

A Climate for Change

annual report 2008



Landcare Research
Manaaki Whenua



This year we have printed our Annual Report in two parts. This part (**A climate for change**) is a summary of our performance. It is complemented by an extensive **new sustainability section of our website**.

The second part of the printed report (**Consolidated financial accounts**) covers information required by our Government owners. Because the move to International Financial Reporting Standards (IFRS) has doubled the length of our financial accounts, we printed a minimal quantity of this section. The full set of audited accounts is available on our website.

We recommend this printed report is read in conjunction with information on our website. The keywords in the printed document are to help readers quickly find more relevant content.

www.landcareresearch.co.nz

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A climate for change
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Highlights

- A four-year international study involving radiocarbon dating of Pacific rat (kiore) bones and rat-gnawed native seeds showed the earliest evidence of human colonisation in New Zealand was about AD1280-1300. Previous research suggested humans reached New Zealand as early as 200 BC.
- Erosion models that will help save tens of millions of dollars worth of productive topsoil are being rolled out to all North Island regional councils. The models were originally developed for Horizons Regional Council where they are being used to prioritise management of the most vulnerable land.
- The highly acclaimed carbonZero^{Cert™} programme went global through a licence agreement with a UK-based verification organisation, Achilles Information. In other commercial developments, Sirtrack, our wildlife tracking solution provider, achieved record sales, and we launched EcoGene, a new DNA-based diagnostics service for biosecurity and biodiversity.
- Research at Molesworth Station demonstrated that effective bovine Tb control could be achieved by identifying and concentrating on areas with higher densities of possums. Other research in the Central North Island showed that effective possum control could be possible with an 80% reduction in the quantity of 1080 used.
- In what is believed to be a world first, Landcare Research scientists combined with Scottish counterparts to demonstrate and measure respiration rates between soil and roots in an undisturbed forest. The work was carried out with a new tuneable diode laser.
- Landcare Research staff produced 200 commissioned research reports during the year, as well as 270 peer-reviewed articles. They also conducted 280 presentations on technical information and their research results.
- Solar panels for water heating were installed at four Landcare Research sites, waste to landfill was reduced by 54%, 13.7 tonnes of paper were recycled and all parent CO₂ emissions were offset.
- Landcare Research Group revenue increased 6.5% to \$56.2m. Net surplus after tax was \$632k.



Janet Wilmshurst, whose radiocarbon dating research provided compelling new evidence of the timing of New Zealand's colonisation



Researchers Helen Fitt and Jeremy Gabe took part in the International Networking for Young Scientists collaborative project with UK counterparts

Landcare Research – also known by our Māori name Manaaki Whenua – is New Zealand’s leading provider of solutions and advice for sustainable development and the management of land-based natural resources.

A Crown Research Institute formed in 1992, Landcare Research functions as an independent company monitored by Government agencies.

Our vision is: Innovative science for a sustainable future.

Fulfilling our vision is important because New Zealand’s social, cultural and economic well-being is inextricably linked to the state of its environment. Excellent science and its effective application can help balance economic growth with quality of life and ecological sustainability, in the face of compelling issues such as globalisation, resource limits, population growth, increased economic activity and climate change.

The cornerstones of our activities are:

- Generating and sharing new knowledge from scientific research
- Integrating environmental social and economic sciences to maximise valuable outcomes
- Proactively working in partnership with government, business, communities and Māori
- Practising the sustainability principles we espouse

Many of our science teams are at the international forefront of developing and sharing knowledge in their specialist areas. We collaborate here in New Zealand and internationally with leading research organisations and partner with key customers to maximise the relevance and effectiveness of our research.

Our commitment to sustainable development extends beyond research to our own practices. In particular, we are serious about reducing our own impacts on the environment. We have an ISO 14001 certified environmental management system and we are a founding member of the New Zealand Business Council for Sustainable Development.

Landcare Research has almost 400 staff at nine locations. The largest of our research sites is at Lincoln, which is also home to our corporate office. We also have regional offices in Palmerston North and Hamilton, plus offices at Auckland, Gisborne, Nelson, Dunedin and Alexandra.

While most of our work is carried out in New Zealand, we have extensive international links, and expertise such as vertebrate pest management is in demand overseas. We also undertake aid-related projects particularly within the South Pacific.

The way we work is shaped by our Guiding Philosophy, in summary:

- Care for the land (Manaaki Whenua) to sustain current and future generations (Manaaki Tangata)
- Honour the Treaty of Waitangi
- Act ethically in all aspects of our business
- Use science to achieve and encourage sustainable development in Aotearoa - New Zealand
- Encourage community participation
- Seek to avoid, mitigate and remedy adverse environmental effects
- Provide information to inform public debate and where necessary advocate publicly
- Publicise our achievements to show we make a difference
- Develop, retain and attract research, science and technology capability for New Zealand’s benefit

Highlights	1
Landcare Research at a glance	2
Chair & Chief Executive's report.....	4
Business strategies	7
A climate for change.....	8
Protection & restoration of biodiversity.....	10
Sustainable land environments.....	12
Sustainable business & living.....	14
Partnerships for influence and impact	16
Networks to foster knowledge.....	18
Celebrating success.....	20
Organisational development.....	21
Reporting responsibilities & summary performance	24
Financial summary	26
Directory.....	28



Indigenous tussock-grasslands on the slopes of Te Kinga, Lake Brunner, Westland



Chair Jo Brosnahan and Chief Executive Warren Parker

Climate change has been described as the defining issue of the 21st century. Certainly, in the past 12 months New Zealanders have become more aware of the challenges inherent in confronting biological limits to natural resources and of lowering greenhouse gas (GHG) emissions. Finding solutions to these complex, multi-faceted, global problems is at the heart of Landcare Research's core purpose – to ensure that New Zealanders enjoy a quality of life and economic well-being through the sustainable development, use and protection of land environments. Changed weather patterns, high oil prices, water shortages and loss of critical biodiversity have increased the urgency and national importance of the broad range of research and other activities that Landcare Research is undertaking.

