



UNLEASHING THE POWER OF FORESTRY

Annual Report
2017

Reports and Financial Statements



Annual Report 2017

Reports and Financial Statements

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

Our Annual Report is presented in two parts - Highlights (Part A)
and Reports and Financial Statements (Part B). Together both documents
fulfil our annual reporting responsibilities under the
Crown Research Institutes Act 1992.

Highlights is an illustrated document containing the Chair
and Chief Executive report, descriptions of our research performance,
collaborations, work with Māori, and outreach summary.

Our Annual Report is also available in digital format at
www.scionresearch.com/annual-reports

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*Cover: Magnified sample of a plastic composite reinforced with Scion's
engineered wood fibre (licensed and sold as Woodforce), colour coded for
particle orientation to predict product strength.*

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GOOD EMPLOYER AND EQUAL OPPORTUNITIES

Scion is committed to being a good employer and promoter of Equal Employment Opportunities (EEO). This commitment is demonstrated through our day-to-day practice and history of compliance with the requirements of the Human Rights Commission Annual Report Review.

Our Scion Values help build a culture that supports empowerment, diversity, inclusion, innovation and accountability. We believe these attributes create an environment that allows the Good Employer principles to thrive.

With our company values, we deliver on the good employer obligations through our Board Good Employer Policy and our Equal Employment Policy, along with our management policies, programmes and practices. Scion's progress against the seven key good employer elements over the 2016-17 financial year are summarised below.

Good employer key element	Scion's achievements 2016/2017
Leadership, accountability and culture	<ul style="list-style-type: none"> • Seventeen new members joined the Future Leaders cohort. • Leadership group strategy session and resilience session held. • Executive Management team completed Leadership Styles Inventory profiling. • Continued embedding of the Scion values in leadership practice, recognition and company processes. • Progress against the 2017 Climate Survey action areas including supporting career pathways, remuneration, helping staff transition through campus upgrade, increasing fun and improving communication. • Two leadership-in-practice training sessions delivered to the first line manager group. • L&D Programme delivered to all employees including Productivity and Self-Management, Unfiltered and Excel. • Two P&P employees completed their crucial conversations accreditation and delivered the programme four times this year. • Te Rangihakahaka professional development programme rolled out and was perceived very positively by staff.
Recruitment, selection and induction	<ul style="list-style-type: none"> • Participated in the Rotorua Careers Expo. • Used diverse media to attract candidates and created an excellent candidate database to achieve our time to fill goal. • Recruitment module delivered to first line managers. • Diversity and Inclusion reference added to policies, job adverts and careers website.
Employee development, promotion and exit	<ul style="list-style-type: none"> • Six employees supported with further tertiary education. • Mindfulness training completed with 70 staff. • Stable turnover of 8.7%. • ACE performance management training rolled out to all ACE managers across the business. • Twenty-four staff promoted via Scion's progression panel process.
Flexibility and work design	<ul style="list-style-type: none"> • One in four employees worked part time. • Draft working remotely policy submitted to Team Managers for consultation. • Twenty-one employees approved for changes in hours to accommodate lifestyle choices. • Eleven employees accessed parental leave (six males and five females) and seven employees received ex-gratia payment upon return from parental leave (three males and four females). • Breastfeeding room was made available for returning mothers.

Good employer key element	Scion's achievements 2016/2017
Remuneration, recognition and conditions	<ul style="list-style-type: none"> • Maintained regular Partnership for Quality meetings with PSA Union. • Scion Science Excellence Award awarded. • One hundred and one employees accessed sick and bereavement leave beyond the legislative allowance. • Two employees accessed income protection and one our life insurance policy. • Remuneration specialist completed an audit on pay equity across Scion.
Harassment and bullying prevention	<ul style="list-style-type: none"> • First line manager training delivered on treating staff consistently and fairly. • Team feedback sessions after climate survey reinforced bullying is unacceptable and staff reminded of their support options. • Positive 11.5% EAP usage compared to national average of 8.20%. • Crucial conversations training delivered to support staff with healthy dialogue.
Safe and healthy environment	<ul style="list-style-type: none"> • Health monitoring implemented for staff exposed to hazards – 26 staff were retested for hearing and lung function. • Influenza vaccinations were taken up by 76 staff. • Wellness calendar introduced with monthly initiatives to support staff in all areas of wellbeing including: <ul style="list-style-type: none"> – Fortnightly seated massages onsite for staff; – Mind Club for staff to 'calm the mind' and practice meditation; – Weekly yoga classes at lunchtime; – Prizes for all teams entering the Rotorua Ekiden relay race; – Men's Health month (subsidised health checks for all male staff, healthy morning tea, screened the Sugar Film for staff and completed a 4-week most waist centimetres lost challenge). • Occupational hygienist engaged to review our nursery, noise and fungal exposure. • Mental health webinar launched for managers. • CIMS emergency training completed by Health and Safety Coordinator. • Emergency warden procedure training for all emergency wardens.

1. Leadership, accountability and culture

Scion recognises that excellent leadership, real accountability and a high performance culture are vital in order to grow the quality and impact of our science and achieve our strategic goals.

We continued to develop our organisational leadership capability, primarily through three targeted programmes. The first, focused on our senior leadership group of tier one to tier three leaders (CEO, executive managers and senior managers) to expand a leadership mindset and provide a forum to address organisational challenges. Highlights include a group strategy session and resilience session to better communicate how the team contributes to the goals of the organisation; mindfulness in business to learn mindfulness techniques that activate clear and focused thinking by Dr Chantal Hofstee; and the Executive Management Team also completed Leadership Styles Inventory profiling to help our leaders make productive changes in their behaviour to improve overall effectiveness.

The second initiative, our research leaders programme (first line management), sought to expand leadership and accountability into tier four and beyond. The 24 members of this cohort are our first line management. They received investment in the form of training, organisational opportunities and coaching to strengthen our leadership depth and allow for succession planning. An external facilitator delivered two sessions on Leadership in Practice to the research leaders, and People and Performance delivered a Tools for Success leadership training module.

The third initiative, the Scion learning and development organisational wide plan, was offered to all staff to support their career development at Scion. A number of new courses were added including Te Rangihakahaka professional development, identity, culture and language programme giving staff a

better understanding of Te Arawa tikanga, Mindfulness in Business, Productivity and Self-management, and Unfiltered.

Promotion of Scion values continued, and we recognised the demonstration of values-aligned behaviours through our reward and recognition programmes. From our quarterly CEO award, our annual Scion Awards to our values-branded mugs for all new staff, we believe that recognition positively impacts the Scion culture.

Our biennial climate survey provides us with insights into our culture and was conducted in February 2017. We reviewed and implemented recommendations over the last four months of the year. Initiatives that resulted from the survey included ACE (performance management system) toolkit training delivered to all managers to ensure consistency in our process and provision of additional tools and resources for staff to feel confident in this process. Other actions included progress on career pathways, remuneration, helping staff transition through the campus redevelopment, bringing more fun to the workplace and improving communication.

2. Recruitment, selection and induction

Scion's recruitment and selection practices are free from discrimination and support our Equal Employment Policy to ensure that we recruit the best person for the job. We reject the use of terms that may be seen as discriminatory in our advertising and our recruitment panels are informed on the principles of the Human Rights Act 1993, particularly the 13 areas of discrimination. We also ensure that candidates are given an opportunity to share any specific needs that they may need to be met in the recruitment process.

We continued to diversify the way in which we recruit, utilising print media, online job sites, social media, industry specific media and the Science New Zealand careers website to ensure a wide range of people have access to the opportunities here at Scion. All Scion job advertisements, policies and careers site have been updated to reflect our commitment to diversity and inclusion and EEO.

Recruitment training was delivered to all first line managers on why, how and what our commitment to EEO consists of, and we encouraged the use of a competency framework in order to shortlist candidates for a role.

Scion's induction programme remained an essential element in successfully 'settling in' employees at Scion. This programme is particularly important when welcoming international employees or those new to the Rotorua area. Our process is guided by a self-directed Induction Passport that engages the employee with all key personnel, processes and policies. Attendance at a whakatau, hosted by the Executive Management Team, is an important element demonstrating respect of Te Arawa, and for some of our employees offers their first experience of tikanga Māori.

3. Employee development, promotion and exit

Our employee development strategy is based on clear goals, fair assessment and access to continued learning and development opportunities. Our performance management tool, known as ACE, is used by all staff to plan their annual work, development and safety goals. Following feedback from the 2017 staff climate survey, all ACE managers received refreshed ACE training.

All employees had access to development opportunities through their ACE and our organisational learning and development programme. We also prioritised training for our first line managers as the employee-line manager relationship is a key driver in terms of positive wellbeing, development and engagement.

Scion offers staff a unique process for career progression via a progression panel that allows staff to apply through a peer review process to advance to a higher job band. The panel consists of a diverse

group of employees from across Scion, including a Public Service Association (PSA) union delegate, one general manager and an external remuneration consultant. Twenty-four employees were promoted via the Progression Panel process.

Employee turnover was 8.7% (including redundancies). We completed exit interviews and surveys with exiting employees to identify opportunities for improvement. Exit survey results reflected a positive experience at Scion, and recorded a 95% satisfaction with Scion's commitment to company values, 95% satisfaction in Scion's commitment to Health and Safety and 85% satisfaction with fairness and equity across Scion. Voluntary departures were 57% and 43% were involuntary. Of the voluntary exits, reasons for leaving were family (17%), new career (33%), not a good fit (25%) or retirement 25%.

Scion's Education Assistance Policy supported five staff members with their PhD studies, one staff member with a Post Graduate Diploma in Business Management and one staff member with the Homeward Bound Leadership Programme in Antarctica.

4. Flexibility and work design

Diversity and staff wellbeing is valued, and we demonstrate this by being a flexible employer, through working hours or location. One in four employees works less than the traditional 40 hour working week, and over the past 12 months 21 employees (15 female and six males) altered their working hours to better achieve their desired lifestyle.

This work-life balance ethos was also demonstrated by the number of staff seen mountain biking, running or walking their dogs in the forest alongside our campus.

Access to meaningful work requires more than flexibility of hours and location, and so we implemented a number of additional initiatives acknowledging external diversity and inclusion standards. These include a breastfeeding room for returning mothers, a wellness calendar with frequent events, competitions, support, resources and giveaways to promote health and wellbeing in and out of the workplace. A working remotely policy was drafted and submitted for approval. Also a greater awareness of our Employee Assistance Programme (EAP) for staff and their families saw a positive increase in our EAP usage.

Paid and unpaid parental leave was taken by 11 employees (six males and five females) and we made ex-gratia payments of six weeks' wages to seven employees (three male and four female) six months after their return to work.

5. Remuneration, recognition and conditions

Remuneration is based on job bands and remuneration ranges sourced from external market surveys produced by Korn Ferry Hay Group. Annually we work with the PSA Union and our Scion Board of Directors to set our remuneration budget. We then determine in negotiation with the PSA Union how this budget will be applied across all staff in the annual remuneration round. This year, as traditionally, we applied a performance-based increase or non-consolidated payment.

We believe that our remuneration process is free from discrimination, and we monitor for potential gender equity issues through an annual review of our remuneration, promotion and performance assessments conducted by an independent consultant.

We worked closely with the PSA Union under a Partnership for Quality Programme and utilised this forum to discuss morale, H&S, operating environment and matters potentially affecting Scion employees.

Additional support was provided to 101 employees for bereavement and/or sick leave beyond legislative entitlements. One employee accessed the long-term illness benefit but passed away so the life insurance

policy became available to her family. The income protection and life insurance policy was available to all permanent staff.

The Scion Annual Awards continued and a highlight was the Science Excellence Award made to Dr Michael Watt, Research Leader Forest Industry Informatics for the impact and significance shown in leadership of the team, funding received, increase in his team's utilisation and lead authorship on papers published.

Recognition for employees also occurred through both Scion and team communication channels such as team meetings, Treehouse (our staff intranet) and external Scion Connections newsletter. Our team managers were also supported with a budget allowing them to celebrate success within their teams.

We completed ongoing review and renewal of our EEO and Good Employer initiatives and policies. We sought input into our Learning and Development calendar from the organisation and ensured leadership and the PSA union delegates had input into policy review.

6. Harassment and bullying prevention

Scion encourages a self-resolution approach to relationship problems at work to empower employees, promote efficiency and support an effective workplace. To achieve this we up-skilled our staff with complementary training including Crucial Conversations, Resilience, Mindfulness and Safe Behaviour workshops.

We promoted our Problem Resolution and Unacceptable Behaviour in the Workplace Policy and the Worksafe Guidelines for 'Preventing and Responding to Workplace Bullying'. Our culture and values endorsed the benefit of prompt and respectful feedback, access to EAP and one-on-one behavioural coaching as methods to ensure a healthy workplace discouraging negative behaviours before they start. This year we completed training for our first line managers around treating staff consistently and fairly to raise awareness that bullying can also be very subtle. Team feedback sessions following the climate survey reminded staff that bullying is unacceptable and that a variety of support is available for staff should they have concerns.

Employees at Scion were able to access EAP for support around personal or workplace matters. A total of 29 employees accessed EAP along with five family members, reflecting a usage rate of 11.15% compared to the national average of 8.20%. Our Christchurch staff indicated a preference for an onsite presence through local provider Workplace Support.

With a very similar usage rate to last year's 11.68%, we believe the higher than average EAP support was in response to the encouragement staff received from their leaders and People and Performance. The session average for the staff members was 2.3, and 71% of the problems were personal rather than work related which was a positive result.

7. Safe and healthy environment

Scion continued to advocate for a culture that promotes employee wellbeing and contribution to the H&S environment. This commitment saw us complete significant training with our H&S Committee, including supporting one employee to undertake a Graduate Diploma in Health and Safety.

We continued to take a base line assessment of new staff and implemented monitoring for staff who were exposed to hazards, with 26 staff re-tested this year on hearing and lung function. This initiative made our staff feel cared for, and the results reflected our good practices in respect of personal protective equipment use.

An occupational hygienist conducted a review of our nursery, noise and fungal exposure and provided recommendations for our housekeeping practices that we will implement in the coming year. CIMS

Emergency training was completed by Scion’s Health and Safety Coordinator, as well as emergency warden procedure training for all emergency wardens.

