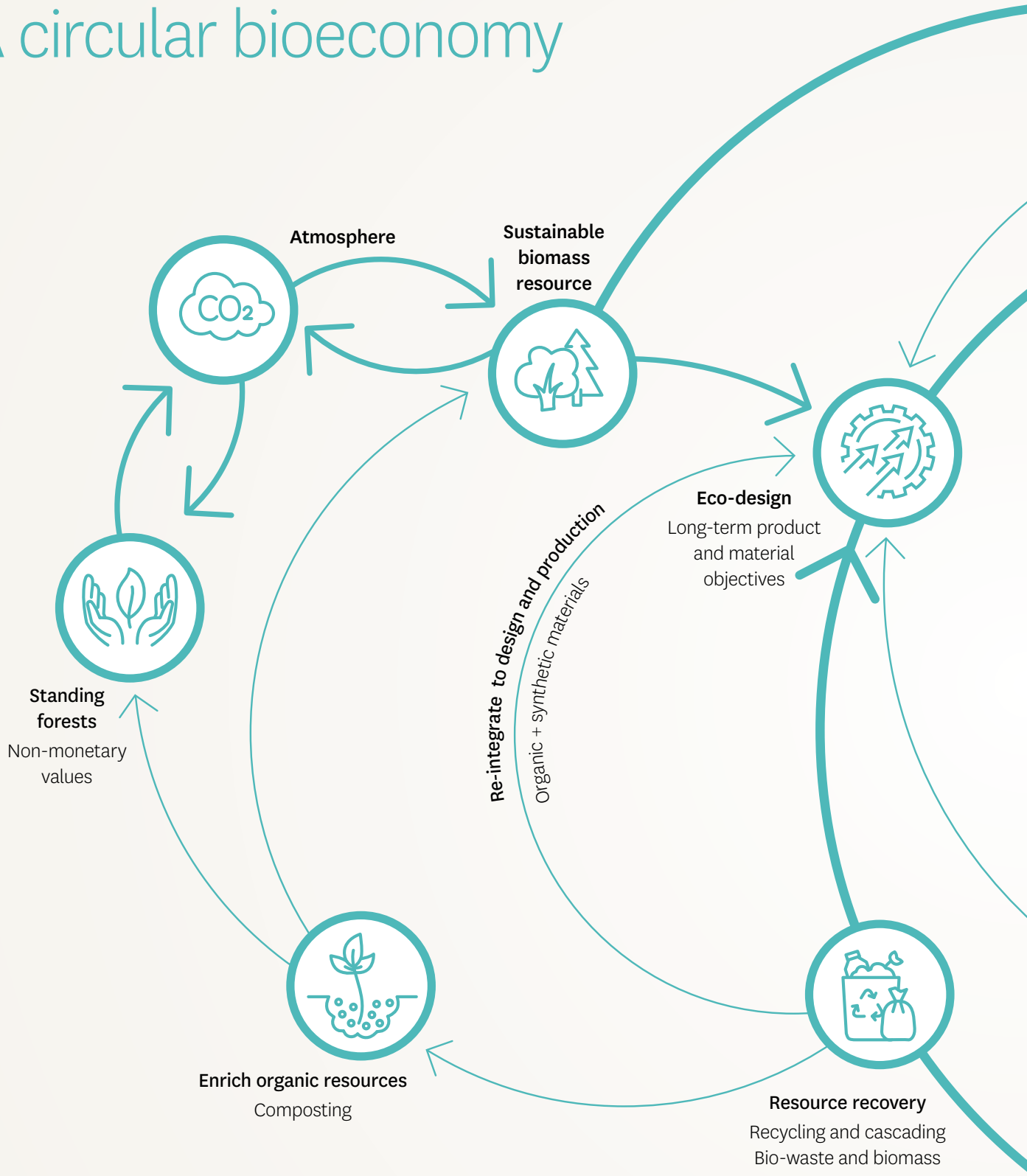
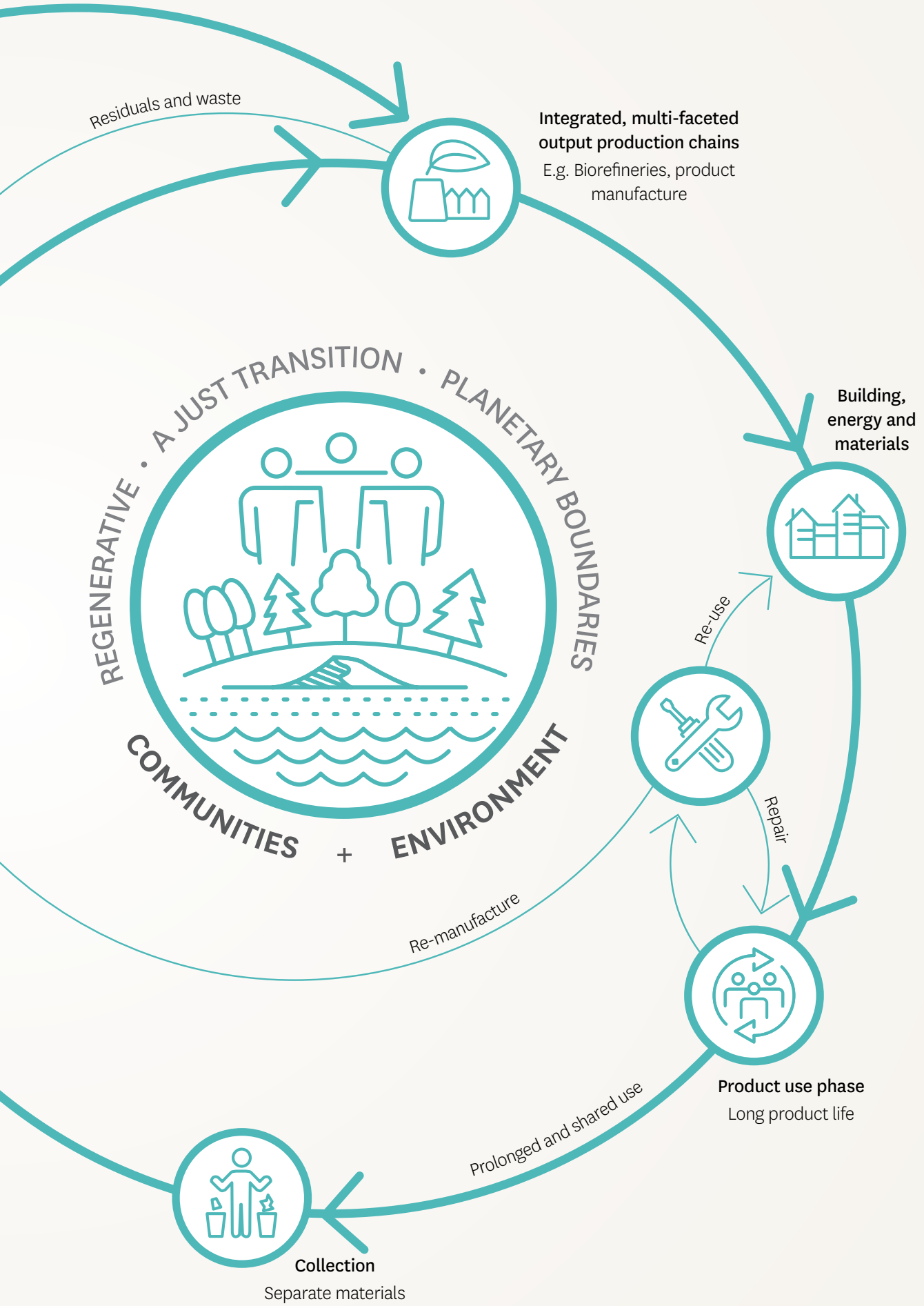

SCION
FORESTS ▪ PRODUCTS ▪ INNOVATION
Statement of Corporate Intent
2023 - 2026

A circular bioeconomy




Residuals and waste
Integrated, multi-faceted output production chains
E.g. Biorefineries, product manufacture
REGENERATIVE • A JUST TRANSITION • PLANETARY BOUNDARIES
COMMUNITIES + ENVIRONMENT
Building, energy and materials
Re-use
Repair
Re-manufacture
Product use phase
Long product life
Prolonged and shared use
Collection
Separate materials

Statement of Corporate Intent 2023–2026

Scion, Te Papa Tipu Innovation Park, Tītokorangi Drive
Private Bag 3020, Rotorua 3046, New Zealand
Telephone +64 7 343 5899

This Statement of Corporate Intent is available on www.scionresearch.com

ISSN 2230-4908 (print)
ISSN 2230-4916 (online)

Printed on FSC mixed paper source.

Published June 2023

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Chair and Chief Executive overview

Prophetically in last year's Statement of Corporate Intent we began "The climate crisis is here". Recent events have reinforced that reality for many people throughout the country. The devastation wrought by Cyclones Hale and Gabrielle in the North Island is shocking, and we acknowledge the pain and hardship experienced by affected communities.

Recovery will be a long journey. It is vital that New Zealand and the world proceed at pace with mitigation and adaptation. Vital too is Scion having a key role in shaping new approaches to sustainable land use, low emissions manufacturing, regional economies and healthy communities.

New Zealand must be bold and steadfast. It is time to take on the transition to a circular bioeconomy as a national research priority and establish it as mission-led research.

Climate change is the challenge of our generation. The consequences of global inaction have rapidly become the catastrophic wake-up call to doing things differently. There are enormous opportunities and rewards for countries, companies and communities that are taking action and becoming disruptors as they adopt circular bioeconomy approaches steering away from fossil fuel-based economies.

The disruption potential for the world is similar to the Industrial Revolution in the 19th century or the advent of refrigerated shipping over 140 years ago. That was game-changing for New Zealand as the way was paved for our trade in frozen meat and dairy products with tremendous impact on our 20th century economy.

Imagine if New Zealand became a global hub for the circular bioeconomy. Could we? Our country has a natural competitive advantage growing sustainable biomass, linked with a high-value emerging biomanufacturing sector, and overlaid by a Te Ao Māori worldview that underpins this vision.

Team Scion is chasing this vision. We hold dear that the impact of circular bioeconomy-related technologies is a win-win for the planet and society. Our work aims to both mitigate climate change - the challenge of our generation - and create prosperity from this disruption or revolution - the opportunity of our generation.

But New Zealand must whole heartedly join the race. Around the world, countries are establishing and implementing national and regional strategies, action plans and programmes to develop sustainable and circular bioeconomies in line with the United Nations Sustainable Development Goals, the Paris Climate Agreement and other multilateral environmental agreements.

A good start is Scion's Strategy to 2030. It's all about making the most of the massive renewable resource on our doorstep – the forests and forestry that provide multiple benefits for New Zealand. We know that forests will be at the heart of a low-carbon biological-based future. We know too that forests will offset greenhouse gas emissions on a scale unmatched by any current technologies. And we know that renewable materials derived from trees will replace those from fossil fuels.

Our strategy seizes the climate change opportunity for New Zealand to take the circular bioeconomy road. The shift to circular bioeconomy approaches will give New Zealand the power to not only reduce waste, pollution and greenhouse gas emissions, but also to grow economically while benefitting the environment and society.

New Zealand must be bold and steadfast. It is time to take on the transition to a circular bioeconomy as a national research priority and establish it as mission-led research with specific timeframes and deliverables backed by sufficient funding to ensure delivery.

We see Scion as central to such a mission with wide national and international collaborations to bring the right teams together. Scion is recognised as a global leader in this space as demonstrated by numerous agreements, exchanges, visits and partnerships. We have much to contribute to the national conversation and policy making around the circular bioeconomy.

Within this Statement of Corporate Intent, we present how we are implementing our strategy – helping New Zealand transition to a circular bioeconomy through right tree, right place, right purpose. Already, trees are the source of over 5000 products used around the world daily. Science, technology and innovation can unlock much more of this extraordinary potential.

And, an exceptional ingredient in unlocking this potential is in our hands. New Zealand has a unique value proposition globally with the alignment between Te Ao Māori and circular bioeconomy views. This uniqueness makes the opportunity to act so significant. Our circular bioeconomy journey will be enriched with the integration of the Māori worldview.

Scion is leading the way in weaving Te Ao Māori, mātauranga Māori and science together to deliver better outcomes as well as demonstrating the creation of strong and enduring relationships with Māori.

We welcomed, therefore, the Government's vision to embed Te Tiriti in the research, science and innovation system as articulated in the Te Ara Paerangi - Future Pathways White Paper launched last November. The establishment of our Te Ao Māori Research Group two years ago and other steps were initiated with Te Tiriti in mind. Inside this document we introduce our Te Ao Māori Strategy and how it will contribute to economic growth and shared prosperity.

To successfully implement our strategy, we work closely and collaboratively with partners and stakeholders from industry, other research providers, government, iwi and the wider community. The challenge for the sectors we serve – forestry, wood products and wood-derived materials and other biomaterials - is accelerating this work.

The Government's Forestry and Wood Processing Industry Transformation Plan (ITP) provides a way forward, and Scion strongly supports the vision it sets out. The ITP reinforces the relevance of our Strategy to 2030 and our leadership role in research that will drive development of new manufacturing sectors and low-carbon products. For example, distributed manufacturing is included in the ITP as a new opportunity within production forests that give rise to new, local production and supply chain businesses that will contribute to regional development.

This ITP and other government initiatives clearly align with our strategy and signal that our direction is solid and our science will make valuable contributions in implementing those initiatives. As yet, however, the mechanisms by which we can actively play our part remain opaque and are a persistent challenge we strive to overcome.

Already, trees are the source of over 5000 products used around the world daily. Science, technology and innovation can unlock much more of this extraordinary potential.

That said, the big picture shows there is much opportunity and potential ahead. We are therefore reflecting ambitious outcomes in this Statement of Corporate Intent and the role our science can play in future proofing our environment, society and economy in a post-hydrocarbon world. While we face funding challenges, numerous reviews and discussions with officials acknowledge that our science is high quality and that the current funding model does not support delivery of our strategy. We are buoyed by ministerial endorsement of our ambition and encouragement to seek additional funding from other sources lead us to be optimistic about our revenue projections.

We are excited by the research we are currently undertaking and the research programmes we are embarking on with our partners. Together, we confidently follow our mission "Enhancing New Zealand's prosperity, wellbeing and environment through trees – Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Dr Helen Anderson QSO
Chair

Dr Julian Elder
Chief Executive

Our purpose

Scion is one of seven Crown Research Institutes that carry out scientific research for the benefit of New Zealand.

Our core purpose

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

Our vision

Prosperity from trees –
Mai i te ngahere oranga

Our mission

Enhancing New Zealand's prosperity, wellbeing and environment through trees.

Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Our role

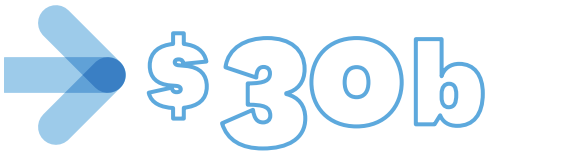
Since our origins as the Forest Research Institute in 1947, Scion has promoted forests and forestry for multiple benefits.

Forests are integral to New Zealand. They are part of our landscapes, our communities, our industries and our export earnings. The future of forests and forestry are fundamental to New Zealand's future wellbeing and prosperity.

Now, and increasingly so, forests are becoming the heart of a low-carbon, biological-based future New Zealand. Forests will offset greenhouse gas emissions on a scale unmatched by any current technologies. And renewable materials derived from trees will replace those from fossil fuels.

In the summer of 2023, we were reminded about the devastating impact of climate change when floods ravaged much of the North Island. As repeated extreme weather events take their toll on communities, infrastructure and our environment, there are growing calls for greater climate change action. At Scion, we have already risen to the challenge and are leading the way with research that supports the growth of our forestry sector and the development of new technologies that use trees and other renewable materials to create environmentally friendly products.

Forestry is recognised as a vital means of tackling climate change. It plays its part in two ways.



A forest-based circular bioeconomy is a $30 billion annual economic opportunity[1]

First, it will help achieve New Zealand's net-zero target by removing CO_2 from the atmosphere. That function is essential to our climate change response as sequestration of carbon by vegetation is the only viable technology to reduce and offset the carbon that we have already put into the atmosphere.

Secondly, sustainable plantation forestry also has a role in reducing our gross CO_2 emissions by substituting products, fuels and energy made from fossil fuels with renewable wood and fibre-based alternatives.

Forests collectively – both production and long-standing indigenous forests – are a massive renewable resource with the scale needed to provide New Zealand with low-emissions materials and fuels. As a country looking to avoid further weather-related catastrophes, we must invest in research and innovation that unleashes the power of forestry for its ability to mitigate the effects of climate change and chart a course for a low-carbon, circular bioeconomy future.

As well as helping New Zealand and the world meet its climate change targets, a forest-based circular bioeconomy is a $30 billion annual economic opportunity[1] that will provide a mosaic of activity for regional New Zealand to thrive through emerging biobased manufacturing, and the creation of new high-value products from what we currently consider waste.

Among its 11 research portfolios, Scion has one portfolio dedicated to helping regions thrive through de-centralised, distributed and circular manufacturing approaches. We see customised product design making the most of regional resources and Māori inspired products that use primary industry residues and Māori inspired feedstocks.

Māori give New Zealand a special uniqueness and have huge relevance in our sectors. Forests and trees are culturally significant to Māori. They are central to the distinct worldview that is Te Ao Māori. Māori are a key resource holder and are intergenerational.

We are seeing a significant shift in terms of respecting the value that mātauranga Māori can assist and partner in terms of our research. This is leading to very authentic, world-leading and exciting programmes of work in partnership with Māori.

New Zealand's forests also are economically and socially important for Māori. Through forestry, Māori contribute hugely to New Zealand's economy. Since 1997 more than 70 state-owned forests have been returned to iwi in Crown Treaty settlements. Māori ownership of land and forests will increase as settlements conclude and more Māori-owned businesses in the value chain emerge.

We are seeing a significant shift in terms of respecting the value that mātauranga Māori can assist and partner in terms of our research. This is leading to very authentic, world-leading and exciting programmes of work in partnership with Māori. In more and more cases, Māori are the lead partner.

Integral to our work too are partnerships with industry, the wider research sector and government. Our vision for the future of New Zealand is bold, and productive long-term partnerships are necessary for our strategy to succeed in creating impact for New Zealand.

Our mission is to enhance New Zealand's prosperity, wellbeing and environment through trees. We know that our excellent science and research, supported and empowered by a coordinated research, science and innovation system, will lead the transition to a circular bioeconomy and put New Zealand firmly on track to a sustainable, productive and inclusive low-carbon future.

Scion's role is pivotal in helping New Zealand make the move to a circular bioeconomy.

38%

10.1 million hectares of forests cover 38% of NZ

$6b

Six billion dollars in yearly forestry exports

35k

35,000 people are employed in forestry

Trees planted as forests can be at the heart of a low-carbon, biobased future New Zealand.

Forests are arguably New Zealand's greatest renewable and sustainable resource. They are carbon sinks and thereby help mitigate climate change. They are integral to our landscapes and how we live in New Zealand. When planted commercially, they contribute massively to our economy.

New Zealand has 10.1 million hectares of forests covering 38 per cent of the land. This tree-clad area comprises 8 million hectares of indigenous forest and 2.1 million hectares of plantation forestry (mostly *Pinus radiata*).

Trees create value for New Zealand in many ways. During its growth a tree stabilises land, enhances water and air quality, absorbs carbon and offers places for recreation and connection to nature. On maturity a tree can be processed to provide materials for construction, building interiors, furniture and landscaping; fibre for packaging and paper; chemicals and energy products. Other companies make high-value manufactured goods replacing fossil-fuel resources with tree-derived materials, and they develop and supply technologies and machinery to keep pace with innovation.

The value of all forestry exports currently is over $6 billion a year, equivalent to 1.6 per cent of New Zealand's gross domestic product. More than 35,000 people are employed in the forestry industry, including wood production, wood processing and supply.

There is potential for these numbers to be much greater. Trees are the source of thousands of products used daily, and we can manufacture some or even all of these products in New Zealand. We can create a climate- and nature-friendly economy replacing fossil energy with renewable energy and replace carbon-intense materials and products with sustainable alternatives.

Our forests are an essential part of New Zealand's future as the world shifts away from dependence on fossil fuels to a low-carbon circular bioeconomy.

Products from trees

Trees are a sustainable and renewable source of materials that can provide thousands of everyday products.

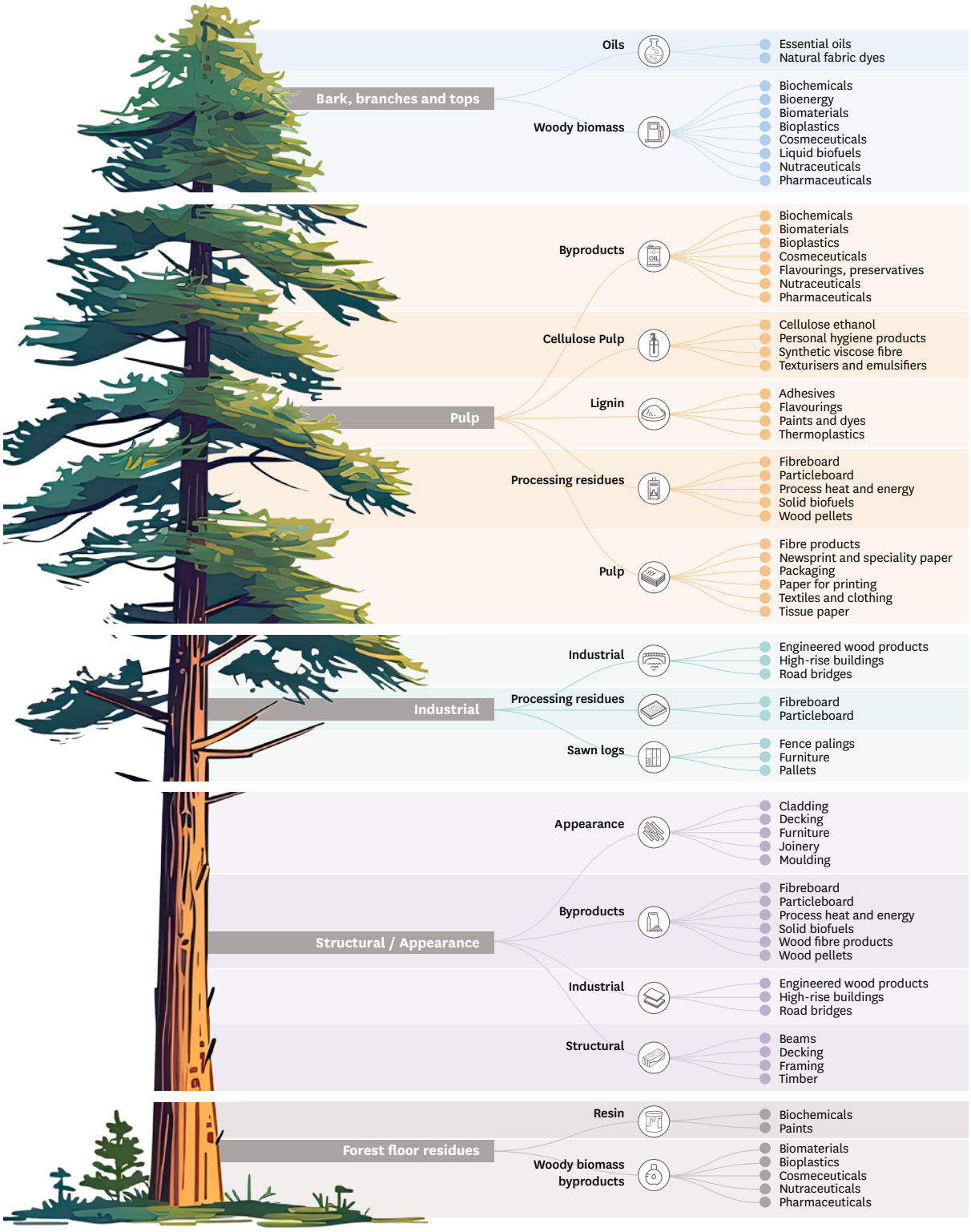


Figure 1: *Products derived from different parts of a tree.*

Our strategy

New Zealand grows forests well. At Scion, we see the potential of trees to enhance New Zealand's prosperity, wellbeing and environment.

We devise new and clever ways to use trees in thousands of everyday products. We are helping build a circular bioeconomy.

Our mission

Enhancing New Zealand's prosperity, wellbeing and environment through trees.

Kia piki te ora, te taiao me te whai rawa o Aotearoa mā te ngāherehere.

Scion goals to 2030

Strategy to 2030

Right tree,
right place,
right purpose

Helping New Zealand transition to a circular bioeconomy

Serving New Zealand's 2050 goals

Our 2050 aspirations for New Zealand

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

Three Impact Areas

Forests to biobased products	Forests to timber products	Forests and landscapes

11 Portfolios

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

Research pathways

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

Figure 2: *Summary of how Scion contributes to beneficial outcomes for New Zealand.*

Scion has ambitious aspirations for New Zealand that we believe are achievable through the potential of forests to transform how we live.

In 2050, we want New Zealand to have:

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

To reach this future point, Scion set research impact goals for 2030 as stepping-stones along the road to 2050.

Our Strategy to 2030 is all about unleashing the potential of trees to benefit New Zealand.

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

Scion's strategy is to help New Zealand transition to a circular bioeconomy through a forestry-based approach that's about growing the right tree, in the right place for the right purpose.

We will do this through research outcomes in three impact areas:

Forests to biobased products

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

Forests to timber products

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

Forests and landscapes

Growing healthy, resilient forests that are planted primarily for their standing forest benefits.

Our science empowers our strategy. To implement the strategy, our science is organised under three research impact areas divided into 11 portfolios. Each portfolio has shared and distinctive stakeholders who participate in designing, co-developing and delivering research programmes that contribute to the goals of the portfolio and the impact area.

Critical to all our work is having a genuine, trusted partnership with Māori. Forests and trees are culturally significant to Māori. They, and the land which enriches them, are central to the worldview that is Te Ao Māori.

What is a circular bioeconomy?

A circular bioeconomy is centred around people and nature – getting the most value out of renewable biological resources while minimising waste.

The essential concept for a circular bioeconomy is to ensure we can unmake everything we make in a clean non-polluting and regenerative way.

For designers and product developers, that approach creates new opportunities. Instead of 'take, make, waste' we now need to think about what raw materials go into a product, how it will be used and what its whole 'life' will be – waste is a concept not found in nature.

The circular bioeconomy is not a new or untested approach. The market for materials and products made from renewable resources, particularly forestry, is developing fast. It is the way other large forest-rich economies are going in Europe and North America.

Trees are the source of over 5,000 products we use every day and more are added daily. New Zealand could become a global hub for a new high-value biomanufacturing sector, addressing both the challenge and opportunity of our generation.

> Anything made from fossil-based materials today can be made from a tree tomorrow
>
> *Stora Enso (a Finnish forest products manufacturer).*

By delivering fully on our core purpose and our Strategy to 2030, Scion will make a difference to New Zealand's wellbeing, economy and environment by the transition to a circular bioeconomy. Doing so, opens an enormous opportunity that could add as much as $30 billion annually to our GDP as we transition away from a linear, fossil-fuel based economy.[1]

New Zealand can and should take advantage of this opportunity to embrace a circular bioeconomy strategy. We have a strong biological-based economy already, an extensive plantation forestry resource, and a high proportion of renewables in our existing energy mix. Scion can help make this transition, replacing materials and energy derived from fossil-fuel with low-carbon renewable alternatives.

We, New Zealand, must act now. We risk getting left behind other countries' responses to the opportunity. Let us ride the wave, not chase it. Let us enable the just and positive future we wish for next generations.

Bioenergy - an example of the application of a circular bioeconomy

The circular economy approach to energy production is illustrated in Figure 3. One of Scion's research portfolios is dedicated to bioenergy as part of the transition away from fossil fuels (see page 28).