The Government's comprehensive climate change package announced in September 2007 and administered through MAF was welcomed by our scientists and contributed significantly to their programme of work this year. This has laid the platform for further work over the next three years on greenhouse gas inventory, mitigation technologies and adaptation strategies, life cycle assessment (carbon footprinting), and soil carbon management. It also facilitated a new level of collaboration with other Crown Research Institutes, and in this respect, we are delighted to have helped foster the formation of the NZ Climate Change Centre, to have signed a collaboration agreement with HortResearch to work jointly on achieving sustainable, low residue, carbon neutral horticulture, and to have bolstered our collaboration with Scion, IRL and AgResearch in researching sustainable production and value chains.

Strengthening collaboration is consistent with changes introduced by our major customer, the Foundation for Research, Science and Technology (FRST), towards more negotiated rather than contested processes for allocating research investment. As an organisation, we

recognise that much more can be achieved for New Zealand by our scientists working together in internationally competitive teams. We are also placing a high importance on building international linkages with leading research providers who have capability complementary to ours in sustaining land environments, business, environmental technologies and climate change, especially at this stage in Australia and the EU. Looking to New Zealand's future economy being more tightly linked with Asia and the Near East, we have continued to extend our network of contacts with research-related entities in India and arranged a secondment of a staff member to New Zealand Trade and Enterprise in Singapore. Our ability to form these partnerships reflects the international standing and relevance of our science – in these times of rapid change it is especially important that an appropriate balance is maintained between transitional (applied) and transformational (strategic) research. The latter, which shapes our future, is under pressure as organisations grapple with immediate problems such as those encountered in transitioning to a lower carbon economy.

With sustainability now mainstream in the activities of most research providers and consulting firms, and with greater potential for collaboration than in the past, we have sharpened the focus of our science efforts. During the year we updated our science and technology strategy to concentrate on achieving three nationally significant outcomes: protection and restoration of biodiversity; sustainable land environments; and sustainable business and living. The attainment of these outcomes will require us to address three cross-cutting themes: climate change; the management of weeds, pests and diseases; and Māori futures.

Collectively, the innovation arising from our work in these areas will help New Zealand enhance the management of its natural capital

through, for example, market-based instruments for ecosystem services, real-time environmental monitoring technologies, eco-verification tools (such as the carboNZero^{Cert™} and Enviro-Mark^{NZ} programmes), scenario planning (such as our Regional Futures programme with Environment Waikato and others), redesigned business processes and changes to consumption behaviour, more effective governance and institutional frameworks for sustainability, and mechanisms for greater community engagement. We recognise faster innovation can be driven by integrating capabilities across our 10 science teams and through high quality customer relationships. To support these, we introduced a personalised leadership development programme this year, with a strong coaching component to build our skill sets in areas such as team work and project management, and we continued to build strategic partnerships with customers.

Our carboNZero^{Cert™} programme continued to gain momentum, with a growing portfolio of New Zealand customers. A significant milestone was achieved in signing our first international licensing agreement, with Achilles, a UK-based verification organisation. The carboNZero^{Cert™} programme also extended its product range through CEMARS[™] (Certified Emissions Measurement and Reduction Scheme) and carboNZero^{Cert™} certification for small enterprises. In light of its expansion and requirement for dedicated management and oversight, the carboNZero^{Cert™} Strategic Business Unit (separate from our Viresco incubator) was established in March with its own strategic advisory board. This is a precursor to its migration to a subsidiary. In addition to developing substantial new methodology at the forefront of international best practice, the carboNZero^{Cert™} team has played an enormously important public good role in technology transfer and community education. With many new players in the marketplace, more incidents of greenwash and increased politicisation of climate

change, we have assiduously worked to ensure that all of our offerings are based on the latest international best practice.

Sirtrack, our subsidiary specialising in wildlife tracking, made excellent progress during the year, with 37% sales growth boosting revenue to a record \$4.8m. Three innovative new products proved popular, particularly in North America, Australia and Europe. During the year Sirtrack completely reconfigured and modernised its Havelock North premises.

Our pipeline of environmental technologies was further developed. We incubated EcoGene, a new business in DNA diagnostics for the wildlife and conservation sectors, at our Tamaki site. It has exciting potential to draw on our world-leading biodiversity and conservation management science and New Zealand's strengths in reproductive biology and livestock genetics to service growing local and international markets in conservation medicine and pest management. Its commercialisation and that of other environmental technologies within Landcare Research will be enhanced by Pre-Seed Funding secured for the first time through the Foundation this year.

Our financial performance of \$56.2m revenues and an after tax surplus of \$632k was a pleasing result after the impact of losing \$850k of Foundation funding in the first quarter. More revenue than planned was carried forward because of delays in contracting and access to external services. This was the primary reason for the operating surplus being behind target. In June 2008, we secured \$2.5m of Equity Investment Funding to strengthen Sirtrack's balance sheet and bolster the growth of the carboNZero^{Cert™} programme. The net operating cash flow of \$4.3m means progress in improving the company's capital structure was slower than planned.





A fly on a native broom

We are beginning to see benefits from our heavy emphasis on collaboration and building deeper strategic partnerships, and expect this to continue into the new financial year. Our 2008 Customer Survey confirmed that Landcare Research is generally perceived as a high performing, professional science organisation. The survey also highlighted the opportunity to better align our research priorities with the needs of some key customers.

We are delighted that our staff received national and international recognition for their work. David Whitehead and Miko Kirschbaum were recognised by the Intergovernmental Panel on Climate Change (IPCC) for their contribution to the 2007 Nobel Peace Prize, which was awarded jointly to the IPCC and former US Vice President Al Gore. Peter Johnson was selected by the Society of Wetland Scientists as this year's recipient of their International Fellow Award in recognition of extensive contribution to wetland science throughout his long career.