A key initiative was the launch of our Safety and Wellness calendar to support staff in all areas of wellbeing, which provided a range of monthly activities as listed in table (see page 4). The year completed with one serious harm incident, 28 incidents, and 31 near misses reported (these compared with 24, 31 and 37 respectively in 2015-16). Eight staff were medically treated, 19 non-medically treated (compared 7 and 15 respectively in 2015-16) and one lost time due to injury. A total of 76 staff received a company-paid influenza vaccination.

Work place profile

Total staff	Total permanent employees 293 – 51.7% male and 48.3% female
FTEs	Full time equivalent permanent employees total 273.46 (excludes fixed-term staff, students & post doctorates - 20)
Māori	Māori represent 9% of permanent employees
Disability	2.7% of employees are recorded as disclosing a disability
Age	26.7% of employees are in the under 40 years age group, 28.4% are in the 40 to 49 years age group and 44.9% in the 50 years and over age group
Nationality	23% of employees are recorded as disclosing a nationality other than New Zealander or Māori, and represent 30 nationalities
Pacific Islander	No employees are recorded as disclosing a Pacific Island nationality

ENVIRONMENTAL PERFORMANCE



Scion obtained Enviro-Mark Silver accreditation in July 2016. We are looking to move to gold certification in the near future.

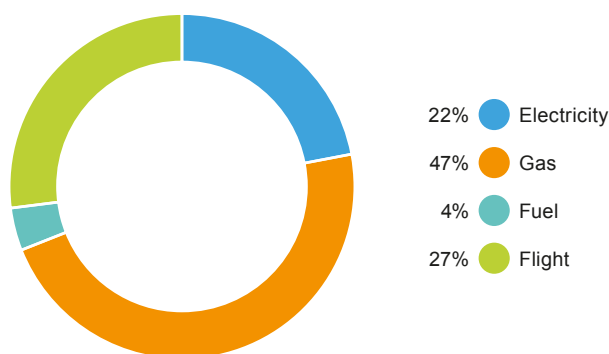
Scion staff were involved in a riparian planting project adjacent to the Puarenga Stream with our neighbour Whakarewarewa School and tenant Wildland Consultants.

Scion staff were active in reducing electricity and gas usage during 2016-17, resulting in a 4 per cent reduction in carbon emissions from the previous year.

Energy efficiency was also a focus of the planning for the renovation of our main office block top floor as well as being integrated into the design of our new innovation building.

Reductions in waste to landfill and water usage will be a focus of the 2017-18 financial year as well as continued reductions in electricity and gas usage.

Comparison of relative CO₂ loads from Scion activities for 2016 - 2017



STRATEGIC SCIENCE INVESTMENT FUNDING (CORE FUNDING)

Intermediate Outcome 1			
Maximise the value and profitability of commercial forests and their ecosystem services			
Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Improve the value and productivity of the New Zealand forestry sector	New Zealand Forest Owners Association and New Zealand Farm Forestry Association	\$3.1 million	\$3.1 million

New tree finger printing kit developed

Scion, with the Radiata Pine Breeding Company Ltd Genomic Selection Programme, has successfully identified markers for *Pinus radiata* (radiata pine) that meet criteria for parentage reconstruction and clone identification. Generating a (near) complete database of potential parents reflecting our breeding and production populations is our next priority. A commercial release of the parentage assay is expected during 2018.

Markers for radiata pine have been combined with markers for parentage reconstruction and genetic diversity analysis for *Eucalyptus nitens*, *E. fastigata* and for *Leptospermum scoparium* (mānuka) to increase the cost-effectiveness of the parentage assay.

Genomic resources

Work continued on the sequencing and assembly of the radiata pine genome, resulting in the most complete assembly for the *Pinus* genus to date. The assembly of the mitochondrial genome was initiated, and is expected to be completed during 2018. With new compute resources in place, long reads will be used to assemble a final 1.0 sequence for publication. This genomic resource is vital for the development of robust genomics platforms in radiata pine and opens the door for greater understanding into epigenetics and functional genomics.

Drought tolerance

Drought tolerance and photosynthetic rate was measured on radiata pine clones using changes in isotope level and chlorophyll fluorescence. Variation in these prior to drought stress was found among genotypes. Results from analysis of changes after drought stress will be used to develop genomic estimated breeding value (GEBV) prediction models to select radiata pine for drought tolerance.

First genomic selection demonstrated greater genetic gain than progeny testing

The first genomic selection paper, on the non-key traits in radiata pine, has been completed, and is ready for submission. These traits, other than growth, wood density and stiffness, are of interest to breeders. The study evaluated the accuracy and predictive ability of genomic selection and its efficiency over traditional forward selection in radiata pine for: branch-cluster frequency; stem straightness; internal checking; and external resin bleeding. The results were very encouraging and further sites, training populations and traits will be examined in future years.

Scenario analysis of genomic selection indicated the importance of a rapid pathway to market

Several scenarios for the implementation of genomic selection in conifers were tested. Genetic gain per generation was found to increase considerably when the size of the training population was largest, or when the heritability was higher. The largest genetic gain (24%) was achieved where large training populations (3000 clones) and high heritability traits (0.5) were combined in the simulation.

Deploying clones of the selected individuals always resulted in higher additional genetic gain than deploying progeny/seedlings. Deploying genetic material selected from genomic selection with top-grafting for early cloning appeared to be the best option. Application of genomic selection to conifer breeding programmes, combined with deployment tools such as top-grafting and embryogenesis are powerful tools to speed the delivery of genetic gain to the forest.

Biotechnology approaches to forest productivity

Scion continues to take a leading role in the application of biotechnology for forestry in New Zealand. Genetic

modification (GM) and new breeding technologies (gene editing) have the potential to make step changes in production forestry through improving productivity and/or profitability. Biotechnology can also address some important social licence to operate issues (e.g. reducing the incidence of wildings) and could be applied in the future to achieve disease resistance. Scion is continuing to evaluate new technologies, carrying out robust science and to keeping up-to-date with international developments to inform commercial forestry companies, the public and to support policy development. We are making a substantial contribution to international science in conifer biotechnology and leveraging that knowledge for New Zealand's benefit. Research has been presented at: American Society of Plant Biologists Annual Conference, Queenstown Molecular Meeting, Australasian Genomics Technologies Association Conference, IUFRO Asia and Oceania Conference, Queensland University of Technology and Institute for Future Environments, Swetree, Forschungszentrum Jülich (a Helmholtz Research Centre Germany) phenotyping workshop.

This evaluation and monitoring of existing plantings continued during 2016/17. Additionally, four new lines of biotechnology trees have been planted in field trials. The new lines have been developed to improve productivity and will allow testing of the performance of the biotech trees compared with unmodified controls during growth under field-trial conditions.

This project will now be complemented by a new Endeavour fund project for sterility research and wilding pine mitigation.

Informatics

'Big-data' approaches, remote sensing and the use of unmanned aerial vehicles (UAVs) are major contributors in the move towards practical precision forestry. Scion is validating many of these tools and defining how they can be applied to develop the next generation of forest management systems.

GeoSpatial data processing has been a major focus for Scion during the past year as extracting maximum value from the large amounts of data being collected is a priority. A collaborative work programme with Forest and Wood Products Australia is pushing the boundaries of useful information that can be extracted from LiDAR point clouds. This work is producing new ways of processing high resolution LiDAR data for tree measurement.

Analysing detailed point cloud data requires large-scale processing. Scion has worked with local technology company Nyriad to produce a new cloud-enabled platform for processing LiDAR data at an unprecedented speed and scale. This new platform will open opportunities for science delivery into the primary sector, enabling analysis of data hitherto impossible to achieve.

The UAV programme continues to push the limits of what these machines are capable of. Scion UAV-collected LiDAR data was showcased at a major remote sensing conference in South America. This work is widely regarded to be world leading in the detail of data being collected and its analysis. Uptake by industry is validating this technology and the approach. Scion has also trialled Virtual Reality, the Internet of Things, and helped our industry deal with new Sentinel 2 satellite data.

Ecosystem services

Scion continued to build national capability and leadership in ecosystem services, bringing in a wider economics perspective and experience in agriculture and the impacts and adaptation to climate change. Scion organised the first Oceania Forest Ecosystem Services Forum and connectivity with Europe has been extended increasing our ability to influence and leverage international research efforts.

Scion is now well recognised for its leading position in Forest Ecosystem Services (FES) and developing a comprehensive understanding of the value of New Zealand's planted forests. We have worked with regional councils, national policy agencies, forestry companies, iwi groups, and through input to the NZ Institute of Forestry Forest Policy discussion piece. The Forest Investment Framework (FIF), alongside economic valuation techniques applied in forestry, are now seen as the state-of-the-art approaches in New Zealand and have significant sector and local government support.

The growing interest of the forest industry on ecosystem services is reflected by the team's invited to contribute to the special issue on Ecosystem Services of the *NZ Journal of Forestry* (two professional papers). The vital importance of ecosystem services in policy is recognised, for example, considering the synergistic effects of forest and dairy industries to inform policy development and forestry as a low-input alternative land use for nitrogen-sensitive catchments.

Scion's ecosystem services work reaches beyond New Zealand. We took part and supported in the first Oceania Ecosystems Forum held in Brisbane, which included a forest ecosystem services specific workshop with speakers from across Oceania. This has strengthened key collaborations (Universities of Melbourne and Queensland, Australia National University, US Geological Survey, Centre for International Forestry Research) that allow both learning from others and extending Scion's work into the Pacific and beyond.

Scion has been recognised for its work on the economic valuation of forest ecosystem services with keynote presentations such as a "Workshop on Ecosystem Services and Land Use" at the International Union of Forest Research Organisations (IUFRO) Congress to be held September 2017 (organised by Institut National de la Recherche Agronomique (INRA) Laboratory of Forest Economics). This invitation has resulted from the launch in 2017 of the four year EU COST Action project on Payments for Environmental Services for Water (PESFOR-W) in which Scion is a foundation partner. This enables strengthening of collaborative research activities on that project. Our involvement in PESFOR-W has resulted in the publication of a journal article.

Scion presented at the 31st International Zamorano Convention in Santa Cruz, Bolivia in August 2016 on the role of forests on climate mitigation. As a result, Zamorano University has approached Scion offering interns as part of the institution's fourth-year teaching curriculum. This will extend our reach into Latin America.

Systems for Economic and Environmental Accounts (SEEA) for forestry have been developed. This includes working with NZFOA, MPI, Treasury and StatsNZ and with international partners. The forestry SEEA will assist New Zealand's development of satellite accounts for the forestry sector to more fully account for the values and benefits over and above that of timber. This work is supported by two conceptual or positioning papers on 'inclusion and recognition of forest ecosystem services into policy', and 'frameworks for policy impact analysis'. Capability in political science has been added to the team to support this work. A third internal discussion paper identifies Scion's scientific niche in the forest policy and economics area (spatial economic approaches with a focus on forestry within wider landscapes and the bioeconomy) and will help overall positioning for Scion.

A computable general equilibrium (CGE) model has been developed and will be used in studies of the impact of various economic and environmental policies, as well as management interventions, on the broader economic performance of the industry and contribution to the national economy. This will be a pivotal tool to get New Zealand involved in the global effort to implement the new SEEA led by the United Nations and World Bank. The CGE model will be used in a sustainable land management and adaptation to climate change project on the impacts of climate change in regional economies led by Landcare Research.

A new programme, 'Connections Matter', is being developed to advance spatial economic modelling methods linking different land uses and the marine ecosystem within an ecosystem services framework. The focus will be on the Marlborough Sounds. The Regional FES Forum held in Havelock on 24 May 2017, with participants from local council, land users, the aquaculture industry, local community groups and businesses, academia, and iwi, along with the Envirolink project in the Marlborough Sounds and conversations with Terra Moana and Moana NZ, have set the foundations for the development of this programme in 2017/18. International ecosystems services collaborators from the US Geological Survey, Purdue University and Durham University will be invited to assist in the development of the programme.

The national forestry Permanent Sample Plot (PSP) database and collection

Scion's longitudinal study of tree growth (PSP), continues to underpin research programmes of national importance. Data from this work has been used to develop new programmes, such as an examination of the technical and economic feasibility of growing short-rotation fibre forests using radiata pine. There has also been a greater focus on undertaking more wide-ranging and comprehensive analyses of the data to test metabolic scaling theories, determine the optimal density (stocking) for growing radiata pine, and calculate the levels of attrition losses due to wind and identify the contributing factors. Advances in data analysis techniques have made this possible. Further development of data visualisation and analytical tools will enable additional interrogation of databases such as studying the impact of drought on the growth of radiata pine.

A focus for 2016-17 was on ultra-high pruning trials and the pruning followers' trials, both of which are reaching maturity and are soon to be harvested. End-of-rotation measurements have been made and the data analysed to show the impact of pruned height, stocking and number of followers on the yield and size of pruned logs. The Specialty Wood Products Partnership programme also support measurement of selected trials and plots in species other than radiata pine. This work will be completed over the next 12 months.

Intermediate Outcome 2			
Increase the profitability of solid wood processing through customer solutions and supply chain innovations			
Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Improve the value and productivity of the New Zealand wood products sector	WoodCo Strategy WPMA Vision 2050	\$3.45 million	\$3.45 million

Work in wood products and processing creates the underpinning knowledge that enables industry to develop and enhance the performance of products that best fit with the needs of high value (and profit) markets. Our aims are: to improve the proportion of each log converted to saleable products through understanding wood quality and the increased use of residues; to provide information to address licence to operate issues; to support the increasing diversity of the wood products portfolio that New Zealand can offer; and to sustain our capability to support current and evolving industry needs and to troubleshoot industry problems. The key outcomes for 2016-17 are:

High-performance wood products

Scion has continued development of high-performance wood products (such as very durable and stable wood). Two technologies using radiata pine have been scaled-up and shown to improve the stability and durability while enabling natural features of the wood to be expressed in colours from natural hues to bright, vivid shades. The project is ready to move to commercialisation of these technologies. Further novel approaches to protect and enhance a range of wood species are being explored at laboratory-scale, such as thermal modification of non-radiata species. The approaches have been successfully applied to three other species. Importantly for the species trialled, this technique produces new colours with greater uniformity, which should enable new market opportunities to be developed.

Extension to drying and stabilising other wood species

Many of the highest value international markets are demanding naturally durable wood, e.g. some eucalypt species. The challenge with these timbers, including many of New Zealand's indigenous species, is drying them in a way that provides high timber recovery and enhances wood material properties such as stability. Building from Scion's experimental knowledge of the effect of supercritical CO₂ on key wood/water relationships, and the effect of mechanical stress, we have been able to successfully predict the softening effect of CO₂ on wood material by means of predictive modelling. This allows us to determine the effect of process parameters on dewatering efficiency and moisture related distortion for a wide range of scenarios, as well as providing an engineering scale-up design tool for larger plants.