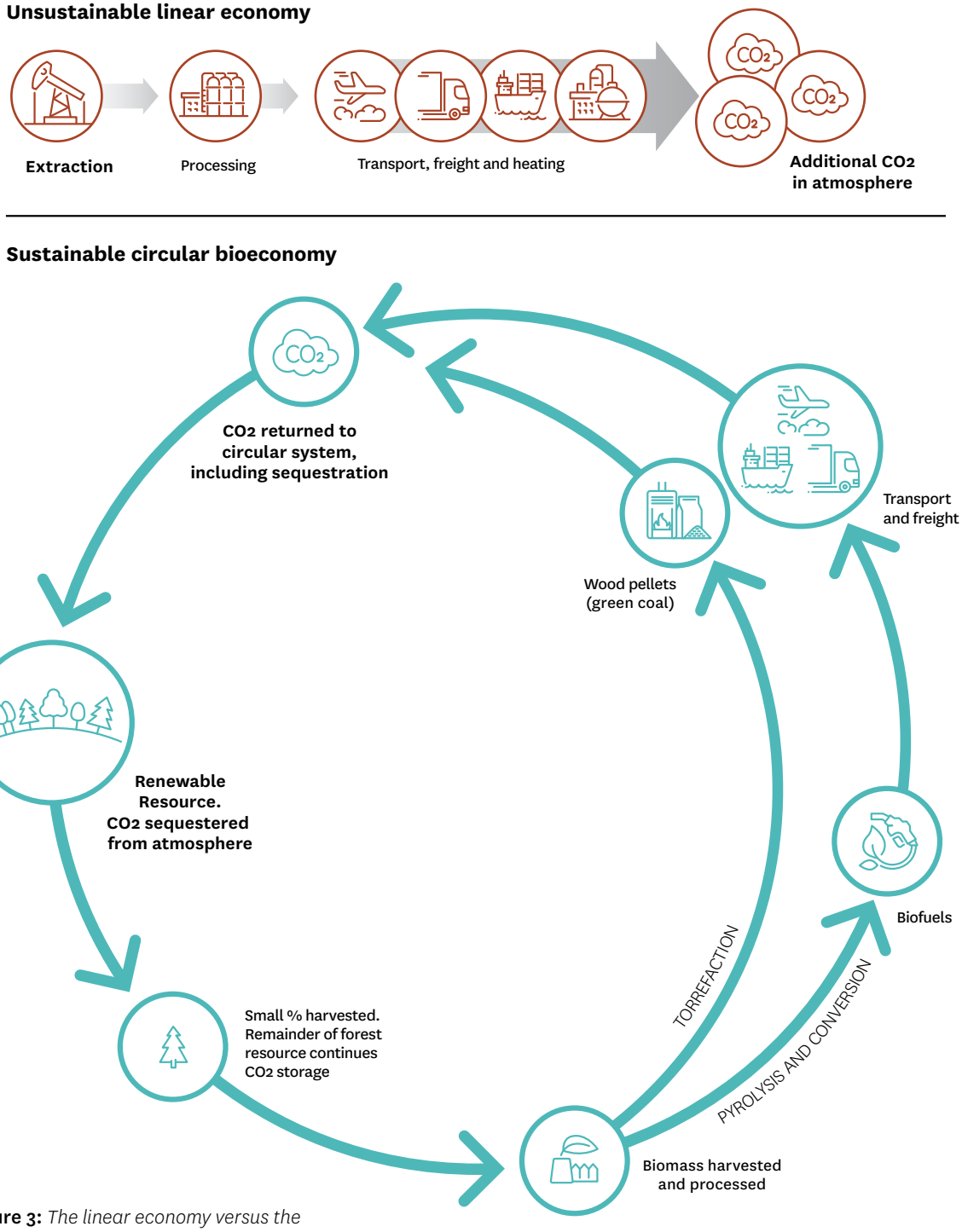


Figure 3: *The linear economy versus the circular bioeconomy for energy production.*

Our operating environment

Climate change response is a priority

The Government has set a clear target for reducing greenhouse gas emissions – to achieve net zero emissions of all greenhouse gases other than biogenic methane by 2050.

Some argue that New Zealand is too small to make a difference to the world's gross emissions. That argument is wrong for many reasons. Our gross greenhouse gas emissions per person are among the highest in the world owing to our high level of agricultural production, which contributes 50 per cent of emissions. We have a moral obligation to act as a member of the global community. Plus, by taking action to achieve net zero emissions we are opening the door to huge economic opportunities enabled by new technologies.

New Zealand must use every tool available to tackle climate change by shifting to a low emissions economy. We should be using forests to meet our emission reduction targets as other forest-rich countries are doing. Forests should not just be seen as temporary carbon sinks. Forests need to be part of the permanent solution as a renewable biomass replacing fossil fuel-based or high-emissions technologies.

Each of our research portfolios directly contributes to climate change mitigation ranging from how well forests store carbon to advanced processing of woody biomass into substitutes for fossil fuels.

Sustainable Development Goals

Scion is using the United Nations Sustainable Development Goals (SDGs) as a primary external driver in setting research objectives and actions. The 17 SDGs cover a wide range of themes from the three dimensions of sustainable development: economic, social and environmental.

Having this driver results in all portfolio strategies aligning with at least one SDG and Scion overall contributing towards 10 SDGs.

Forestry integrates the SDGs in many ways benefiting communities and the environment. For example, using sustainably grown wood in construction supports communities by providing employment opportunities and qualifications in both rural and industrialised areas. It is a multi-industry value chain that spans forestry, wood product manufacturing, building design and construction, including waste management, energy production, logistics and transportation.

By declaring alignment to the United Nations SDGs, Scion is strongly signalling to its staff and its partners a commitment to deliver impactful outcomes, actions and global partnerships for "peace and prosperity for people and the planet" through science, knowledge and innovations from forests, wood products, wood-derived materials and other biomaterials within a circular bioeconomy.

Supporting key government priorities

Scion's Strategy to 2030 continues to support government priorities in primary sector and regional economic development, climate change and sustainable, productive and inclusive economic growth. Our research and innovation can underpin national priorities that will help build a productive and sustainable circular bioeconomy, eliminating waste, building and empowering mātauranga Māori and boosting regional economic growth.

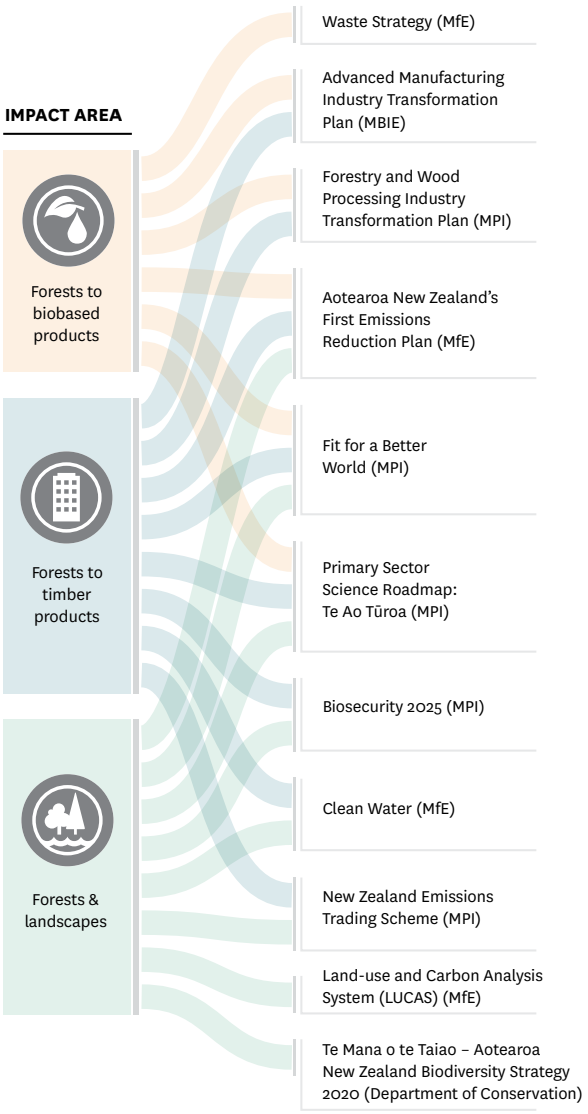
New Zealand faces significant land use challenges and opportunties. Responses to devastating cyclones in early 2023 offer the opportunity to re-imagine how sustainable land use can look, especially in regions that are particuarly vulnerable to the effects of climate change.

One of Scion's seven 2050 aspirations for New Zealand is that all erodible land is planted in permanent forest. Achieving that will require government to work alongside communities to develop integrated land use systems that provide employment for local people, opportunities for innovation, entrepreneurship and regional economic development. Scion looks forward to being part of that journey.

The Government's Forestry and Wood Processing Industry Transformation Plan (ITP) has moved from development to implementation. Te Uru Rākau – New Zealand Forest Service will be procuring the research and innovation needed to support the ITP's priority outcomes and actions. Scion's Strategy to 2030, together with our 75 years' experience in research, science and technology development, coupled with our extensive knowledge in forestry, wood product and wood-derived materials and other biomaterial sectors, make us uniquely qualified to help deliver the transformative opportunity offered by the ITP and unlock the potential of our country's forests for the benefit of New Zealand.

We are also working with other government departments as they develop policies that can be supported by Scion's capability and expertise, and by outcomes generated from our work to deliver our Strategy to 2030. We are in active discussions with the Ministry of Business, Innovation and Employment (MBIE), the Ministry for Primary Industries, particularly Te Uru Rākau (MPI) and the Ministry for the Environment (MfE), among others, including on how we can help lead the transition to a circular bioeconomy.

Government initiatives that align with our strategy via research goals across our three research impact areas are set out below.



Regional economic development

We frequently hear about transitioning to a circular bioeconomy being the solution to our pressing challenges and a generational opportunity. What is often forgotten and underestimated is the importance of this transition for rural and regional New Zealand. A shift to a circular bioeconomy would be an unprecedented opportunity for regional New Zealand to answer their multiple economic, environmental and social needs and aspirations. This transition opens up pathways for diversification and new economic opportunities, coupled with social and environmental benefits.

New industries and value chains create opportunities for existing and new companies around pre-processing, processing, logistics and numerous supporting services that should occur in close proximity to the biomass. It does not stop there. These circular business models attract collaborative ecosystems benefiting regional New Zealand through integration into new biobased value chains.

This transition has the potential to fundamentally transform the economies in regional areas giving New Zealand the power to not only reduce waste, pollution and greenhouse gas emissions but also to grow prosperity, jobs and resilience.

As a long-standing, regionally headquartered Crown Research Institute, Scion has valuable insights and experience to inform this opportunity for New Zealand. Scion is uniquely placed both to understand the regional nature of forestry, wood processing, biobased industries and what might be needed to create new and innovative regional development opportunities.

Scion's main campus is in Rotorua within Te Papa Tipu Innovation Park, which we share with our tenants from around 40 different organisations and companies. Being co-located with forestry and related industries, relevant government organisations and mana whenua brings daily physical connections and interactions on campus that keep relationships vibrant and dynamic.

~ 40 tenants share Te Papa Tipu Innovation Park with Scion

The relationship between Scion and regional New Zealand is particularly pertinent in Rotorua, physically, economically and culturally. As one of the largest employers in Rotorua, many people rely on Scion staff directly and indirectly for their livelihood. Scion provides a wide variety of jobs ranging from highly skilled science roles to various corporate, technical, nursery and field support roles.

Scion has strong links and strengthening partnerships with local iwi, including Ngāti Hurungaterangi, Ngāti Taeotu, Ngāti Te Kahu, and our wider iwi of Ngāti Whakaue and Te Arawa.

A bioeconomy pilot network to scale-up new bioeconomy enterprises

A key gap in the New Zealand bio-innovation system constrains the innovation needed for the transition to a circular bioeconomy. From promising lab-scale development we hit a roadblock. Lack of pilot facilities to scale-up and test new technology at pre-commercial scale hampers deployment and investment in the innovative products and processes needed to underpin a circular bioeconomy.

Scion is committed to work with our key partners to help close this gap. The ITP has identified the need for emerging and growing enterprises to have access to appropriate scale-up facilities to enable the sector to achieve economies of scale.

We continue to work with key partners in government and industry to articulate the feasibility of developing new scale-up and bio-pilot infrastructure. This would see an expanded network of open-access test bed and pre-commercial scale-up infrastructure, with a hub in Rotorua having the ideas, technology and equipment needed to transform bio-feedstocks into the new compounds and materials needed to pivot to a fossil carbon-free bioeconomy.

A future-fit science and innovation system

Change to New Zealand's research, science and innovation system is overdue. Scion supports the intentions of *Te Ara Paerangi – Future Pathways* for transformative change in delivering research, science and innovation. This science system review is important and necessary work that will enable science to serve New Zealand and its people well into the future. We are excited by the key policy directions set out in the White Paper and will continue to contribute constructively to the review.

We agree that embedding Te Ao Māori/Te Tiriti in science reforms should be an initial focus of Te Ara Paerangi. Scion is strongly committed to advancing Māori aspirations and investing in mātauranga Māori.

Our impact focus

Over the past three years, we have rebuilt our organisation to better drive impact and achieve our strategic vision for New Zealand. We have transformed who we are and how we work and embedded capability alignment to deliver three major impact areas that focus where we apply our expertise to provide maximum impact for New Zealand.

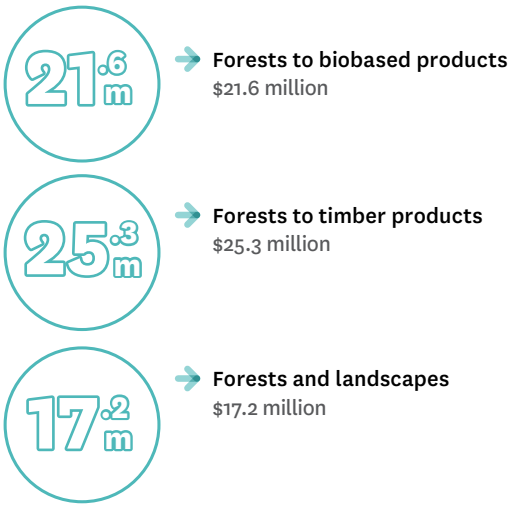
Within those three impact areas we have 11 research portfolios, each with its own research roadmap incorporating 36 research programmes. These roadmaps were informed and co-designed with key stakeholders from central and local government, iwi/hapū, industry, researchers and members of the public.

As expressed previously, the level of investment that aligns with our purpose and Strategy to 2030 priorities needs to increase. The current funding system risks undermining our ability to deliver impact and help address complex, systemic challenges facing New Zealand.

Continual bidding takes a toll on our teams and individuals. Secure funding would enable a better balance between applied and stretchy science and more productively provide the solutions New Zealand needs.

Our investment

We will be investing our revenue across the three impact areas as shown below.



Te Ao Māori

Scion recognises Māori as a critical partner in research, science and innovation, both as inter-generational kaitiaki of significant natural resources and mātauranga and as owners and managers of commercial assets.

Te Ao Māori

We welcome and celebrate the Government's vision for the research, science and innovation (RSI) system as articulated in the *Te Ara Paerangi - Future Pathways* White Paper. We support the Te Ara Paerangi intent to embed commitments and obligations to Te Tiriti o Waitangi in the RSI system.

Steps Scion has taken in recent years were initiated with Te Tiriti in mind. These steps include establishing a Te Ao Māori Research Group in 2021 to:

- Lead our approach to delivering excellence in research and innovation that helps to advance Māori aspirations.
- Actively seek out pathways for Māori partnership, co-development and co-design.
- Support and enable Māori-led research.
- Uphold and nurture our valued relationship with Ngāti Hurungaterangi, Ngāti Taeotu, Ngāti Te Kahu - the tangata whenua for where our Rotorua campus sits.
- Build Scion's cultural capability so we are well equipped as an organisation to work authentically and effectively with Māori.