Looking to the future, we note the scale of NZ Fast Forward and its significance for driving innovation in the pastoral and food industries, including with respect to sustainable production and eco-verification. This should provide substantial opportunities over the next few years for Landcare Research to become established as a partner in these sectors. We are also pleased that initial funding for New Zealand's science backbone – the national databases and collections (of which we host seven) – was announced in Budget 2008, along with new funding for the Outcome Based Investments (we host three and are a member of a fourth), whose impact and influence is continuing to grow steadily.

We consider that the implications of land-use change in New Zealand, which is rapid by OECD standards, are not sufficiently well

understood or planned for. Getting the right balance in using land, especially that with our best soils, to meet immediate pressures such as for urban population growth or to provide renewable energy, and ensuring the best long-term outcome for New Zealanders is not easy. Our science focus on sustainable land environments reflects this large gap in knowledge and need to improve present practice. Land-use choices have profound consequences for biodiversity, GHG emissions and carbon sequestration, land productivity, water yield and quality, landscape aesthetics, infrastructure and energy demand, export earnings and in defining the scope for future land-use options. Accordingly, this year we began to reposition much of our soils and landscape capability around a holistic framework for land use that draws on scenario planning tools to envision and quantify mid-to-long-term consequences of policy, management practices and environmental technologies. We are encouraged by strong end-user and Foundation support for this and are enjoying the benefits of working with our colleagues at NIWA, AgResearch and other research providers in developing a comprehensive science strategy for sustainable land management.

The past 12 months have been demanding of Landcare Research staff. We acknowledge their dedication, leadership and passion to enhance New Zealand land environments and enable sustainable development, and thank them for their enthusiastic support and commitment. No changes to directors were made during the year but in July we welcome Dr Robin Pratt to the Board. We are delighted our immediate past Chairman, Rob Fenwick, was awarded the CMNZ.

Jo Brosnahan

Jo Brosnahan

Warren Parker

Warren Parker

In the past year Landcare Research achieved significant progress in relation to our five-year strategic goals.

One Landcare Research: *Build internal cohesiveness across teams through a shared vision, distinctive culture, and strengthen connections between science and support.*

An organisation-wide review of how we manage our reputation; improved internal communication through a new fortnightly staff e-newsletter and revamped intranet; new leadership development training and workforce planning methodology (page 21); new company-wide information technology tools, e.g. improved online performance appraisal system, and a shared workspace (InfoFile) to foster teamwork.

Customer focus: *Increase financial resilience by strengthening existing customer relationships and broadening customer base for contract research through the private sector and internationally.*

An independent survey of key commercial customers (page 16); heightened news media profile; regular senior management strategic reviews with leading clients; significant growth in the customer bases of Sirtrack and carboNZero programme (page 17).

Māori – the next step: *Sustain distinctive bicultural character. Develop excellent relationships and partner with Māori organisations to support sustainable economic development.*

New Māori collaborative research projects (page 17); closer relationships were forged with key Māori stakeholders such as Te Puni Kokiri; and new tools to aid staff bicultural understanding were created.

Science to value: *Promote and support science excellence; formally plan connections between today's discoveries and tomorrow's policy, practice, products and services.*

Updated science and technology strategy to focus on 3 key outcomes and 3 cross-cutting themes (page 8); created new marketing material to promote our capability; internal investment into technology pipelines and to explore promising concepts including algae-related techniques and denitrification beds; launch of EcoGene DNA-based diagnostics service (page 17); deployment of erosion models by multiple councils (page 13).

Innovation through integration: *Address the dilemmas posed by sustainable development by integrating our capabilities in biophysical, economic and social sciences, and through collaboration with other world-leaders in these fields of science.*

Established multidisciplinary research teams in soil microbiology and climate change; built international links with complementary organisations in Australia, Europe and India.

Financial resilience: *Generate increased financial flexibility and capacity to reinvest in new science through new revenues, improved project margins and target internal investment to emerging areas of growth.*

Secured \$2.5m from Equity Investment Fund and for the first time \$150k per annum of devolved Pre-Seed Funding; deployed \$4.2m of internal and Capability Fund investment in new and emerging areas of research; improved performance of Enviro-Mark NZ business (page 17); Sirtrack achieved record revenues of \$4.8m (page 17).



Researchers returning from a day in the field in Fiordland



Electric fishing in the Motupiko River, Nelson, as part of an irrigation feasibility project

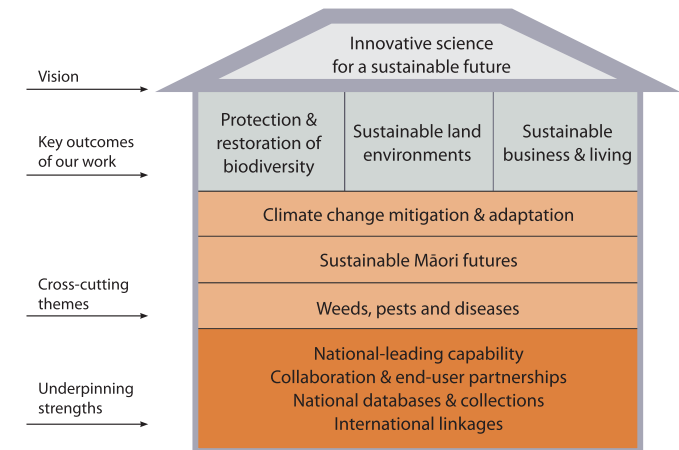
New Zealand's social, cultural and economic well-being is inextricably tied to the state of its natural capital – the irreplaceable biotic and abiotic components and processes that underwrite our way of life, many of our cultural aspirations, and the key industries and services upon which our economy is based. Depletion of our natural capital reduces options for future generations, and threatens the sustainability of our national character, quality of life and well-being. It is imperative that we have the ability to:

- Identify many of the key components of natural capital and understand the inherent processes in order to monitor their state and resilience
- Understand current pressures and potential threats such as invasive species and climate change
- Develop mitigation strategies and technologies
- Recognise opportunities for integrated economic, environmental, social and cultural development
- Ensure the development and uptake of effective stewardship that preserves our natural capital for future generations.