We have also shown that using supercritical CO₂ and a new thermal drying technique can reduce the development of shrinkage and internal checking in a hard-to-dry species. This work is supported by novel drying research with an industry partnership focussing on eucalypts, Douglas-fir and cypresses. These potential drying solutions could also be used for tōtara and beech; and is part of a programme with Ministry for Primary Industries (MPI), Northland Inc, Tane's Tree Trust and iwi in developing greater economic returns from planted tōtara.

Wood preservation treatment options

Scion continued to develop options to address radiata pine wood treatment options that avoid the use of chemicals such as copper-chrome-arsenic (CCA) formulations. This can be a market access issue in some countries. Scion has developed a bio-based chemical option that can be delivered into the wood in water emulsions. Initial evaluation suggests this will meet the challenges of above-ground applications such as decking, flat-panel, joinery, and framing. In 2016-2017, our bio-based chemical durability samples showed no signs of decay after three years in above-ground trials. Scion is now exploring whether the bio-based chemical durability treatment affects paint and fastener corrosion performance with the establishment of a long-term exposure trial. In response to an increasing demand for non-radiata species, a range of house-framing and exterior-decking applications have also been treated and installed in long-term exposure trials.

New wood product species - indigenous forests and wood products

Ngāti Whare opened a state-of-the-art nursery for propagating native trees and plants at Minginui in September 2016. The iwi investment includes irrigation booms and tray-filling equipment from Italy, the latest technology from New Zealand's nursery sector and locally engineered plant tables. The nursery development is the direct result of

the experience provided by over 60 years of nursery experience at Scion and capability supported through this programme. The nursery aims to use Scion-developed propagation protocols for indigenous forest plants in order for Ngāti Whare to regenerate part of the Whirinaki forest, as well as providing plants for commercial-scale, regeneration and riparian plantings.

Scion and Ngāti Whare have partnered to build on the science and innovation potential of Māori knowledge, resources (Whirinaki Forest), and people (Ngāti Whare). A Vision Mātauranga programme is providing additional support to build capability within the iwi to do research to take nursery production of rimu, miro, kahikatea, and tōtara from a research scale to a commercial nursery and forest out-planting scale. Scion staff will be mentored by kaumātua and hāpu to explore and understand Ngāti Whare mātauranga for integration into the research work.

The indigenous forestry programme in 2016/17 focussed on better understanding the potential for the development of a commercial industry based on the sustainable management of farm-grown tōtara in Northland. A pilot study looking at the properties of farm-grown tōtara, the timber grade recovery and the costs of harvesting and processing trees has been carried out. A sample of approximately 40 trees were selected on a property that had an existing harvesting permit. The trees were characterised *in situ*, felled and processed into boards that were graded. The results showed that both the volume and grade recovery were good, providing confidence around a critical factor that affects the viability of a commercial industry. The timber will be characterised. Some of it will be used to test the viability of kiln drying, while other material will be sliced into veneer and tested. The project has helped to create momentum around tōtara, which will help support and inform future initiatives in this area.

Scion has also developed kauri DNA extraction methodologies, contributed to additional collections of kauri populations for testing and a hypothetical breeding plan. These projects are aimed at supporting partnering with iwi and developing an iwi-based genetics solution to host resistance to kauri dieback disease.

New wood product value chains from non-radiata pine exotic species

Scion has tested genomic selection in an advanced generation open-pollinated *Eucalyptus* population. Breeding values estimated using the EUChip 60K SNP chip genotyping tool were compared with a scenario using the documented (non-marker-based) pedigree. The marker-based model gave better model fit and accuracy of breeding values. Inbreeding was found in growth traits, and appeared to have actually inflated documented pedigree-based estimates, probably over-estimating predicted genetic gain for these traits. The beneficial effect of using genomics was profound, especially in traits suffering from inbreeding depression such as DBH and height. Genomic selection using the EUChip60K SNP chip appears to be useful and it is hoped to test and implement this technology further during the next few years.

Scion has continued to build a strategy to test genomic selection in Douglas-fir. DNA was extracted and identified from a number of trees during 2016-17 in preparation for extensive genotyping throughout 2017-19. A provisional economic analysis has been undertaken to test the expected benefits of implementation of genomic selection compared with quantitative breeding. Results showed that the genomics programme delivers a potential \$47.8 million to the forestry growing and processing sectors, or \$290 ha⁻¹ over the predicted 40,000 ha of new plantings. In contrast, traditional breeding with the current modelled genetic gains delivered potential losses.

Tissue culture pathways for Douglas-fir

Previous work in Douglas-fir propagation has now migrated to a new pan CRI-industry programme focussed on eliminating wilding trees. Most of the development of Douglas-fir propagation technologies now lies within the Wildings research project. A small amount of support is focussed on tissue culturing of control-pollinated Douglas-fir material. Proof of concept transformation testing is proving challenging due to the difference in behaviour of Douglas-fir in culture compared to radiata pine, and issues around the recovery of some of the embryogenic cultures previously stored in cryopreservation. Recently, there has been some limited success in the transformation of embryogenic cultures. Development of cryopreservation protocols has been initiated to improve the success of recovery of lines cryopreserved in the future.

Wildings

Wilding conifers invading conservation and pastoral land are a major concern in New Zealand. Current wilding conifer control methods are effective but expensive, and depend on herbicide used at rates that exceed label recommendations. Improved control that reduces cost and risks to people and the environment requires reductions in herbicide use and new application systems, while maintaining efficacy. Scion's goal is to enhance herbicide efficacy and optimise spraying methods. This year, our programme collaborated with Plant Protection Chemistry, DOC and HeliResources: to develop laboratory methods to test the phytotoxicity and efficacy of different chemical mixes; to test the effect of a range of adjuvants on the uptake of triclopyr; and to compare these

results to those used in current operations for controlling dense wilding infestations. Early results indicate there is scope to refine the adjuvants currently used operationally, which could reduce costs and increase the efficiency. Together with DOC and HeliResources, we evaluated the targeting efficiency of a novel helicopter spot-application system and incorporated the AIMMS software into the helicopter flight-control software systems and synchronised this platform with the spray boom. In association with the Winning Against Wildings theme, a programme with strong industry direction, we have engaged with DOC, regional councils, forest owners, the Defence Force, Ngai Tahu and many trusts and commercial spray operators. These facilitated workshops and meetings have ensured that the research is aligned with the needs of those managing wilding conifers across New Zealand.

Better home and building decision making

In New Zealand, designers and developers who focus on the cosmetics and functions of buildings make many of the decisions around the design and construction of our homes and buildings. This drives a 'code minimum' approach that does not always produce energy efficient and healthy homes. Design of performing, affordable, neighbourhood-integrated and fit-for-purpose homes requires information that currently is not easy to access. Presenting this information in an appropriate way will help people make informed decisions encompassing energy/operation, transportation and capital costs while providing a healthy living environment. In 2016-17, we produced a demo version of a tool that collated a wide range of background material on the current building design and built environment planning decision tools. This supports the development of Scion's interface and partnership with the National Science Challenge "Better buildings, towns and cities". With an international secondment from VITO (a Belgian Research Organisation), the role, the uptake and the impact of life cycle analysis (LCA) and environment product declarations (EPDs) in the New Zealand building sector has been explored. The Scion built environment programme has also secured a position in the Australian Tall Timber Building Hub, which aims to grow the role of timber in the medium-rise buildings.

Value chain optimisation

The forest industry operates across a value chain that is a complex series of highly inter-related activities. The forestry value chain includes growing, haulage, processing, shipping, marketing and the final customer. Less tangible activities include managing risk, international financial transactions and biosecurity impacts and addressing market trends.

Forests in New Zealand seldom change hands. When it does happen, buyers and vendors have to rely on *ad hoc* agreements and negotiations in order to enable a trade. The value of a forest depends not only on the volume and quality of the wood, but also on accessibility, market outlooks and the location of the forest relative to sawmills and ports. Scion has developed models that can be used to estimate forest production and assess the issues concerning the infrastructure and the location of a commercial pine forest. In 2016, Scion entered a partnership with ForestX, a company that has a unique business model to provide a commercial forestry-resource electronic trading board. Scion combined several models and derived a Forest Expectation Report for any forest that is listed on the trading board. This report helps buyers compare listed forests. Training for rural real estate agents to help them develop a better appreciation of forest resources was carried out. By the end of 2016/17, a number of listed forests had changed hands and Forest Expectation Reports supported some of these listings. This process is now being used by third parties.

Scion has been disseminating quarterly operational log-price outlooks since 2015. The outlooks reflect the main drivers expected to influence log prices in the coming months and provide a consensus view among approximately 50 industry participants. These participants deal with at least 70% of the entire industry's logs. Following on from the short- to medium-term outlooks, Scion has generated a longer-term outlook towards 2025 and 2035. More than 130 stakeholders spanning the value chain participated in this. Opportunities and challenges with respect to wood availability, harvesting, transport, ports and shipping, processing, international markets and competitors have been identified and will be the focus of on-going work.

Scion undertook a national logistics scan in 2016/17 to assess qualitatively significant logistics challenges and opportunities in the regions. Some 67 councils throughout New Zealand participated in 10 regional reference panels held online throughout May 2017. There were significant differences between the logistics needs in rural communities compared to those in urban areas. Challenges in rural areas revolve around communication infrastructure, aging populations, public transport and labour availability to industry. Several opportunities for emerging technologies to resolve many of these issues were identified.

Two specific opportunities were further developed. The first of these was a container terminal operation in the Eastern Bay of Plenty. As part of a commercial contract, a container packing and transshipment terminal in Kawarau (EBOP) was found to be of exceptional value to the industry and the community. This will move 50,000 twenty-foot

equivalent containers from the road to rail with savings to the exporters in the region of \$4 million per annum, as well as environmental and social annual savings estimated at \$3 million. A second study investigated the opportunity to import pruned logs from the South Island to supply North Island appearance lumber mills via the Port of Tauranga. The most viable option was to utilise empty space on vessels already travelling from Southland to Tauranga at a delivery cost of approximately \$55 per m³.

The WoodScape tool developed within this programme enables companies to identify options and intervention points that, if overcome, will increase confidence for companies to invest in new wood processing options in New Zealand. Monte Carlo risk analysis (@Risk) has been added to the WoodScape model. Log prices, exchange rates and product prices were updated as part of the process. Preliminary results show that risk adjusted return on capital employed (ROCE) are consistently lower, with ROCEs dropping on average by 17%, under a wide range of variation. The updated WoodScape model was used within the Government funded Industrial Symbiosis project to assist with identification of wood processing options suitable for expansion of wood processing in Kawerau.

Intermediate Outcome 3			
Expand opportunities in the wood fibre, pulp, biopolymer, packaging and biochemical industries and from their biomass side streams			
Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Improve the value and productivity of the New Zealand wood products sector and bio-material industries	WoodCo Strategy, WPMA Vision 2050, Packaging Council strategy, packaging industry, polymer, pulp and paper and biobased/renewable chemicals	\$5.7 million	\$5.7 million

High-value products from biomass

Scion continued to invest in its programme targeting the conversion of woody biomass and other sustainably derived feedstocks into valuable plastics/polymers (bioplastics) and ultimately into biobased products. Converting biobased feedstocks into higher value products creates beneficial outcomes for New Zealand. It increases the intrinsic value of the biomass feedstock (e.g. trees), and creates new high-value biomaterials and bioproducts manufacturing industries for a large and growing international market as well as providing bioproducts that add value to New Zealand’s other export industries such as high-value food.

We are focussing on de-risking new technologies and developing bioproduct prototypes and pilot plant scale processing options. At the same time, we are exploring the fundamental problems in bringing these materials to market. An important part of the programme is interaction with industry and the ultimate end users. A key recognition of Scion’s national and international role in developing bioproducts combined with sustainable manufacturing technologies are the expanding strategic relationships with Fraunhofer IGB and ICT (Germany), VTT (Finland) and VITO (Belgium).

Staff were supported in building collaborations relating to packaging, biorefineries, nanotechnology and 3D printing. During 2016-17, Scion established two virtual research programmes - aligning all internal work related to polyhydroxyalkanoate (PHA) and 3D/4D printing. These virtual programmes ensure that activities across a number of government funded projects maximise the research outcomes.

Scion considers PHAs as a feasible target for polymer production in New Zealand as we are lacking the infrastructure for refining petroleum to chemicals and polymers. PHAs can be produced using renewable feedstocks including plant material, biobased oils and fats and carbon dioxide and methane. A commercially viable biopolymer plant can be as small as 50 kt/pa of production capacity – a perfect size for New Zealand – leading to new onshore manufacturing and export opportunities.

We have improved the production of different forms of PHAs through fermentation. This was accelerated through hosting a postdoc from the University of Manitoba (Canada) allowing Scion to build on the knowledge around production of PHAs. PHA polyesters have a wide range of properties. Combining these with Scion’s industrial

extrusion processing capability led to a number of new bioplastic composites. Additionally, a successful Catalyst Proposal with Professor Michelle Coote from the Australian National University allows us to work with her to bring computational modelling into stronger alliance with plastic design and degradation – enabling us to predict the best plastics for the future before they are even realised.

Some of the PHA containing biopolymers produced at Scion have been tested in 3D printing processes. Additive manufacturing suits New Zealand perfectly – it enables onshore added manufacturing (decentralised, regional and small scale) for a range of innovative and complex products. Both the emerging bio- and circular economies offer several opportunities to utilise 3D printing at several points of the value chain.

Other programmes at Scion have focussed on using high-molecular weight wood hemicelluloses (from thermo-mechanical pulping pressate water) as feedstock for the production of durable oxygen barrier films. This is a joint project with VTT developing new biobased products through co-invention and adaptation of partner technologies.

Scion's activities in this area are closely aligned with targets of the recently established National Science Challenge Science for Technological Innovation. A multi-party spearhead team has been working together for one year and first new materials and 3D-printed prototypes have been manufactured.

Converting 'wastes' into high-value products

Hemicellulose fragments are part of the pulp and paper by-product streams. This year, Scion explored producing films from these hemicelluloses at a large scale in collaboration with international partners. The ability to remove resin from liquid waste to improve the value proposition for pulp mills has also been explored. We have completed proof-of-concept experiments and assessed the feasibility of resin recovery from pulp-mill process waters.

