling average available)



Collaborations

146 Publication collaborations with international research institutions[2]

91 Publication collaborations with other New Zealand institutions[2]

16 Partnerships with Māori

6 National Science Challenges

Tech transfer

288 Commissioned reports to users

208 Peer-reviewed articles

176 Presentations on technical information and research results

141 Publications on technical information and research results

Communication

208 Media mentions

1,551 Subscribers to *Scion Connections*

13,429 Followers on our social media channels

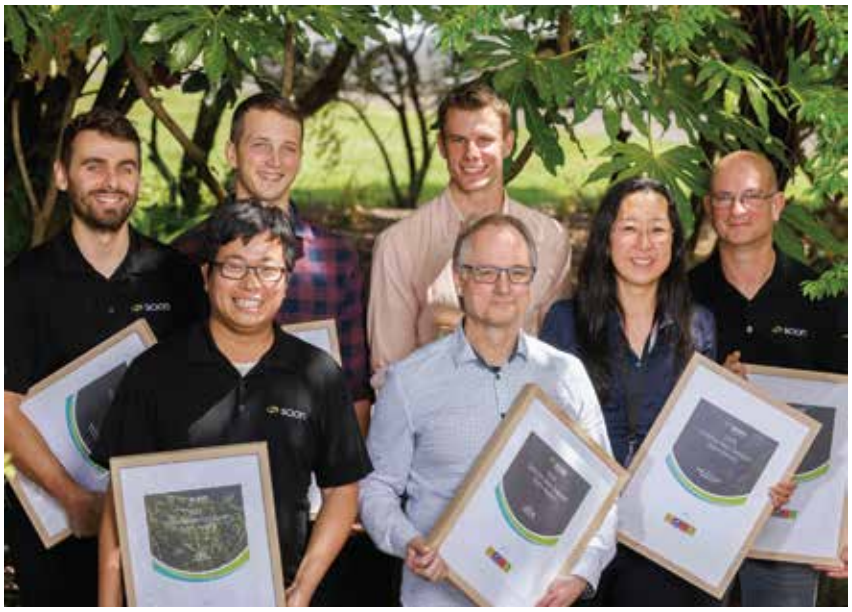
14,827 Views of Scion YouTube videos

42,099 Scion website page views

Notes: [1] Calendar year Jan-Dec 2021. [2] Comprises peer-reviewed articles, technical publications and contract reports.

Celebrating our people

Science New Zealand 2021 Awards



Scion recipients of the Team Award. L-R: *Dr Maxime Barbier, Dr Yi Chen, Karl Molving, Rob Whitton, Dr Stefan Hill, Dr Marie Joo Le Guen and Sean Taylor.*

These awards celebrate the cutting-edge work of New Zealand's Crown Research Institutes. The 24 awardees across three categories were announced and applauded at a virtual event in December 2021. Scion's awardees were:

Team Award – AgriSea NZ/Scion. Scion and whānau-owned business AgriSea joined forces to produce high-value nanocellulose products from seaweed. Scion's wood pulping expertise and AgriSea's 25 years in seaweed processing resulted in a novel seaweed hydrogel.

Applications include wound care, cosmetics, drug delivery, performance biocomposites and biomedical engineering. AgriSea is now upgrading its factory in Paeroa to include an industrial nanocellulose production plant. It's a great step into the global nanocellulose market, which is forecast to be worth US$783 million by 2025.

Team members: Scion recipients named above and AgriSea - Clare and Tane Bradley, Dr Melodie Lindsay.

https://tinyurl.com/mry74tw8

Early Career Researcher Award – Dr Qiliang Fu. Dr Qiliang Fu can do wonders with wood using nanotechnologies to modify wood's nanostructure. He is among the leaders worldwide in developing this field. His original research on transparent wood and wood film, novel designs and functionalities of wood-based materials has led to breakthroughs for many industrial applications.

Transparent and flexible wood film could replace petroleum-based plastics and reduce our reliance on non-degradable polymers in our daily life.

https://tinyurl.com/5appnsxj

Individual/Lifetime Achievement Award – Dr Lloyd Donaldson. Dr Lloyd Donaldson is an internationally recognised expert in capturing images of the cell structure of plants and plant anatomy. He has pioneered techniques in fluorescence imaging of wood and biomaterials. His microscopy skills have not only provided huge insights into the structure of plants, but his methods are part of the toolbox that researchers all over the world use.

https://tinyurl.com/2p8mp9cf

Accolades

Wood and fibre scientist **Dr Qiliang Fu** received the Ron Cockroft Award at the International Research Conference on Wood.

Dr Rebecca McDougal was a finalist in the 2021 Biosecurity Awards in the Bioprotection Aotearoa Science Award category. A member of Scion's Pathogen Diagnostics and Collections Team, Rebecca was nominated by the Forest Owners Association and the Forest Industry's Biosecurity Committee for her outstanding contribution to the protection of the plantation forest estate.

Scion and AgriSea NZ Seaweed Ltd are finalists in the 2021 Kudos Awards, which are regional science awards within the greater Waikato Region, including the Bay of Plenty. These awards will be announced later in 2022. Scion and AgriSea created nanocellulose from seaweeds and kelp, opening up a sustainable, high-value side-line using waste from AgriSea's core business.

The collaborative **Myrtle Rust Team**, which includes Scion's myrtle rust experts, were finalists in Federated Farmers 2022 Primary Industries New Zealand Awards – Guardianship and Conservation (Kaitiakitanga) Award. The team consists of 70 researchers, iwi, government and industry and was formed when myrtle rust was discovered in New Zealand in 2017. This is an unprecedented collaboration as a response to a biosecurity threat.

Dr Brian Richardson, Principal Scientist, received the Superior Paper Award from the American Society of Agricultural and Biological Engineers for the paper: Richardson, B, Rolando, CA & Kimberley, M 2020, 'Quantifying spray deposition from a UAV configured for spot spray applications to individual plants', *Transactions of the ASABE*, vol. 63, no. 4, pp. 1049-1058. https://doi.org/10.13031/trans.13724

2021 Scion Employee Recognition Awards

These annual awards were held on 11 November 2021 as a combined physical and virtual event in keeping with COVID-19 settings.

Roger Newman Award for Science or Engineering Excellence - Doug Gaunt

Industry/Stakeholder/External Customer Engagement Award (two awards made) - Stephanie Sopow and
CVC Vaccine Biotech Team: Alyesha Candy, Dr David Hooks, Dr Christophe Collet, Dr Gareth Lloyd-Jones, Dr Hilary Corkran, Dr Mark West, Dr Maxime Barbier, Dr Peter Mabbitt, Regis Risani, Dr Sumanth Ranganathan, Dr Taryn Saggese, Yeganeh Eslami

Enabling Science Award - Dr Dagmar Cheeseman

Recognition of Contribution to Māori Award - Dr Elizabeth Dunningham

Recognition of Publication Success Award - Loretta Garrett, Dr Michael Watt

Stretchy Science/Smart Ideas Award - Dr Katharine Challis

Scion Values Awards
- **Collaboration** - Dr Muthasim Fahmy
- **Excellence** - Dr Marie Joo Le Guen
- **Ingenuity** - Dr Richard Parker
- **Manaakitanga** - Rose O'Brien-Gardner
- **Health and Safety Award** - Eva Gaugler

People and culture

Scion is committed to be a good employer and promoter of equal employment opportunities.

Our people and performance practices and organisational values help the good employer principles to thrive by building a culture and working environment that supports empowerment, diversity, equity, inclusion, innovation and accountability.

We fulfill the good employer obligations through our Board Good Employer Policy and our Equal Employment Policy, along with our management policies, programmes and practices. How we delivered during 2021-22 is summarised below.

Staff, executives and directors marked the first of Scion's 75th anniversary activities with a celebratory morning tea.

Leadership, accountability and culture. Following establishment of our new science operating model last year, the revised corporate function came into effect in August 2021.

An Active Leadership Programme commenced in August 2021 focusing on practical management and leadership skills such as delegation, difficult conversations and personal organisation. Feedback was extremely positive and ongoing participation remained high.

Staff engagement is measured annually through our Pulse survey. Results from the 2021 survey saw a small dip in overall favourability to 62% (down 1%) from 2020. In response, the Active Leadership Programme continued, and the CEO started a weekly live video to all staff.

Recruitment and selection. Our recruitment and selection practices ensure that we recruit the best person for the job. Discriminatory terms and bias are excluded from our recruitment practices, and our interview panels follow the principles of the Human Rights Act 1993.

Recruitment continued to be affected by the COVID-19 pandemic and the Government's immigration response resulting in challenges for potential overseas candidates. The biggest impact was the length of time to get a new employee into New Zealand.

We appointed our first Māori Emeritus Researcher who will mentor the growing number of Māori early career researchers at Scion.

We were involved with the Te Ara Putaiao group in formulating a bid for MBIE's Equity, Diversity and Inclusion Capability Fund to host Māori graduates and students and help increase the pipeline of Māori researchers.

During summer, we engaged 28 university students who provided excellent feedback at the end of the programme.

Employee development, promotion and exit. Some 51 staff applied for career progression resulting in 37 promotions.

The technologist career pathway was adopted last year to enable those who focused on applied science to progress their career as a technologist. During 2021-22, three staff who had not pursued the traditional scientist career path were formally recognised on this new path.

Turnover of permanent appointed employees was 17.6%, a sharp increase of 5.1% in turnover from the previous year.

Exit survey results were positive overall, with 84% recommending Scion as an employer (an increase of 6% from the previous year). Primary reasons given for leaving were career alignment and remuneration.

Flexibility and work design. Flexible 'ways of working' options were explored in depth with staff through focus groups and roadshows. This work resulted in a flexible work programme, starting 1 July 2022, where a nine-day fortnight and regular working from home options will be trialled for six months.

Rotorua staff were encouraged to make the most of the neighbouring Whakarewarewa Forest during breaks, and the Rotorua campus remained dog friendly.

Remuneration, recognition and conditions. Remuneration is based on job bands and remuneration ranges are sourced from external market surveys produced by Korn Ferry Hay Group. Benchmarking of our internal position and salary data is done against the "All

of Organisations Public Sector" and "CRI-R&D job family" surveys to accurately allow us to set a competitive pay position for Scion. Annually we work with the PSA Union and our Board of Directors to set the remuneration budget.

Collective negotiations for 2021-22 were conducted within the Public Service Commission's guidance, concluding with a ratified settlement.

Scion provided supportive paid sick leave to all employees. We recognised the impact of the pandemic on individuals and their families and had 98 staff receive sick and domestic leave beyond the legislative allowance. Scion also maintained an income protection and life insurance policy available to all permanent staff.

The 2021-22 year saw an overall reduction in Gender Pay Gap (GPG) to 11.7%, down from 12.4% (in 2020) and 17.1% (in 2017). Within pay bands the average GPG was 0.9%.

Our annual Staff Recognition Awards were successfully held to celebrate the outstanding contributions Scion people made to the organisation.

Harassment and bullying prevention. Scion provides staff with the necessary skills to address relationship issues. Policies are in place to deal with problem resolution and challenging behaviour. Facilitated processes and discussions continued to positively resolve interpersonal issues and improved working relationships. No formal complaints of bullying were received.