The widespread public debate over global warming has created new awareness of the vulnerability of our natural capital. **Climate change has created a climate for change.** In this timely new era, Landcare Research has a key role in fostering understanding of the issues and helping New Zealand meet its sustainability challenges. This year we revised our science strategy (above right) to reflect this.

Climate change

Climate change is an issue that runs through all our science...from understanding the ecological and anthropogenic processes causing (and in turn affected by) climate change through to the much wider environmental, economic and social implications for natural, productive, urban and business systems.



Science underpins New Zealand's ability to reduce greenhouse gas emissions, develop new mitigation options and adapt to the effects of a changing climate; for example, the likely increase in invasive invertebrates, weeds and diseases, and changing distribution of species across the landscape. Changing climate also brings new opportunities for managing biodiversity and economic development – for example encouraging marginal hill country to regenerate back to native shrubland, which protects catchment headwaters from erosion and enables landowners to obtain an income from sale of carbon credits. This is the basis of our EBEX21 programme and work with Ngāti Porou, who own extensive areas of mānuka and kānuka covered land on the East Coast of New Zealand. The wine industry has been the first to see economic benefits of carbon-neutral exports, and now their lead is being followed by others in the horticultural sector.

However, to take sustainable advantage of opportunities and mitigate risks, we need to understand and quantify the nature of change. Robust data on biophysical functioning of ecosystems and

greenhouse gas exchange processes support the development of sophisticated computer models that are essential in analysing ecosystem responses to climate change, feedback effects, and the resilience of natural and managed terrestrial systems.

Our climate change researchers work on methods to quantify and forecast sources and sinks of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), and the effects of land-use change and land management on the terrestrial-atmospheric exchange of these greenhouse gases at multiple spatial and temporal scales. Their work contributes to global programmes, including the Intergovernmental Panel on Climate Change (IPCC) that was awarded the 2007 Nobel Peace Prize, jointly with former US Vice President Al Gore, for efforts in raising awareness of climate change. Two of our scientists received certificates acknowledging their contribution.

This year, the Ministry for the Environment (MfE) commissioned us to map national land use through remote sensing (aerial and satellite imagery). This inventory establishes the benchmark against which changes to land use and forest carbon stocks will be measured and reported as part of our Kyoto Protocol reporting responsibilities.

The Ministry of Agriculture and Forestry (MAF) commissioned us to lead a multi-provider programme to understand the changing national status of carbon in vegetation and soils, which is required for the national carbon inventory and to support future negotiations on post-Kyoto emissions reduction targets.

Future reporting requirements of changes in sources and sinks of carbon with land-use change will become more stringent and new process-based research is underway to support these needs. During the year, we commissioned a tuneable diode laser, the first of its

kind in the Southern Hemisphere, to gain a better understanding of carbon dynamics at the scale of plants, roots and surrounding soil. Further work for MAF began to assess the albedo effect in New Zealand's forest carbon inventory. Albedo is reflectance. Dark-leaved forests reflect less solar radiation than the lighter pasture or snowfields the forests may replace. Thus the global cooling effect of carbon storage by forests may be offset by a global warming effect of forests absorbing more solar radiation.

Two of our scientists were asked to establish, facilitate and lead a proposed global denitrification-decomposition (DNDC) network, funded by MAF and Landcare Research. The DNDC model enables N₂O emissions to be mapped at regional and national scales using data on climate, soils, and management practices, and has been adapted for New Zealand pastoral grazing systems. The NZ-DNDC model was used to map N₂O emissions across the Manawatu-Wanganui Region.

Innovative science led by one of our Research Associates is developing filters for removing methane from air (e.g. over dairy shed effluent ponds). These filters comprise methane-destroying bacteria found in New Zealand soils. In this project we have collaborated with the Macaulay Institute in Scotland and a Canadian research group.

A new opportunity, initiated by MAF this year, is the development of the LEARN (Livestock Emissions & Abatement Research Network) programme to improve the quantification of non-CO₂ greenhouse gas emissions from animal agriculture at all scales; and to facilitate the development of cost-effective and practical greenhouse gas mitigation solutions. Two of our scientists are contributing to the development of this international network.



Margaret Barbour studying carbon dynamics



Larry Burrows and Jenny Hurst flying into Waitutu Forest, Western Southland

Vision: By 2020, New Zealand is meeting its national priorities and international obligations to biodiversity protection, is providing Māori with the knowledge to manage biodiversity on their lands to meet cultural and economic aspirations, and has implemented land use policies that reflect an increased understanding of the role biodiversity plays in supporting sectorial interests.

Our work on sustaining and restoring biodiversity encompasses an enormous breadth of activity, from the fundamental understanding of the biological building blocks of New Zealand's terrestrial ecosystems to the interventions necessary to protect and restore biodiversity for its inherent value, and to recognise the keystone role it plays in critical biological interactions

Biodiversity and healthy ecosystem processes are central to New Zealand's natural capital. Our national identity is firmly centred in natural settings – the deep forests where Tane Mahuta instils mauri in all living things; the places where we walk, climb and paddle; or the paddocks, vineyards and orchards where we harvest produce valued by the rest of the world. Our spectacular 'clean green' landscapes attract visitors from overseas, and underpin the high value of agricultural exports. However, in the current climate of public and government expectations for greater sustainability, national parks and green pastures are no longer enough.

Society is increasingly demanding that production systems be more compatible with the protection and restoration of native flora and fauna in human-dominated areas. Our increasingly urbanised population is challenging planners to bring nature back to the cities, and accommodate the plants and animals that characterise our New Zealand way of life. Māori are partnering with researchers to develop the capacity to manage and restore threatened taonga species so

that this legacy is passed on to future generations.

What is less well recognised is that climate change could affect biodiversity in profound ways. For example, alpine areas, drylands, and wetlands are highly sensitive to climate change. Our research into how ecosystems have responded in the past, and how and why they are changing now, enables us to develop more effective strategies, restoration initiatives, and reserve design to reverse biodiversity decline. In managing forests for specific values and products, Māori want to know the possible impacts of climate change.