Scion's break-through technology to deconstruct the organic component of waste streams (TERAX®) is a continuing focus. The application of the technology has been extended into other areas, including a concept for the processing of the organic fraction of municipal organic wastes using the TERAX® technology. Reducing landfill by converting the organic component into high-value products is potentially a very large economic and environmental opportunity for New Zealand. The application of the wet oxidation technology at small scale is being supported by the Bill and Melinda Gates Foundation.

Enhancing the resilience of fibre processing industries and fibre composites manufacturing

Finding ways to lightweight materials, such as glass fibre plastic composites, while maintaining performance and end of life benefits is a global challenge. Scion has developed a world-leading approach to integrating polymers and wood-fibre to produce a high performing product able to be developed into complex three-dimensional shapes with an excellent sustainability footprint and yet able to be processed in standard industrial manufacturing equipment. This is licensed for manufacture in several countries. During 2016-17, we worked towards the identification of a fully biobased and biodegradable composite with good mechanical properties that would be able to compete with commodity plastic available on the market. Scion opted for PHA as its strategic choice for a biobased plastic matrix. To support Scion's fibre-composite technology, the focus this year was on the interface between matrix and fibres, aiming to increase stress transfer that will lead to better mechanical properties when used in conjunction with matrix reinforcement. Another focus was the need for more fibre availability that fits within investment cycles, the potential for products such as paper and board (packaging) and fibre composites to be produced through short-rotation forests.

High-value products from lignin

Lignin, about a third of the composition of wood, is currently seen as a low-value product arising from wood processing and is burnt for its energy content. Lignin has the potential to directly substitute for the aromatic subset of petrochemicals. The challenges are isolating lignin in a useful form and managing the high level of variability of materials arising from plant sources. Applications include lignin that can be converted to carbon nanofiber mats, or used in polymer blends, for moulded or extruded products and in developing industrial resins (e.g. coatings and adhesives). Overcoming processing challenges could lead to high-value industries in New Zealand turning our forests into feedstocks for biorefineries.

The processing of industrial lignin into lignin-nanofibre materials and thus carbon-nanofibre materials has opened up new electrical applications. Scion's work in deconstructing lignin to produce lignin derivatives formed by hydrogenolysis is continued through an international collaboration with VITO (Belgium). This approach aims to develop new opportunities for lignin oligomers in multiple industrial uses. At Scion, bio-oil production and thermal treatments developed initially for bioenergy applications have been used to deconstruct lignin to produce

derivatives that have been modified using specific enzymes developed at Scion to improve chemical properties of the lignin derivatives for further processing into industrial resins or adhesives.

Scion is a member of CLIB 2021, an international open-innovation cluster of companies, academic institutes, and universities in Northern Europe that is active in biotechnology and the bioeconomy as a whole. Scion staff presented at the CLIB2021 conference (January 2017).

Packaging

Packaging is a critical element in New Zealand's \$60 billion dollar export industry. It is needed to contain and protect the product while communicating essential information and the brand story. Packaging is also an export product in itself and contributes 1.8% of New Zealand's GDP. Globally, there is a need for improved packaging quality, reliability, sustainability and traceability.

Scion packaging capability supports the wider export sector and the packaging manufacturing sector. In the past year, we have continued to develop new technologies, specialised equipment and capability in:

- Fibre-based packaging including measuring performance in chilled supply chains;
- Printing and ink development including printed electronics;
- Plastics processing including the development of biobased gas barrier coatings; and
- Global requirements to ensure materials are safe for food contact.

This work provides New Zealand-centric solutions and give local firms a competitive advantage in materials, product support and new intellectual property. Investment in this area in 2016-17 delivered the following outcomes:

Scion's specially designed test facility (the WHITE room) with accurately controlled temperature and cycle humidity is fully operational and being used by national and global partners for box testing. The WHITE room is the only facility of its kind in New Zealand, and one of very few globally, providing truly independent test evaluation capability for New Zealand and international firms. First-test results outlining the importance of investigating creep in corrugated packaging under temperature control and cycle humidity have been published.

Increasing regulatory mandates put commercial pressures and expectations on businesses. They rely on traceability to manage quality, recalls, liability, counterfeit parts, inefficiencies in manufacturing and cost savings. Through an ongoing collaboration with AgResearch and Plant & Food Research, several technologies enabling packaging to provide product traceability are being explored. This has included trials of both near field communication (NFC) tags and isotope testing of papers from different parts of the world (New Zealand, Australia, and Sweden).

Scion's moisture barrier coating research has progressed into commercialisation. A patent for the most recently invented formulation has been filed. Extensive market validation and customer engagement with New Zealand and international companies to map their requirements with the attributes of our coating technologies is underway.

Scion is member of the new New Zealand-China Food Protection Network (NZ-CFPN) partnership involving nine New Zealand research organisations and is providing expertise in packaging for food protection. The network will enhance communication between research scientists, government organisations and industries here, and in China. The network will create a new mechanism for knowledge generation and exchange, transforming research into effective policies that reduce hazards in the food chain and ensure a sustainable supply of safe and nutritious food.

Scion's packaging research has been communicated widely in industry through visits and presentations at national and international conferences and workshops. A Scion-organised packaging workshop brought over 40 representatives of New Zealand companies together to learn about Scion's packaging capability and international trends around packaging technologies and emerging biobased material opportunities. Scion's General Manager Manufacturing and Bioproducts sits on the executive board of the Packaging Council of New Zealand.

Intermediate Outcome 4			
Increase New Zealand's energy security through the use of forest and waste biomass for bioenergy			
Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Increase renewable energy production and energy security by growing New Zealand's ability to produce sustainable bioenergy and liquid biofuel products	New Zealand Energy Efficiency and Conservation Strategy 2017-2022 NZ commitment to 30% GHG emissions reduction by 2030 WoodCo strategy WPMA Vision 2050.	\$2.6 million	\$2.6 million

Energy is of critical importance to any economy, particularly its cost, availability and, increasingly, source (renewable or non-renewable). The forest industry currently produces about 10% of New Zealand's total energy supply. Expansion of production, increased efficiency and material utilisation (including maximum use of a tree through biorefining approaches) creates substantial direct economic advantage to forest-based industries, and also seeds new manufacturing firms creating benefit to New Zealand. This will increase the country's ability to use renewable energy directly, support the Government's aim to reduce greenhouse gas emissions (30% by 2030), and reduce sovereign risk through New Zealand's exposure to imported energy sources. The role the transport and industrial heat sectors could play in greenhouse-gas (GHG) emission reduction has been recognised in the recently published New Zealand Energy Efficiency and Conservation Strategy (MBIE).

Scion focus is on providing the underpinning technologies necessary to support the above, identifying the most likely value chains for biofuels implementations and leveraging international research capability for direct New Zealand benefit. Scion contributed to several workshops and exchanges to maintain national and international connections and to support national forums in bioenergy and related fields. This activity involved the Bioenergy Association of New Zealand, Advanced Biofuels Research Network, IEA (International Energy Association) Bioenergy, IRENA (International Renewable Energy Agency/United Nations Economic and Social Commission for Asia and the Pacific, and an MBIE German exchange.

A senior staff member participated in an expert advisory role for the Royal Society in Climate Change Mitigation, as a board member on the Building Association of NZ (BANZ) and as a member on the executive committee of IEA Bioenergy. Scion was also interviewed as part of IEA's five-year review of New Zealand's Energy Strategy. New and strengthened international collaborations were established within the programme. These included the Korean Institute of Energy Research, and Fraunhofer Umsicht and Karlsruhe Institute of Technology in Germany. By leveraging off larger international programmes, Scion has been able to secure access to state-of-the-art knowledge in important areas such as pyrolysis and biochemical conversion of biomass.

Scion's capabilities in biofuels has convinced several companies, five government agencies, land owners (including iwi) and four industry bodies and universities to collaborate in the Biofuels Roadmap project. National linkages with New Zealand universities were also strengthened, particularly via jointly-supervised students with Canterbury, Otago and Waikato Universities. The programme work led to several firms and an iwi investing in the on-going industrial symbiosis programme that started in 2015. The Energy Efficiency and Conservation Agency recently joined this programme.

Bioenergy research directly links to our work in developing high-value chemicals from woody biomass. This is part of validating biorefining in New Zealand with the ability to produce high-value products from our forest resources, strengthen existing manufacturing processes and develop new firms. To that end, Scion is developing cost-effective pre-treatment approaches to convert cellulose/hemi-cellulose components into sugar precursors and also capture lignin as a valuable co-product. The focus is to de-risk this technology. Scion has developed a fast pyrolysis unit and established a fluidised bed micro-reactor, which are vital capabilities as we develop our understanding of thermochemical approaches towards biofuel and biochemical production.

Intermediate Outcome 5**Protect and enhance market access and improve risk management in the forest industry including forest health and preparedness for biosecurity incursions, fire and climate change**

Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Protect and enhance market access and improve risk management in the forestry industry and enhance New Zealand's opportunity to benefit from forestry based ecosystem services to improve global market position of the industry and the environmental sustainability of forestry production in New Zealand	New Zealand Forest Owners Association, Ministry for Primary Industries	\$2.7 million	\$2.7 million

Biosecurity

Protecting New Zealand's forests and exports from biotic and abiotic threats is a priority for the forest industry. Scion's work in this area sustains existing capability, enables development of leading tools and new capabilities, maintains international linkages and supports future planning. Scion and the forestry industry activities are strongly tied with industry and government (MPI, DOC and regional and other authorities) co-funding.

Preventing new pests

Work aimed at preventing the establishment of new pests and pathogens included reviewing Import Health Standards for relevance to forestry and to determine which standards may require further review in order to minimise biosecurity risks from imported goods. Over 400 standards were screened, of which 54 needed more detailed examination. Fortunately, only seven of these warranted further consideration and action. They included import standards for nursery stock, seeds for sowing, and wood packaging. The report is being considered by MPI for action.

A new formal collaboration began with the Centre of Excellence of Biosecurity Risk Analysis (CEBRA) from Australia to determine the effectiveness of all interventions across the entire biosecurity system and then guide where operational effort should be placed. The project uses additional funding from CEBRA and MPI and links to a Better Border Biosecurity (B3) project that will start in July 2017. During this year, data were collected from pest risk pathways and stakeholders were consulted. A total of 11 manuscripts were submitted for publication, including four that will appear in the journal *Biological Invasions* and another in *Nature Ecology & Evolution*. A major effort was the preparation and coordination of a special issue of *Biological Invasions* on the topic of 'Biological invasions of forests' with about 24 papers on a range of taxa and biosecurity measures, by authors from several countries, including several from New Zealand.

Surveillance that results in early detection increases the probability of eradication and reduces incursion response costs. Scion has developed a risk-based surveillance system whereby most of the surveillance aimed at detecting forest pests will be carried out in urban areas where imported goods arrive and where pests most often first establish. A pilot study demonstrating the feasibility of the system is planned for late 2017 with full adoption in 2018. This will be the first surveillance system of its kind in the world and it should lead to improved early detection and eradication probability. With pest detection in urban areas becoming more likely, it is important that we have the tools to eradicate those pests. Scion investment supplemented an Endeavour funded programme aimed at developing a toolbox for pest eradication in urban areas. The funding was directed at targeted spraying. An aerial spot-spraying trial using a 'ring' boom suspended on a tether demonstrated that this is a useful method for pest eradication in an urban environment, particularly where aircraft access is challenging. It is possible that, for aerial spraying of myrtle rust, those techniques would minimise the risk of spore dispersal from the aircraft's turbulence. A paper on an analysis of host and geographical range of *Phytophthora* spp. and their risk of spread to new regions

was presented as a keynote speech at an IUFRO conference in Vietnam. It was concluded that understanding the biogeography of pathogens is essential to biosecurity risk management.

Management of existing diseases and threats

Reduction of red needle cast disease (caused by *Phytophthora pluvialis*) on trees is a priority for the forest industry. Phosphite and copper were trialled for effective control of this disease. An aerial spray trial that was monitored for over 12 months showed that phosphite was not as effective as hoped, but copper continues to show promise. We have recommended the use of copper to control red needle cast, and one major company applied copper to affected trees in February 2017. More research needs to be done on optimising dose and timing of application and this will be a focus for 2017/18. A supervised MSc student received the Sir Don Llewellyn Scholarship for \$22,000 for her research on how repeated phosphite use affects *Phytophthora* disease resistance. Scion has evaluated industry relevant radiata pine genotypes for susceptibility to red needle cast in laboratory and field trials. In collaboration with researchers from the Al Rae Centre at Massey University, an epidemiological model for red needle cast was developed. It will allow examination of the dynamics, genetic drivers and chemical signatures associated with infection, sporulation and host defence, leading to application in field chemical control and epidemiological studies.

Molecular assays have been developed that will allow differentiation and quantification of the problematic foliage pathogen of pines, *Cyclaneusma* species. This will be especially important when more than one needle disease exists and will have application in determining the effectiveness of breeding programmes to reduce the impact of pine foliage disease.

Kauri dieback caused by *Phytophthora agathadicida* remains a key focus. Seedlings from 110 family lines have been potted up in a new growth facility ready for screening for resistance next year. Cones were collected from Northland through to Tauranga under partnership agreements with local mana whenua. Initial indications are that the germination rates have been good and should provide a solid resource for further screening.

Biological control programmes for an important eucalypt pest and giant willow aphid made excellent progress. Eight non-target species were tested to determine if they were at risk from attack by the eucalypt pest biocontrol agent and only one was shown to be a potential host. This is a very helpful result to input into the formal approval process to release the agent. In California, a parasitic wasp attacking giant willow aphid was found. This wasp will be imported into quarantine in September 2017. Scion is contributing to international knowledge of wood decay fungi by examining DNA sequences from 36 fungal isolates. These will be used to construct a phylogenetic tree, thus making sequences of morphologically identified southern hemisphere wood decay species available internationally on GenBank, where they tend to be under-represented, and to investigate taxonomic relationships.

Market protection

An important outcome from the market access programmes (includes an Endeavour Fund programme) is that a phytosanitary treatment-free winter period is feasible, especially in the cooler regions. Scion was invited to present the idea of a treatment-free period based on forest insect ecology at trade bilateral discussions to improve outcomes for New Zealand plantation forest exports. However, before trading partners will adopt the low pest prevalence approach more data needs to be presented and more discussion needs to take place. Supporting this call for more evidence stakeholders in Methyl Bromide Reduction (STIMBR) funded two literature reviews that demonstrated that the trapping programme (an Endeavour Fund programme) was robust and that mass rearing of *Sirex noctilio* woodwasps (a wood-boring insect that could be a potential impediment to adoption of a treatment-free period) is feasible. Scion investment was used to prepare eight papers from the market access programme to improve science impact and progress the acceptance of a treatment-free period by our trading partners. Investment was used to start a *Sirex noctilio* colony so as to be well prepared if STIMBR agrees to fund further work in this area. Scion also provided MPI with advice on directions of strategic importance that can pave the way for future phytosanitary measures to support the export of wood products.