Scion staff were able to access EAP for support with workplace and personal matters.

Safe and healthy environment. Scion continued to promote staff well-being and improve the health and safety environment, such as taking a team approach to collaboratively manage identified risks. We updated our emergency response to align with CIMS and provided training to the executive management team.

Role descriptions of laboratory managers, health and safety representatives and the high hazard team were reviewed resulting in clear responsibilities and time allocation for those roles.

Training was provided in outdoor first aid, mental health first aid and de-escalation of violence in the workplace.

The year ended with no notifiable injuries and no lost-time injuries. There were 36 incidents and 64 near misses reported, compared with 51 incidents and 90 near misses reported in 2020-21.

A company-paid influenza vaccination was taken up by 187 staff. Biennial occupational health checks were completed for 200 laboratory and field staff.

A new sensitive form was added to our risk management system for reporting employment concerns of a sensitive nature.

COVID-19. We are proud of our response to COVID-19, having actively supported our international staff on immigration issues by engaging licensed immigration consultants to hold seminars as well as reimbursing staff for unforeseen costs associated with their immigration.

For the wider workforce, we actively checked in on staff members who lived alone during lockdown periods, incentivised vaccinations, provided RATs and communicated clearly on requirements at each change in alert levels or traffic light settings.

Workplace profile at 30 June 2022

Total staff	334 total permanent employees (excludes 26 fixed-term, student, post-doc and casual employees)
	52% male and 48% female
FTEs	316.33 total full time equivalent (FTE) permanent employees (excludes 13.9 fixed-term, student, post-doc and casual employees)
Māori	7.19%
Pacific Islander	0.06%
Nationality	• New Zealand - 61% • Europe & USA - 24% • Asia – 9% • Middle Eastern & Latin America – 2% • Other or not specified – 4%

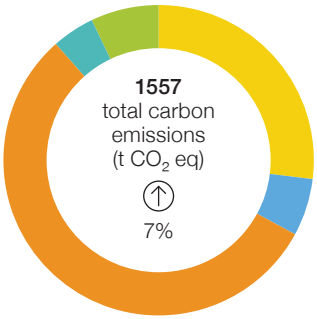
Environmental footprint

Scion's carbon emissions* for 2021-22 were 98 t CO_2eq higher than last year. For the first time, we included the loss of refrigerant gas in our emissions and that largely explains the increase.

In the year ahead, 2022-23, we will be working with an external company to calculate our emissions in accordance with ISO 14064-3 and will have our emissions independently verified.

Use of natural gas at our Rotorua site decreased by 7 t CO_2eq from 2020-21 but remained the highest source of our emissions at 865 t CO_2eq (56%).

Relative CO_2 emissions from Scion activities for 2021-22



		Change from 2020-21
†Electricity	420	↑ 6%
†Refridgerant	93	○ Not reported last year
†Gas	865	↓ 1%
*Fuel	70	↓ 9%
*Flights	109	↑ 7%

†Rotorua only *All of Scion

We initiated a detailed assessment of the boiler needs at our Rotorua site with WoodBeca. This work continues towards our aim to phase out the use of natural gas at this site within the next three years. Our plan to upgrade the main chiller system commenced, which will increase efficiency and allow the move to a lower GWP (global warming potential) refrigerant. These initiatives are co-funded with support through EECA.

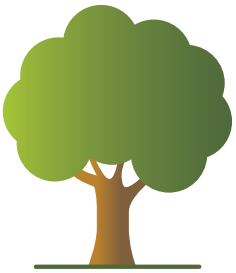
The volume of waste picked up from bins during the year was 200 m³ less than during 2020-21. Our waste diversion activities resulted in 2.1 t of organic waste and 6.2 t of scrap metal being diverted from landfill. The organic waste included 1.4 t of food waste going to our vermicompost system on site and 0.7 t of used coffee grounds taken home by staff for composting.

Our recycling programme at the Rotorua site continued with 20 m³ of milk bottles, glass bottles and steel cans picked up by a waste management company for recycling. Cardboard and paper recycling went directly to OjiFS for fibre recovery at the Kinleith and Penrose mills. E-waste was sent to the local E-waste recycling centre. Used alkaline, lead acid and LiPo batteries, amounting to 452 kg, were sent for recycling. Old mobile phones were also collected for recycling through the ReMobile scheme.

Staff actions contributed to helping reduce environmental impact. Initiatives included cleaning up along the Puarenga Stream that bounds our Rotorua site and tree planting by Christchurch staff during the year.

Income from recycling metal, broken science equipment and 12,935 aluminium cans supplied by Rotorua staff (and from roadside clean-ups) this year was used to purchase 92 indigenous trees for restoration work through the Trees that Count and Million Meter Stream programmes. These programmes provide funds to trusts around New Zealand for purchasing and planting out the trees.

Trees donated



116
indigenous trees donated for community planting projects since December 2019

Trees purchased with proceeds from aluminium can recycling

Scion started its "Cans for Trees" initiative in 2020 and since then has raised funds for 116 indigenous trees.

We also donated $60 to the Garden to Table Trust via the Terracycle Glad Recycling programme. In the process, we diverted 61 kg of Glad products that would otherwise have gone to landfill.

**The emissions reported for the 2021-22 financial year include electricity and natural gas use at our main site, fuel use for our fleet, air travel for all business-related activities (excluding radiative forcing) and refrigerant loss. Emissions were calculated using the ACE carbon calculator from Catalyst NZ (now Tadpole).*

Corporate governance

Scion's Board of Directors is appointed by its Shareholding Ministers, the Minister of Research, Science and Innovation and the Minister of Finance. All members of the Board are independent. The responsibility of the Board is to guide and monitor the business of Scion and its subsidiaries including:

- reviewing and approving Scion's strategy and Statement of Corporate Intent;
- adopting policies of corporate conduct (including risk management and delegations of authority) and ensuring that systems and procedures are in place to carry out those policies;
- adopting annual operating and capital plans, and budgets;
- monitoring performance against key objectives and budgets on a monthly basis;
- ensuring Scion proactively meets all health and safety requirements;
- evaluating the performance of the Chief Executive; and
- reviewing and improving the effectiveness of the Board.

The Board operates in accordance with Scion's Constitution. It has up to seven directors who meet up to 11 times over the year either in person or by video conference. The Board may retain independent advisers, including independent legal counsel or other experts, as it deems appropriate.

The Board has three standing committees: the Audit and Risk Committee, the People and Culture Committee and the Master Plan Committee.

The function of the Audit and Risk Committee is to assist the Board in discharging its responsibilities regarding financial reporting, regulatory conformance and matters of risk management. The committee is the liaison point for internal and external auditors, assesses the performance of financial management (the investment cases for major items of capital expenditure), reviews audit findings, the annual financial statements and interim financial information, and has oversight of the development and review of policies to ensure compliance with statutory responsibilities.

The function of the People and Culture Committee is to assist the Board in the establishment and regular review of remuneration and organisation policies and practices, and to assist the Board in discharging its responsibilities relating to the appointment, remuneration setting and review of Scion's Chief Executive. The committee also approves the appointment and remuneration of executives and inputs into and monitors achievement of the annual Health and Safety Plan.

The objective of the Master Plan Committee is to provide master planning oversight to the design, build and operations of facilities and significant capital investments across all locations and make recommendations to the Board. All discussions are made with full consideration to mana whenua.

Each standing committee comprises no less than three members of the Board, appointed by the Board from time to time; and meets at least twice annually and intersessionally as required. While the Chair of the Board is an ex-officio member of each committee and has full voting rights, s/he may not be Chair of the Audit and Risk Committee.

All discussions are to be made with full consideration to mana whenua. For the Rotorua campus those principles have been set out in the kawenata between Ngā Hapū e Toru and Scion which was signed in August 2022.

All Directors are entitled to attend all committee meetings. Each committee establishes annual work plans and undertakes an annual review of its objectives and responsibilities and its terms of reference. Each committee also makes regular reports to the Board.

The Board's risk management policy and procedures involve formal reporting by management of the most significant risks Scion is exposed to, and the Board regularly monitors management of those risks. There is also regular monitoring and reporting on progress in meeting recommendations made by external auditors.

Directors' report

Principal activities. New Zealand Forest Research Institute Limited (trading as Scion) is a company registered under the Companies Act 1993. Our principal activity is to conduct research in accordance with the purpose and principles specified in Sections 4 and 5 of the Crown Research Institutes Act 1992 (the Act). Scion has met all the obligations under the Act for the year ended 30 June 2022.

Scion, a Crown Research Institute, is a science and technology company delivering solutions to both commercial and government clients. While the principal research campus is in Rotorua, there are also offices in Christchurch and Wellington.

Our core purpose is to drive innovation and growth from New Zealand's forestry, wood product and wood-derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

Scion's strategic plan is set out in the Scion Strategy to 2030. The strategy provides a long-term direction and programme of work to deliver Scion's core purpose and deliver great outcomes for New Zealand nationally and regionally. The strategic goal is "Helping New Zealand transition to a circular bioeconomy", and Scion will do this through three research impact areas: Forests and landscapes; Forest to timber products; and Forests to biobased products.

Scion's *Statement of Corporate Intent 2022-2025* sets out our goals for each research impact area and outlines our focus on:

- Climate change response;
- Circular bioeconomy;
- Partnering with Māori;
- Regional economic development; and
- Enabling scale up for new bioeconomy enterprises.

Our work is delivered in the context of our operating environment, supporting key government priorities and COVID-19 recovery while working within the current science system.

Scion has two wholly owned subsidiaries (Te Papa Tipu Properties Limited and Sala Street Holdings Limited) and has a 14.56% shareholding in Biopolymer Network Limited.

Te Papa Tipu Properties Limited owns the Group's land assets.

Sala Street Holdings Limited is currently a dormant holding company, its investment Terax 2013 Limited having been liquidated during the year.

Biopolymer Network Limited's purpose is to create technologies for advancing the utilisation of renewable biobased materials in industrial applications. Scion does not have director representation nor voting rights.

Summary of Group financial results to 30 June 2022

	2022 $000	2021 $000
Operating revenue	58,716	61,083
Profit/(loss) before tax	510	6,590
Taxation expense	(87)	(1,905)
Profit/(loss) after tax	423	4,685
Net comprehensive income attributable to shareholders	880	4,870
Equity		
Issued and paid up capital	17,516	17,516
Retained earnings	35,372	34,949
Reserve	1,039	582
Total equity	53,927	53,047

The state of the Company's affairs. A commentary on the year's performance is outlined in the Chair's and Chief Executive's Report (page 6), and in the opinion of the Directors, the state of the company's affairs continues to be satisfactory.

Dividend. No dividend was recommended for the year ended 30 June 2022 (2021: $0k).

Donations. No donations were made during the year (2021: $0k).

Executive remuneration. Executive remuneration is managed within the terms and conditions of the Executive Remuneration Policy summarised below. This policy sets out remuneration elements and design principles informing the remuneration arrangements for executive management. Remuneration practice throughout Scion is transparent in the way in which it is determined and administered and will always conform to sound corporate governance principles.