Some examples from 2007/08:

As part of our Sustaining and Restoring Biodiversity OBI programme, Landcare Research facilitates an expanding network of biodiversity sanctuaries across New Zealand through a range of government- and community-led projects. Sanctuaries of New Zealand (www.sanctuariesnz.org) provides a key pathway for uptake of science such as pest management and monitoring, biodiversity assessment, conservation genetics and enhanced methods for captive breeding. The network now links about 50 sanctuary projects totalling 37,000 ha of reserve, which exceeds the area of pest-free offshore islands. Some key breakthroughs this year included new understanding of the dispersal of translocated giant weta, the behaviour of rats getting into pest-free enclosures, and recording a massive increase in beetle numbers following eradication of mammalian predators.

The National Vegetation Survey (NVS) Databank is a resource managed by Landcare Research to archive and provide access to vegetation survey data from across New Zealand. The databank spans 60 years, and contains data from more than 45,000 survey plots, including data from over 12,000 permanent survey plots. With global

focus on reporting on carbon sinks and biodiversity, databanks such as NVS have gained immense national and international significance because they are enabling us to address issues not foreseen at the time of the original data collection. While use by New Zealand agencies continues to grow, the most rapid increase in demand for data has been from overseas – mostly for studies on global distribution patterns of specific types of plants, and understanding biophysical influences on tree mortality, recruitment and growth. Data on NVS vegetation plots are readily available via the GBIF (Global Biodiversity Information Facility) website.

Our drylands ecology research is examining the present distribution of woody plant species, succession pathways, and factors controlling their spread. Many indigenous species are regionally threatened; concentrated in small refuges with reduced regeneration, compromised genetic structure and limited resilience; and are progressively disappearing from the gene pools. This research will increase the effectiveness of restoration initiatives and also help us manage other landscapes that become drier due to climate change. Extensive public promotional efforts have significantly raised community appreciation of these unique environments.

Invasive species may become an even greater threat to New Zealand with more tropical species likely to establish here. This year we completed an assessment of risks posed by all the invasive ant species known to have established in New Zealand. This work is enabling regional councils and other organisations to prioritise resources for invasive ant surveillance and management, and to make policy decisions about including invasive ants in regional pest management strategies (RPMS). Northland Regional Council, Environment Southland, Hawkes' Bay Regional Council, and Tasman District Council have all initiated reviews of invasive ants in their region.

Our four nationally significant biological collections (plants, fungi, invertebrates, and plant diseases) are vitally important references for introduced species as well as our native biodiversity, with biosystematics research complemented by significant expertise in ecological genetics. Using a range of techniques, we identified several new plant species of four important genera on the Chatham Islands this year. Because of the significant habitat modification or loss, most of these species are very rare and require careful conservation management. Surveys also turned up many new records of mosses, lichens and liverworts for the Chatham Islands (and New Zealand), including species previously known from Australia, northern New Zealand, or tropical parts of the Pacific.

We are recognised as international leaders in the management of vertebrate pests that threaten biodiversity. During the year, our pest management scientists were contracted on projects on national biosecurity (Mauritius), planning pest eradication (beavers in Chile and Argentina, mice on the UK territory of Gough Island, a suite of pests in New Caledonia, exotic rodents on all Australian islands, overabundant native animals in Tasmania), and to audit the success of major control programmes (feral pigs in California and Hawai'i, starlings in Western Australia).

I would single out the contributions made by Landcare Research scientists as being particularly innovative and of a very high standard. The long-term research projects being undertaken by Landcare Research on complex interactions between pests and their resources in New Zealand forest and dryland ecosystems provide a clear direction for science to better manage threats to biodiversity. Prof. Tony Peacock – Chief Executive, Invasive Animal CRC



Arthur's Pass National Park



Vision: By 2012 regional councils and other relevant groups adopt strategies that focus on integrated management of ecosystem services for a full range of environmental, social, cultural, and economic co-benefits.

An estimated 17% of New Zealand's Gross Domestic Product depends upon the health of the top 15 cm of soil. This supports most of our country's primary sector production, the landscapes on which our tourism depends, and the quality and supply of our water in many places. It also provides a sink or buffer for many of the pollutants we put into the environment, and it stores more carbon than above-ground vegetation does.

Yet the land environment is a fragile resource. Pressures on land environments from urbanisation, forestry, lifestyle blocks, and alternative crops are increasing the intensity of production in remaining areas. Society is starting to face fundamental choices between economic well-being from intensified primary production and retention of other environmental assets such as landscape and water values.

Our work provides understanding of the basic biophysical processes in the soil and terrestrial ecosystems and how they respond to the pressures of economic land use. We work at a range of scales from the microscopic in soil and plant structures, through to regional and national integration of land environment knowledge. Integration is a unifying theme. We take a systems approach at all scales, bringing together different disciplines (natural, social and economic sciences) and stakeholders (government, landowners and business). We seek to make the 'big picture' clearer for all parties, revealing the connections and inherent trade-offs in that picture, and to provide tools to help groups make choices about the future.

Some examples from 2007/08:

The Creating Futures FRST programme, led by Environment Waikato, is exploring future regional scenarios in the Waikato in the form of dynamic maps of changing land use and related social, economic and environmental matters. Our role is to manage the integration of diverse information sources in a spatial model for long-term, integrated policy analysis. This means integrating the skills of eight New Zealand and overseas organisations with very different backgrounds. In 2007/08 we settled on the basic framework and likely components of the Waikato Spatial Decision Support System (SDSS). These will include a dynamic economy–environment model (input/output), climate scenarios, demography, hydrology, water quality, zoning, dairying, terrestrial biodiversity and land use change models. When complete in 2010 the SDSS will greatly assist the regional council and Waikato communities in choosing realistic, integrated goals for economic development, environmental quality and social well-being. (See www.creatingfutures.org.nz)

In 2004 floods, 20,000 hectares were lost from the Manawatu Region's farmland causing \$300m of damage. Since then, our erosion science has helped to support the Horizon Regional Council's strategy to manage the multiple pressures and impacts of land use in an integrated way. The council intends to spend \$80m bringing about land use change and implementing soil conservation throughout hill country in the region, initially following a 'first come first served' basis for assistance with developing and implementing farm plans. However, our modelling work showed that this approach reduced sediment yields and turbidity in the Manawatu River by less than 10%. However, prioritising 500 of the highest priority farms produced a 50% reduction. The economic value of this research could be argued to be up to \$40 million (assuming the benefits accrue equally to farmers and the wider community).