The current state of the processes involved with meeting phytosanitary compliance requirements for Australia and Asia for sawn timber was determined in collaboration with the University of Lincoln by applying Value Stream Mapping (VSM) across multiple organisations in a supply chain. The same approach was also used to suggest a future state map for the phytosanitary compliance system in New Zealand. VSM is a lean production tool normally used to identify areas of waste. It is traditionally used in manufacturing processes in a single organisation. Six operational timber supply chains were analysed. Overall, the current phytosanitary processes were found to be well managed in New Zealand and to meet the requirements of our key export customers. Applying a supply-chain VSM view also revealed opportunities for improving the process.

Fire protection

Loss from fire and the increasing risk of fire in New Zealand forests and rural landscape is a serious issue for New Zealand. Several major rural fires (in Hawkes Bay and the Port Hills in Canterbury) occurred during the year. Scion supported the Incident Management Teams by providing fire behaviour predictions to help operational decision-making on firefighting resource needs and control tactics. Scion also provided smoke model forecasts throughout the Port Hills incident, which were used to inform the public of potential health threats. After the immediate fire threat, the fire break-out potential for the Port Hills was modelled over subsequent days using the Prometheus fire growth tool. The results assisted decision-making around the lifting of evacuation cordons and recreational access restrictions. Scion's fire research staff worked 180 hours over two weeks supporting the fire response at Port Hills. They provided presentations on fire progression, behaviour and wildfire risk mitigation opportunities to recovery staff and affected residents at six community recovery meetings and additional workshops. Strategic Science Investment Funding (Core Funding) was used for operational research at the fire. Life and property were saved because of adoption of our fire research. In addition, the data gathered was used to validate our models and recommendations.

Herbarium

The nationally significant database and collection National Forestry Herbarium has been heavily involved with:

- Identifying myrtle rust host plants based on morphology as well as using a DNA barcoding library developed by the herbarium
- Next Generation Sequencing analyses of mānuka and kānuka to determine the number of species in New Zealand. This is supporting MPI's manuka honey validation project
- Collecting seed of New Zealand Myrtaceae to support a project determining the variation in susceptibility of native Myrtaceae to myrtle rust
- Sequencing species of *Metrosideros* to determine the nature of the relationship between the South American, African and Pacific species.

The herbarium continues to acquire new specimens, including those submitted for identification, particularly from biosecurity surveys of sites considered at high risk of incursions, and research reference specimens. During the year, 407 specimens were added. In addition, 1,737 specimens were imaged and 2,923 nomenclatural edits to species were made. Two popular articles were also written, and three scientific papers are in preparation.

Intermediate Outcome 6			
Ensure the forest industry and bioeconomy businesses' licence to operate			
Alignment to Statement of Core Purpose	Alignment to Sector Priorities	Investment as per the SCI 2016-17	Investment Actual
Protect and enhance market access and improve risk management in the forestry industry	New Zealand Forest Owners Association, Ministry for Primary Industries	\$0.2 million	\$0.2 million

Safety

Key stakeholders understanding of how evolutionary human cognition can significantly influence safety and performance in complex, high-risk situations has been improved through presentations at the New Zealand and Australian Forest Industry Safety Summit conferences (March 2017), a position paper in the *New Zealand Journal of Forestry* and several articles were published in popular media channels.

The use of fast and frugal heuristic decision-making in motor-manual tree-falling operations in New Zealand is being investigated by Scion in collaboration with Associate Professor Konstantinos Katsikopoulos of the University of South Hampton. Further work and our findings will be published next financial year.

An article exploring improved motor manual exhaust exposure practices has been published in the *Journal of Occupational and Environmental Health*. Opportunities for collaboration have also been explored with the New Zealand Defence Technology Agency (DTA). Common areas of interest were sensor technology, inhaled toxins, situational awareness, wearable technology and fatigue. The DTA are providing us with information on the operational use of their technology. This could improve our ability to solve industry problems.

New perspectives on Human Factors in automation and robotics have been developed into a work plan. This represents one third of the new steepland harvesting PGP proposal that has proceeded to the preparation of its business case. Using the novel approach of considering the human brain as an incredibly well-developed robot that we can study, understand and learn from, our goal is to incorporate mechanisms honed by evolution into our machines for smarter, more effective performance. Data from this approach will help flesh out specific requirements for future forestry automation with a focus on using a virtual reality paradigm to assess and augment human-machine interaction and teaming. The seven-year proposal for the Human Factors stream is for approximately \$3,000,000 and will be led by Scion.

Informing the GM debate

Scion provided input into the national debate on New Zealand policy on genetic modification technologies including gene editing by presenting to industry and policymakers an authoritative robust scientific perspective on alternative biotechnologies through workshops and seminar presentations and visits to our field trials.

Standards for wood products, packaging and new bio-based products

Scion provides independently sourced data for the review and updating of many of the New Zealand and Australasian standards that incorporate the use of wood to ensure their ongoing ease of use and relevance to modern timber use, design and safety. Scion, with the Wood Processing Manufacturers' Association, have started to provide information to the Chinese Timber Use manual. This follows the inclusion of New Zealand structural grades in the Chinese Timber standard GB50005. A public draft document is now available on the revision of NZ timber design standard NZS3603. Scion is also supporting the revision of timber standards NZS3602 (Timber and Wood-based Products for Use in Buildings) and NZS3640 (Chemical Preservation of Round and Sawn Timber).

Commissioning trials of the facility to measure and quantify the aerobic composting and biodegradation of bio-based materials are nearly complete. The facility is unique-to-New Zealand and was built to ISO 14855-1 to provide results showing levels of biodegradation within six months. Scion will be using the facility to quantify the biodegradation of newly developed biomaterials. It will also be available to commercial clients, seeking evidence to support environmental marketing claims.

Scion participated in the EU project "Open-Bio" from November 2013 to October 2016. The project investigated how markets for bio-based products could be expanded through standardisation, labelling and procurement. The project has used the data on customer needs and demands to develop a database that provides information about bio-based products to assist people making purchasing decisions. The database was launched in November 2016 and is available to the public.

Scion has completed validating the migration testing method in accordance with European food contact material regulations. Scion-developed products can be now be assessed. Monitoring developments in the areas of food contact materials and regulations continues.

CORPORATE GOVERNANCE

Scion's Board of Directors is appointed by its shareholding Ministers, the Minister of 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 11 times over the year either in person or by video conference. The Chief Executive and Chief Financial Officer (who is also the Company Secretary) attend all meetings. The Board may retain independent advisers, including independent legal counsel or other experts, as it deems appropriate. The Board's Strategic Advisory Māori Panel (Ngā Rangatira Rōpu) provides input to Scion's Te Papa Tipu (Māori) plan and its effective implementation.

The Board has two standing committees, the Audit and Risk Committee and the Remuneration and Organisation Committee. These meet twice yearly but may meet more regularly if the need arises.

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 Remuneration and Organisation 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 senior executives and inputs into and monitors achievement of the annual Health and Safety Plan.

Each 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.

A Campus Master Plan Board Committee has been established in 2017 to support the Board with its governance and guidance of the redevelopment of the Rotorua campus.

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 2017.

Scion is a commercially focused science and technology company, delivering solutions to both commercial and Crown clients. While the principal research facility is located in Rotorua our co-location with the School of Forestry at the University of Canterbury provides access to complementary capabilities on the campus and postgraduate students.

Scion has two wholly-owned subsidiaries (Te Papa Tipu Properties Limited and Sala Street Holdings Limited), is a 50% shareholder in Terax 2013 Limited and is a 50% partner in Terax Limited Partnership, and has a 33% shareholding in an associate company Biopolymer Network Limited. Scion is a member of the research consortium WQI Limited with a 5.05% shareholding.

- Te Papa Tipu Properties Limited owns the Group's land assets.
- Sala Street Holdings Limited is a holding company, holding Scion's 50% share of Terax 2013 Limited and Terax Limited Partnership.
- Terax 2013 Limited is the general partner for Terax Limited Partnership.
- Terax Limited Partnership is a limited partnership jointly owned by Scion (through Sala Street Holdings Limited) and Rotorua District Council and has been set up to commercialise a waste minimisation process.
- Biopolymer Network Limited is an incorporated joint venture whose purpose is to create technologies for advancing the utilisation of renewable bio-based materials in industrial applications.
- WQI Limited is a consortium that carries out research focused on wood quality, appearance and stability that can affect the performance of the wood, and to develop effective segregation methods and technologies that allow the industry to gain maximum value from their timber resource. WQI Limited ceased trading on 30 June 2016 and has moved into solvent liquidation process from 1 July 2016.

Summary of Group Financial Results to 30 June 2017

	2017 \$000	2016 \$000
Operating revenue	51,897	49,599
Surplus before taxation	3,312	2,494
Taxation expense	(980)	(657)
Net surplus attributable to the shareholders	2,332	1,837
Equity		
Issued and paid up capital	17,516	17,516
Retained earnings	21,140	18,808
Reserve	61	61
Total equity	38,717	36,385

Scion's strategy focuses on delivering science and technologies in the following key areas:

- Commercial forestry
- Wood products and processing
- Wood fibre, biopolymer and biochemical industries
- Risk and adaptation
- Licence to operate
- Bioenergy and energy security through forest biomass.

The Statement of Corporate Intent maps out the strategic framework for Scion to achieve outcomes aligned to its Statement of Core Purpose, and the New Zealand Government’s overarching objective for Crown Research Institutes to lead the country’s economic growth with improved environmental, social and cultural outcomes; in particular increase export earnings to the equivalent of 40% of GDP by 2025.

Scion’s science and commercial focus is strongly aligned with the opportunities being presented locally, nationally and globally, and when brought together, will continue to enable Scion to provide leadership on issues of local, national and global significance.

Remuneration and Compensation

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
\$460,000 - \$469,999	1
\$250,000 - \$259,999	2
\$230,000 - \$239,999	1
\$220,000 - \$229,999	1
\$170,000 - \$179,999	2
\$160,000 - \$169,999	2
\$150,000 - \$159,999	2
\$140,000 - \$149,999	5
\$130,000 - \$139,999	5
\$120,000 - \$129,999	8
\$110,000 - \$119,999	13
\$100,000 - \$109,999	7

During the year ended 30 June 2017, \$334,082 was paid to 7 employees in relation to cessation of employment with Scion (2016: \$231,479 to 7 employees). Cessation payments included \$28,956 of retirement benefits (2016: \$10,763).

Dividend

No dividend was recommended for the year ended 30 June 2017 (2016: \$0k).

Director Profiles

Mr Anthony (Tony) Nowell CNZM (Chair) is a professional company Director and in addition to his chairmanship of Scion he is currently Chair of Wellington Drive Technologies, The Omega Lamb Primary Growth Partnership and Douglas Nutrition, he is a board member of New Zealand Food Innovation Auckland Limited and in June 2017 completed an 8-year term as a board member of Food Standards Australia New Zealand (FSANZ). Mr Nowell is Founding Director of Valadenz Limited, a trade and export development company and was previously the CEO of Zespri International, the Managing Director of Griffin's Food Limited and Regional Vice President of Sara Lee Asia. Mr Nowell brings extensive experience in corporate management, governance and international trade and development to the Board and for the past 10 years he represented New Zealand on the APEC Business Advisory Council (ABAC), the APEC Policy Partnership for Food Security (PPFS) and was Chair of the Asia Pacific Food Industry Forum. He has previously chaired the New Zealand Food and Grocery Council, the New Zealand Food and Beverage Taskforce and the New Zealand Packaging Accord Governing Board, was Deputy Chair of Leadership New Zealand and a member of the Export Advisory Board of Business New Zealand. Mr Nowell is also independent Chair of the Professional Golfers' Association of New Zealand.

Mrs Judith Stanway (Deputy Chair), a Fellow of the New Zealand Institute of Accountants, retired as a partner of BDO Rotorua Limited and was the Chair of BDO New Zealand Limited, a New Zealand wide Chartered Accountancy and Business Advisory firm. Mrs Stanway is also a Fellow of the New Zealand Institute of Directors, a Director of Wharerata Forest Limited, and a number of private companies. She has also chaired the Lakes District Health Board and has been a Director of Te Puia. Mrs Stanway lives in Tauranga, has worked with the forestry sector for many years and has wide experience in tourism and with charitable organisations and was a Director of the Charities Commission. Judith was also chosen as 2012 Rotorua Business Person of the Year. Mrs Stanway resigned from the Scion Board as at 30 June 2017.

Mr Sheldon Drummond (Director) has worked in the forest and wood processing industry for more than four decades, having held a range of senior company executive roles as well as industry board positions over time. Mr Drummond has forestry as well as wood technology qualifications and from his years of experience in both sectors of the industry he has a very detailed knowledge of the forestry and wood products business. As a board member at Scion for the past eight years he brings together the research and industry knowledge to assist Scion's progression for the industry benefit. Mr Drummond resigned from the Scion Board as at 30 June 2017.

Ms Colleen Neville (Waikato-Tainui) (Director) is the Rotorua-based Chief Executive Officer of Te Arawa Group Holdings Limited. She is a chartered accountant and has 18 years' experience in a range of financial roles for national and international companies. Colleen has governance experience as a Director of Te Arawa Group Holdings Limited subsidiaries, Te Kakano Whakatipu Limited & Te Ohu Kaimoana Portfolio Management Services Limited, and as a trustee for Poutama Trust.

Dr Barry O'Neil (Director) is Chief Executive of Kiwifruit Vine Health, the kiwifruit biosecurity organisation that also leads the response to the vine disease Psa-V. Barry is the principal Director of Biosecurity NZ Ltd, a company specialising in biosecurity consultancy, and is an independent Director on Horticulture NZ, and the Bio-Protection Research Centre based in Lincoln. He also sits on the governance board of New Zealand's Biological Heritage National Science Challenge. Barry's experience includes policy and international standard setting; trade negotiations; operational biosecurity risk-management activities involving the border, surveillance, response and eradication; and organisational change management. Barry also owns a kiwifruit orchard in Katikati.