Governance. The People and Culture Committee oversees the application and implementation of the executive remuneration policy.

Basic pay principles. Pay principles offer clarity and guide decisions around executive remuneration that ensure fair, competitive and appropriate pay for the markets in which Scion operates. Scion's executive pay principles aim:

- To pay executives at a level commensurate with their contribution to Scion and appropriately based on skill, experience and performance achieved.
- The level of remuneration paid is considered appropriate for motivation and retention of the calibre of executive required to ensure the successful formation and delivery of Scion's strategy and management of the environments in which it operates.
- Executive remuneration is set having regard to typical pay levels across organisations of a similar size along with public sector guidance.
- When reviewing remuneration, the committee considers all relevant factors, including:
  - Prevailing market and economic conditions;
  - Organisational performance and individual experience and contribution;
  - Internal equity and pay parity;
  - Accurate benchmark position and job size; and
  - Market benchmark survey results.

Executive pay position and structure.

- Scion participates in industry and profession-based market salary surveys using external remuneration consultants to understand what the market is paying for roles like ours.
- Executive remuneration consists of base salary, superannuation payments and benefits (being KiwiSaver contributions), which makes up total remuneration.
- The Base Salary and Total Remuneration Position in Range of individual executives are reviewed against the All Organisations Base Salary Market Median Line and the All Organisations Total Remuneration Market Median Line.
- Scion aims to position executive remuneration at the appropriate Position in Range (PIR) of the relevant All Organisations Market Median Line. Experienced executives are positioned at 96-109% PIR.
- Base salary increases are capped at 120% PIR of the All Organisations Base Salary Market Median Line and one-off performance payments may be considered in this regard. In accordance with the Public Service Commission's pay guidelines, no executive received a pay increase in the 2021/2022 year.
- Total executive remuneration for the 2021/22 financial year excluding Chief Executive remuneration was $1,503,057 (2020/21 $1,800,068), the year on year decrease was due to changes in the structure of the executive team and timing of recruitment into new roles.

Chief Executive remuneration. The structure of the Chief Executive remuneration is consistent with the prior year being:

	2022 $000	2021 $000
Base salary	470,176	470,152
Benefits, comprising KiwiSaver contributions, additional leave insurance and the use of a motor vehicle	31,835	31,695
Total remuneration	501,987	501,847

In addition to the benefits noted above the Chief Executive receives three days Company Holidays, consistent with all Scion employees and 25 days annual leave.

Employee remuneration. Section 211(1)(g) of the Company's Act requires the disclosure of the number of people paid in excess of $100,000 in bands of $10,000.

Remuneration and compensation included performance awards, superannuation benefits, and KiwiSaver subsidy. Some other benefits were not quantified and are therefore excluded, including staff parking, home telephone and membership of relevant professional societies.

Bands	Number in each band
$490,000 - $499,999	1
$270,000 - $279,999	1
$260,000 - $269,999	1
$210,000 - $219,999	1
$180,000 - $189,999	1
$170,000 - $179,999	1
$160,000 - $169,999	4

Bands	Number in each band
$150,000 - $159,999	2
$140,000 - $149,999	6
$130,000 - $139,999	7
$120,000 - $129,999	8
$110,000 - $119,999	21
$100,000 - $109,999	28
Total	82

During the year ended 30 June 2022 $184,336 was paid to six employees in relation to cessation of employment with Scion (2021: $128,322 to four employees). Cessation payments included $35,082 for retirement benefits for two employees (2021: $83,322 for two employees).

Changes in directors. Mr Brendon Green commenced as a director on 1 February 2022.

Directors' interests. Any business the company has transacted with, or organisations in which a Director has an association has been carried out on a commercial 'arms-length' basis. Director's interests included in the interest register during the year are:

Director name	Director's interests	Relationship
Helen Anderson	Antarctica NZ	Director
	Anderson Associates NZ Ltd	
	Studio Pacific Architects and parent company Nationwide Architects Ltd	Chair
	The Nature Conservancy NZ Ltd	Advisory Board Member
	AWPT Ltd	Director
	Ministry of Foreign Affairs & Trade	Member, Risk & Assurance Committee
	Informing New Zealand Beef (INZB)	Chair
Stana Pezic	Cerbere Investments Ltd	Director and Shareholder
	Pink Ice Ltd	
	Genesis Energy Ltd	General Manager - Retail Finance and Commercial
	NZFF Holdco Ltd and subsidiary companies	Director
Jon Ryder	Oji Oceania	Director
	Wood Processors and Manufacturers Association	Director
	The Wood Council of New Zealand	Director
	Bearing 360	Director
	Forestry and Wood Processing Industry Transformation Plan Advisory Group	Member
Greg Mann	ArborGen ANZ Ltd Partnership	Employee
	ArborGen New Zealand Unlimited	Director
	ArborGen Australia Pty Ltd	Director
	ArborGen Australia Holdings Pty Ltd	Director
	MBIE Tissue Culture Project	Member – Programme Governance Group
Steve Wilson	SW Holdings 2021 Ltd (formerly Talbot Technologies Ltd)	Director and Shareholder
	Skellerup Holdings Ltd	Employee
	Industry Transformation Plan for Advanced Manufacturing Working Group	Member
	Holmes GP Products Ltd	Chair
	Product Accelerator Advisory Board	Director
	Design Energy (Robotics)	Advisor and Investor
	Te Papa Tipu Properties Ltd	Director
Brendon Green	Watercare Services Ltd	Director
	Kaitiaki Advisory Ltd	Director and Shareholder
	Tainui Kawhia Incorporation	Director
	Hiringa Energy Ltd	Director
	Hiringa Refueling Investments Ltd	Director

Directors' interests *(Continued)*

Director name	Director interests	Relationship
Brendon Green	Tainui Kawhia Minerals	Management contract
	Wattstock LLC (USA)	Australia-NZ representative
	Te Whakakitenga o Waikato Tainui	Representative of Waipapa Marae, Kawhia
	Runanga Manukau Institute of Technology	Te Whakakitenga o Waikato representative
	Waikato District Council – Infrastructure Committee	Member
	Te Taumata Aronui – Ministry of Education	Advisor
	University of Canterbury – Department of Chemical Engineering	Adjunct Senior Fellow
	Waikato Regional Skills Leadership Group	Co-chair
	Construction and Infrastructure Workforce Development Council	Member

Directors' remuneration

Director	30 June 2022	
Helen Anderson	58,000	Chair
Brendon Green	12,083	Appointed 1 February 2022
Greg Mann	29,000	
Stana Pezic	30,500	Chair – Audit and Risk Committee
Jon Ryder	36,250	Deputy Chair/Chair – People and Culture Committee
Steve Wilson	29,000	Chair – Master Plan Committee
Total	$194,833	

Subsidiary entities. Steve Wilson, Dr Julian Elder and John Kahukiwa are directors of Te Papa Tipu Properties Limited. There were no changes to directors during the year and no remuneration was paid to these directors for the year ended 30 June 2022. The directors' interests are:

Director name	Director's interests	Relationship
Julian Elder	The Elder Group	Director
	Sala Street Holdings Ltd	Director
	Te Papa Tipu Properties Ltd	Director
John Kahukiwa	Te Whakarewarewa No.1 Block Ltd	Director and Shareholder
	Te Papa Tipu Properties Ltd	Director

Use of company information. During the year no notices were received from members of the Board requesting to use Scion information received in their capacity as Directors which would not otherwise have been available to them.

Directors' indemnity and insurance. Scion has insured all Directors and the Directors of its subsidiaries against liabilities to other parties (except to Scion or a related party of Scion) that may arise from their position as Directors. The insurance does not cover liabilities that may arise from criminal actions.

Auditor. In accordance with Section 21 of the Crown Research Institutes Act 1992, the Office of the Auditor General is Auditor for the Company and, pursuant to Section 29 of the Public Finance Act 1977, has appointed Ernst & Young to undertake the audit on its behalf. Auditor remuneration is detailed in note 4 to the financial statements.

Dr Helen Anderson QSO
Chair

Dr Julian Elder
Chief Executive

Performance

Financial indicators

Indicator name	Calculation	Actual 2022	Budget 2022	Actual 2021
Efficiency: Operating margin	Earnings before interest, tax, depreciation, amortisation and fair-value (EBITDAF)/revenue	10.4%	11.4%	19.4%
Operating margin per FTE	EBITDAF/FTE	$19,354	$19,361	$36,083
Quick ratio	Current assets less inventory less prepayments/current liabilities less revenue received in advance	2.70:1	1.07:1	2.12:1
Interest coverage	EBITDAF/interest paid	N/A	N/A	N/A
Operating margin volatility	Standard deviation of EBITDAF for past five years/average EBITDAF for the past five years	36.2%	22.3%	35.1%
Forecasting risk	Five-year average of return on equity less forecast return on equity	4.8%	3.8%	5.3%
Adjusted return on equity	NPAT excluding fair value movements (net of tax)/average of share capital plus retained earnings	0.8%	1.2%	8.8%
Revenue growth	% change in revenue	(3.9%)	(3.9%)	5.5%
Capital renewal	Capital expenditure/depreciation expense plus amortisation expense	1.2x	1.9x	1.5x

Summary of group financial results to 30 June 2022

	2022 $000	2021 $000
Operating revenue	58,716	61,083
Profit/(loss) before tax	510	6,590
Taxation expense	(87)	(1,905)
Profit/(loss) after tax	423	4,685
Total comprehensive income attributable to shareholders	880	4,870
Equity		
Issued and paid up capital	17,516	17,516
Retained earnings	35,372	34,949
Reserves	1,039	582
Total equity	**53,927**	**53,047**

Non-financial indicators

CRI generic performance indicators

Indicator name	Measure	Frequency	2022 Target	2022 Actual
End user collaboration	Revenue per full-time employee (FTE) from commercial sources	Quarter	$65,114	$65,630
Research collaboration	Publications with collaborators[1]	Quarter	75	107
Technology and knowledge transfer excellence	Commercial reports per scientist FTE	Annual	2.0	2.0
Science quality	Impact of scientific publications – mean citation score	Annual	3.3	5.0
Financial indicator	Revenue per FTE	Quarter	$168,701	$185,810

[1] Peer-reviewed articles from Scopus database.