We continue to work at strengthening our relationship with the tangata whenua of our Rotorua campus – Ngāti Hurungaterangi, Ngāti Taeotu, Ngāti Te Kahu. Our growing partnership with these three hapū was formalised in August 2022 through the signing of a kawenata (covenant) in both te reo Māori and English, establishing our shared commitment to five mātāpono (principles): whakapapa, kotahitanga, rangatiratanga, manaakitanga and tiakina te mana o te whenua.

This relationship also includes a future director appointment to represent the hapū on Scion's board, as well as the appointment in 2021 of a Hunga Whakahaere Matua – Hapū Operations Manager.

Our approach encompasses the Te Tiriti principles of partnership, participation, protection and equity.

Our Strategy to 2030 sets out a path to build science and research partnerships with Māori with a focus on enhancing Māori use of land and forestry resources to realise the economic, social, environmental and cultural opportunities of the circular bioeconomy.

The strategy also recognises how deeply Māori are woven into the national forestry estate – as landowners, as forest managers, as knowledge holders, as kaitiaki and as kin.

Māori interests in forestry – stemming from their cultural, spiritual and whakapapa connection to the whenua, the ngahere and te taiao – continue to grow as those intrinsic interests are acknowledged, and as Māori economic interests expand. Māori trusts and incorporations own $4.3 billion of assets in forestry and have ownership of more than 30 per cent of land under plantation forestry as well as large areas of indigenous forest. Around 8300 Māori work across the forestry and wood processing sector, making up 22 per cent of the workforce (Te Uru Rākau, 2022).

Scion's Te Ao Māori approach is underpinned by an overarching principle – "Te Hononga – Empowering Partnership". It provides a framework to:

- Deliver against key priorities;
- Embed an enhanced operating model;
- Give effect through three implementation goals:

  Respond – To identify and elevate Māori research needs and aspirations and provide space within Scion and the RSI system for Māori aspirations to flourish.

  Deliver - To build and maintain capability and capacity in priority areas for Māori, ensuring timely and effective delivery of Māori-centred science, research, innovation and development.

  Commit - Securing investment and funding in work programmes to achieve outcomes for Scion and Māori.

Te Ara Paerangi will create the conditions we need to build on the important relationships we are forming with Māori and lift our performance as we strive to be a trusted partner of Māori. We are confident that the RSI system can be a major driver of economic growth and shared prosperity. We believe this can be achieved through a system that is collaborative and inclusive, with a focus on addressing the challenges and opportunities of the 21st century. We look forward to working with government to ensure Te Ara Paerangi is a success.

Delivering on our strategy

Our purpose, set by government more than a decade ago, is still very relevant and has steered us to our current strategy to help New Zealand transition to a low-carbon, forestry-based circular bioeconomy.

How? Through new permanent forests that sponge up carbon and provide increased biodiversity and ecosystem services; through forests grown for timber products that sequester and lock the carbon; and through forests that are grown to replace petroleum-based fuels and products, like fleece jackets, sourcing the carbon from a renewable source.

IMPACT AREA:

Forests to biobased products

All activities in this impact area are needed to deliver New Zealand's net-zero 2050 emissions aspirations. While 55 per cent of greenhouse gas emissions can be tackled by transitioning to renewable energy, the remaining 45 per cent of emissions comes from the way we make and use products and food and manage land.

Success in this impact area is not possible without using renewable biobased materials and energy that replace and outperform current carbon-intense equivalents. Scion is working with partners in industrial value chains to accelerate solutions that will create regional jobs, unlock investments and put New Zealand well on track to meet our global climate commitments.

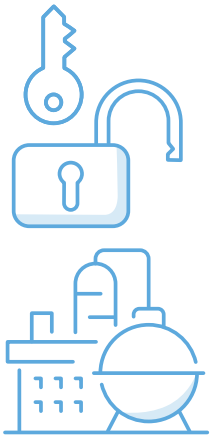
'Forests to biobased products' impacts will be delivered through four research portfolios and their associated research programmes.

Aligns with government initiatives

Forests to biobased products

- Aotearoa New Zealand's First Emissions Reduction Plan (MfE)
- Fit for a Better World (MPI)
- Advanced Manufacturing Industry Transformation Plan (MBIE)
- Forestry and Wood Processing Industry Transformation Plan (MPI)
- Primary Sector Science Roadmap: Te Ao Tūroa (MPI)
- Waste Strategy (MfE)

Goals Targeting solutions that impact several industrial value chains resulting in:



- Unlocking future investment for new infrastructure such as biorefineries.

- $20 billion sustainable GDP growth driven through existing and new companies.

- 10 million tonnes reduction in CO_2 equivalents.

- Substituting fossil energy and materials with sustainable alternatives.

- 2500 new regional and rural jobs.

High-value biorefineries

Portfolio vision: Making high-value chemicals and materials in New Zealand from sustainably sourced trees and other biomass.

Programmes:

- Indigenous biomass-based biorefineries
- Pine and other exotic forestry-based biorefineries
- Alternative sustainable biomass-based biorefineries

This portfolio ensures that New Zealand's companies are fit to benefit from the global shift to sustainable and ecologically responsible chemical resources.

Biorefineries will be at the heart of new industries producing novel chemicals derived from indigenous and exotic plants. These refineries will become the centrepiece of a new cross-sectorial, high-value biomanufacturing industry. This work's scope will impact GDP growth and provide high-value regional jobs. Products will feature high-value bioactive compounds for cosmetics and specialty/fine chemicals. Primarily these chemicals will be for export into the global chemical supply chains utilising feedstocks of radiata pine, exotic and indigenous species, short-rotation trees, designer trees for high-value chemicals and other biomaterials.

10-year focus points:

Biorefineries will be at the heart of new industries producing novel chemicals derived from radiata pine, indigenous and exotic plants. These refineries will become the centre piece of a new cross-sectorial, high-value biomanufacturing industry. The scope of this work will deliver impact in GDP growth and regional high-value jobs. Products will feature high-value bioactive compounds and specialty/fine chemicals largely for export into global chemical supply chains.

Specifically in New Zealand, the development of high-value biorefineries that blend Māori leadership, knowledge and ownership underpinned by fundamental science is a significant opportunity. This will build new industry sectors based on unique indigenous feedstocks linked with a Māori worldview.

Taking a waste to high-value approach that turns biomass side streams, currently discarded or landfilled, into fine chemicals will build cross-value chain consortia and unlock a new biomanufacturing sector.

The transformation of today's pulp and paper mills into more expansive biorefineries that produce a range of biochemicals to replace petrochemicals and provide new export opportunities and economic resilience. We will explore emerging biorefinery opportunities with exotic species, work wider than the current established forestry and pulp and paper sector, and use virtual biorefineries to optimise and assess the technical and sustainability impacts of different biorefinery approaches.

Scion's vast knowledge of the molecular architecture of plants will be used to develop value add opportunities from currently underutilised biomass.

Deliverables

BY JUNE 2024

- Prototype one new bioproduct derived from underutilised biomass for commercial use.
- Deliver a business case for the construction of a pine-based bark biorefinery.
- Explore with industry partners the modification of existing or design of a new high-value biorefinery.

BY JUNE 2025

- An existing pulp & paper mill produces a new high-value chemical in its product suite.
- Demonstrate the use of at least one extracted product from underutilised biomass in a commercial product.
- Deliver a lab-scale ‘Lignin first’ biorefinery as proof of concept.

BY JUNE 2026

- Conceptualise a Māori owned biorefinery taking waste biomass and producing high-value materials.
- Demonstrate a pilot-scale ‘Lignin first’ biorefinery.
- Conceptualise the commercial viability of a high-value biorefinery that includes the use of primary industry side streams, waste forestry materials, e.g. slash and short-rotation crops.

Bioproducts and packaging

Portfolio vision: Enabling onshore manufacturing of bioproducts and packaging from New Zealand's natural resources for global markets.

Programmes:

- Bioplastics made in New Zealand
- Compostable and recyclable packaging
- Sustainable composite products
- Distinct products from indigenous fibres

This portfolio works with and enables New Zealand companies to create, manufacture and use bioproducts that are environmentally friendly, socially responsible and economically viable.

This approach integrates advanced biomaterials into a variety of industries and sectors, impacting a myriad of industrial value chains unlocking future investments.

The scope of this portfolio is GDP growth, regional high-value jobs and petrochemical products substitution. This is achieved through the bioconversion of a variety of feedstock streams (low-value waste streams, greenhouse gases, engineered feedstocks, indigenous fibres) and converting them into higher value materials, packaging and commodity solutions.

10-year focus points:

Onshore manufacture of bioproducts and biopolymers including plastic substitutes such as polyhydroxyalkanoates (PHAs) and beyond. These products have inbuilt compostability addressing the plastic and fibre recycling challenge, are uniquely New Zealand with indigenous and novel fibres and developed with innovative designers, are Māori-led with co-design opportunities and ensure overall circularity across the value chain. We will encourage onshore production of new bioproducts developing easy transfer of technology to New Zealand companies. Low-emission, non-toxic biobased coatings and adhesives that are fit for purpose for interior, exterior or even food-based application. We will harness nature's ability to use greenhouse gases and waste to make novel bioproducts.

Deliverables

BY JUNE 2024

Deliver a plastic substitute polymer that has been generated by utilising greenhouse gases and other waste streams - scaled to a fermentation process.

Deliver a genetic tool kit that will enable an engineered hardwood species (feedstock) to be developed.

BY JUNE 2025

Deliver a prototype process for a sustainable, low-emission, non-toxic, bioproduct with properties that include hydrophobicity.

Demonstrate a new biotechnology product, achieved through genetic modification.

BY JUNE 2026

Support New Zealand export industries through the development of a packaging platform aligned with international regulations.

Through partnerships deliver a Māori lead bioproduct, utilising a sustainable feedstock.

Distributed and circular manufacturing

Portfolio vision: Kick-starting a distributed, circular bioeconomy that brings economic, social and environmental benefit to our regions by using the resources of today and tomorrow.

Programmes:

- Distributed biomass conversion
- Eco-industrial regions
- Modular and circular manufacturing

This portfolio accelerates and contributes to thriving regions through de-centralised, distributed and circular manufacturing approaches.

The aim is conversion of underutilised, scattered or seasonal forest and/or agro-based biomass resources into intermediates and products. This approach will break up traditional (centralised) manufacturing by combining scalable processing, emerging new technologies and biomass supply and demand predictions. It will create new thriving regional industries, build new manufacturing models and value creation from new networked eco-industrial systems. The impact will come from regional high-value jobs and fuel and plastics substitutions (imports). Regions will thrive through distributed manufacturing and customised product design - Māori inspired products that use primary industry side streams, in forest/timber manufacturing waste, as well as Māori inspired feedstocks.

10-year focus points:

Downsizing, modularising and mobilising the biomass conversion process, which means taking the equipment to the resource. A distributed approach that reduces transport of volume and provides opportunities for new skilled employment in regions. Key will be developing and implementing scalable and modular biorefining approaches to demonstrate turning forestry waste and by-products to value-add biochemicals. New and emerging technologies such as machine learning, AI and additive manufacturing enable more flexible, agile and resilient ways of manufacturing bioproducts. Distributed manufacturing enabled by technology will also provide opportunities for Māori communities and companies. Pulling these pieces together and developing networked eco-industrial regional ‘symbiosis’ beyond the industrial symbiosis established in Kawerau.

Deliverables

BY JUNE 2024

Demonstrate the feasibility of distributed/mobile biomass conversion technology for onshore processing of New Zealand bioresources.

BY JUNE 2025

Through regional collaboration, support regional partners and communities through the development of regional-scale future resource-use decision tools.

Demonstrate the potential of modular biomaterial manufacturing systems for New Zealand bioeconomy manufacturing sector.

With partners define future regional, modular and distributed forestry manufacturing value-chains.

BY JUNE 2026

Show potential pathways for New Zealand to implement and benefit from distributed, bioeconomy symbiosis networks.

Support commercial adoption of modular biomass to biochemicals processes.

Ensure that New Zealand's forest industry has access to scaleable, modular forestry-product (re) processing technologies.

Integrated bioenergy

Portfolio vision: Positioning bioenergy as part of the transition away from fossil fuels.

Programmes:

- Transport bioenergy
- Process heat bioenergy
- Bioenergy feedstocks

This portfolio will position bioenergy as part of the transition away from fossil fuels. Modern bioenergy is an essential component of the future low-carbon global and New Zealand energy systems if global climate change commitments are to be met.

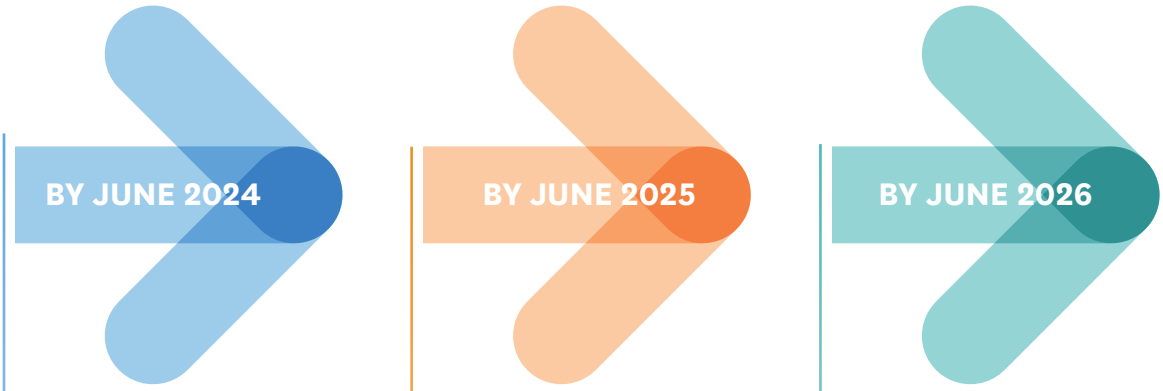
Bioenergy is the main source of renewable energy today, contributing to energy used in power generation, heat for industry and buildings and for transport. The scope of this portfolio is to deliver impact through fuel and plastic substitution and therefore reducing CO_2 equivalents. Products we are focusing on are biojet, marine biofuels, solid industrial energy carrier and biohydrogen manufacturing and uptake in New Zealand. This will use radiata pine and other species where short rotation crops and waste streams are available.

10-year focus points:

Aviation fuel is a highly regulated market that is unlikely to use electrification and hydrogen. Liquid biofuels from biomass feedstocks are available now and are blended with fossil fuels but will require mandates and targets to be set in aviation biofuels. Marine fuels is another sector linked to liquid biofuels, with 99 per cent of current ships, and nearly 80 per cent of new builds, using liquid fossil fuels, there is a need to replace 'like for like'. Replacements for coal using existing biomass are near term and swapping coal for products made from renewable resources utilising forestry and mill residues, is a fast way for New Zealand to remove the greenhouse gas.

The technology to produce biohydrogen from biomass is an alternative sustainable energy source still at early stages. Combined with existing carbon capture and storage (CCS) technologies, biohydrogen offers the unique opportunity to create negative carbon emissions.