Mr Jon Ryder (Director) is currently the Chief Executive Officer of Oji Fibre Solutions (Oji FS) - Pulp, Paper and Packaging and is directly responsible for all activities of these businesses: health safety and environment, EBIT, manufacturing, engineering, sales and marketing and strategic development. Jon has gained over 25 years' experience in the forestry, pulp and paper business. Jon's interest in the industry started from his biochemistry degree from Manchester University and then a PhD from UMIST in Pulp and Paper Manufacturing. His career has spanned international boundaries starting in the United Kingdom in technical and production management of fine coated papers mills, in New Zealand with packaging paper manufacturing at Kinleith and then pulp mill management experience at Tasman. He also managed the Pulp and Paper Mills in Australia as well as sales and marketing functions for Australian Papers. Jon returned to New Zealand in 2012 to take up the challenge as CEO of the business formerly known as Carter Holt Harvey Pulp, Paper and Packaging. The name changed to Oji Fibre Solutions (Oji FS) in November 2015 following the sale of the business on 1 December 2014 to a joint venture between Oji Holdings and Innovation Network Corporation of Japan (INCJ).

Mr Steve Wilson (Director) was awarded the New Zealand Order of Merit (MNZM) for services to industry and is a Fellow of the New Zealand Institute of Management (Southern) and a Life Member of Plastics New Zealand. Steve is Executive Director and owner of Talbot Technologies Ltd, a technical plastics manufacturer based in Christchurch. His other current roles include Director, Holmes Solutions LP, Chairman of the Advisory Board for the Product Accelerator, and advisory board member for Mechanical Engineering, University of Canterbury. Steve was one of the founders, and is a shareholder of, Powerhouse Ltd, a venture investment company. He began life as a mechanical engineer after graduating from Canterbury University with a B.E. (1st Class Hons) and started in business as a design engineer when at the age of 23 he became CEO of a manufacturing engineering company. Steve has had 34 years' experience as a CEO of companies primarily in the garments and plastics industries. He has also had 28 years' experience in governance roles. Mr Wilson commenced on 1 July 2016.

Changes in Directors

Mrs Judith Stanway's term concluded on 30 June 2017. Mr Sheldon Drummond's term concluded on 30 June 2017. Mr Steve Wilson commenced on 1 July 2016.

Directors' Interests

Any business the company has transacted with organisations in which a Director has an association has been carried out on a commercial 'arms-length' basis.

Directors' Remuneration

	Scion 30 June 2017	Te Papa Tipu Properties Ltd 30 June 2017	Terax 2013 Ltd 30 June 2017	Total 30 June 2017
Tony Nowell	58,000			58,000
Judith Stanway ¹	39,500	2,000	8,000	49,500
Sheldon Drummond	28,500			28,500
Colleen Neville	28,500			28,500
Barry O'Neil ²	30,500			30,500
Jon Ryder	28,500			28,500
Steve Wilson	28,500			28,500
Total	\$242,000	\$2,000	\$8,000	\$252,000

¹ Chair Audit and Risk Committee

² Chair Remuneration and Organisation Committee

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. Additions to the Interests Register are noted in the profiles above.

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 and in the opinion of the Directors, the state of the company's affairs continues to be satisfactory and the outlook bright.

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.

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.



For and on behalf of the Board
Tony Nowell CNZM
Chair

31 August 2017

Statement of Responsibility

The following statement from the Board is made in accordance with Section 155 of the Crown Entities Act 2004:

1. The Board is responsible for the preparation of the annual financial statements and the judgements used in these.
2. The Board is responsible for establishing and maintaining a system of internal control designed to provide reasonable assurance as to the integrity and reliability of the financial reporting.
3. In the opinion of the Board, the annual financial statements for the year ended 30 June 2017 fairly reflect the financial position and operations of the New Zealand Forest Research Institute Limited.



Tony Nowell CNZM
Chair



Barry O'Neil
Director

31 August 2017

PERFORMANCE TARGETS

	Actual 2017	Budget 2017	Actual 2016
Efficiency:			
Operating margin	12.6%	12.3%	15.1%
Operating margin per FTE	\$22,126	\$20,569	\$26,564
Risk:			
Quick ratio	2.78:1	1.76:1	2.39:1
Interest coverage	N/A	N/A	N/A
Operating margin volatility	12.3%	12.6%	20.9%
Forecasting risk	1.8%	1.4%	1.7%
Growth/Investment:			
Adjusted return on equity	6.2%	4.3%	4.4%
Revenue growth	4.6%	1.9%	4.8%
Capital renewal	1.1X	2.1X	0.5X

Formula for the above calculations can be found at:

<http://www.mbie.govt.nz/info-services/science-innovation/research-organisations/crown-research-institutes/critoolkit/section-3/#generic-indicators>

NON-FINANCIAL INDICATORS

	Indicator name	Measure	Frequency	2017 Target	2017 Actual
CRI generic indicators	End user collaboration	Revenue per FTE (\$) from commercial sources	Quarterly	\$62,817	\$72,495
	Research collaboration	Percentage of peer-reviewed publications with collaborators	Quarterly	75%	73%
	Technology and knowledge transfer excellence	Number of commercial/customer reports per Scientist FTE	Annual	2.5	4.23
	Science quality	Mean journal impact factor	Annual	2.8	2.29
	Financial indicator	Revenue per FTE (\$)	Quarterly	\$166,885	\$175,976
CRI generic indicators	Stakeholder engagement	Relevant funding partners and other end users (number and %) that have a high level of confidence that Scion sets research priorities relative to the forest industry and biomaterials sector	Biennial	MBIE survey n>30; 85%	No survey conducted for 2017
		National and international research providers (%) who have a high level of confidence in Scion's ability to assemble the most appropriate research team	Biennial	>85%	No survey conducted for 2017
		Relevant end-users (%) who have adopted knowledge and/or technology from Scion	Biennial	>90%	No survey conducted for 2017
Scion strategic indicators	Maori economic development	Partnerships (number (n) and value (\$)) established with Māori entities to support economic development through the forest industry	Quarterly	n>5; >\$1.0m	n= 9 >\$3m
	Accelerated commercialisation	Technologies in Scion's pipeline (number and co-investment (\$)); projects that progress to the business case stage (case studies)	Quarterly	25 & \$600k; Cases ≥4pa	12 & \$385k; Cases 2
	Internationalisation	Joint research and technology development programmes and staff exchanges with Scion's international strategic partner organisations	Six monthly	>5 1	6 21
	People and culture	Staff recruitment and retention (quality and days to fill); leadership development (assessment); good employer (EEO rating); health and safety; and internal staff satisfaction survey (biennial)	Annual and Biennial	Qualitative <50 days; EEO rating; Zero harm	51 days to fill; 8.7% turnover; EEO level one; 1 serious harm

AUDIT REPORT



INDEPENDENT AUDITOR'S REPORT

TO THE READERS OF NEW ZEALAND FOREST RESEARCH INSTITUTE LIMITED'S FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2017

The Auditor-General is the auditor of New Zealand Forest Research Institute Limited (the company). The Auditor-General has appointed me, Susan Jones, using the staff and resources of EY, to carry out the audit of the financial statements of the company, on his behalf.

Opinion

We have audited the financial statements of the company on pages 34 to 60, that comprise the statement of financial position as at 30 June 2017, the statement of comprehensive income, statement of changes in equity and statement of cash flows for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information.

In our opinion, the financial statements of the company:

- present fairly, in all material respects:
 - its financial position as at 30 June 2017; and
 - its 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.

Our audit was completed on 31 August 2017. 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 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). 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 financial statements

The Board of Directors is responsible on behalf of the company for preparing 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 financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Directors is responsible on behalf of the company for assessing the company'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 financial statements

Our objectives are to obtain reasonable assurance about whether the 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 financial statements.

For the budget information reported in the financial statements, our procedures were limited to checking that the information agreed to the company's statement of corporate intent.

We did not evaluate the security and controls over the electronic publication of the 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 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 company'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 company'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 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 company to cease to continue as a going concern.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

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 on pages 34 to 60, but does not include the financial statements, and our auditor's report thereon.

Our opinion on the 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 financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work, 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 company in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1 (Revised): *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 company.



Susan Jones
EY
On behalf of the Auditor-General
Auckland, New Zealand

FINANCIAL STATEMENTS

GROUP STATEMENT OF COMPREHENSIVE INCOME

FOR THE YEAR ENDED 30 JUNE 2017

		ACTUAL	BUDGET	ACTUAL
	Note	2017	(unaudited)	2016
		\$000	2017	2016
		\$000	\$000	\$000
Revenue	2 (a)	51,897	50,307	49,599
Other Income/(Expenditure)	2 (b)	(14)	o	297
Expenditure	3 (a)	(48,363)	(47,977)	(47,001)
Finance Costs	3 (b)	(9)	o	o
Share of Profit/(Loss) of Associates	14 (b)	(199)	o	(401)
Profit Before Tax		3,312	2,330	2,494
Tax Expense	9	(980)	(734)	(657)
Total comprehensive income for the period attributable to the shareholders of the parent company		2,332	1,596	1,837

The accompanying notes form part of these financial statements.

GROUP STATEMENT OF CHANGES IN EQUITY

FOR THE YEAR ENDED 30 JUNE 2017

	Ordinary Shares	Asset Revaluation Reserve	Retained Earnings	Total	Ordinary Shares	Asset Revaluation Reserve	Retained Earnings	Total
	2017 \$000	2017 \$000	2017 \$000	2017 \$000	2016 \$000	2016 \$000	2016 \$000	2016 \$000
GROUP								
Balance as at 1 July	17,516	61	18,808	36,385	17,516	61	16,971	34,548
Profit for the period	0	0	2,332	2,332	0	0	1,837	1,837
Total comprehensive income	0	0	2,332	2,332	0	0	1,837	1,837
Balance as at 30 June	17,516	61	21,140	38,717	17,516	61	18,808	36,385

The accompanying notes form part of these financial statements.

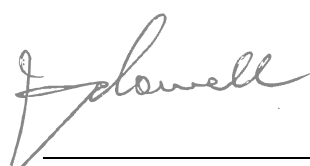
GROUP STATEMENT OF FINANCIAL POSITION

AS AT 30 JUNE 2017

		ACTUAL	BUDGET (unaudited)	ACTUAL
	Note	2017 \$000	2017 \$000	2016 \$000
Equity				
Share capital	5	17,516	17,516	17,516
Retained earnings	5	21,140	20,286	18,808
Revaluation reserve	5	61	61	61
		38,717	37,863	36,385
Non-Current Liabilities				
Provisions	6	481	439	472
Defined benefit plan	7(a)	696	1,013	796
Deferred tax liability	9(d)	980	1,957	1,132
		2,157	3,409	2,400
Current Liabilities				
Trade and other payables	8	12,516	8,276	8,013
Provisions	6	98	214	256
Defined benefit plan	7(a)	238	62	200
Tax payable		475	285	780
		13,327	8,837	9,249
Total Equity and Liabilities				
		54,201	50,109	48,034
Non-Current Assets				
Property, plant and equipment	10	27,801	34,446	27,346
Biological assets	11	548	466	550
Intangible assets	12	719	550	746
Investments in associates	14	433	313	332
Other investments		30	30	30
		29,531	35,805	29,004
Current Assets				
Cash and cash equivalents	15	15,517	7,317	11,433
Trade and other receivables	16	8,847	6,607	7,217
Inventories	17	306	380	380
		24,670	14,304	19,030
Total Assets				
		54,201	50,109	48,034

The accompanying notes form part of these financial statements.

For and on behalf of the Board, who authorised the issue of these accounts on 31 August 2017.


Chairman


Director

GROUP STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED 30 JUNE 2017

		ACTUAL	BUDGET	ACTUAL
	Note	2017	(unaudited) 2017	2016
		\$000	\$000	\$000
Cash Flows from Operating Activities				
Cash was provided from:				
Receipts from customers		53,159	49,672	49,520
Interest received		422	348	331
		53,581	50,020	49,851
Cash was applied to:				
Payments to employees		25,406	26,204	24,522
Payments to suppliers		18,370	17,900	17,105
Interest paid		9	0	0
Income tax paid		1,437	721	1,191
		45,222	44,825	42,818
Net cash flows from operating activities	19	8,359	5,195	7,033
Cash Flows from Investing Activities				
Cash was provided from:				
Proceeds from sale of fixed assets		19	0	0
		19	0	0
Cash was applied to:				
Purchase of property, plant and equipment		3,736	8,651	2,781
Purchase of intangibles		188	120	213
Additional investment in associate		370	200	350
		4,294	8,971	3,344
Net cash flows used in investing activities		(4,275)	(8,971)	(3,344)
Net Increase (Decrease) in Cash Held		4,084	(3,776)	3,689
Add opening cash brought forward		11,433	11,093	7,744
Ending Cash Carried Forward	15	15,517	7,317	11,433

The accompanying notes form part of these financial statements.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

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 financial statements consists of New Zealand Forest Research Institute Limited and its subsidiaries (the group).

New Zealand Forest Research Institute Limited (the Company) is a reporting entity for the purposes of the Financial Reporting Act 2013. It is domiciled and incorporated in New Zealand and is wholly owned by the Crown.

The 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 Statement of Financial Position.

The activities of New Zealand Forest Research Institute Limited include a range of research and development programmes aimed at using plant-based renewable resources and waste streams to create new materials, energy sources and environmentally sustainable products and processes.

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 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 and the Financial Reporting Act 2013. The 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 financial statements are presented in New Zealand dollars and all values are rounded to the nearest thousand dollars (\$000).

b) Statement of Compliance

The financial statements have been prepared in accordance with NZ GAAP. They comply with New Zealand equivalents to International Financial Reporting Standards, and other applicable Financial Reporting Standards, as appropriate for profit-oriented entities. The financial statements comply with International Financial Reporting Standards (IFRS).

c) Basis of Consolidation

The consolidated financial statements comprise the financial statements of the Group 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
- 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.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

c) Basis of Consolidation (continued)

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 parent's share of components previously recognised in 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

These are companies in which the group holds substantial shareholdings but does not have control and in who's commercial and financial policy decisions it participates.

Associate companies have been reflected in the consolidated financial statements on an equity accounting basis which shows the group's share of surpluses 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.

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 profit and loss.

Intangible assets created within the business are not capitalised and expenditure is charged to profit and loss in the year in which the expenditure is incurred.

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.