The erosion work coming out of the Manawatu has been rolled out to all the North Island regional councils in the form of erosion models. MAF paid for this out of its Hill Country Erosion project so that land with high risk of erosion could be targeted in its Afforestation Grant Scheme (AGS), through which \$50m will be spent to encourage new forestry by buying the associated carbon credits from landowners.

Soil science has been in a hiatus in New Zealand and maintaining a succession of skilled scientists has been challenged by uneven science funding. A critical need for land management is having good quality data about our soils, and the ability to interpret it for the multitude of scenarios confronting landowners. Investment in new models must be matched by investment in the data that will enable them to be used effectively. This year we started a process to seek multi-party funding for S-Map – a digital soil mapping initiative that combines the best of the old data with new data for a significantly upgraded national soil map and database. S-map underpins the application of new environmental and sustainable production models at landscape, regional and national scales. Increasingly complex issues such as matching land use decisions to land capability, and nutrient, pollutant, groundwater and carbon management require more sophisticated models that in turn need more sophisticated soil data.

Landcare Research is part of IRAP (Integrated Research for Aquifer Protection), which also includes Crop & Food Research, AgResearch, Dairy NZ, ESR, Lincoln Ventures, Aqualinc, Environment Canterbury, and Environment Waikato. Landcare Research has been one of the developers of AquiferSim, which simulates what happens when nitrate from various agricultural land uses leaches to groundwater. This is vital for testing the effect of different policy options for tackling the cumulative effects of intensive land use. This year we

installed AquiferSim on Environment Canterbury's network so they could begin testing it. Aspects that have impressed users are the speed of AquiferSim in processing the different land use scenarios and environmental variables, and its deceptively simple visual outputs that show where nitrate moves through the aquifer. There is considerable interest from other regions as well.

While soil quality literally underpins the sustainability of land use, pests and diseases have a huge impact on biodiversity, land use and productivity. Elimination of bovine-Tb in domestic herds is critical to market access for our exports. New Zealand's pastoral industries have relied heavily on the use of 1080-poison to control wildlife vectors of Tb – feral pigs, ferrets and possums – with the latter being the most significant vector. With ongoing public concern about the use of 1080 we have continued our research into reduced application. Two years of trials in the Central North Island showed that effective possum control could be possible with an 80% reduction in the quantity of 1080 used – as little as a few hundred grams of bait per hectare.

Other work undertaken by Landcare Research on Molesworth Station in the South Island demonstrated that by concentrating on 'hotspots' with higher densities of wildlife vectors, particularly possums, the amount of 1080 needed to achieve effective disease control can be dramatically reduced. This highly targeted approach was not only effective in reducing Tb to very low levels in sentinel species (pigs), but was also considerably more cost-effective than broadacre aerial baiting and dramatically reduced the amount of 1080 in the environment. The work also unequivocally demonstrated the limited role wild pigs play in maintaining Tb, with prevalence of the disease in pigs declining quickly once effective possum control was achieved. Further research into low-sowing techniques, combined with highly targeted possum control, is taking place next year.



Hugh Gourlay and a biocontrol agent released during the year: the Californian green thistle beetle



Robyn Simcock working on one of the environmental features of the new Talbot Park redevelopment

Vision: By 2012 the New Zealand identity is associated with businesses and communities that create blended value (economic, environmental, and social), innovate to develop solutions to environmental and social issues, and reduce the aggregated environmental impacts associated with lifestyles.

Climate change and the wider sustainability agenda are creating new opportunities and risks for New Zealand businesses and communities. Rising energy costs, changing consumer demands, and growing availability of new technologies are challenging 'business as usual' projections in all sectors. Urban designers and householders are also looking at new alternatives in urban and building form, and lifestyles. A unifying theme is that of choice – for example, between sources of energy, forms of mobility, materials for building, processes of production, and now, job opportunities emerging in the 'green economy' (sustainable products and services). Knowledge of the issues and having a choice between alternative responses combine to facilitate a sustainable future for New Zealanders. Science and technology are needed to provide that knowledge and support technical and behavioural choices.

Evaluation frameworks provide a way of assessing future scenarios against community goals. This year the *Four Scenarios for New Zealand*, produced by Landcare Research and collaborators in 2005 (and updated in 2007), continued to be used in workshops with organisations and community groups. In each case, the approach contributed to deeper thinking about sustainability and its implications for New Zealand and their organisation. They were used by Te Puni Kokiri in preparing its report *Nga Kaihanga Hou, For Maori Future Makers*. The work has also led to an invitation to run a future scenarios process at the IUCN World Congress in Barcelona in 2008, and to developing the *FutureMakers Project*. This

is a collaboration between the Institute of Policy Studies (Victoria University of Wellington), Landcare Research and Secondary School Futures. The State Services Commission has supported the project in obtaining over 100 government and non-government futures work for a meta-analysis of trends and patterns, joining it up with other international futures studies.

Since 2002 Landcare Research has provided pragmatic business tools to enable businesses to understand their environmental impacts, and certification standards to demonstrate that credible responses are being made. The most significant of these are our Enviro-Mark[®]NZ programme, enabling businesses to manage their health & safety and environmental impacts, and our carboNZero^{Cert™} programme for greenhouse gas emissions inventory, reductions and offsets. During the year, both programmes participated in the Small Business Expos around New Zealand, with the carboNZero^{Cert™} programme using these events to launch its small enterprise certification programme.