Deliverables



Develop pathway for marine biofuels technology commercialisation.

Undertake industry scale trial of coal replacement.

Develop full feasibility study and feedstock plan for sustainable aviation fuel plant in New Zealand.

IMPACT AREA:

Forests to timber products

Laying the pathway for the forests to wood products value chain transition into a circular system that is more productive and more sustainable.

The power of forests and timber products is undeniable. From carbon sequestration to regional growth and communities, forests and wood-related products have long been a staple of the New Zealand economy and a source of wellbeing for its people. However, with complex and ever-changing market environments and a single species, the forest and wood products sectors need transformation along the path of transition from a linear to a circular economy.

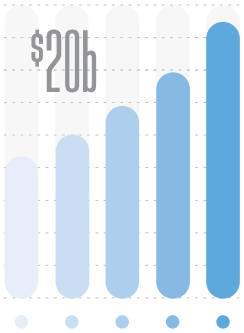
'Forests to timber products' impacts will be delivered through four research portfolios and their associated research programmes.

Aligns with government initiatives

Forests to timber products

- Biosecurity 2025 (MPI)
- Clean Water (MfE)
- New Zealand Emissions Trading Scheme (MPI)
- Aotearoa New Zealand's First Emissions Reduction Plan (MfE)
- Fit for a Better World (MPI)
- Advanced Manufacturing Industry Transformation Plan (MBIE)
- Forestry and Wood Processing Industry Transformation Plan (MPI)
- Primary Sector Science Roadmap: Te Ao Tūroa (MPI)

Goals Via the forest, manufacturing and construction industries we aim to:



- Increase GDP by $20 billion through low emissions, forest diversity, timber products and sustainable and healthy communities.

- Reduce CO2 emissions by 10 million tonnes from the adoption of circular principles.

- Have New Zealand embrace forests as a core element of a circular bioeconomy.

Trees to high-volume wood products

Portfolio vision: Transforming plantation forestry in New Zealand to deliver diversified, productive, sustainable and climate adapted forests.

Programmes:

- Managing value chain system risk
- Climate adaptive forest management
- Sustainable forest management
- Managing resilient forests for productivity and wood quality

This portfolio underpins the backbone of our $6.8 billion forest industry, which is growing trees, mainly *Pinus radiata*, for a range of high-volume wood products.

This portfolio aims to transform plantation forestry in New Zealand to deliver diversified, productive, sustainable and climate adapted forests that produce solid wood for export and processing into various exterior and interior structural products. The portfolio will identify and develop new management practices, processes, and technologies to increase efficiency, reduce costs and improve wood performance across the forestry value chain. These improvements can benefit all stakeholders in the industry, from landowners, growers, managers and end-users.

The scope of this portfolio includes biosecurity research to protect our forests from new and existing pests and diseases; forest management and environmental stewardship to enable increased productivity within sustainability limits; breeding, biotechnology and propagation techniques to increase forestry productivity and resilience of planted forests to abiotic and biotic threats.

10-year focus points:

Developing biosecurity surveillance, risk assessment and diagnostic tools and growing knowledge to allow industry to prevent and manage new pest incursions. Developing next generation breeding technology utilising genomic resources and 'genotype by environment' interactions to facilitate rapid and accurate breeding selection and deployment. Develop *Pinus radiata* silviculture methodologies for improved site productivity within ecological limits.

Deliverables

BY JUNE 2024

Forestry managers or central and regional governments adopt at least one new tool, management approach or technology to mitigate the impacts of the increasing risk to New Zealand's forests from pests (insects or weeds) and disease (pathogens).

BY JUNE 2025

New integrated forest management tools and improved germplasm embedded into New Zealand's forests and forestry practices to support the industry's target to increase radiata pine MAI from an average of 20 m^3 ha^{-1} yr to 35 m^3 ha^{-1} yr and in a way that enhances the sustainability of forest growing in New Zealand.

BY JUNE 2026

Deliver a sustainable and climate-adaptive forestry management framework that will improve the resilience and productivity of plantation forestry in New Zealand.

Trees to high-value wood products

Portfolio vision: Unlocking the value of wood products from diverse exotic forests to deliver a low-carbon built environment.

Programmes:

- Shaping future forestry, processing and built environments
- Quality performance and innovations
- Removing barriers and enhancing values through partnerships

This portfolio supports New Zealand's transition towards a circular bioeconomy by facilitating the planting of exotic tree species 'other than radiata pine' and improving the performance and sustainability of wood products for building systems through engineering, functionalisation and modification techniques.

Included is the adoption of sustainable and diversified landscape management practices within the forestry industry, alongside enhancing material properties, performance optimisation and innovative solutions, to foster circular and sustainable construction and building applications. We seek to drive the transition to circular and sustainable practices in New Zealand's built environment and communities by supporting the use of high-quality and performing wood products sourced from sustainable forestry and wood processing systems. Our ultimate objective is to establish forest-to-building supply chains that prioritise low-carbon emissions and nature-based solutions to deliver higher economic, social and environmental values.

The scope of this portfolio spans from exotic trees and production forestry systems to the manufacturing of high-value wood products, the enhancement of their quality and performance, to innovations in circularity and sustainability across the built environment, from low-carbon construction systems to biobased buildings within regenerative urban environments and communities.

10-year focus points:

Optimising knowledge, techniques, modelling and deployment guides for selected species to diversify the forestry sector, which will support increased planting of exotic tree species other than pine to enhance resilience, sustainability and wood supply. Additionally, research and development to improve the performance and circularity of wood products and building systems by engineering, modifying and functionalising wood and veneer-based materials for built environment applications. Working across the forest-to-built environment value chain with a comprehensive approach to remove barriers, increasing knowledge and confidence on sustainable forestry and timber construction. Supporting industry partners optimising the processing and use of wood in New Zealand's built environment, including in Māori housing and papakāinga, to contribute reducing the carbon footprint of the construction sector and transitioning towards circularity in wood-based urban environments.

Deliverables

BY JUNE 2024

- Deliver a report on imported wood products substitutions informing on New Zealand grown alternatives.
- Publish information on the impact of building physics best practice design and control approaches on timber building performance.
- Map the forest-to-building value chain in relation to its integrated social, economic and environmental value proposition.

BY JUNE 2025

- Deliver case studies on alternative productive forest models for selected species.
- Progress nanoparticles-based wood functionalisation proof of concept towards an Endeavour Fund application or a research and development engagement with industry partners.
- Contribute transitioning the New Zealand Timber Design Centre to an independent entity.

BY JUNE 2026

- Deliver a tool that will assess social, economic and environmental benefits that the forest-wood products based circular bioeconomy provides to New Zealand.
- Develop a framework to remove barriers to a faster uptake of the use of wood species and engineered wood products in construction of tall timber and hybrid buildings in collaboration with industry, research and policy making stakeholders.

Distinct value indigenous wood products

Portfolio vision: Amplifying innovative indigenous value chains to deliver distinct value wood products for the wellbeing of Tāne and his children.

Programmes:

- Indigenous forest-to-wood-products paradigms
- Enabling environment
- Values from indigenous wood products

The aim of this portfolio is to create value through generating productive indigenous forestry that is based in Māori connections, approaches and practices with indigenous forests.

The portfolio frames indigenous forestry differently to the current paradigms of exotic plantations or indigenous trees for conservation. This requires new ways of thinking, approaches and models in forestry that lead us toward an intergenerational circular bioeconomy. This portfolio bundles the intrinsic, cultural, economic and environmental value of our unique indigenous trees and lands. It is about developing business opportunities that are Māori led and science and sector supported, delivering new benefits to regions. The scope of this portfolio spans co-innovation pathways, protocols and benefit sharing to unlock the potential of innovative indigenous value chains and products and the benefits that flow from them.

10-year focus points:

Certification of whakapapa to indigenous land, tagging of mother trees to improve traceability, provenance and seed ownership for cultural exchange will increase the distinct value from indigenous trees. Unlocking the potential of speciality indigenous wood products with unique Aotearoa cultural philosophies, design thinking to develop innovative indigenous value chains incorporating tikanga, science and industry know-how and incorporation of mātauranga Māori inspired wood uses for high-value wood products.

Deliverables

BY JUNE 2024

Develop tools and research for land-use decision-making. This includes research on potential processing technologies and their application on indigenous species; and tools to assist in transitioning Māori land to indigenous or mixed forest models. Our research will facilitate and support landowners to make evidence-based decisions to meet their own aspirations for their lands and forests.

BY JUNE 2025

Put in place a research pathway and roadmap that builds new knowledge about at least two indigenous species in terms of material characteristics, establishment, harvest, manufacturing or products. This work will both fill the existing gap on data about indigenous species, and it will facilitate our ability to pathway towards innovation, uses, benefits and product development from indigenous species.

BY JUNE 2026

Identify, build or connect at least two kaupapa Māori-led indigenous value chains that provide multiple bottom-line benefits to Māori land-owners and local communities for multiple purposes. The value chains will facilitate growth of Māori and regional economies, greater connection to whenua and indigenous forests and stimulate growth of sustainable and appropriate jobs in those economies. This work will also provide new ways of thinking about productive forestry in ways that is sustainable and regenerative in practice.

New value digital forest and wood sector

Portfolio vision: Enabling smart decisions through interconnected data, by championing digitalisation and automation through the life of the forest and the harvested wood products processing chain.

Programmes:

- Supply connectivity
- Intelligent forest systems
- Precision forestry at scale
- Future-proofing forestry

Forestry is on the brink of a game-changing transformation. By driving a paradigm shift through data and precision technology, we can unlock the full potential of our forests and make every tree count.

Imagine a network of data flowing seamlessly from genetics, environment, management, harvest, processing, into the built environment and back again, delivering new insights and value. This transformation calls for a move away from highly manual systems and processes towards digitisation, automation and mechanisation. Leading this change will enable us to manage the forest lifecycle with unparalleled accuracy, at individual tree level using real-time, scalable information to simulate and reduce the risk of climate change, biotic and abiotic threats. Unlocking the potential of data will capture new value and enhanced intelligence, leading to the emergence of new players, platforms and jobs.

10-year focus points:

Enabling a smarter more connected forest to wood product supply chain to track and protect our wood flows, spot opportunity for efficiency and automation but also pave the way for new product pathways for the sector. Demonstrating new ways to visualise change using digital tools rich in multi-dimensional data to create decision support that gives new insights to the forestry and wood processing industry and advances research to new levels. Scaling up and scaling out precision forestry approaches through advanced tissue culture techniques, phenotyping and precision management to transform the way nursery and forestry industry selects, deploys and manages trees. Delivering mechanisation and automation of forestry silviculture, harvest and processing systems to support existing workforces to do their jobs better and with greater safety.

Deliverables

Deliver a scaled spatial digital forest that utilises remote sensing technology to allow a more dynamic view of forest inventory for government, industry and research.

Provide forest growers access to new tools and technologies to enable the ability to monitor, predict and simulate productivity and risk to their forest estates.

Use artificial intelligence to deliver new knowledge and practice in nursery and forest management in selection of best genetics, grading of seedlings and wood quality assessment.

IMPACT AREA:

Forests and landscapes

New Zealand's current standing permanent forests, scrub and wetlands provide non-market value ecosystem services estimated to be worth billions in perpetuity[2]. Ecosystem services on Rakiura/Stewart Island alone were found to be over $100 million in estimated value[3].

Standing native forests are highly valued and a pre-pandemic study found New Zealanders willing to pay approximately $100 per household per year to support indigenous tree planting on public land[4].

Today's permanent forests are a sponge holding an estimated 250 years of fossil-fuel-sourced carbon[5]. What is our sponge of the future? New Zealand is operating outside what our natural resources can support, known as planetary boundaries. Co-designed research on the circular bioeconomy will enable the return to within these boundaries.

This impact area provides the knowledge, innovation and tools for establishing permanent forests to bring about the non-monetary balance in the circular bioeconomy.

'Forests and landscapes' impacts will be delivered through three research portfolios and their associated research programmes.

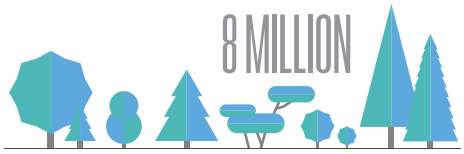
Aligns with government initiatives

Forests & landscapes

- Land-use and Carbon Analysis System (LUCAS) (MfE)
- Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020 (Department of Coinservation)
- Biosecurity 2025 (MPI)
- Clean Water (MfE)
- New Zealand Emissions Trading Scheme (MPI)
- Aotearoa New Zealand's First Emissions Reduction Plan (MfE)
- Fit for a Better World (MPI)
- Primary Sector Science Roadmap: Te Ao Tūroa (MPI)

Goals Via permanent standing forests we aim to achieve:

- 100% increase in afforestation of highly erodible red zone land.
- 100% increase in the value of Māori standing forests with maximum carbon net returns defined by landowner values.
- 100% increase in the use of forests for human health and wellbeing.



- 8 million tonnes increase in sequestered above and below ground carbon storage in new forests.

- 80% increase in forested area managed to enhance soil and water resources, biodiversity, landscape resilience.

- Converting 30% of underutilised Māori land to standing forest plantations.

Establishing indigenous forests

Portfolio vision: Enabling New Zealanders to recloak the whenua by helping to establish indigenous forests so that these forests will be resilient and thrive, bringing health, wealth and wellbeing to communities, ecosystems and the environment.

Programmes:

- Indigenous plant production at scale
- Smart establishment of indigenous forests
- Establishment of complex indigenous forests

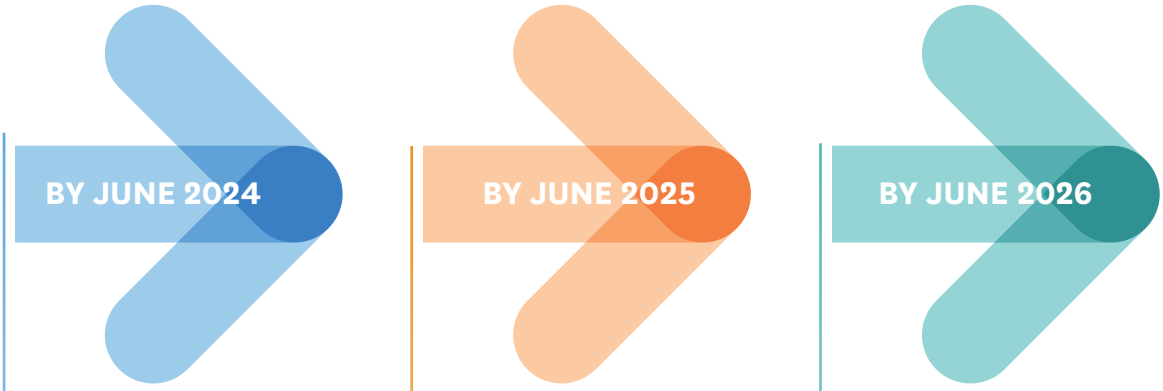
This portfolio covers seedling to canopy closure and aims to make indigenous forest establishment as easy and economically viable as possible.