A summary of the policies applied to the group's capitalised intangible assets is as follows:

	Software
Useful lives	Finite
Method used	4 years – Straight line
Type	Acquired
Impairment test/Recoverable amount testing	Amortisation method reviewed at each financial year-end; Reviewed annually for indicators of impairment

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.

Carbon Credits

New Zealand emission reduction units (NZU's) 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 NZU's arises when the Group is entitled to claim the NZU's from the government.

NZU's are initially measured at fair value on entitlement as an intangible asset unless the Board have 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 of Directors consider there is an active market for the sale of NZU's. NZU's 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.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

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 valued at the cost of 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. 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

h) Recoverable amount of non-current assets

At each reporting date, the group assesses whether there is any indication an asset may be impaired. Where an indicator of impairment exists, the group makes a formal estimate of 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 initially recognised at fair value and subsequently valued at amortised cost less impairment allowance.

Collectability of trade receivables is reviewed on an ongoing basis. Debts that are known to be uncollectible are written off when identified. An allowance for doubtful debts is raised when there is objective evidence that it is probable the group will not be able to collect the debt. Financial difficulties and payment defaults without explanation are considered objective evidence of impairment.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

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 and Employee Benefits

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 Statement of Financial Position date using a discounted cash flow methodology.

(i) Wages, Salaries and Annual Leave

The liability for wages, salaries and annual leave recognised in the 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 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 in the profit and loss account in the period in which they arise.

The defined benefit liability recognised in the 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.

m) Leases

The determination of whether an arrangement is or contains a lease is based on the substance of that arrangement at inception date.

Group as a Lessee

Operating lease payments, where the lessors effectively retain substantially all the risks and benefits associated with ownership of the leased items, are included as an expense in the profit and loss in equal instalments 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. Initial direct costs incurred in negotiating an operating lease are expensed as incurred.

n) Cash and Cash Equivalents

Cash and short-term deposits in the Statement of Financial Position comprise cash at bank and in hand and short-term deposits with an original maturity of three months or less.

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

o) 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.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

p) 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 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.

q) Revenue Recognition

Research Revenue

Research revenue from both Government and commercial sources is recorded when earned based on the percentage of work completed. Percentage of work completed is based on management judgement, after considering costs incurred 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 includes revenue received from the Ministry of Science and Innovation in the form of Core Funding, Public Good Science and Technology investment, and Preseed Accelerator Fund programmes. Funding includes both devolved and milestone related programmes. Government revenue has only been recognised after all appropriate conditions have been met.

Rent Revenue

Rent revenue is recognised when earned.

Sale of Goods

Revenue is recognised when the significant risks and rewards of ownership of the goods have passed to the buyer. Risk and reward are considered passed to the buyer at the time of delivery.

Interest Revenue

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

r) 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.

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.

s) Borrowing Costs

Borrowing costs are recognised as an expense when incurred except for those borrowing costs determined as directly attributable to the acquisition, construction or production of a qualifying asset (i.e. an asset that necessarily takes a substantial period of time to get ready for its intended use or sale).

t) Interest-bearing Loans and Borrowings

All loans and borrowings are initially recognised at the fair value of the consideration received net of issue costs associated with the borrowing.

After initial recognition, interest-bearing loans and borrowings are subsequently measured at amortised cost using the effective interest method. Amortised cost is calculated by taking into account any issue costs, and any discount or premium on settlement.

For the purpose of valuing bank borrowings, the bank interest rate is taken as the discount rate. As such the bank borrowings are carried at the value of the debt with the bank.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

u) Trade and Other Payables

Trade and other payables 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

a) Revenue Recognition

Revenue is recognised based on the percentage of work completed on a project basis. Percentage of work completed is based on management judgement after considering such things as hours completed, costs incurred, milestones achieved, costs to complete and actual results to date.

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.

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 10 and 21.

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.

d) Defined Benefit Scheme

The group operates an unfunded defined benefit plan. Significant assumptions used involving the plan include the discount rate and future salary increases as set out in the notes to the financial statements. Management used the experience of a registered actuary to reduce the risk of misstatement resulting from these judgements and estimates.

1.3 Accounting Standards Issued but not yet Effective

The following standards have had changes that have been issued but not yet made effective:

	Date Applicable for Scion
• NZ IFRS 9 Financial Instruments (2014)	1 July 2018
• NZ IFRS 10 Consolidated Financial Statements	1 July 2020
• NZ IFRS 15 Revenue from Contracts with Customers	1 July 2018
• NZ IFRS 16 Leases	1 July 2019
• NZ IAS 28 Investments in Associates and Joint Ventures	1 July 2020

The group has chosen not to apply the changes in the above standards prior to their effective date. While these standards are applicable to the group they are not, except for NZ IFRS 15, expected to have a material impact on our accounts.

NZ IFRS 15 potentially has a material impact on revenue recognition. The company is reviewing its revenue types and contractual terms and processes to ensure it can effectively meet the standard requirements.

There are no amendments to standards under the Annual Improvements to NZ IFRS programme that affect Scion's Financial Statements.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL	ACTUAL
	2017	2016
	\$000	\$000
2. Revenue and Other Income		
(a) Revenue		
Government research revenue	30,195	30,301
Commercial research revenue	20,405	17,975
Software product sales and maintenance	102	155
Commercial lease revenue	696	714
Royalty	63	86
Interest revenue	436	368
	51,897	49,599
(b) Other Income/(Expenditure)		
Change in fair value of plantation trees	(2)	84
Change in fair value of carbon credits	(12)	213
	(14)	297
3. Expenditure and Finance Costs		
(a) Expenditure		
Personnel remuneration and expenses	25,370	24,311
Other personnel related costs	692	502
Contractors and subcontractors	7,794	6,472
Consumables	1,363	1,211
External services	3,244	2,981
Travel and accommodation	1,887	1,506
Lease and rental costs	211	184
Depreciation	3,383	5,481
Amortisation	201	191
Loss on disposal of fixed assets	71	298
Impairment of assets	47	140
Reversal of impairment	(4)	(23)
Premises	3,015	2,756
Directors' fees	253	224
Restructuring costs	122	152
Doubtful debt provision	0	2
Bad debts expense	0	1
Compensation provision	50	0
Realised exchange fluctuations	1	0
Unrealised exchange fluctuations	0	1
Other	663	611
	48,363	47,001
(b) Finance Costs		
IRD use of money interest	9	0
	9	0
4. Auditor's Remuneration		
Amounts paid or due and payable to the auditors for:		
Auditing financial statements		
Parent entity auditor	113	116
	113	116

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

5. Equity

New Zealand Forest Research Institute Limited has authorised, issued and paid up capital of 17,516,000 (2016: 17,516,000) 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 (2016: \$0).

The asset revaluation reserve is used to record increments and decrements in the fair value of heritage book assets. Movements in the asset revaluation 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, Scion considers any capital requirements for the future. 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 totals \$551k at June 2017 (2016: \$545k) and was actuarially valued by Aon Hewitt Consulting, an independent risk management and consulting organisation.

The group has a restructuring provision of \$28k at June 2017 (2016: \$183k).

The provisions are made up as follows:

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Current Provision	98	256
Non-Current Provision	481	472
	579	728

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

	Long Service Leave 2017 \$000	Restructuring 2017 \$000	TOTAL 2017 \$000	Long Service Leave 2016 \$000	Restructuring 2016 \$000	TOTAL 2016 \$000
Balance 1 July	545	183	728	553	121	674
Provision reversed during the year	0	(72)	(72)	0	(31)	(31)
Amounts used during the year	(85)	(111)	(196)	(87)	(90)	(177)
Provisions made during the year	91	28	119	79	183	262
Balance 30 June	551	28	579	545	183	728

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

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 42 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 the Profit and Loss account. Past service cost is recognised immediately.

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

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Net plan expense		
Current service cost	27	35
Interest cost on benefit obligation	33	45
Net actuarial gains recognised in the year	(88)	31
Net plan expense/(income)	(28)	111

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

	Defined Benefit Plan				
	2017 \$000	2016 \$000	2015 \$000	2014 \$000	2013 \$000
Benefit liability included in the Statement of Financial Position					
Present value of defined benefit obligation	934	996	960	1,030	1,264
				ACTUAL 2017 \$000	ACTUAL 2016 \$000
Changes in the present value of the defined benefit obligation are as follows:					
Opening balance				996	960
Current service cost				27	35
Interest cost				33	45
Actuarial gains recognised in the year				(88)	31
Benefits paid				(34)	(75)
Closing balance				934	996
Current provision				238	200
Non-current provision				696	796
				934	996

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

7. Pension Plans (cont.)

a) Defined Benefit Plan

The history of experience adjustments is as follows:

	2017 \$000	2016 \$000	2015 \$000	2014 \$000	2013 \$000
Experience adjustments on plan liabilities	(80)	(37)	(75)	(59)	(103)

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

	2017 \$000	2016 \$000
Discount rate	3.61%	3.30%
Future salary increases	4.10%	4.20%

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 2017 \$000	ACTUAL 2016 \$000
Current obligation	934	996
Salary growth		
Reduction of 1% per annum	884	932
Increase of 1% per annum	988	1,056
Resignation rates		
150% of assumed rates	912	963
50% of assumed rates	957	1,021

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

b) Defined Contribution Plan

During the period defined contributions totalling \$703k (2016: \$699k) were made to the Government Superannuation Fund and KiwiSaver.

8. Trade and Other Payables

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Trade payables	5,335	4,179
Employee payables and accruals	2,278	2,009
Revenue in advance	4,903	1,825
	12,516	8,013

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

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
9. Income Tax		
(a) Income Tax Expense		
The major components of income tax expense in the Statement of Comprehensive Income are:		
Current income tax		
Current income tax charge	1,096	1,436
Adjustments to prior year current income tax charge	36	47
	<u>1,132</u>	<u>1,483</u>
Deferred income tax		
Deferred tax expenses/(income) related to prior year	(41)	(38)
Relating to origination and reversal of temporary differences	(111)	(788)
	<u>(152)</u>	<u>(826)</u>
Income tax expense/(income) reported in the Statement of Comprehensive Income	<u>980</u>	<u>657</u>
(b) Amounts charged or credited directly to other comprehensive income		
<i>Deferred income tax related to items charged (credited) directly to other comprehensive income</i>		
Net gain on revaluation of heritage assets	<u>0</u>	<u>0</u>
(c) Reconciliation between the aggregate tax expense recognised in the Statement of Comprehensive Income to tax expense calculated at the statutory income tax rate		
Accounting profit before income tax	3,312	2,494
Tax at the statutory income tax rate of 28% (2016: 28%)	927	698
Adjusted by:		
Prior year income tax	(5)	10
Entertainment	16	14
Other	42	(65)
Income tax expense	<u>980</u>	<u>657</u>
(d) Deferred income tax relates to the following:		
<i>Deferred tax liabilities</i>		
Property, plant and equipment	(1,796)	(1,923)
Nursery inventory	(77)	(102)
Standing timber	(154)	(154)
	<u>(2,027)</u>	<u>(2,179)</u>
<i>Deferred tax assets</i>		
Patents and trademarks	200	177
Payroll provisions	732	798
Provision for doubtful debts	10	10
Income in advance	28	42
Other	77	20
	<u>1,047</u>	<u>1,047</u>
<i>Net Deferred Tax Asset/(Liability) per Statement of Financial Position</i>	<u>(980)</u>	<u>(1,132)</u>

The group has no unused tax losses (2016: \$0k).

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

10. Property, Plant and Equipment

GROUP	Land & Improvements \$000	Buildings \$000	Plant & Equipment \$000	Furniture & Fittings \$000	Motor Vehicles \$000	Books & Periodicals \$000	Capital Work in Progress \$000	Total \$000
At 1 July 2016								
Carrying amount net of accumulated depreciation and impairment at 1 July 2016	1,860	12,182	10,248	897	297	82	1,780	27,346
Additions	0	10	1,865	106	96	0	1,893	3,970
Transfers from CWIP	0	0	1,277	19	0	0	(1,296)	0
Disposals	0	(181)	(4)	0	(1)	0	(44)	(230)
Impairment provision made	0	(47)	0	0	0	0	0	(47)
Reversal of impairment provision	0	145	0	0	0	0	0	145
Depreciation expensed	(62)	(606)	(2,547)	(91)	(77)	0	0	(3,383)
Carrying amount net of accumulated depreciation and impairment at 30 June 2017	1,798	11,503	10,839	931	315	82	2,333	27,801
At 30 June 2017								
Cost or fair value	2,357	22,717	45,561	2,861	908	82	2,333	76,819
Accumulated depreciation and impairment	(559)	(11,214)	(34,722)	(1,930)	(593)	0	0	(49,018)
Net carrying amount	1,798	11,503	10,839	931	315	82	2,333	27,801

Books and periodicals include some library books classified as Heritage Assets. 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 2013. Fair value is the amount for which the books could be exchanged between a knowledgeable willing buyer and a knowledgeable willing seller in an arms-length transaction as at valuation date. Fair value is determined by reference to recent prices realised at national and international auctions and prices being asked for by specialist dealers for comparable items. Refer to Note 21 regarding other heritage assets. The heritage asset library books have been valued at \$82k (2016: \$82k).

Scion recognised an impairment loss of \$47k on buildings which are not tenanted and the company considers that they are unlikely to be tenanted in the foreseeable future (2016: \$140k). Scion also re-assessed the economic useful life of some buildings that are to be partly or wholly demolished as part of its campus development plans and accordingly accelerated depreciation on the buildings. Scion made no other impairment provisions and reduced provisions where depreciation on an asset has continued to be recognised.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

10. Property, Plant and Equipment (cont.)

GROUP	Land & Improvements \$000	Buildings \$000	Plant & Equipment \$000	Furniture & Fittings \$000	Motor Vehicles \$000	Books & Periodicals \$000	Capital Work in Progress \$000	Total \$000
At 1 July 2015								
Carrying amount net of accumulated depreciation and impairment at 1 July 2015	1,784	15,126	10,395	987	362	251	1,448	30,353
Additions	136	0	1,787	0	41	0	925	2,889
Transfers from CWIP	0	0	572	0	0	0	(572)	0
Disposals	0	0	(108)	0	0	(169)	(21)	(298)
Impairment provision made	0	(140)	0	0	0	0	0	(140)
Reversal of impairment provision	0	23	0	0	0	0	0	23
Depreciation expensed	(60)	(2,827)	(2,398)	(89)	(106)	0	0	(5,481)
Carrying amount net of accumulated depreciation and impairment at 30 June 2016	1,860	12,182	10,248	897	297	82	1,780	27,346
At 30 June 2015								
Cost or fair value	2,220	23,260	40,851	2,755	812	251	1,560	71,709
Accumulated depreciation and impairment	(436)	(8,134)	(30,456)	(1,768)	(450)	0	(112)	(41,356)
Net carrying amount	1,784	15,126	10,395	987	362	251	1,448	30,353
At 30 June 2016								
Cost or fair value	2,357	23,024	42,768	2,742	853	82	1,780	73,606
Accumulated depreciation and impairment	(497)	(10,842)	(32,520)	(1,845)	(556)	0	0	(46,260)
Net carrying amount	1,860	12,182	10,248	897	297	82	1,780	27,346

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

11. Biological Assets

Biological assets consist of tree plantations. The group has 73.2 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 2017 \$000	ACTUAL 2016 \$000
Carrying amount 1 July	550	466
(Loss)/Gain from changes in fair value less estimated point-of-sale costs	(2)	84
Carrying amount 30 June	548	550

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

The group has tree plantations at three 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) 5.5 hectares of Mexican Cypress are located at Tikokino. The trees were planted for experimental purposes. The Mexican Cypress has a clear fell date of June 2033.
- (c) 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 2017 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.