We commissioned a study on a New Zealand company, Grove Mill, that took the lead in using its carboNZero^{Cert™} certification to brand its wine in export markets. The study found a dramatic increase in demand for Grove Mill wines and, taking into account the cost of emissions reduction, verification and marketing, carboNZero^{Cert™} certification was a very cost-effective business and promotional strategy. Had the winery not acted, sales may have dropped because of overseas market concerns about 'food miles'. To maintain its lead, Grove Mill is now seeking to influence its supply chain to adopt the carboNZero^{Cert™} process.

This year, enquiries relating to our Low Impact Urban Design and Development (LIUDD) programme shifted significantly from wanting justification for the approach to wanting implementation

pathways. In response, we increased emphasis on developing tools to assist developers and council planners in selecting materials and appropriate infrastructure solutions (<http://costnz.landcareresearch.co.nz>). More information was disseminated via the LIUDD National Task Force, which includes 27 external stakeholders from 15 councils, government agencies and consultancy companies. The networking approach is supported by a case study portal that showcases current implementation practices and experiences from the Ministry for the Environment (MfE), Infrastructure Auckland, Auckland Regional Council (ARC) and the LIUDD programme (http://www.landcareresearch.co.nz/research/built/liudd/casestudies/case_studies.asp). In June 2008, a one-day Suburban Safari, attended by more than 60 urban development practitioners, looked at how Christchurch City Council has used LIUDD thinking to change its policies and practices.

Building on successful collaboration during Talbot Park redevelopment, we commenced a new project with Housing New Zealand to develop a process for refurbishing its housing with low impact technologies appropriate for its clientele. The project will contribute to the Tamaki Transformation Project, the largest urban redevelopment in New Zealand.

At national and international conferences during the year, we presented the first detailed water balance and occupant-perception analysis for a New Zealand 'green' building. The study showed that our Auckland facilities are one of the best performing green buildings internationally in terms of mains water use per square metre of floor area and per FTE occupancy despite the large water demand in the building for laboratories and glasshouses.

We provided technical advice and supporting documents for a raingarden at the Ellerslie Flower Show sponsored by Auckland

Regional Council and designed and built by Unitech students. The beautifully landscaped and highly functional domestic raingarden won a prestigious gold medal. We were similarly part of another team that designed the 500-m² green roof for the new Waitakere Civic Centre building, which received an Award of Excellence for Sustainability (plus a Gold Award in the Planning, Communication and Promotion category) from the New Zealand Institute of Landscape Architects. We developed a new biofiltration substrate that can be produced inexpensively from local materials, but which has improved water-retention and nutrient-holding performance for New Zealand conditions.

During the year also, we contributed to a range of initiatives designed to raise awareness of the importance of biodiversity in cities. For example, we worked with Christchurch City Council and the Botanic Gardens to establish demonstration gardens incorporating alternative landscape and garden designs employing indigenous species for a range of biotopes. The gardens incorporate designs and species suitable for wastelands, rock gardens, lawns, herbaceous borders and hedges.

We also published an urban greening manual for incorporating indigenous biodiversity in urban development. The manual incorporates results from site characterisation, landscape design, restoration trials, and biofiltration studies.

Landcare Research also supports a number of urban community-awareness-raising initiatives such as BioBlitz (at Smith's Bush in North Shore City this year), Glen Innes Family Fun Day, and the Lincoln Envirotown.





carboNZero^{Cert™} and Enviro-Mark[®]NZ programme staff were prominent at business and sustainability expos

In the decade and a half since its inception, Landcare Research has earned an enviable reputation as a very good environmental science organisation. A key goal, as we continue to evolve, is to achieve greater influence and impact with our research. Partnerships are critical to that development and the organisation is focusing on a strategy to better understand and interact with its customers.

Foundation for Research, Science and Technology (FRST)

As the source of almost half of our research funding, FRST has always been our most important partner. During the year we strengthened our relationship with a focus on seeing the Foundation more as an investor, rather than a provider of funding. FRST had considerable input into our revised science and technology strategy to ensure we are better aligned to the Foundation's strategic direction.

Customer surveys

The key to improving partnerships is first to understand them. In June 2007 we undertook an independent review of our relationships with our four largest non-FRST customers – Department of Conservation (DOC), Ministry of Agriculture and Forestry (MAF), Ministry for the Environment (MfE) and Animal Health Board (AHB). This year we took that review a step further by polling 21 important regional council, Māori and business contacts. Both reviews reflected positively on Landcare Research. Eighty percent of 2008 survey respondents rated our performance as excellent or very good (71% in 2007). About 90% of participants in both surveys rated our staff as 'highly professional'. The opportunity to improve strategic alignment with our customers was evident in both surveys. While we have very good personal relationships with our key customers at senior level, and many staff and customers have an excellent operational-level rapport, the surveys showed we can better match our research capabilities with the needs of our customers.

Māori partnerships

Research that supports Māori economic development and the management of their natural resources is one of our cross-cutting science themes. This year we developed a five-year Māori Strategy primarily aimed at developing long-term relationships. This commitment led to Landcare Research being accorded preferred supplier status by Te Puni Kokiri. Our partnership focus was also evident in our FRST-funded Māori and Environmental Decision Making Project and our role in the Massey University-led Iwi Futures Project. Landcare Research's ability to partner with Māori is also being enhanced by the strengthening of our bicultural capability.