The scope of this portfolio will weave mātauranga with Scion's knowledge and experience in planted forests. The portfolio extends from the selection of trees for their desired characteristics, propagation from seeds and cuttings, through to the establishment of successfully growing forests at canopy closure. We will also explore the opportunity for mixed use forests with under-storey crops and the establishment of forests to maximise biodiversity and community resilience.

10-year focus points:

Growing healthy nursery stock utilising automation that are cheaper and more resilient, screening and breeding for pests and diseases. Unlocking the seed supply and germination bottlenecks. Understanding the complex ecophysiology of climate, soil, weeds and microbiome on healthy forest establishment. The natural flow of genetics between rohe, the role of eco-source boundaries, rohe-based seed industries and database tracking of important taonga genetic material. Economic incentives to establish indigenous forests, including understorey crops that realise the value within indigenous forests.

Deliverables



Adopt nursery propagation protocols and plant quality metrics for indigenous forest plants in New Zealand nurseries.

Develop at least one partnership with the intent to co-develop a breeding programme for resilient indigenous forest trees in the content of future climates.

Establish at least one demonstration plot to show the potential of complex multi-age multi-species forest to maximise biodiversity and community resilience with climate change.

Restoration, protection and mauri o Te Waonui a Tāne

Portfolio vision: Ko te whakahaumanu, ko te whakamaru, ko te mauri ora o te waonui me te ao tūroa: Restoration and protection of indigenous forests for intergenerational prosperity and perpetuity.

Programmes:

- Whakamaru Ngahere - Protect indigenous forests
- Kia Ora te Waonui - Ecological wellbeing

To ensure that Aotearoa indigenous forests are protected into the future it is critical to ground this portfolio on a Te Tiriti approach.

Biosecurity and enhancing mauri of ngahere requires authentic partnerships with tangata whenua to protect and restore indigenous forests. This portfolio will promote holistic and interdisciplinary methods required to respond to the complex nature of ngahere ecosystem wellbeing.

10-year focus points:

Fundamental to a circular bioeconomy is circular bioecology. Ensuring indigenous forests are high in biodiversity and resilient to environmental changes is essential for climate, social, cultural and environmental economy prosperity. Scion's research leadership in current and future needs of ngahere bio-protection is critical to contributing to protecting indigenous forests and biodiversity. In valuing Te Tiriti partnerships and Te Ao Māori worldviews, Scion will enable research opportunities and outcomes that are meaningful and impactful. Holistic approaches to science, research and innovation, alongside partners and collaborators, will steer Aotearoa toward a connected, sustainable future for standing forests.

Deliverables

BY JUNE 2024

Develop capability and capacity to partner and deliver Te Ao Māori approaches for ngahere research; specialist, interdisciplinary and collaborative approaches that respond to biosecurity and bio-protection of indigenous forest biodiversity.

BY JUNE 2025

Provide plan for a proof of concept of an aggregated risk decision-making tool and new technologies that enable detection, monitoring and planning for increased indigenous forest resilience to biosecurity, climate or extreme fire challenges.

BY JUNE 2026

Deliver modern science and indigenous knowledge research, science and innovative projects and applications that increase ngahere (ecosystem) wellbeing, resilience into the future.

Designing forests - Mahi tahi whaihua

Portfolio vision: Designing forests to meet the needs and values of communities that restore and enhance New Zealand's natural capital, delivering sustainable and resilient ecosystem functions and equitable outcomes over generations and within a rapidly changing environment.

Programmes:

- Carbon secure forests
- Resilient landscapes
- Urban forests
- Complex forest systems

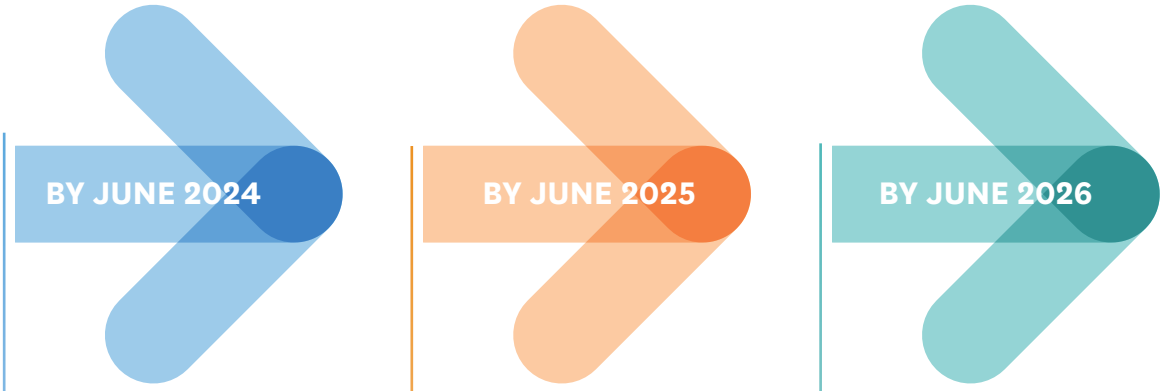
This portfolio is about designing forests to meet landowner and society's needs and values. The forests can be indigenous, exotic or novel fusions of both to meet delivery of portfolios of ecosystem functions.

We will use environmental engineering principles, mātauranga, ecosystem ecology, socio-economic and forestry sciences with a focus on New Zealand's big issues. The portfolio covers forests and trees to mitigate climate change, protect soil and water, promote landscape resilience and enhance our urban environments. It includes trees and forests in rural landscapes that provide balance portfolios of ecosystem services, and climate adaptation of forests to secure the carbon they sequester.

10-year focus points:

Urban forests that increase people's health and wellbeing, increased biodiversity, protection of coastal margins, diversion of waste- and storm-water discharge and avoided costs of climate change. In rural landscapes, mātauranga-based solutions will link with environmental engineering principles that connect ecosystem services, spanning from water quality, carbon budgets to biodiversity across mosaics of land-use types that are co-designed by the community. Indigenous and fusion forests that provide multiple ecosystem services driven through carbon monitoring with optimised indigenous species for the environment and improved carbon capture datasets.

Deliverables



Scion continues to contribute to New Zealand's ongoing national and international carbon reporting obligations.

Deliver a strategic plan for the development of models for complex forest systems with multiple species, multiple ages, and/or multiple benefits.

Develop at least one effective strategy to promote long-term resistance to re-invasion of wilding conifers on treated land.

Partnerships to deliver impact

We have a bold vision for the future of New Zealand and are focused on helping lead the transition to a circular bioeconomy. We cannot achieve that alone. Meaningful long-term partnerships are necessary for our strategy to succeed in creating impact for New Zealand.

Delivery of impact can only be achieved through robust partnerships across all players along the innovation pathway adapting science to achieve a business, social or environmental outcome.

Innovating with industry

Scion's traditional industry stakeholders include nurseries, forest growing companies and wood processing and manufacturing (timber and pulp and paper) companies. Interest is increasing from existing and new stakeholders, including Māori, in growing and using indigenous trees.

Most definitions of the forest industry focus on forest growing and wood manufacturing. Trees and other feedstocks, however, can be made into a wide variety of materials suitable for general manufacturing such as bioplastics, biochemicals, biofuels and bioenergy.

Increasingly Scion's stakeholders include plastics manufacturers, fuel and energy companies, primary producers interested in sustainable packaging and other solutions and industry bodies that support them. Organisations we work with include Bioenergy Association of New Zealand, National Energy Research Institute, Business NZ, Venture Taranaki, NZ Automobile Association, Sustainable Business Network, Plastics NZ, Packaging NZ, WasteMINZ, the Sustainable Aviation Fuel (SAF) Consortium and more.

Some of the materials and innovations Scion works on may form the basis of industries that do not exist at scale in New Zealand, such as biochemicals. This presents a funding challenge as industries still to emerge cannot provide research and development funding for the science to underpin those economic development opportunities.

Commercialisation remains an important focus for Scion as we develop new industry partnerships across the forestry and wood processing value chain and creating opportunities for adding value to these partners. We are continuing to build our innovation and commercialisation capacity through our internal accelerator programme 'Impact Jumpstart', which takes proposals from idea to pitch leveraging pre-seed accelerator funding support from the Ministry of Business, Innovation and Employment.

We are working more closely with Callaghan Innovation Technology Incubators to leverage their capability and investment to help commercialise complex technologies.

Government

Government is a significant consumer and end-user of science, both to inform government policy development and to support delivery of key policy priorities. Our Strategy to 2030 aligns closely with key government priorities, and we are developing the science and innovation needed to support outcomes of the Emissions Reduction Plan and the Forestry and Wood Processing Industry Transformation Plan. Significant new funding was announced in Budget 2022 to deliver these initiatives, which offer significant opportunity for New Zealand in the context of climate change and sustainable development.

Scion's research around forest systems, ecosystems, biodiversity, water quality, carbon sequestration by trees, fossil fuel substitution (such as biofuels and bioplastics) and distributed manufacturing all provide key evidence to inform the development of government climate change, biodiversity, environmental and economic policies.

In addition, Scion provides submissions on a range of government policy consultations led by the Ministry for the Environment, the Climate Change Commission, Department of Conservation, the Ministry of Business, Innovation and Employment, the Ministry for Primary Industries and Te Uru Rākau – New Zealand Forest Service. We are encouraged that senior staff are increasingly invited to sit on ministerial and governmental advisory groups. These contributions are not currently funded, and so we must provide capacity for this work as an overhead to other contracted work.

Key government operational responsibilities such as biosecurity (through Biosecurity NZ as part of the Ministry for Primary Industries) and rural fire prevention and fighting for Fire and Emergency New Zealand are also advanced and informed by Scion's research in these areas. This work provides significant public benefit for New Zealand as a whole.

Science system collaboration

Bringing together multiple perspectives through science collaborations yields better, more robust solutions and innovation. Scion actively collaborates with other Crown Research Institutes, New Zealand universities and research organisations and with many international research organisations.

Scion is also an active member of Science New Zealand, collaborating with the six other Crown Research Institutes on science research and joint projects to support the science system, such as the National Environmental Data system, science policy and general operational coordination.

Te Papa Tipu Innovation Park

Scion's campus – Te Papa Tipu – is an innovation park with around 40 organisations and companies, including Te Uru Rākau – New Zealand Forest Service, Department of Conservation, NIWA, Timberlands, Oji Fibre Solutions and PF Olsen.

Scion's innovation building, Te Whare Nui o Tuteata, provides an anchor for Scion's leadership and growth to flourish by providing a hub for innovation between Scion and its partners (government, private sector and local community). Part of the building is available as a partnership and innovation space for stakeholders and like-minded groups.

Scion's innovation building, Te Whare Nui o Tuteata, provides an anchor for Scion's leadership and growth to flourish by providing a hub for innovation between Scion and its partners.

The building strengthens the connection between Scion and the local tangata whenua and their ancestral land. The name Te Whare Nui o Tuteata was gifted by Ngā Hapū e Toru (comprising Ngāti Hurungaterangi, Ngāti Taeotu and Ngāti Te Kahu) who hold mana over the Scion campus and innovation park, Te Papa Tipu. It is a tangible step in Scion's growing relationship with Māori and our support of Māori plans and activities that may call on us.

A public café on the ground floor is open seven days and is a popular destination for Rotorua locals and tourists who get to experience the beauty of wood in an iconic setting. The visitor experience is enhanced through story boards about the land and the people and exhibits that showcase science and technology innovation. We will continue to welcome the public onto the campus as an important part of our community engagement activities.

Supporting science and enabling impact

Critical to achieving the objectives of Scion's Strategy to 2030 is having an organisation that can efficiently conduct and deliver high-quality science and facilitate use of that science to create impact.

Scion uses a matrix model (see Table 1) to be more agile in use of our science capabilities across our three impact areas.

SCIENCE CAPABILITY	SCIENCE IMPACT		
	GM Forests to biobased products	GM Forests to timber products	GM Forests and landscapes
GM Te Ao Māori & Science Services			
Te Ao Māori	High-value biorefineries	Trees to high-volume wood products	Establishing indigenous forests
Economy & society			
Forest genetics & biotechnology	Distributed & circular manufacturing	Trees to high-value wood products	Restoration, protection & mauri o Te Waonui a Tāne
Plant development & physiology			
Ecology & environment	Bioproducts & packaging	Distinct value indigenous wood products	
Materials, engineering & manufacturing			
Chemistry & physics	Integrated bioenergy	New value digital forest & wood sector	Designing forests - Mahi tahi whaihua
Data & geospatial intelligence			

Table 1: Scion's science matrix model.

Research programmes and projects that contribute to the research impact goals are homed under each of the 11 portfolios and are coordinated by Portfolio Leaders.

All our science capability resides in eight research groups reporting up through Research Group Leaders to the General Manager Te Ao Māori and Science Services. The Portfolio Leaders draw on this pool of science capability to resource the programmes and projects under the respective portfolios with project leaders and contributing scientists.

75 years delivering science impact

The General Manager Te Ao Māori and Science Services has responsibility for ensuring that Scion maintains a sustainable level of scientific capability across the research groups to adequately resource the work of the portfolios and to ensure that we partner and collaborate to avoid duplicating existing resources. Where resource might not currently exist or is over-utilised the General Manager Te Ao Māori and Science Services might contract in needed capability.

The make-up and mix of the research groups may change over time as the programmes and projects Scion is working on change. This flexibility will allow us to be more agile in responding to changing priorities and to take advantage of emerging opportunities more quickly.

The functional mix

Our functional roles provide the right capability to efficiently support our science and scientists through project, operational and project-level finance management, bid support, modern and enabling IT and improved facilities and infrastructure.

Other roles help enable impact through external stakeholder relationships with government (including to inform policy) and industry (including contract research and developing R&D partnerships), moving Scion technology through a commercialisation pipeline (supported by PreSeed Accelerator Fund and investment funds), and external communications.

Workforce capacity and capability

As the research portfolios map out their programmes of work and projects we are gaining greater clarity on specific capability and capacity required to deliver our strategy. By the start of the 2023/24 financial year, team business plans will be in place and resourcing needs defined in line with budgets. These plans will be rolled up to an organisation level to ensure resources are prioritised in the right areas. Capability or capacity gaps can be identified early, and decisions made as to whether to develop staff, recruit or collaborate externally.

Through the 2022/23 year, Scion experienced increased levels of staff turnover resulting from historical challenges with remuneration competitiveness (as indicated by exit survey data). During the 2022 remuneration round, we made positive progress against our remuneration benchmarks as well as significantly reducing our gender pay gap. Being mindful of the challenging economic environment and talent shortage, we will need to ensure we can maintain this competitiveness.