12. Intangible Assets

Software

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Opening balance 1 July		
At cost	4,028	3,817
Less accumulated amortisation	(3,628)	(3,439)
Opening net carrying amount 1 July	400	378
Opening carrying amount 1 July	400	378
Additions	186	213
Current year amortisation	(201)	(191)
Closing carrying amount 30 June	385	400

Closing balance 30 June

At cost	4,214	4,028
Less accumulated amortisation	(3,829)	(3,628)
Closing net carrying amount 30 June	385	400

Carbon Credits

Carrying amount 1 July	346	133
Increase/(Decrease) in fair value	(12)	213
Carrying amount 30 June	334	346

Total intangible assets 30 June	719	746
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NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

13. Investments in Subsidiaries

	Shares	Percentage Held 2017	Percentage Held 2016	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.

All subsidiaries are incorporated in New Zealand.

14. Investments in Associates

(a) Investment Details

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Biopolymer Network Limited	241	259
Terax 2013 Limited	0	0
Terax Limited Partnership	192	73
	433	332

New Zealand Forest Research Institute Limited has a 33.33% (2016: 33.33%) shareholding in Biopolymer Network Limited, a company carrying on research, development and commercialisation of biopolymers.

New Zealand Forest Research Institute Limited Group has a 50% shareholding in Terax 2013 Limited. The company was incorporated in February 2012. Terax 2013 Limited manages Terax Limited Partnership in which Scion Group also has a 50% interest. Terax Limited Partnership was registered on 8 April 2013.

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

All of the companies are incorporated in New Zealand.

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
(b) Movements in the carrying amount of the group's investments in associates		
Opening carrying amount of investments	332	313
Current year investment in associates	300	420
Current year share of increase/(decrease) in net assets of associates	(199)	(401)
Closing carrying amount of investments	433	332

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

14. Investments in Associates (cont.)

(c) Summarised financial information

The following table illustrates summarised financial information relating to the group's associates:

Extract from the associates' Statement of Financial Position:

	ACTUAL	ACTUAL
	2017	2016
	\$000	\$000
Current assets	1,424	1,112
Non-current assets	405	347
	1,829	1,459
Current liabilities	746	536
	746	536
Net assets	1,083	923
Share of associates' net assets	433	332

Extract from the associates' Statement of Comprehensive Income:

Revenue	3,399	4,039
Net Profit/(Loss)	(75)	(536)

There are no known contingent liabilities relating to Associates.

15. Cash and Cash Equivalents

Cash on hand	5	7
Bank	1	1
Call deposits	4,811	3,791
Short term deposits	10,700	7,634
	15,517	11,433

Deposits earn interest at rates ranging from 1.60% to 3.81% (2016: 2.25% to 3.57%). For the purposes of the Statement of Cash Flows, Cash and Cash equivalents are equivalent to Cash and Cash equivalents presented in the Statement of Financial Position.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
16. Trade and Other Receivables		
Trade receivables	6,983	5,091
Allowance for impairment loss	(35)	(35)
Other debtors	97	79
Prepayments	917	927
Accrued revenue	718	989
Related party receivables:		
Associates	167	166
Other related parties	0	0
Carrying amount 30 June	8,847	7,217

(a) The carrying amount disclosed above is a reasonable approximation of fair value due to the short term nature of the receivables.

(b) Allowance for Impairment Loss
Trade receivables are non-interest bearing and are generally on 30–60 day terms. A provision for impairment loss is recognised when there is objective evidence that a trade receivable is impaired. No increase or decrease in the allowance for impairment loss in the current year.

Movements in the allowance for impairment loss were as follows:

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Opening balance 1 July	35	37
Reversal of prior year provision	0	(2)
Charge for the year	0	6
Bad debts written off	0	(6)
Closing balance 30 June	35	35

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

	Total	0-30 Days	0-30 Days	31-60	31-60	61-90	61-90	+91	+91 Days
		CNI*	CI*	Days	Days	Days	Days	Days	CI*
	\$000s	\$000s	\$000s	CNI*	CI*	PDNI*	CI*	PDNI*	\$000s
	\$000s			\$000s	\$000s	\$000s	\$000s	\$000s	
2017	6,983	6,653	0	186	0	76	0	33	35
2016	4,724	4,294	0	218	0	3	0	174	35

* Current not impaired (CNI)

* Past due not impaired (PDNI)

* Considered impaired (CI)

(c) For related party terms and conditions refer to Note 23.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
17. Inventories		
Consumable stores (at cost)	30	16
Nursery stock	276	364
Closing carrying amount	306	380

Consumable stores recognised as an expense for the year are \$67k (2016: \$35k). The expense has been included in the "consumables" line item in Note 3 (a). Consumable inventory write-down in the period was \$0k (2016: \$0k).

18. Financial Instruments

Financial Instruments include:

Loans and Receivables

Cash and cash equivalents

Trade receivables

Other debtors

Related party receivables

Other Financial Liabilities

Trade payables

Other payables

Related party payables

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

All financial instruments held at fair value are Level 2.

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 (\$2,753k) are non-interest bearing and are normally settled within 60 days. The company and 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 2017 \$000	ACTUAL 2016 \$000
Current account	1	1
Call and short term deposits	15,511	11,425
Trade receivables	6,893	5,091
Other debtors	97	79
Related party receivables	167	166

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

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

18. Financial Instruments (cont.)

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 relates primarily cash deposits. Cash and cash equivalents have increased during the year to a year ended 30 June 2016 group balance of \$15,517k (2016: \$11,433k).

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Cash in hand	5	7
Current account	1	1
Call deposits	4,811	3,791
Short term deposits	10,700	7,634
	15,517	11,433

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 2017 bank call and short term deposits were earning interest at rates between 1.60% and 3.81% (2016: 2.25% and 3.57%).

At 30 June 2017, 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:

	2017	2017	2016	2016
Judgement of reasonably possible movements in interest rates	Change in Interest Rate	Effect on Post Tax Profit & Equity \$000	Change in Interest Rate	Effect on Post Tax Profit & Equity \$000
	+1%	112	+1%	82
	-1%	(112)	-1%	(82)

Management has taken account of Reserve Bank of New Zealand indications of future interest rate movements in the Official Cash Rate and various other market indicators and after considering these indicators, believe the interest rate changes are reasonable and possible.

Currency Risk

Only small balances are held in currencies other than New Zealand dollars, materially all in debtors. Collection on all these debtors is expected within 60 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.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
19. Reconciliation of Operating Surplus after Taxation with Cash Flows from Operating Activities		
Reported surplus/(loss) after taxation	2,332	1,837
Add/(less) non-cash items:		
Depreciation (Refer Note 3 and 10)	3383	5,481
Amortisation	201	191
Compensation provision	50	0
Impairment provision	43	117
Movement in deferred tax (Refer Note 9)	(152)	(825)
	3,525	4,964
Add/(less) items classified as investing activity:		
Investment contribution included in payables	70	(70)
(Gain)/loss on disposal of property, plant and equipment	71	299
Share in associate company (profit)/loss	199	401
Capital related items in creditors	(234)	(109)
Fair value movement in carbon credits	12	(213)
Fair value movement in biological assets	2	(84)
	120	224
Movements in working capital items:		
(Increase)/Decrease in debtors and prepayments	(1,630)	(779)
(Increase)/Decrease in inventories	75	76
Increase/(Decrease) in creditors and accruals	4,242	420
Increase/(Decrease) in taxation payable	(305)	291
	2,382	8
Net cash flows from operating activities	8,359	7,033
20. Contingencies		
Treaty of Waitangi Issues		
Two verified land claims affecting the group currently exist:		
(i) Ngati Whakaue – covering the whole Rotorua Campus		
(ii) Ngati Wahiao – covering the southern end of the Rotorua Campus		
No reliable estimates can be made of the impact of these contingencies.		
21. Heritage Assets		
The company has identified its library, herbarium and germplasm collections as heritage assets. For the herbarium and germplasm collections the Directors believe that there is no practical basis upon which to reliably value these collections. For the library refer to note 10.		

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

22. Commitments

Operating Lease Commitments – Group as Lessee:

The group has entered into commercial leases on certain motor vehicles and items of office equipment. The leases have lives of three or four years with renewal options included in the motor vehicle leases only. There are no restrictions placed on the lessee by entering into these leases. In addition the parent company leases land from its subsidiary Te Papa Tipu Properties Limited.

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

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Lease commitments under non-cancellable operating leases:		
Within one year	20	22
One to five years	18	31
	38	53

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 a 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 basis according to prevailing market conditions.

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

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
Within one year	364	344
One to five years	504	617
Greater than five years	406	483
	1,274	1,444
Capital Commitments		
Capital expenditure contracted for at balance date but not provided for	484	0

23. Transactions with Related Parties

(a) Parent

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 at arms-length. Government Public Good Science funding and Capability funding comprises close to 50% of research revenue earned by Scion.

	ACTUAL 2017 \$000	ACTUAL 2016 \$000
(b) Subsidiary Companies of Parent		
<i>Te Papa Tipu Properties Ltd</i>		
Charge for services	76	76
Payment of rent	(398)	(398)
Net Paid on behalf	187	151
Amount (payable)/receivable at balance date		
– Intercompany account	(215)	(80)
<i>Sala Street Holdings Ltd</i>		
Paid on behalf	370	100
Amount receivable at balance date	470	100

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2017

	ACTUAL	ACTUAL
	2017	2016
	\$000	\$000
23. Transactions with Related Parties (cont.)		
(c) Associates of Parent		
<i>Biopolymer Network Ltd</i>		
Supplied goods and services	1,737	1,722
Receivable at balance date	167	163
<i>Terax 2013 Ltd</i>		
Services provided	101	288
Cash contributions made	300	420
Receivable at balance date	0	2
<i>Terax Limited Partnership</i>		
Services provided	20	0
Services paid on behalf	0	22
Receivable at balance date	0	0
(d) Other Related Parties		
<i>WQI Ltd</i>		
Supplied goods and services	0	211
Received goods and services	0	(13)
Receivable/(Payable) at balance date	0	0

New Zealand Forest Research Institute Limited has a 5.05% shareholding in WQI Limited (2016: 5.05%). The company's policy is to record such investments at fair value but these shareholdings have not been recorded in the financial statements as their value is not considered to be material to the group. Refer to Note 14 for shareholdings in associates.

Other

The group's transactions during the year and year end balances with other parties are as follows:

i) Oji Fibre Solutions (NZ) Limited (related party from 1 January 2016)

Provided services during the period totalling \$412k (2016: \$137k for the period from 1 January 2016 to 30 June 2016). The amount receivable at year end was \$173k (2016: \$21k).

ii) Wood Processing and Manufacturing Association (related party from 1 January 2016)

Received services totalling \$12k at year end (2016: \$3k for the period from 1 January 2016 to 30 June 2016). The amount payable at year end was \$1k (2016: \$0k).

iii) University of Canterbury

Provided services during the period totalling \$386k (2016: \$142k). The amount receivable at year end was \$431k (2016: \$150k). Also services totalling \$407k were received during the period (2016: \$457k) and the amount payable at year end was \$33k (2016: \$138k).

Mrs Judith Stanway, a director of New Zealand Forest Research Institute Limited, is Chair of Te Papa Tipu Properties Limited and a Director at Terax 2013 Limited. Mrs Stanway's term concluded 30 June 2017.

Mr Jon Ryder, a director of New Zealand Forest Research Institute Limited, is CEO of Oji Fibre Solutions NZ Limited and a director of Oji Oceania and Wood Processors and Manufacturers Association.

Mr Steve Wilson, a director of New Zealand Forest Research Institute Limited, is a University of Canterbury Mechanical Engineering Advisory Board Member.

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 (2016: \$0k) and no impairment allowance has been raised for any of these debts.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS
FOR THE YEAR ENDED 30 JUNE 2017

24. Key Management Personnel
Short term employee benefits
KiwiSaver employee benefits

ACTUAL	ACTUAL
2017	2016
\$000	\$000
1,968	1,925
36	34
2,004	1,959

BOARD OF DIRECTORS

Mr Tony Nowell CNZM – Chair
Mr Sheldon Drummond (resigned 30 June 2017)
Ms Colleen Neville
Dr Barry O’Neil
Mr Jon Ryder
Mrs Judith Stanway (resigned 30 June 2017)
Mr Steve Wilson

Mr Rob Trass (Company Secretary)

EXECUTIVE MANAGEMENT

Dr Warren Parker – Chief Executive Officer (resigned 6 March 2017)
Dr Julian Elder – Chief Executive Officer (commenced 7 February 2017)

Dr Russell Burton – General Manager, Research and Investments
Dr Elspeth MacRae – General Manager, Manufacturing and Bioproducts
Mr Rob Lei – Acting General Manager, Business Development and Commercialisation
Prof Alison Stewart CNZM – General Manager, Forest Science
Mrs Keri-Anne Tane – General Manager, People, Culture and Safety (resigned 26 May 2017)
Mr Rob Trass – Chief Financial Officer

AUDITORS

Susan Jones
Ernst & Young, Auckland, on behalf of the Auditor-General

BANKERS

ANZ Bank of New Zealand

SOLICITORS

Bell Gully, Auckland

REGISTERED OFFICE DETAILS

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