Additional performance indicators

Indicator name	Measure	Frequency	2022 Target	2022 Actual
Stakeholder engagement	Relevant partners (number and %) that have a high level of confidence that Scion sets research priorities relative to their industry	Annual	>85%	No formal survey undertaken
	Percentage of stakeholders who have engaged with Scion about their strategic direction (new metric)	Annual	Establish benchmark	
	Relevant end-users (%) who are likely or very likely to recommend working with Scion	Annual	>90%	
	Māori partners relationships measure are "Very good" or "Improving" through customer survey (new metric)	Annual	Establish benchmark	
Māori economic development	Partnerships (number (n) and value ($)) established with Māori entities to support economic development through the forest industry	Quarter	n>15 $2.0m	n = 16 $1.93m
Accelerated commercialisation	Technologies in Scion's pipeline (number and co-investment ($)); projects that progress to the business case stage (case studies)	Quarter	25 and $400,000 Cases ≥4	15 and $423,103 Cases 1
Good employer	Staff engagement	Annual	>75%	85%
	Staff retention – staff turnover	Annual	10%	17.6%
	Health and safety – serious harm events	Annual	0	0
	Staff diversity – percentage of permanent staff of Māori descent	Annual	11%	7.19%

Financial Statements

Consolidated Statement of Comprehensive Income

For the year ended 30 June 2022

	Note	Actual 2022 $000	Budget 2022 $000	Actual 2021 $000
Revenue	2(a)	58,716	57,830	61,083
Other income/(expenditure)	2(b)	13	-	322
Expenditure	3(a)	(58,145)	(56,752)	(54,767)
Finance costs	3(b)	(16)	(64)	(48)
Share of profit/(loss) of associates		(58)	-	-
Profit/(loss) before tax		510	1,014	6,590
Tax expense	9	(87)	(284)	(1,905)
Profit/(loss) for the year after tax		**423**	**730**	**4,685**
Other comprehensive income that will not be classified to profit or loss in subsequent periods net of tax				
Remeasurement gain/(loss) on defined benefit plan		121	-	(41)
Revaluation of carbon units		336	-	226
Total other comprehensive income net of tax		**457**	**-**	**185**
Total comprehensive income for the period attributable to the shareholders of the parent company		**880**	**730**	**4,870**

The accompanying notes form part of these consolidated financial statements.

Consolidated Statement of Changes in Equity

For the year ended 30 June 2022

	Note	Ordinary shares 2022 $000	Asset revaluation & pension reserve 2022 $000	Retained earnings 2022 $000	Total 2022 $000	Ordinary shares 2021 $000	Asset revaluation & pension reserve 2021 $000	Retained earnings 2021 $000	Total 2021 $000
Group									
Balance as at 1 July		**17,516**	**582**	**34,949**	**53,047**	17,516	397	30,264	48,177
Profit for the period		-	-	423	423	-	-	4,685	4,685
Other comprehensive income		-	457	-	457	-	185	-	185
Total comprehensive income		**-**	**457**	**423**	**880**	-	185	4,685	4,870
Balance as at 30 June	5	**17,516**	**1,039**	**35,372**	**53,927**	17,516	582	34,949	53,047

The accompanying notes form part of these consolidated financial statements.

Consolidated Statement of Financial Position

As at 30 June 2022

	Note	Actual 2022 $000	Budget 2022 $000	Actual 2021 $000
Equity				
Share capital	5	17,516	17,516	17,516
Revaluation reserves	5	1,039	397	582
Retained earnings	5	35,372	35,992	34,949
Total equity		**53,927**	53,905	53,047
Non-current liabilities				
Provisions	6	396	1,273	459
Defined benefit plan	7(a)	508	-	552
Deferred tax liability	9(d)	-	(234)	-
Lease liability	10	183	328	328
Total non-current liabilities		**1,087**	1,367	1,339
Current liabilities				
Trade and other payables	8	15,470	13,461	14,983
Provisions	6	30	-	38
Defined benefit plan	7(a)	110	-	118
Lease liability	10	141	145	140
Tax payable		19	95	1,248
Total current liabilities		**15,770**	13,701	16,527
Total equity and liabilities		**70,784**	68,973	70,913
Non-current assets				
Property, plant and equipment	11	45,696	48,913	44,796
Biological assets	12	1,374	1,069	1,391
Intangible assets	13	1,529	1,040	915
Investments in associates	15	-	201	61
Investments in fair value through P&L		170	-	140
Right-of-use assets	10	270	274	408
Deferred tax asset	9(d)	261	-	117
Total non-current assets		**49,300**	51,497	47,828
Current assets				
Cash and cash equivalents	16	12,727	10,527	14,643
Trade and other receivables	17	8,572	6,447	8,106
Inventories	18	185	502	336
Total current assets		**21,484**	17,476	23,085
Total assets		**70,784**	68,973	70,913

The accompanying notes form part of these consolidated financial statements.

For and on behalf of the Board, who authorised the issue of these accounts on 21 September 2022.

Dr Helen Anderson QSO
Chair

Stana Pezic
Director

Consolidated Statement of Cash Flows

For the year ended 30 June 2022

	Note	Actual 2022 $000	Budget 2022 $000	Actual 2021 $000
Cash received from operating activities				
Receipts from customers (excluding government grants)		32,774	22,320	32,265
Receipts from government grants		27,354	35,509	28,576
Interest received		81	30	62
		60,209	57,859	60,903
Cash disbursed on operating activities				
Payments to employees		32,033	31,148	29,810
Payments to suppliers		22,028	19,997	18,549
Interest paid		-	21	48
Income tax paid		1,460	1,645	2,229
		55,521	52,811	50,636
Net cash flow from operating activities	20	**4,688**	5,048	10,267
Cash received from investing activities				
Disposal of property, plant and equipment		-	-	-
Government grant		-	-	-
		-	-	-
Cash disbursed on investing activities				
Investment in property, plant and equipment		6,567	8,979	8,257
Purchase of other investments and intangible assets		(107)	50	35
		6,460	9,029	8,292
Net cash flow from investing activities		**(6,460)**	(9,029)	(8,292)
Cash received from financing activities				
Term loan drawdown		-	-	-
Total cash received from financing activities		-	-	-
Cash disbursed on financing activities				
Repayment of the lease liabilities		144	135	134
		144	135	134
Net cash flow from financing activities		**(144)**	(135)	(134)
Total net cash flow		**(1,916)**	(4,116)	1,841
Net Increase/(decrease) in cash held		(1,916)	(4,116)	1,841
Add opening cash brought forward		14,643	14,643	12,802
Ending cash carried forward	16	**12,727**	10,527	14,643

The accompanying notes form part of these consolidated financial statements.

Notes to and forming part of the consolidated financial statements

For the year ended 30 June 2022

1. Statement of accounting policies

Reporting entity. New Zealand Forest Research Institute Limited is a Crown Research Institute registered under the Companies Act 1993. The registered office is Te Papa Tipu Innovation Park, 49 Sala Street, Rotorua. The consolidated financial statements consist of New Zealand Forest Research Institute Limited and its subsidiaries (the Group). The consolidated financial statements of New Zealand Forest Research Institute Limited for the year were authorised for issue in accordance with a resolution of the directors on the date as set out on the Consolidated Statement of Financial Position.

New Zealand Forest Research Institute Limited (the Company) is domiciled and incorporated in New Zealand and is wholly owned by the Crown.

The activities of New Zealand Forest Research Institute Limited include a range of research and development programmes aimed to drive innovation and growth from New Zealand's forestry, wood-derived materials and other biomaterial sectors to create economic value and contribute to beneficial environmental and social outcomes for New Zealand.

New Zealand Forest Research Institute Limited trades as Scion and these names have identical meaning in this report.

1.1 Summary of significant accounting policies

a. **Basis of preparation.** The consolidated financial statements have been prepared in accordance with generally accepted accounting practice in New Zealand (NZ GAAP) and the requirements of the Companies Act 1993, the Financial Reporting Act 2013, the Public Finance Act 1989, the Crown Entities Act 2004 and the Crown Research Institutes Act 1992. The consolidated financial statements have also been prepared on a historical cost basis, except for forestry assets, carbon credits and certain heritage assets that have been measured at fair value.

   The consolidated financial statements are presented in New Zealand dollars and all values are rounded to the nearest thousand dollars ($000).

b. **Statement of compliance.** The consolidated financial statements have been prepared in accordance with NZ GAAP. For the purpose of complying with NZ GAAP, the Group is a for profit entity. They comply with New Zealand equivalents to International Financial Reporting Standards (IFRS), and other applicable Financial Reporting Standards, as appropriate for profit-oriented entities. The consolidated financial statements comply with IFRS.

c. **Basis of consolidation.** The consolidated financial statements comprise the financial statements of the Company and its subsidiaries as at 30 June. Control is achieved when the Group is exposed, or has rights, to variable returns from its involvement with the investee and has the ability to affect those returns through its power over the investee. Specifically, the Group controls an investee if and only if the Group has:
   - Power over the investee (i.e.existing rights that give it the current ability to direct the relevant activities of the investee);
   - Exposure, or rights, to variable returns from its involvement with the investee; and
   - The ability to use its power over the investee to affect its returns.

   When the Group has less than a majority of the voting or similar rights of an investee, the Group considers all relevant facts and circumstances in assessing whether it has power over an investee, including:
   - The contractual arrangement with the other vote holders of the investee;
   - Rights arising from other contractual arrangements; and
   - The Group's voting rights and potential voting rights.

The Group re-assesses whether or not it controls an investee if facts and circumstances indicate that there are changes to one or more of the three elements of control. Consolidation of a subsidiary begins when the Group obtains control over the subsidiary and ceases when the Group loses control of the subsidiary. Assets, liabilities, income and expenses of a subsidiary acquired or disposed of during the year are included in the statement of comprehensive income from the date the Group gains control until the date the Group ceases to control the subsidiary.

All intra-group assets and liabilities, equity, income, expenses and cash flows relating to transactions between members of the Group are eliminated in full on consolidation.

A change in the ownership interest of a subsidiary, without a loss of control, is accounted for as an equity transaction. If the Group loses control over a subsidiary, it:

- Derecognises the assets (including goodwill) and liabilities of the subsidiary;
- Derecognises the carrying amount of any non-controlling interests;
- Derecognises the cumulative translation differences recorded in equity;
- Recognises the fair value of the consideration received;
- Recognises the fair value of any investment retained;
- Recognises any surplus or deficit in profit or loss;
- Reclassifies the Group's share of components previously recognised in other consolidated income (OCI) to profit or loss or retained earnings, as appropriate, as would be required if the Group had directly disposed of the related assets or liabilities.

d. Associate companies. The Group's investment in its associates is accounted for using the equity method of accounting in the consolidated financial statements. The associates are entities over which the Group has significant influence and that are neither subsidiaries nor joint ventures.

The Group deems it has significant influence if it has over 20% of the voting rights.

The reporting dates of the associates and subsidiaries, and the Company, are identical, and the associates' accounting policies conform to those used by the Company for like transactions and events in similar circumstances.

Associate companies have been reflected in the consolidated financial statements on an equity accounting basis which shows the Group's share of profit in the Consolidated Statement of Comprehensive Income and its share of post-acquisition increases or decreases in net assets, in the Consolidated Statement of Financial Position.

e. Intangible assets. Intangible assets acquired separately are capitalised at cost and those acquired from a business combination are capitalised at fair value as at the date of acquisition. Following initial recognition, the cost model is applied to the class of intangible assets.

Research costs are not capitalised and expenditure is charged to profit and loss in the year in which the expenditure is incurred. Other intangible assets are capitalised where they meet the relevant criteria and include the purchase price and any directly attributable cost of preparing the asset for its intended use.

The useful lives of these intangible assets are assessed to be either finite or indefinite.

Where amortisation is charged on assets with finite lives, this expense is recognised in the profit and loss.

Intangible assets are tested for impairment where an indicator of impairment exists, and in the case of indefinite life intangibles, annually, either individually or at the cash generating unit level. Useful lives are also examined on an annual basis and adjustments, where applicable, are made on a prospective basis.