Career pathways

Formalised career pathways will form an integral piece of Scion's talent framework in responding to new capability and capacity requirements. Over the past year we built a competency-based development and remuneration framework. The key intentions of this framework are to provide a meaningful mechanism for staff and managers to plan and discuss career development in line with business need, as well as creating the ability for staff to progress within their existing pay band based on the development of specific competencies relevant to their role. A competency development tool was created based on feedback and focus groups with internal teams. When the 2023/24 year commences the tool will be populated for each staff member.

Leadership and staff behaviour

Scion continues its commitment to leadership development by extending the Active Manager Programme to the next tier of leaders as well as some who have expressed a desire to grow their career in this direction. The programme delivers succinct and practical material through online learning, which is bolstered through collab groups and individual coaching where participants reflect on applying the learnings in the workplace.

Additionally, the executive management team commenced an externally delivered Leadership Development Programme that will continue into 2023/24. This work focuses on the team's purpose and how members function as well as how they perform and behave as individuals.

With much focus in recent years on strategic and structural change, Scion also embarked on a significant cultural renewal programme to ensure cultural elements such as leadership and values are aligned to delivery of our strategy. The work involved over half of Scion's workforce through focus groups and an online tool and more recently a leadership (tiers 1-3) away-day to envisage what a great culture would look like and what we would need to do to shift us there.

Over the coming six months into 2023/24, two main streams of work will be undertaken based on this work. These streams are a refresh, rebrand and revitalisation of our organisational values and mindset as well as establishment of behaviours to be role modelled throughout the organisation. Once established these values and behaviours will be included in the competency-development tool.

Māori engagement

We have significantly increased our Māori capability. Te Hunga Whakahaere Matua (the Hapū Operations) role is working successfully and integrated into the organisation. This gives Scion direct engagement with our hapū partners. The hapū also have a future director seat on the Scion Board.

Within our research structure, a Te Ao Māori capability team supports mātauranga throughout our research programmes, cultural capability and critical relationships with Māori. We have strengthened this further with additional appointments to our Te Ao Māori Research Group.

We also have a contracted Te Reo tutor who provides Te Reo training, which is available to all staff and will continue to offer Vision Mātauranga training.

Safety and wellbeing of all workers

Our Health and Safety Team progressed several initiatives in 2022/23 including supporting our lab management and nursery teams to mitigate hazards and operationalise recommendations identified in a guarding audit. Utilising our in-house learning platform, we improved the Health and Safety team induction and lab inductions.

In 2023/24, we will focus on embedding learning teams within Scion, improving field operations safety through new information technology solutions. Through auditing, the Health and Safety Team will identify continuous improvement opportunities within Scion. Within the wellness area, the Health and Safety Team is exploring what neuro-diverse and cultural safety look like at Scion.

Facilities development

Creating the right environment for our work and staff remains important to Scion. This includes continuing to invest in leading edge science equipment and facilities and information technology systems.

Our Rotorua campus, Te Papa Tipu Innovation Park, is undergoing master planning that will transform the campus into a modern, high-tech research facility. The Campus Master Plan encourages industry and science collaboration and co-innovation, makes efficient use of space and provides an improved interface with the public. New facilities are being planned to attract staff and foster great, innovative science.

The campus transformation is being managed in stages with the first stage completed in 2020 with the construction of Te Whare Nui o Tuteata, our innovation hub. Designed using sustainable principles and showcasing timber technology Te Whare Nui o Tuteata is now the signature building on campus, encouraging collaboration and providing a welcoming gateway for industry and visitors alike. Te Whare Nui o Tuteata represents the heart of our campus with our people and facilities emanating from this centre.

This investment was followed by the implementation of new technology and expansion of our research nursery, which is being implemented in three stages with stage two completed in early 2023. The next stage of our campus improvements is the repurposing of buildings close to our heart. Currently three projects are being planned that will include developing concept designs to upgrade and/or replace our aging facilities, labs and workshops with adaptable facilities enabling us to continue delivering innovative science in a safe and healthy environment.

Collections, databases and specific capability

Scion has stewardship of several resources of national significance listed in Table 2. These collections, databases and research assets are maintained to a high standard enabling ongoing use of the data and public access where appropriate.

The Ministry of Business, Innovation and Employment directly funds the National Forestry Herbarium database and xylarium database through Strategic Science Investment Fund infrastructure funding. The other collections and databases under Scion's care are funded through research investment.

Database/Collection	Description
National Forest Culture Collection & Database	An internationally registered living collection of almost 6500 fungal specimens (including a few bacteria and lichens) stored in culture. The collection supports diagnostics services and a broad range of fundamental and operational pathology research. Over 150 specimens a year are loaned to New Zealand and overseas researchers. The collection includes some pathogenic fungi from overseas, which are stored in a containment facility.
National Forestry Herbarium and Database	This nationally significant database and collection specialises in plants significant to plantations and indigenous forestry in New Zealand and includes a wide range of indigenous and amenity species.
National Forest Insect Collection	An internationally registered collection of forest insects from New Zealand and overseas containing about 150,000 specimens dating back to 1948. The collection supports diagnostics services for Forest Owners Association along with fundamental taxonomic research carried out at Scion and other organisations.
National Forest Fungarium & Database	An internationally registered forestry-focussed collection of almost 5000 dried fungal specimens and plant material containing fungi. The earliest collections date back to late 1800s from Sweden. The collection serves the same purpose as the culture collection.
National Forestry Library	The National Forestry Library contains publications, in a variety of formats, relating to forestry and wood processing research over >75 years. It represents the collected published heritage of forestry and related industries in New Zealand.

Table 2: Scion's databases and collections of national significance.

We need to ensure that these collections and databases are preserved, maintained and enhanced through sustainable long-term investment. A biocollections strategy and infrastructure plan is in development to ensure we achieve best possible curatorial standards. Currently, two capital expenditure projects are underway to upgrade the herbarium and insect collection spaces.

Securing long-term funding for biocollections is a challenge and needs national priority. Base funding for national infrastructure that includes critical data collection is identified by Science New Zealand, in its response to the Te Ara Paerangi White Paper, as a key component in funding mechanisms that support science goals.

Database/Collection	Description
National Forestry Xylarium & Database	An internationally registered collection of wood blocks from all over the world and one of two (and the largest) xylarium in New Zealand. About 8000 blocks of wood, representing about 4500 different species, provide an invaluable resource for wood anatomists. It is also a fascinating record of the diversity of the world's trees and their importance in human culture and history.
National Wood Performance Archive ('Graveyard')	Around 70 years of records of wood durability and performance across four sites in New Zealand, including the 'Graveyard' on Scion's campus in Rotorua. The archive is the reference for standard and building code development, evaluation of wood products developed in New Zealand and overseas and establishment of durability classification for timber grown In New Zealand and overseas.
Permanent Sample Plot (PSP) Database	An internationally unique database of sites that are used to measure growth and development of plantation forest trees across New Zealand.
Tree Genetic Archive	A living collection of genotypes across a range of indigenous and exotic species for the purposes of gene conservation, archival history and germplasm resources.
Wood Mycology Culture Collection	A nationally significant fungal collection (mould and decay fungi) isolated from the leaky building syndrome and from other buildings and wood products across New Zealand. The collection of about 300 fungi support evaluation of wood products to be used in New Zealand buildings.

Table 2 (continued): Scion's databases and collections of national significance.

Scion holds specific sole research capability for New Zealand including:

Compostability facility:

This is the only DIN CERTCO-accredited testing facility in Australasia. Being able to design, manufacture, test and certify compostable products and materials is crucial for the success and future growth of New Zealand's packaging and plastics related businesses. Scion can test the compostability (including biodegradation) of materials as part of a manufacturer's or producer's application for certification by a certifying body such as DIN CERTCO or the Australasian Bioplastics Association.

GMO field trial:

Scion's genetically modified organisms field trial, approved by the Environmental Protection Authority, provides a unique capability to prototype genetically modified pine trees in real world (outdoor) conditions. It is the only plant GMO field trial currently operating in New Zealand.

Packaging box performance testing:

Scion has a unique purpose-built coolroom that tests box failure under controlled conditions. The WHITE room (an acronym for weight, humidity intervals, temperature and experiments) enables our packaging scientists to study the causes of box failure. Solutions are developed that both protect and add value by reducing the amount lost through package failure, which costs millions to produce exporters annually.

Rural fire research:

Scion's Rural Fire Research Group is New Zealand's only provider of specialist fire research expertise in rural and forest landscapes. With the annual average direct impact of rural fire on New Zealand's economy estimated at $67 million per year, with indirect costs estimated to be at least two to three times more, this capability is vital for protecting life and property and managing fire in the landscape.

Wood fibre refining facility:

This is a small-scale industrial facility capable of processing wood to produce fibre and pulp. It is used extensively to test operational scenarios for New Zealand's pulp and fibre production companies. It is the largest such test operation in the Southern Hemisphere.

Smart processes and systems

Scion has been reinvesting in its business systems to support the science matrix. A specific focus is on our future needs in finance and project management and in the cross over between the two. We have a multi-year programme to refresh our finance system with a transition to a modern interface and improved functionality with better project accounting at the heart of the changes. We are also removing legacy technologies, with their poor function and technology risk. Specifically for our portfolio management approach we are supporting our business planning and performance function in the design of their processes from idea to impact and looking to the technology that will best support Scion's project delivery.

In support of Scion's science operations and delivery, we are looking to review key areas of technology enablement for science and planning how best to support requirements of open science both from publishing and research data management domains.

We continue to invest in maturing our practices and operations to enhance our information security.

We maintain a very strong working brief and regular and often in depth interactions across the CRI sector in all areas of IT, information management and information security aligned to Te Ara Paerangi White Paper direction.

Financial sustainability

We will continue our focus on building long-term financial resilience and sustainability so that we can deliver on our strategy and capitalise on 75 years of science impact backing us.

Reassuringly, ministerial support continues for our strategy and the role that Scion should play in supporting many of the Government's objectives, particularly in the areas of emissions reduction, carbon sequestration, climate change response, bioenergy, biofuels, new plastics and regional economic development.

The Scion-MBIE Long-term Funding Working Group did not last year find a financially resilient funding solution for Scion. Until the Te Ara Paerangi process comes up with a sustainable future funding model that enables Scion to flourish, we will continue to work with government departments and engage with cross-government initiatives (like the Forestry and Wood Processing ITP and Climate Emergency Response Fund) to secure opportunities and access funds aligned with our Strategy to 2030.

Inclusion of Scion on the Te Uru Rākau – New Zealand Forest Service Science and Research Services Panel will provide a new funding opportunity.

Risks and assumptions

This Statement of Corporate Intent reflects Scion's ambitious outcomes for New Zealand and the role our science can play in future proofing our environment, society and economy in a post-hydrocarbon world.

Our Strategy to 2030 details where our science is needed, and our annual plans and reports have articulated the changes we have made to ensure we are optimally placed to deliver on that. We have intentionally realigned our capability and refocussed on sourcing funding that is specifically aligned to our strategy.

Numerous reviews and discussions with officials during the last three years have acknowledged that our science is high quality, and that the current Ministry of Business, Innovation and Employment (MBIE) funding model does not support delivery of our strategy. These reviews include MBIE's 2020 Te Pae Kahurangi report on Crown Research Institutes, the MBIE-commissioned Scion Science Report (May 2021) and the Scion-MBIE Long-term Funding Solution Working Group.

We have been heartened by the Minister's endorsement of our ambition and by her encouragement to seek additional revenue from other sources, such as initiatives tackling climate change, decarbonisation, energy security and waste minimisation which have targeted investment of $2.9 billion from the multi-year Climate Emergency Response Fund in Budget 2022. The Forestry and Wood Processing ITP, launched last November, is another funding source with millions of government and industry investment allocated to support ITP-related initiatives and projects. Those sources, along with achieving limited growth in commercial revenue in a constrained economy, lead us to be optimistic about our revenue projections.

We are confident that we can fund relatively short-term (two-three year) projects through these sources, but our long-term capability must be underpinned by long-term MBIE funding. Examples of research without long-term funding include forest fire and forest biosecurity, which are unlikely to be directly supported by other government agencies.

The Te Ara Paerangi process has acknowledged these challenges and begun high-level policy changes. Funding to support long-term research capability does not seem imminent, so we have been realistic in assuming no change in our Strategic Science Investment Funding (SSIF). Current MBIE long-term funding is declining significantly in real terms and does not enable us to retain core capability required to deliver on our core purpose as a Crown entity.

Recruitment and turnover remain a significant risk for us. As much as possible we recruit New Zealand researchers, and we actively contribute to many collaborative research programmes with other Crown Research Institutes and universities. Currently our ability to grow our core capability is being severely hampered by immigration settings that make recruitment of international researchers extremely challenging. A solution does not appear forthcoming. Our experienced researchers are being actively recruited and attracted to higher paying roles, often in government agencies. Addressing retention through remuneration increases is part of the solution to this challenge.

Risks and assumptions

Risk	Mitigation
Research revenue from non-MBIE funds is not accessible	We are making positive progress in developing relationships with at least one government agency to develop a portfolio of research to underpin their policy priorities. Government contracting rules hamper their ability to engage in a longer term contracting especially for underpinning research capability and/or collections and databases.
Commercial revenue growth is limited	Scion continues to engage with commercial parties in New Zealand and internationally, however, securing additional business presents challenges when local co-funding opportunities, which are often expected, and business development resources are limited.
MBIE SSIF and contestable revenue continues to decline	We are engaged in the Te Ara Paerangi process and will continue to work collaboratively with other CRIs and research organisations to pursue efficiencies in operations and capex.
Recruitment and turnover	We will continue to address remuneration expectations and, with Science NZ, are working with MBIE to address researcher immigration issues.

Table 3: Risks and assumptions mitigation

Measuring our performance

CRI generic performance indicators

Indicator name	Measure	Frequency	2021/22 Target	2021/22 Actual	2022/2023 Target	2023/2024 Target
End user collaboration	Revenue per full-time employee (FTE) from commercial sources	Quarter	$65,114	$65,630	$60,377	$51,326
Research collaboration	Publications with collaborators (Peer-reviewed publications from Scopus database)	Quarter	75	107	90	100
Technology and knowledge transfer excellence	Commercial reports per scientist FTE	Annual	2.0	2.0	>2.0	>2.0
Science quality	Impact of science publications - mean citation score	Annual	3.3	5.0	3.5	4
Financial indicator	Revenue per FTE	Quarter	$168,701	$185,810	$175,208	$176,031

Table 4: Scion's performance monitoring scorecard indicators and measures.