Gains or losses arising from de-recognition of an intangible asset are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognised in the profit and loss when derecognised.

Software. A summary of the policies applied to the Group's capitalised software is as follows:

	Software
Useful lives	Finite
Method used	Four years – straight-line
Type	Acquired
Impairment test/recoverable	Amortisation method reviewed at each financial year-end
Amount testing	Reviewed annually for indicators of impairment

Carbon credits. New Zealand emission reduction units (NZUs) are recognised when the Group controls the units, provided that it is probable that economic benefits will flow to the Group and the fair value of the units can be measured reliably. Control of the NZUs arises when the Group is entitled to claim the NZUs from the Government.

NZUs are initially measured at fair value on entitlement as an intangible asset unless the Board has determined they are held for sale, in which case they would be recorded at fair value as inventory.

Following initial recognition, the intangible asset is measured at fair value when the Board consider there is an active market for the sale of NZUs. NZUs determined as held for sale at recognition and recorded as inventory, are subsequently measured at the lower of cost and net realisable value.

The liability arising from the deforestation of eligible land is measured using the market value approach. A liability exists and is recognised on pre-1990 forests if the land use changes from forestry.

f. Biological assets. Biological assets consist entirely of tree plantations which are measured at fair value less any point of sale costs. Gains and losses arising on initial recognition or change in fair value, less estimated point of sale costs, are included in profit and loss in the period in which they arise.

The fair value of tree plantations is determined by an independent valuer.

The valuation method for immature trees is the net present value of future net harvest revenue less estimated costs of owning, protecting, tending and managing trees. For mature trees, fair value is deemed to be the net harvest revenue value.

g. Property, plant and equipment. All items of property, plant and equipment are initially recorded at cost, where relevant on purchase from the Crown as at 1 July 1992, adjusted for subsequent additions at cost, disposals, depreciation and impairment. Plant and equipment are recorded at cost less accumulated depreciation less accumulated impairment losses (if any). Land and capital work in progress are recorded at cost. Some library books have been identified as heritage assets and are recorded at fair value as determined by an independent valuer. Valuations are obtained every five years or more often where circumstances indicate that a significant change in fair value has occurred.

Expenditure incurred on property, plant and equipment is capitalised where such expenditure will increase or enhance the future benefits provided by the asset. Expenditure incurred to maintain future benefits is classified as repairs and maintenance.

When an item of property, plant and equipment is disposed of the difference between the net disposal proceeds and the carrying amount is recognised as a gain, or loss, in profit and loss.

Depreciation is provided for using the straight-line method to allocate the historical cost, less an estimated residual value, over the estimated useful life of the asset.

The useful lives of the major classes of assets have been calculated as follows:

Buildings and land improvements	20 – 60 years
Plant and equipment	3 – 20 years
Furniture and fittings	10 – 20 years
Motor vehicles	3 – 7 years
Library books and periodicals	20 years or longer

h. Recoverable amount of non-financial assets. At each reporting date, the Group assesses whether there is any indication a non-financial asset may be impaired. Where an indicator of impairment exists, the Group makes a formal estimate of the recoverable amount. Where the carrying amount of an asset exceeds its recoverable amount the asset is considered impaired and is written down to its recoverable amount.

Recoverable amount is the greater of fair value less costs to sell and value in use. It is determined for an individual asset, however, if the asset's value in use cannot be estimated to be close to its fair value less costs to sell, and it does not generate cash inflows that are largely independent of those from other assets or Groups of assets, it is determined for the cash-generating unit to which the asset belongs.

In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects current market assessments of the time value of money and the risks specific to the asset.

i. Trade receivables. Trade receivables are classified as financial assets at amortised costs. Trade receivables are initially recognised at fair value and subsequently valued at amortised cost less impairment allowance.

The Group applies a simplified approach in calculating expected credit losses (ECLs) for trade receivables, i.e. a loss allowance for trade receivables is based on lifetime ECLs at each reporting date. The Group has established a provision matrix that is based on its historical credit loss experience, adjusted for forward-looking factors specific to the debtors and the economic environment. The provision rates are based on days due for grouping of various customer segments with similar loss patterns. The calculation reflects the probability-weighted outcome, the time value of money and reasonable and supportable information that is available at the reporting date about past events, current conditions and forecasts of future economic conditions.

j. Inventories. Consumable stores are valued at the lower of cost, on a weighted average price of stock on hand, and net realisable value.

Nursery stocks are valued at lower of cost or net realisable value. Changes in net realisable value are recognised in the profit and loss account in the period in which they occur.

k. Research costs. Research costs are expensed in the period incurred.

l. Provisions. Provisions are recognised when the Group has a present obligation (legal or constructive) as a result of a past event, it is probable that an outflow of resources embodying economic benefits will be required to settle the obligation and a reliable estimate can be made of the amount of the obligation.

Provisions are measured at the present value of management's best estimate of the expenditure required to settle the present obligation at the consolidated statement of financial position date using a discounted cash flow methodology.

m. Employee benefits

i ***Wages, salaries and annual leave.*** The liability for wages, salaries and annual leave recognised in the Consolidated Statement of Financial Position is the amount expected to be paid at balance date. Provision has been made for benefits accruing to employees for annual leave in accordance with the provisions of employment contracts in place at balance date.

ii ***Long service leave.*** The liability for long service leave (which includes service recognition leave) is recognised and measured as the present value of expected future payments to be made in respect of services provided by employees up to the reporting date using the projected unit credit method. Consideration is given to expected future wage and salary levels, experience of employee departures, and periods of service. Expected future payments are discounted using market yields at the reporting date on national government bonds with terms to maturity and currencies that match, as closely as possible, the estimated future cash outflows.

iii ***Defined benefit plan.*** The defined benefit plan is unfunded. The cost of providing benefits under the defined benefit plan is determined using the projected unit credit actuarial valuation method. Actuarial gains and losses are recognised through other comprehensive income in the period in which they arise.

The defined benefit liability recognised in the Consolidated Statement of Financial Position represents the present value of the defined benefit obligations.

Long service leave and defined benefit plan provisions are based on an actuarial valuation.

n. **Leases.** The Group assesses at contract inception whether a contract is, or contains, a lease. That is, if the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration.

Group as a lessee. The Group applies a single recognition and measurement approach for all leases, except for short-term leases and leases of low-value assets. Lease payments are recognised as lease liabilities, the right to use the underlying lease assets are represented as right-of-use assets.

i ***Right-of-use assets.*** The Group recognises right-of-use assets at the commencement date of the lease (i.e., the date the underlying asset is available for use). Right-of-use assets are measured at cost, less any accumulated depreciation and impairment losses, and adjusted for any remeasurement of lease liabilities. The cost of right-of-use assets includes the amount of lease liabilities recognised, initial direct costs incurred, and lease payments made at or before the commencement date less any lease incentives received. Right-of-use assets are depreciated on a straight-line basis over the shorter of the lease term and the estimated useful lives of the assets, as follows:

Building	3 – 6 years
Forestry rights	70 years

ii ***Lease liabilities.*** At the commencement date of the lease, the Group recognises lease liabilities measured at the present value of lease payments to be made over the lease term. The lease payments include fixed payments (including in-substance fixed payments) less any lease incentives receivable, variable lease payments that depend on an index or a rate, and amounts expected to be paid under residual value guarantees. The lease payments also include the exercise price of a purchase option reasonably certain to be exercised by the Group and payments of penalties for terminating the lease, if the lease term reflects the Group exercising the option to terminate.

Variable lease payments that do not depend on an index or a rate are recognised as expenses (unless they are incurred to produce inventories) in the period in which the event or condition that triggers the payment occurs.

In calculating the present value of lease payments, the Group uses its incremental borrowing rate at the lease commencement date because the interest rate implicit in the lease is not readily determinable. After the commencement date, the amount of lease liabilities is increased to reflect the accretion of interest and reduced for the lease payments made. In addition, the carrying amount of lease liabilities is remeasured if there is a modification, a change in the lease term, a change in the lease payments (e.g., changes to future payments resulting from a change in an index or rate used to determine such lease payments) or a change in the assessment of an option to purchase the underlying asset.

iii ***Short-term leases and leases of low-value assets.*** The Group applies the short-term lease recognition exemption to its short-term leases of temporary buildings (i.e., those leases that have a lease term of 12 months or less from the commencement date and do not contain a purchase option). It also applies the lease of low-value assets recognition

exemption to leases of office equipment that are considered to be low value. Lease payments on short-term leases and leases of low-value assets are recognised as an expense on a straight-line basis over the lease term.

Group as a lessor. Leases in which the Group retains substantially all the risks and benefits of ownership of the leased asset are classified as operating leases.

o. Cash and cash equivalents. Cash and cash equivalents in the Consolidated Statement of Financial Position comprise cash at bank and in-hand and short-term deposits with an original maturity of three months or less or greater than three months with no significant risk of a change in value from an early withdrawal.

For the purposes of the Consolidated Statement of Cash Flows, cash and cash equivalents consist of cash and cash equivalents as defined above, net of outstanding bank overdrafts.

p. Goods and services tax (GST). All items in the financial statements are stated net of GST, with the exception of trade receivables and payables, which are inclusive of GST invoiced.

q. Foreign currencies

Functional and presentation currency. Both the functional and presentation currency of New Zealand Forest Research Institute Limited and its subsidiaries is New Zealand dollars.

Transactions and balances. Transactions in foreign currencies are initially recorded in the functional currency by applying the exchange rates ruling at the date of the transaction. Monetary assets and liabilities denominated in foreign currencies are retranslated at the rate of exchange ruling at the Consolidated Statement of Financial Position date.

Non-monetary items that are measured in terms of historical cost in a foreign currency are translated using the exchange rate as at the date of the initial transaction. Non-monetary items measured at fair value in a foreign currency are translated using the exchange rates at the date when the fair value was determined.

r. Revenue recognition

Revenue from contracts with customers

Research revenue. Research revenue from both Government and commercial sources is recognised over time using an input method to measure progress toward complete satisfaction of the service, because the Group's performance does not create an asset with an alternative use and the Group has an enforceable right to payment for performance completed to date. Revenue is recognised by reference to costs incurred to date and other contracted commitments. Work completed but not invoiced is recorded as accrued revenue while work invoiced but not completed is recorded as revenue in advance.

Government revenue under research revenue includes non-devolved revenue received from the Ministry of Business, Innovation and Employment in the form of Endeavour Funding, and Preseed Accelerator Fund programmes.

Sale of goods and rendering services (fee for services). Revenue from work programmes under commercial testing services and nursery crops is recognised at the point of time when control is transferred to the customer, generally on dispatch of crops to the customer or when service is completed.

Other revenue

Government grants. Government grants includes devolved revenue from the Ministry of Business, Innovation and Employment in the form of Strategic Science Investment Funding and COVID-19 Response and Recovery Funding. Government grant revenue is only recognised after all appropriate conditions have been met.

Rent revenue. Rent revenue is recognised on a straight-line basis over the lease term.

Interest revenue. Interest revenue is recognised when earned based on applicable interest rates applied to the Group's cash deposit balances.

s. Taxation. The income tax expense charged to the profit and loss includes both the current year's provision and the income tax effects of temporary differences calculated using the liability method. Current income tax relating to items recognised directly in equity is recognised in equity and not in profit or loss.

Tax effect accounting is applied on a comprehensive basis to all temporary differences. A debit balance in the deferred tax account, arising from temporary differences or income tax benefits from income tax losses, is only recognised if it is probable there will be taxable profits available in the future against which the deferred tax asset can be utilised.

Subsequent realisation of the tax benefit is subject to the requirements of income tax legislation being met.

t. Trade and other payables. Trade and other payables are classified as financial liabilities at amortised costs. They are carried at amortised cost and due to their short-term nature they are not discounted. They represent liabilities for goods and services provided to the Group prior to the end of the financial year that are unpaid and arise when the Group becomes obliged to make future payments in respect of the purchase of these goods and services. The amounts are unsecured and are usually paid within 60 days of recognition.

1.2 Significant accounting judgements, estimates and assumptions

The preparation of the Group's consolidated financial statements requires management to make judgements, estimates and assumptions that effect the reported amounts of revenue, expenses, assets and liabilities, and the accompanying disclosures.

a. Revenue recognition from contracts with customers. Revenue is predominately recognised based on the percentage of work completed on a project basis over time. Percentage of work completed is based on costs incurred from inception of the project as a percentage of total forecasted project costs. Management judgement is required in estimating total forecasted costs which impacts the revenue recognised (Note 2), the revenue in advance (Note 8) and accrued revenue (Note 17).

In determining if a customer contract can be recognised over time, management have considered their right to receive payment for work done up to the point of any termination of contract. In the absence of a termination clause management has assessed that the Group has a clear right to be paid for work completed up to the point of termination.

b. Heritage assets. The Group holds several heritage assets which have significant value due to being both rare, and having importance to the nation. Where a heritage cost can be measured reliably they are revalued at least every five years and included as part of property, plant and equipment.

The increase/decrease in value is recognised in the Consolidated Statement of Financial Position through other comprehensive income.

Due to the nature of some heritage assets, management does not believe they can be valued reliably. These assets have been identified and disclosed. Details of heritage assets can be found in Note 11 and 22.

c. Biological assets. The Group's biological assets consist of tree plantations. These are valued at the net present value of future net harvest revenue less estimated costs of owning, protecting, tending and managing trees. The valuation process includes several judgements and estimations around discount rates, future costs, and future prices. Management used the experience of a registered forestry valuer to reduce the risk of misstatement resulting from these judgements and estimates.

1.3 Accounting standards issued but not yet effective

The following standards that have been issued but not yet effective and have not been earlier adopted by the Group and may have an impact on the Group's financial statements:

	Date Applicable for Scion
• NZ IAS 1 Classification of Liabilities as Current or Non-current	1 July 2023

There are no amendments to standards that affect Scion's Consolidated Financial Statements.

1.4 New accounting standards and amendments

There are no new accounting standards or amendments adopted this financial year.

2. Revenue and other income

	Actual 2022 $000	Actual 2021 $000
(a) Revenue		
Revenue from research contracts		
Ministry of Business, Innovation and Employment revenue	12,955	9,844
Other Government and Crown Research Institute revenue	9,355	8,854
Commercial research revenue	11,384	12,701
	33,694	31,399
Government grants		
Strategic Science Investment Fund	23,786	23,786
COVID-19 Response and Recovery Fund	-	4,790
	23,786	28,576
Other revenue		
Commercial lease revenue	1,036	1,017
Interest revenue	145	77
Other revenue	55	14
	1,236	1,108
Total revenue	58,716	61,083
(b) Other income/(expenditure)		
Change in fair value of plantation trees	(17)	322
Revaluation of non-controlling interests	30	-
	13	322

3. Expenditure and finance costs

	Actual 2022 $000	Actual 2021 $000
(a) Expenditure		
Personnel remuneration and expenses	31,196	29,540
Other personnel related costs	767	631
Contractors and subcontractors	14,536	13,312
Consumables	1,645	1,409
Travel and accommodation	711	760
Rental and equipment hire costs	153	145
Depreciation on leases	134	135
Depreciation	5,665	5,446
Amortisation	26	41
(Gain)/loss on disposal of fixed assets	6	22
Impairment of assets	-	-
Premises	2,467	2,427
Directors' fees	195	241
Other	644	658
	58,145	54,767
(b) Finance costs		
IRD use of money interest	-	26
Lease interest	16	22
	16	48

4. Auditor remuneration

	Actual 2022 $000	Actual 2021 $000
Amounts paid or due and payable to the auditors for:		
Auditing financial statements		
Parent entity auditor	175	101
	175	101

The values above are the amounts recorded as expenses in the year and so include accruals and/or deferrals of cost. The contracted amounts for the annual audit is $165k (2021: $125k).

5. Equity

New Zealand Forest Research Institute Limited has authorised, issued and paid up capital of $17,516k (2021: $17,516k) ordinary shares. Shares do not have a par value.

All shares have equal rights with respect to voting, dividends and distribution on winding up. There are no restrictions on the distribution of dividends or repayment of capital.

No dividends were declared or paid to shareholders during the year (2021: $0).

The asset revaluation and pension reserve is used to record increments and decrements in the fair value of heritage assets, fair value movement in revaluation of carbon units and remeasurement of defined benefit plan liabilities. Movements in the asset revaluation and pension reserve are not reclassified to the profit and loss in subsequent periods.

Capital management. Scion is 100% Crown owned. Scion completes a five-year plan on an annual basis and as part of that five year plan, any capital requirements for the future are identified. When managing capital, management's objective is to ensure the entity continues as a going concern while balancing its financial goals of delivering returns in line with market cost of capital, with its public good goals of reinvesting in science that will benefit New Zealand. Management uses total equity as capital. The Group has no externally imposed capital requirements.

6. Provisions.

The Group has provisions for long service leave and restructuring. The long service leave provision was actuarially valued by Aon Hewitt Consulting, an independent risk management and consulting organisation.

The provisions are made up as follows:

	Actual 2022 $000	Actual 2021 $000
Current provision	30	73
Non-current provision	396	459
	426	532

Movement in each class of provision during the year is as follows:

	Long service leave 2022 $000	Restructuring 2022 $000	Total 2022 $000	Long service leave 2021 $000	Restructuring 2021 $000	Total 2021 $000
Balance 1 July	497	35	532	563	-	563
Provision reversed during the year	-	-	-	-	-	-
Amounts used during the year	(72)	(107)	(179)	(82)	-	(82)
Provisions made during the year	1	72	73	16	35	51
Balance 30 June	426	-	426	497	35	532

7. Pension plans

(a) Defined benefit plan. Scion operates an unfunded final salary defined benefit plan. The level of benefits provided depends on the member's length of service and salary at retirement age. The plan is closed to new members and will cease when the current four members have either retired or left the Group. There are no assets backing the unfunded liability.

The cost of providing benefits under the defined benefit plan is determined using the projected unit credit actuarial valuation method. Actuarial gains and losses are recognised in Statement of Comprehensive Income. Past service cost is recognised immediately in profit or loss.

The defined benefit liability recognised in the Consolidated Statement of Financial Position represents the present value of the defined benefit obligations.

	Actual 2022 $000	Actual 2021 $000
Net plan expense		
Current service cost	17	18
Interest cost on benefit obligation	21	12
Net actuarial gains recognised in the year	(55)	(56)
Net plan expense/(income)	(17)	(26)

The net plan expense is included in the personnel remuneration and expense line in Note 3(a) Expenditure.

Benefit liability included in the Consolidated Statement of Financial Position	Defined benefit plan				
	2022 $000	2021 $000	2020 $000	2019 $000	2018 $000
Present value of defined benefit obligation	618	670	819	838	941

Changes in the present value of the defined benefit obligation are as follows:

	Actual 2022 $000	Actual 2021 $000
Opening balance	670	819
Current service cost	17	18
Interest cost	21	12
Actuarial gains recognised in the year	(55)	(56)
Benefits paid	(35)	(123)
Closing balance	618	670
Current provision	110	118
Non-current provision	508	552
	618	670

The history of experience adjustments is as follows:

	Defined benefit plan				
	2022 $000	2021 $000	2020 $000	2019 $000	2018 $000
Experience adjustments on plan liabilities	(10)	(27)	(20)	(6)	(22)

7. Pension plans *(continued)*

The principal actuarial assumptions used in determining the defined benefit plan obligations as shown below:

	Actual 2022	Actual 2021
Discount rate	4.02%	3.12%
Future salary increases	2.00%	2.00%

At 30 June a change in the assumed rates of salary growth and resignation rates, all other assumptions remaining unchanged, would affect the balance of the liability as follows:

	Actual 2022 $000	Actual 2021 $000
Current obligation	618	670
Salary growth		
Reduction of 1% per annum	594	637
Increase of 1% per annum	644	705
Resignation rates		
150% of assumed rates	618	670
50% of assumed rates	618	670

Interest rate assumptions are based on Treasury's published risk-free discount rates.

(b) Defined contribution plan. During the period defined contributions totalling $792k (2021: $789k) were made to the Government Superannuation Fund and Kiwisaver.

8. Trade and other liabilities

	Actual 2022 $000	Actual 2021 $000
Trade payables	3,996	5,628
Employee payables and accruals	3,137	2,975
Revenue in advance	8,337	6,380
	15,470	14,983

The carrying amount disclosed is a reasonable approximation of fair value. Trade creditors are non-interest bearing and are normally settled within 60 days.

Revenue in advance includes advances relating to 30 June each year. Total revenue recognised during the year that was in revenue in advance at the start of the year totals $6,400k (2021: $5,344k).

9. Income tax

	Actual 2022 $000	Actual 2021 $000
(a) Income tax expense		
The major components of income tax expense in the Consolidated Statement of Comprehensive Income are:		
Current income tax		
Current income tax charge	409	1,741
Adjustments to prior year current income tax charge	228	(21)
	637	1,720
Deferred income tax		
Deferred tax expenses/(income) related to prior year	47	53
Relating to origination and reversal of temporary differences	(597)	29
Impact of changes to building depreciation	-	88
	(550)	170
Income tax expense/(income) reported in the Consolidated Statement of Comprehensive Income	87	1,890
(b) Amounts charged or credited directly to other comprehensive income		
Deferred income tax related to items charged (credited) directly to other comprehensive income		
Revaluation of carbon credits	335	-
Remeasurement of gain/loss on defined benefit plan	(31)	(15)
Deferred tax charged to other comprehensive income	304	(15)
(c) Reconciliation between the aggregate tax expense recognised in the Consolidated Statement of Comprehensive Income to tax expense calculated at the statutory income tax rate		
Accounting profit before income tax	510	6,590
Tax at the statutory income tax rate of 28% (2021: 28%)	143	1,845
Adjusted by:		
Prior year income tax	271	33
Entertainment	5	10
Impact of changes to building depreciation	-	88
Other	(332)	(71)
Income tax expense	87	1,905
(d) Deferred income tax relates to the following:		
Deferred tax liabilities		
Property, plant and equipment	(99)	(436)
Leases	15	17
Nursery inventory	(38)	(86)
Standing timber	(389)	(389)
Carbon credits	(381)	-
	(892)	(894)
Deferred tax assets		
Patents and trademarks	171	191
Payroll provisions	749	790
Allowance for impairment loss	8	8
Other	225	22
	1,153	1,011
Net Deferred Tax Asset/(Liability) per Consolidated Statement of Financial Position	261	117

The Group has no unused tax losses (2021: $0k).