Additional performance indicators

Indicator name	Measure	Frequency	2021/22 Target	2021/22 Actual	2022/2023 Target	2023/2024 Target
Stakeholder engagement	Relevant partners (number and %) that have a high level of confidence that Scion sets research priorities relative to their industry	Annual	>85%	No formal survey undertaken	>85%	>85%
	Percentage of stakeholders who have engaged with Scion about their strategic direction	Annual	Establish benchmark		>90%	Establish benchmark
	Relevant end-users (%) who are likely or very likely to recommend working with Scion	Annual	>90%		>90%	>90%
	Māori partners' relationships measures are "Very good" or "Improving" through customer survey	Annual	Establish benchmark		-	Establish benchmark
Māori economic development	Partnerships (number (n) and value ($)) established with Māori entities to support economic development through the forest industry	Quarter	n>15 $2.0m	n = 16 $1.93m	n>15 $2.5m	n>15 $2.5m
Accelerated commercialisation	Technologies in Scion's pipeline (number and co-investment ($)); projects that progress to the business case stage (case studies)	Quarter	25 and $400,000 Cases ≥4	15 and $423,103 Cases 1	25 and $500,000; 2 cases to validation stage	14 and $500,000; 2 cases to validation stage

Additional performance indicators *(continued)*

Indicator name	Measure	Frequency	2021/22 Target	2021/22 Actual	2022/2023 Target	2023/2024 Target
Good employer	Staff engagement	Annual	>75%	85%	>80%	>80%
	Staff retention – staff turnover	Annual	10%	17.6%	12%	12%
	Health and safety – serious harm events	Annual	0	0	0	0
	Staff diversity - % of permanent staff of Māori decent	Annual	11.0%	7.19%	>12%	>12%
	Gender neutral – pay equity (Median – total compensation unexplainable differences)	Annual	<5%	<5%	<5%	0
Environmental footprint	Waste	Annual	-	-	40% reduction from 2018/19	45% reduction from 2018/19
	Water	Annual	-	-	Baseline year (1st year with new water meters installed)	25% reduction from 2022/23 year
	Carbon emissions	Annual	-	-	Baseline year certified	45% reduction from baseline year

Table 5: Scion's additional performance monitoring scorecard indicators and measures.

Our financials

Financial projects and performance

Scion's financial projections through to June 2026 are summarised in Table 6. Associated consolidated cashflow and balance sheets details are presented in Tables 7 and 8. Financial performance indicators are included in Table 9.

Scion is budgeting for a revenue growth for the year ending June 2024 and the outyears beyond this. This revenue growth is aligned to strategy and is a combination of organic growth and long-term funding solutions being in place to secure delivery. There is an element of risk in the outyears if we are unable to secure funding and continue to see the ongoing effects of capability challenges. For the year ending June 2024 we currently see a shortfall in revenue of $5 million. We will need help in unlocking the Climate Emergency Response Fund and Cyclone Gabrielle Response Funding if we are to achieve our revenue target.

Projected Income Statement

	30/06/2023 $000 Forecast	30/06/2024 $000 Budget	30/06/2025 $000 Projection	30/06/2026 $000 Projection
Revenue				
Total revenue	64,769	70,412	76,007	83,840
Total operating expenditure	66,279	64,704	66,680	69,902
EBITDAF	(1,509)	5,708	9,327	13,938
Profit/(loss) before tax	**(1,484)**	**(1,174)**	**1,619**	**5,074**

Table 6: *Projected income statement for the years ended 30 June 2023 to 2026.*

Cash position, balance sheet structure and dividends

As at 30 June 2023, Scion is forecasting end of year cash balances of $12.3m.

Projected Consolidated Statement of Cashflows

	30/06/2023 $000 Forecast	30/06/2024 $000 Budget	30/06/2025 $000 Projection	30/06/2026 $000 Projection
Net cashflows from operations	**5,769**	**5,708**	**9,327**	**13,938**
Net cashflows from investing activities	**(6,235)**	**(9,001)**	**(9,001)**	**(9,001)**
Net cashflows from financing activities	**-**	**-**	**-**	**-**
Net increase (decrease) in cash	**(466)**	**(3,293)**	**326**	**4,937**
Opening cash balance	12,727	12,260	8,968	9,295
Closing cash balance	12,260	8,967	9,294	14,232

Table 7: *Projected consolidated statements of cashflows for the years ended 30 June 2023 to 2026.*

Projected Consolidated Balance Sheet

	30/06/2023 $000 Forecast	30/06/2024 $000 Budget	30/06/2025 $000 Projection	30/06/2026 $000 Projection
Total assets	**69,996**	**68,822**	**70,441**	**75,515**
Projected closing shareholders' funds	**53,931**	**53,361**	**52,187**	**53,806**
Shareholders' funds to total assets	**0.77**	**0.78**	**0.74**	**0.71**

Table 8: *Projected balance sheet for the years ended 30 June 2023 to 2026.*

Financial performance targets

	Forecast	Budget	Projection	Projection
Efficiency:	**2023**	**2024**	**2025**	**2026**
Operating margin	**8.1%**	**8.1%**	**12.3%**	**16.6%**
Operating margin per FTE	$14,976	$14,270	$22,207	$30,973
Risk:	**2022**	**2023**	**2024**	**2025**
Quick ratio	2.35:1	1.95:1	1.99:1	2.58:1
Growth/Investment:	**2022**	**2023**	**2024**	**2025**
Adjusted return on equity	(1.1)%	(2.2)%	3.1%	9.6%
Revenue growth	13.0%	6.4%	7.9%	10.3%
Capital renewal	2.4x	2.6x	2.3x	2.0x
FTE	360	400	420	450
Revenue per FTE	$ 180	$ 176	$ 181	$ 186

Table 9: *Financial performance targets for the years ended 30 June 2023 to 2026.*

Appendix 1: Other matters required by the Crown Research Institutes Act 1992

Information to be reported to shareholders

Scion will provide information that meets the requirements of the:

- Crown Research Institutes Act 1992 (the Act);
- Companies Act 1993;
- Financial Reporting Act 1993;
- Crown Entities Act 2004; and
- New Zealand Institute of Chartered Accountants (NZICA) with regards to Generally Accepted Accounting Practice (GAAP).

The following information is made available to enable our shareholders to make an informed assessment of Scion's performance:

- A Statement of Corporate Intent (SCI) which sets out Scion's strategy for delivering against its core purpose and the company's financial and non-financial performance targets. The draft SCI is due not later than one month before the start of the financial year (31 May).
- An Annual Report containing sufficient information to allow an informed assessment to be made against the performance targets in the SCI. This report includes comments on our core business and how we communicate our science, financial statements (including audit report), and a report from the Directors to the shareholders. The Annual Report is to be provided within three months of the financial year ended 30 June. A public Annual General Meeting is to be held no later than six months after balance date and not later than 15 months after the previous AGM.
- A Half-Yearly Report containing unaudited financial statements (including comparatives of the same period in the previous year) and major highlights during the period. The Half-Yearly Report is due within two months of the first half of each financial year ended 31 December.
- A Quarterly Report containing information such as unaudited financial statements (including current quarter and year-to-date budgets and a forecast for the financial year ended 30 June). The Quarterly Report also includes financial performance measures and progress towards meeting non-financial performance targets. The Quarterly Report is currently requested within one month of each financial quarter ended 30 September, 31 December, 31 March, and 30 June.
- Any other information relating to the affairs of the company, as reasonably required by shareholders, under section 20 of the Act and section 45B of the Public Finance Act 1989.

Accounting policies

Scion adopts generally accepted accounting practice in New Zealand as prescribed by the External Reporting Board. The accounting policies for the measurement and reporting of financial performance, movements in equity, financial position, and cash flows are detailed in Scion's Annual Reports available at www.scionresearch.com

Dividend policy

In determining the amount of ongoing dividend (if any) recommended to be distributed to the shareholders, consideration will be given to:

- providing for capital investment requirements and consideration as to whether there is a need for capital injection from shareholders;
- Scion's working capital requirements;
- the ongoing financial viability of Scion, including the ability to repay debt;
- the need to comply with Bank Covenants;
- the obligations of the directors under the Companies Act 1993 and other statutory requirements;
- resilience against fluctuations in the demand for Scion's services;
- the need to ensure the maintenance of scientific capability through the provision of scientific technology, equipment and science capability building.
- Any dividend would be paid within three months of the financial year-end.

Activities where shareholder compensation would be required

The Board would look to seek compensation from the shareholders in the following circumstances:

- Where the shareholders instruct Scion to undertake activities or assume obligations that would result in a reduction of the company's profit or net realisable value.
- Where the Board may consider undertaking strategic investments for the wider benefit of the New Zealand public, involving financial outlays beyond those incorporated within the company's Statement of Corporate Intent or financing capabilities.

No request for compensation is currently being sought from the shareholders. At this time no such investment has been identified, nor have any financial projections for such investment been included in Scion's 2023-2026 Statement of Corporate Intent.

Other matters specifically requested by the shareholder

There are no other matters that have been specifically requested by the shareholders.

Significant transactions policy

As required by section 13(1)(d) of the Crown Research Institutes Act 1992, neither Scion nor its subsidiaries will acquire:

- shares that give it substantial influence in or over a company; or
- an interest in any partnership, joint venture, or other association of persons, or an interest in a company other than in its shares; or
- settle, or be or appoint a trustee of, a trust except after written notice to the shareholding Ministers.

The Board will obtain prior written consent from shareholding Ministers for any transaction or series of transactions involving a full or partial acquisition, disposal or modification of property (buildings, land, and capital equipment) and other assets with a value equivalent to or greater than $10m.

The Board will obtain prior written consent for any transaction or series of transactions with a value equivalent to or greater than $5m involving:

- the acquisition or disposal, in full or in part, of shares or interests in a subsidiary, external company or business unit
- transactions that affect a company's ownership of a subsidiary or a subsidiary's ownership of another entity (provided that transactions which include "drag-along" clauses that compel Scion to sell interests at a future date at the direction of the investors shall be valued at the time of the investment transaction)
- other transactions that fall outside the scope of the definition of the company's core business or that may have a material effect on the company's science capabilities.

The Board will advise shareholding Ministers in writing before entering any transaction related to property and commercialisation activities below this threshold in accordance with notice requirements agreed between the Ministers and Scion from time to time.

Commercial value of the shareholders' investment

Section 16(3) of the Act requires the Scion Group to furnish an estimate of the current commercial value of the Crown's investment. The Scion Board is satisfied that the projected net asset position (or shareholders' funds) as at 30 June 2023 is a fair and reasonable indication of the commercial value of the Group. The net asset position as shown in accordance with the company's accounting policies for 30 June 2022 was $53.9 million.

Appendix 2: References

1 Circular Business Solutions (2019). Strategic rationale for a bio-pilot plant hub for New Zealand. Retrieved from www.mpi.govt.nz

2 Patterson, M. G., & Cole, A. O. (2013). 'Total economic value' of New Zealand's land-based ecosystems and their services. In J. Dymond (Ed.), Ecosystem Services in New Zealand: Conditions and Trends (pp. 496-510). Manaaki Whenua Press. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.825.5760&rep=rep1&type=pdf

and

Yao, R. T., & Velarde, S. J. (2014). Ecosystem services in the Ōhiwa catchment (A commissioned report submitted by Scion to the Bay of Plenty Regional Council. https://www.boprc.govt.nz/media/395767/ecosystem-services-in-the-ohiwa-catchment.pdf

3 Morgan, G., & Simmons, G. (2014). Predator-free Rakiura: an economic appraisal https://library.sprep.org/sites/default/files/economic-appraisal-predator-free-stewart-rakiura-island-final.pdf

4 Yao, R., & Kaval, P. (2010). Valuing biodiversity enhancement in New Zealand. International Journal of Ecological Economics and Statistics, 16(10), 26-42.

5 Collins, C. (1996). Forests and the carbon cycle: Emerging opportunties for native forest protection and afforestation in New Zealand. Conservation Advisory Science Notes No. 132. Department of Conservation. Wellington.

Appendix 3: Portfolio roadmaps to impact

Each of the 11 research portfolios described on pages 22 to 47 has a roadmap detailing critical issues, research programmes, research outputs to 2030 and impacts delivered with partners.

These roadmaps are available at www.scionresearch.com/sci2023appendix

Scion profile

New Zealand Forest Research Institute Limited	Trading as Scion
Ownership	Crown owned entity (established under the Crown Research Institutes Act 1992)
Head Office	Te Papa Tipu Innovation Park, Tītokorangi Drive, Rotorua
Postal Address	Private Bag 3020, Rotorua 3046
Web address	www.scionresearch.com
Governance	Shareholder-appointed Board: Dr Helen Anderson QSO (2018) (Chair); Brendon Green (2022), Greg Mann (2017), Stana Pezic (2017), Dr Jon Ryder (2016), Steve Wilson (2016); Future Director Dr Melinda Webber (2022)
Executive Management	Dr Julian Elder (Chief Executive), Dr Henri Baillères (GM Forests to Timber Products), Dr Roger Dungan (GM Strategic Partnerships and Communication), Dr Florian Graichen (GM Forests to Biobased Products), Cameron Lucich (GM People, Culture and Safety), Hēmi Rolleston (GM Te Ao Māori and Science Services), Dr Tara Strand (GM Forests and Landscapes), Justine Wilmoth (GM Finance and Corporate Services)
Staff	344 full-time-equivalent staff at three sites: Rotorua (298), Christchurch (42), Wellington (4), as at 30 May 2023
Vision	Prosperity from trees - Mai i te ngahere oranga
Core Purpose	To drive innovation and growth from New Zealand's forestry, wood product and wood-derived materials and other biomaterial sectors, to create economic value and contribute to beneficial environmental and social outcomes for New Zealand
Values	Ingenuity, Collaboration, Excellence, Manaakitanga
Reporting	Financial and non-financial performance against SCI targets is reported to the shareholders quarterly and to the public via a six-month and annual report
Shareholders' Funds	Total book value of $53.927 million at 30 June 2022

Shareholdings

Company	Company type	Scion shareholding %
Te Papa Tipu Properties Limited	A land holding subsidiary	100.00
Biopolymer Network Limited	An incorporated joint venture	14.56
Kiwi Innovation Network Limited	A limited company funded by MBIE and owned collectively by the CRIs, some universities and other public research organisations.	6.67
WQI Limited (in liquidation) (T/A Solid Wood Innovation)	An MBIE-industry partnership in wood processing. WQI Limited is in voluntary liquidation and is not trading.	5.05
Terax Limited Partnership (in liquidation)	A limited partnership to commercialise the Terax technology	50.00
Terax (2013) Limited (in liquidation)	The General Partner in Terax Limited Partnership	50.00
Sala Street Holdings Limited	Holds Scion's 50% share in both Terax (2013) Limited and Terax Limited Partnership	100.00

Science working for New Zealand

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

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