10. Leases

Group as a lessee. The Group has lease contracts for buildings in Christchurch and Wellington plus Forestry rights in Puruki. The building leases are for terms of 3 to 6 years with the Forestry rights being for a period of 70 years. The Group obligations under its leases are secured by the lessor's title to the leased assets. Generally, the Group is restricted from assigning and subleasing the leased assets. The lease contracts include extension and termination options.

Set out below are the carrying amounts of right-of-use assets recognised and the movement during the period:

	Building $000	Forestry Rights $000	Total $000
As at 30 June 2020	436	107	543
Additions	-	-	-
Depreciation expense	(132)	(3)	(135)
As at 30 June 2021	304	104	408
Adjustments	(4)	-	(4)
Depreciation expense	(132)	(2)	(134)
As at 30 June 2022	168	102	270

Set out below are the carrying amounts of lease liabilities and the movements during the period:

	Actual 2022 $000	Actual 2021 $000
As at 1 July	468	602
Realignment of lease end date	(10)	-
Accretion of interest	16	22
Payments	(150)	(156)
As at 30 June	324	468
Current	141	140
Non-Current	183	328
The following are the amounts recognised in profit or loss:		
Depreciation expense of right-of-use assets	134	135
Interest expense on lease liabilities	16	22
Variable lease payments (included in other expenditure)	23	38
Total Amount recognised in profit or loss	173	195

The Group had total cash outflow for leases of $238k in 2022 (2021: $194k).

11. Property, plant and equipment

Group	Land and improvements $000	Buildings $000	Plant and equipment $000	Furniture and fittings $000	Motor vehicles $000	Books and periodicals $000	Capital work in progress $000	Total $000
At 1 July 2021								
Carrying amount net of accumulated depreciation and impairment at 1 July 2021	1,442	18,658	14,519	6,507	441	101	3,128	44,796
Additions	-	(6)	56	(104)	91	-	6,556	6,593
Transfers from CWIP	-	116	3,615	302	93	-	(4,126)	-
Disposals	-	-	(2)	-	(26)	-	-	(28)
Impairment provision	-	-	-	-	-	-	-	-
Depreciated expensed	(48)	(671)	(4,000)	(816)	(129)	(1)	-	(5,665)
Carrying amount net of accumulated depreciation and impairment at 30 June 2022	1,394	18,097	14,188	5,889	470	100	5,558	45,696
At 30 June 2022								
Cost or fair value	2,244	31,827	58,453	9,150	1,234	106	5,558	108,572
Accumulated depreciation and impairment	(850)	(13,730)	(44,265)	(3,261)	(764)	(6)	-	(62,876)
Net carrying amount	1,394	18,097	14,188	5,889	470	100	5,558	45,696
At 1 July 2020								
Carrying amount net of accumulated depreciation and impairment at 1 July 2020	1,501	12,191	13,808	4,001	394	102	10,799	42,796
Additions	-	1,449	1,921	1,013	307	-	2,934	7,624
Transfers from CWIP	-	5,895	2,566	2,144	-	-	(10,605)	-
Disposals	-	-	(22)	-	(157)	-	-	(179)
Impairment provision	-	-	-	-	-	-	-	-
Depreciated expensed	(59)	(877)	(3,754)	(651)	(103)	(1)	-	(5,445)
Carrying amount net of accumulated depreciation and impairment at 30 June 2021	1,442	18,658	14,519	6,507	441	101	3,128	44,796
At 30 June 2021								
Cost or fair value	2,244	31,717	55,238	8,952	1,109	106	3,128	102,494
Accumulated depreciation and impairment	(802)	(13,059)	(40,719)	(2,445)	668	(5)	-	(57,698)
Net carrying amount	1,442	18,658	14,519	6,507	441	101	3,128	44,796

Books and periodicals include some library books classified as Heritage Assets. Last year the Group engaged Rowan Gibbs, an antiquarian bookseller of 37 years' experience of Smith's Bookshop Limited to determine the fair value of the heritage library books as at 30 June 2019. These assets are level 3 in the fair value hierarchy. Refer to Note 22 regarding other heritage assets.

12. Biological assets

Biological assets consist of tree plantations. The Group has 65.5 hectares of trees planted initially for experimental purposes. When experiments are completed, they are classified as biological assets. Trees will be harvested when they reach maturity.

	Actual 2022 $000	Actual 2021 $000
Carrying amount 1 July	1,391	1,069
Sale of trees	-	-
(Loss)/gain from changes in fair value less estimated point-of-sale costs	(17)	322
Carrying amount 30 June	1,374	1,391

The above biological assets are level 3 in the fair value hierarchy.

The Group has tree plantations at two locations:

(a) 31 hectares of immature Radiata Pine is located at Puruki. The trees were planted for experimental purposes. The Group has a forestry right which expires in 2067.

(b) 34.5 hectares of immature Radiata Pine is located at Mamaku plus 2.2 hectares of mature Sitka Spruce. The trees were planted for experimental purposes. The Group has a forestry right which terminates when the trees are harvested or in 2024, whichever is the earlier.

The tree plantations were valued as at 30 June 2022 by PF Olsen Limited, an independent forestry management and consultancy company.

The valuation method for immature trees is the net present value of future net harvest revenue less estimated costs of owning, protecting, tending and managing trees. For mature trees fair value is deemed to be the net harvest revenue value.

Fair value is sensitive primarily to log prices. Significant increase (decreases) in log prices would result in a significantly higher (lower) fair value.

13. Intangible assets

	Actual 2022 $000	Actual 2021 $000
Software		
Opening balance 1 July		
At cost	2,348	2,443
Less accumulated amortisation	(2,285)	(2,374)
Opening net carrying amount 1 July	63	69
Opening carrying amount 1 July	63	69
Additions	8	35
Disposals	-	-
Current year amortisation	(26)	(41)
Amortisation write back	-	-
Closing carrying amount 30 June	45	63
Closing balance 30 June		
At cost	2,356	2,348
Less accumulated amortisation	(2,311)	(2,285)
Closing net carrying amount 30 June	45	63
Carbon credits (NZUs)		
Carrying amount 1 July	852	626
Increase/(decrease) in fair value	632	226
Carrying amount 30 June	1,484	852
Total intangible assets 30 June	1,529	915

The Group holds a total of 19,494 New Zealand Emission Reduction Units (NZUs). Of these units 5,340 were allocated at zero cost and 14,154 were purchased for a cost of $61k. These units are classed as level 1 in the fair value hierarchy.

14. Investments in subsidiaries

	Shares	Percentage held 2022	Percentage held 2021	Balance Date
Subsidiaries				
Te Papa Tipu Properties Limited	100	100%	100%	30 June
Sala Street Holdings Limited	100	100%	100%	30 June

Te Papa Tipu Properties Limited was incorporated on 25 March 2004. The company owns the Group's land assets.

Sala Street Holdings Limited was incorporated on 9 November 2015. The company holds the Groups 50% investment in Scion Terax technologies. The Terax entities were liquidated during this financial year.

All subsidiaries are incorporated in New Zealand.

15. Investments in associates

	Actual 2022 $000	Actual 2021 $000
Terax 2013 Limited	-	-
Terax Limited Partnership	-	61
	-	61

New Zealand Forest Research Institute Limited Group had a 50% shareholding in Terax 2013 Limited. The company was incorporated in February 2012. Terax 2013 Limited managed Terax Limited Partnership in which Scion Group also had a 50% interest. Terax Limited Partnership was registered on 8 April 2013. Terax 2013 Limited was removed from the Companies Office register on 10 August 2021 and Terax Limited Partnership was deregistered on 18 August 2021.

The Group's proportion of voting power held in each associate was the same as its ownership interest.

All of the companies are incorporated in New Zealand.

16. Cash and cash equivalents

	Actual 2022 $000	Actual 2021 $000
Cash on hand	6	6
Bank	1	1
Call deposits	8,110	9,069
Short-term deposits	4,610	5,567
	12,727	14,643

17. Trade and other receivables and accrued revenue

	Actual 2022 $000	Actual 2021 $000
Trade receivables	5,662	5,435
Allowance for impairment loss	(28)	(28)
Other debtors	88	25
Prepayments	1,258	1,282
Accrued revenue	1,581	1,412
Related party receivables:		
Associates	11	(20)
Carrying amount 30 June	8,572	8,106

(a) The carrying amount of trade and other receivables disclosed above is a reasonable approximation of fair value due to the short-term nature of the receivables.
(b) Accrued revenue is initially recognised for revenue earned from research projects as receipt of consideration is conditional on successful completion of projects. Upon completion of the project, the amounts recognised as accrued revenue are reclassified to trade receivables.
(c) Trade receivables are non-interest bearing and are generally on 30–60-day terms.

At 30 June, the ageing analysis of trade receivables is as follows:

	Total $000	0-30 days CNI* $000	0-30 days CI* $000	31-60 days CNI* $000	31-60 days CI* $000	61-90 days PDNI* $000	61-90 days CI* $000	+91 days PDNI* $000	+91 days CI* $000
2022	5,663	5,466	-	157	-	-	-	12	28
2021	5,416	5,207	-	88	-	9	-	84	28

*Current not impaired (CNI)
*Past due not impaired (PDNI)
*Considered impaired (CI)

(d) For related party terms and conditions refer to Note 24.

18. Inventories

	Actual 2022 $000	Actual 2021 $000
Consumable stores (at cost)	50	27
Nursery stock	135	309
Closing carrying amount	185	336

Consumable stores recognised as an expense for the year are $79k (2021: $100k). The expense has been included in the "consumables" line item in Note 3 (a). Consumable inventory write-down in the period was $0k (2021: $0k).

Nursery stock recognised as an expense during the year was $940k (2021: $752k)

19. Financial instruments

Financial instruments include:
Financial assets at amortised costs
Cash and cash equivalents
Trade receivables
Other debtors
Related party receivables

Financial liabilities at amortised costs
Trade payables
Other payables
Related party payables

All the above financial instruments are measured at amortised cost. Due to their short-term nature their carrying amount is a reasonable approximation of their fair value.

Management have not identified any concentrations of risk for any of the below risk categories.

Liquidity risk. The Group's objective is to maintain a balance between continuity of funding and flexibility through the use of a bank debt facility and a bank overdraft. Management monitors, on a monthly basis, our free capacity within the debt facility and our forecasted ability to pay for that debt.

Trade payables ($655k) are non-interest bearing and are normally settled within 60 days. Other than lease liability which extends up to 46 years remaining, the Group liabilities all have contractual maturities of less than 120 days.

Credit risk. Financial instruments that potentially subject the Group to credit risk consist of bank balances and accounts receivable. The Group generally does not require any security.

Significant new non-Government customers are credit checked. Trade receivable ageing is reviewed monthly and all aged trade receivables are followed up. Credit stops are used for non-paying customers.

Maximum exposures to credit risk as at balance date are:

	Actual 2022 $000	Actual 2021 $000
Current account	1	1
Call and short-term deposits	12,719	14,636
Trade receivables	5,633	5,407
Other debtors	88	25
Related party receivables	11	(20)

The above maximum exposures are net of any provision for impairment of these financial instruments.

Market risk. Market risk on financial instruments comprise the following three types of risk.

Interest rate risk. The Group's exposure to market interest rates primarily to cash deposits.

	Actual 2022 $000	Actual 2021 $000
Cash in hand	6	6
Current account	1	1
Call deposits	8,109	9,069
Short-term deposits	4,610	5,567
	12,726	14,643

19. Financial instruments *(continued)*

The current account is managed at low levels and interest returns on the current account are not material. Cash funds in excess of our current requirements are invested in short-term bank deposits to attract improved interest returns. At 30 June 2022 bank call and short-term deposits were earning variable interest rates (2021: 0.85% and 0.95%).

At 30 June 2022, if interest rates moved as indicated in the table below, with all other variables being held constant, post-tax profit and equity would have been affected as follows:

Judgement of reasonably possible movements in interest rates	Change in interest rate	Effect on post tax profit and equity $000	Change in interest rate	Effect on post tax profit and equity $000
	1%	92	1%	105
	-1%	(92)	-1%	(105)

Currency risk. Only small cash balances are held in currencies other than New Zealand dollars. There is limited exposure to trade receivables and payables. Collection and payment on all these balances are expected within 30 days resulting in minimal foreign exchange risk.

Other price risk. Other price risk primarily relates to the market price of financial instruments. As Scion does not trade in financial instruments there is no perceived risk in this category.

20. Reconciliation of operating profit after taxation with cash flows from operating activities

	Actual 2022 $000	Actual 2021 $000
Reported profit/(loss) after taxation	423	4,685
Add/(less) non-cash items:		
Depreciation	5,667	5,446
Amortisation	26	41
Movement on employee provision	(288)	-
Provision for doubtful debts	-	(26)
Movement on lease liability	-	134
Movement in deferred tax	(144)	117
	5,261	5,712
Add/(less) items classified as investing activity:		
(Gain)/loss on disposal of property, plant and equipment	6	22
Share in associate (profit)/loss	58	-
Capital related items in creditors	-	788
Fair value movement in biological assets	(13)	(322)
	51	488
Movements in working capital items:		
(Increase)/decrease in debtors and prepayments	(441)	(1,621)
(Increase)/decrease in inventories	151	(97)
Increase/(decrease) in creditors and accruals	471	1,554
Increase/(decrease) in taxation payable	(1,228)	(454)
	(1,047)	(618)
Net cash flows from operating activities	4,688	10,267

21. Contingencies

Treaty of Waitangi issues. Two verified land claims affecting the Group currently exist:
i) Ngāti Whakaue – covering the whole Rotorua Campus
ii) Ngāti Wāhiao – covering the southern end of the Rotorua Campus

No reliable estimates can be made of the impact of these contingencies.

22. Heritage assets

The Company has identified its library, herbarium and germplasm collections as heritage assets. For the herbarium and germplasm collections the Board believes that there is no practical basis upon which to reliably value these collections. For the books and periodicals within the library refer to Note 11.

23. Commitments

Operating lease – Group as lessor: The Group has entered into commercial property leases for buildings and land. These non-cancellable leases have remaining terms including rights to renew of up to 5 years on buildings and 13 years on land leases, with rights to renew for further 40 years. All leases include a clause to enable upward revision of the rental charge at a specified review date of between one and five years according to prevailing market conditions.

Future minimum rentals receivable under non-cancellable operating leases as at 30 June are as follows:

	Actual 2022 $000	Actual 2021 $000
Year one	431	403
Year two	303	249
Year three	303	198
Year four	185	198
Year five	154	166
Greater than five years	1,280	1,377
	2,656	2,551
Capital commitments		
Capital expenditure contracted for at balance date but not provided for	2,661	3,869

The prior year value has been updated from $477k to $3.9m as a result of a change to the methodology used for determining capital commitments.

24. Transactions with related parties

(a) **Group.** New Zealand Forest Research Institute Limited is wholly owned by the New Zealand Government (the ultimate parent). All transactions with the Government, government departments and agencies and government entities are conducted on normal terms between government agencies. Government Endeavour Funding, Strategic Science Investment Funding and Preseed Accelerator Funding from the Ministry of Business, Innovation and Employment comprises 65% of research revenue earned by Scion and is disclosed in Note 2 (a).

(b) Associates and investments of parent

	Actual 2022 $000	Actual 2021 $000
Biopolymer Network Ltd		
Supplied goods and services	-	66
Receivable at balance date	10	8

(c) **Other.** The Group has transactions with other parties that are related by virtue of the relationship Scion directors have with that other party, but these relationships do not alter the nature and amount of those transactions. These relationships and transactions are summarised below where annual transactions with a given related party in either FY22 or FY21 are greater than $100k.

Dr Helen Anderson, the Chair of New Zealand Forest Research Institute Limited, was a director of NIWA until 30 June 2021.

Dr Jon Ryder, the Deputy Chair of New Zealand Forest Research Institute Limited, is CEO of Oji Fibre Solutions.

(i) In the 2021 financial year Scion provided services totalling $281k and received services totalling $1,398k. The amount receivable at the year ending 30 June 2021 was $53k.

(ii) Oji Fibre Solutions. Scion provided services during the period totalling $450k (2021: $319k) and received services totalling 5k (2021: nil). The amount receivable at year end was $28k (2021: $84k).

Terms and conditions of transactions with related parties. Outstanding balances at year end are unsecured and interest free. No guarantees are provided or received for any related party receivables or payables.

No related party debts were written off during the year (2021: $0k) and no impairment allowance has been raised for any of these debts.

(d) Key management personnel

	Actual 2022 $000	Actual 2021 $000
Short-term employee benefits	1,973	2,503
KiwiSaver employee benefits	53	60
	2,026	2,563

Audit report

Building a better working world

Independent auditor's report
To the readers of New Zealand Forest Research Institute Limited's Group financial statements for the year ended 30 June 2022

The Auditor-General is the auditor of New Zealand Forest Research Institute Limited group (the Group). The Auditor-General has appointed me, Simon Brotherton, using the staff and resources of Ernst & Young, to carry out the audit of the financial statements of the Group on his behalf.

Opinion

We have audited the financial statements of the Group on pages 46 to 72, that comprise the consolidated statement of financial position as at 30 June 2022, the consolidated statement of comprehensive income, consolidated statement of changes in equity and consolidated statement of cash flows for the year ended on that date and the notes to the consolidated financial statements that include accounting policies and other explanatory information.

In our opinion, the consolidated financial statements of the Group:

- present fairly, in all material respects:
  - its consolidated financial position as at 30 June 2022; and
  - its consolidated financial performance and cash flows for the year then ended; and
- comply with generally accepted accounting practice in New Zealand in accordance with New Zealand Equivalents to International Financial Reporting Standards and International Financial Reporting Standards.

Our audit was completed on 23 September 2022. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the consolidated financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of the Board of Directors for the consolidated financial statements

The Board of Directors is responsible on behalf of the Group for preparing consolidated financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand.

The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare consolidated financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, the Board of Directors is responsible on behalf of the Group for assessing the Group's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors has to cease operations, or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Research Institutes Act 1992.

Responsibilities of the auditor for the audit of the consolidated financial statements

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but it is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these consolidated financial statements.

For the budget information reported in the consolidated financial statements, our procedures were limited to checking that the information agreed to the Group's budget.

We did not evaluate the security and controls over the electronic publication of the consolidated financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the consolidated financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- We obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances but not for the purpose of expressing an opinion on the effectiveness of the Group's internal control.
- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.
- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the consolidated financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to continue as a going concern.
- We evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures and whether the consolidated financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

- We obtain sufficient appropriate audit evidence regarding the financial statements of the entities or business activities within the Group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the Group audit. We remain solely responsible for our audit opinion.

We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

Other information

The Board of Directors is responsible for the other information. The other information comprises the information included in the Annual Report, but does not include the financial statements or our auditor's report thereon.

Our opinion on the consolidated financial statements does not cover the other information and we do not express any form of audit opinion or assurance conclusion thereon.

In connection with our audit of the consolidated financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the consolidated financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based upon the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Independence

We are independent of the Group in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1: International Code of Ethics for Assurance Practitioners issued by the New Zealand Auditing and Assurance Standards Board.

Other than the audit, we have no relationship with, or interests in, the Group.

Simon Brotherton
Ernst & Young
On behalf of the Auditor-General
Auckland, New Zealand

Directory

Directors

Dr Helen Anderson QSO (Chair)
Mr Brendon Green (commenced 1 February 2022)
Mr Greg Mann
Ms Stana Pezic
Dr Jon Ryder (Deputy Chair)
Mr Steve Wilson

Registered Office

Rotorua
Te Papa Tipu Innovation Park
49 Sala Street
Private Bag 3020, Rotorua 3046, New Zealand
Telephone: +64 7 343 5899
Facsimile: +64 7 348 0952
Email: enquiries@scionresearch.com
Website: www.scionresearch.com
NZBN Number: 9429038975189

Christchurch
10 Kyle Street, Riccarton
Christchurch 8011
PO Box 29237, Riccarton,
Christchurch 8440, New Zealand
Telephone: + 64 3 363 0910

Wellington
Level 6, 17-21 Whitmore Street
Wellington Central 6011
PO Box 10 345, The Terrace,
Wellington 6143, New Zealand
Telephone: +64 4 472 1528

Executive Management

Dr Julian Elder	Chief Executive
Ms Sharon Cresswell	Acting General Manager, Finance and Corporate Services (resigned 30 November 2021)
Dr Roger Dungan	Strategic Relationships Director
Mr Douglas Gaunt	Acting General Manager, Forests to Timber Products (commenced 21 March 2022)
Dr Florian Graichen	General Manager, Forests to Biobased Products
Dr Roger Hellens	General Manager, Forests to Timber Products (resigned 28 February 2022)
Mr Arron Judson	General Manager, Marketing and Partnerships (resigned 14 January 2022)
Mr Cameron Lucich	General Manager, People, Culture and Safety
Mr Hēmi Rolleston	General Manager, Te Ao Māori and Science Services
Dr Tara Strand	General Manager, Forests and Landscapes
Ms Justine Wilmoth	General Manager, Finance and Corporate Services (commenced 11 October 2021)

Bankers: ANZ Bank of New Zealand Limited
Auditors: Ernst & Young, Auckland on behalf of the Auditor-General
Solicitors: Bell Gully, Auckland

Science working for New Zealand

The Crown Research Institutes (CRIs) proudly work, individually and collectively, to create a more prosperous, sustainable and innovative New Zealand

www.sciencenewzealand.org

3,800	54	6,000	40
SMART AND PASSIONATE PEOPLE	SITES ACROSS NEW ZEALAND	SCIENCE PROJECTS EACH YEAR	NATIONALLY SIGNIFICANT DATABASES & COLLECTIONS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FORESTS PRODUCTS INNOVATION
75
years
of
impact