Commercial partnerships

Effective partnerships were also evident in many of our commercial successes. The complex and transdisciplinary nature of modern research necessitates partnering with science organisations that have complementary expertise. One of the best examples was the combination of Landcare Research's expertise in greenhouse gas accounting with HortResearch's expertise with fruit to secure two MAF carbon footprint contracts for the kiwifruit and wine industries.

carboNZero^{Cert™} programme

The carboNZero^{Cert™} team has the goal of being one of the world's leading greenhouse gas (GHG) certification schemes. In 2008 the programme took a significant step towards that objective through a licensing agreement with a UK-based verification organisation, Achilles Information, which has 32,000 customers in 24 countries. The potential significance of the Achilles partnership is evident in the fact that the companies in the pilot programme have a combined carbon footprint that is greater than New Zealand's Kyoto Protocol deficit. Rapid domestic growth in the programme mean 40 New Zealand organisations have been certified as carbon neutral, while more

than 200 other organisations are contracted to become certified. Reinforcing the importance of reducing emissions, and recognising that a lot of organisations want to measure and reduce their carbon footprints but do not aspire to be carbon neutral, we developed CEMARS (Certified Emissions Measurement and Reduction Scheme). CEMARS offers the credibility of the carbonZero^{Cert™} programme without the final step – the purchase of carbon credits to offset unavoidable emissions.

DNA-based diagnostics

In recent years the Landcare Research Ecological Genetics Laboratory in Auckland has developed a range of DNA-based diagnostics services valuable for organisations protecting biosecurity and biodiversity. The challenge has been to undertake the work in addition to our busy research schedule. This year we created EcoGene, a new customer-focused entity, to provide four services: species identification, mammal pest monitoring, genotyping and disease screening. To provide a timely service, EcoGene is separate from the laboratory's research arm, although links are maintained for the development of new applications. EcoGene has been well received by customers such as DOC and MAF here in New Zealand, and was successfully launched in Australia at the Australasian Vertebrate Pest Conference in Darwin.

Wildlife tracking

This was a record year for Sirtrack, Landcare Research's wholly owned specialist in wildlife tracking solutions. Sales were up 37% with considerable growth coming from North America, Australia and Europe in particular. Critical to that sales growth were three products: GPS Argos (which enables GPS location information to be transferred via satellite), Micro GPS (a tiny, 22-gram GPS unit), and Fastloc (a GPS unit designed for difficult applications, such as the tracking of marine mammals). Sirtrack was formed by wildlife researchers and it

continues to excel by having a very good understanding of the needs of its customers. With an ongoing focus on product development, the Havelock North business is dividing its efforts between enhancements to existing products, developments of new species applications for the latest GPS technologies, and development of new products.

Environmental management systems (EMS)

Landcare Research is the market leader in EMS but for several years our Enviro-Mark^{NZ} and EnviroSmart[®] programmes have been provided at a significant cost to the organisation. This year we restructured both programmes and achieved the dual goals of providing the best possible solutions to members and financially breaking even. While we remain responsible for the EnviroSmart[®] technical content, the programme management and administration has been devolved to the eight regional and local councils we partner with. Membership of Enviro-Mark^{NZ} grew by 50% during the year.

International capacity development projects

Through aid-funded networks, Landcare Research actively shares skills and experience with developing countries, particularly in Asia and the Pacific. In the Mekong Region we are assisting with a phytosanitary-capacity-building project to help develop expertise to combat crop pests. In Fiji we are sharing our geographic information system (GIS) expertise to help sustainable-land-use decision making in the sugar cane belt. Through the South Pacific Agricultural Chemistry Laboratory Network we are assisting nine laboratories in five South Pacific countries to enhance the quality of their soil, plant and water analysis. Biodiversity and biosecurity in the South Pacific is being enhanced by our work to improve the capacity of the South Pacific Regional Herbarium in Suva, as well as the expertise in molecular systematics at the University of the South Pacific.



Sirtrack wildlife tracking equipment was fitted to cheetahs in Africa



INYS project researchers at a Craigieburn Forest retreat

Networking with colleagues and scientific organisations in New Zealand and overseas is one of the most fundamental ways that staff ensure they are at the forefront of their field. Networks may be the result of strategic management decisions (such as our co-location and links with universities) or they may simply be the product of serendipitous meetings at international conferences. Whatever form networks take, they offer opportunities to share resources and foster the knowledge, intellectual curiosity and investigative capabilities that are the lifeblood of our scientists.

Links with universities & CRIs

Our five largest sites are located on or close to university campuses, and four of these sites are co-located with or near other CRIs. There is increasing focus on collaborative centres as a means of sharing and developing capability; the New Zealand Centre for Ecological Economics (NZCEE) is a joint venture between Landcare Research and Massey University; the Centre for Urban Environmental Sustainability (CUES) and the Centre for Biodiversity & Biosecurity (CBB) are partnerships with the University of Auckland. During the year we joined the Centre of Biodiversity and Ecological Restoration (CBER), led by the University of Waikato, and the newly formed New Zealand Climate Change Centre, which involves all nine CRIs, University of Canterbury and Victoria University of Wellington. During the year we established a Landcare Research professorial chair at Lincoln University, to complement the one at Massey University, for one of our senior staff to foster links with teaching and postgraduate development in environmental sciences.

Māori networks

Landcare Research has had a strong track record of working with Māori, either directly involving them in research or through consultation when research occurs on Māori-owned land. In

addition to networks linked to research programmes, our Māori staff participate in science and support networks within Landcare Research and also across CRIs and universities. This year one of our Māori researchers is spending seven months at Trent University in Canada working on environmental contamination issues and further developing indigenous networks and research linkages with Guelph, Toronto and Trent universities. As a result of that fellowship, Landcare Research hosted a group of First Nations academics from Guelph and Toronto universities on a study tour in New Zealand.

International networks

Landcare Research encourages staff to establish international networks despite the travel adding to our carbon footprint. Where possible we use videoconferencing and have had good experiences linking overseas in this way. We also foster regular exchanges of staff via a wide range of fellowships.

During the year we linked with the British Council as part of the International Networking for Young Scientists (INYS) programme on sustainable consumption and low impact urban design. Ten young New Zealand researchers, including five of our staff, joined 10 counterparts from the UK for two weeks of intensive research workshops and meetings. Participants relished opportunities to reach across the usual 'silos' of expertise, and produced 12 proposals for collaborative research. As part of a return visit, one of our researchers was awarded a grant from the Ministry of Foreign Affairs and Trade (MFAT) to visit the UK, hosted by the Universities of Exeter and Sheffield. While there, he presented a seminar to the New Zealand High Commission in London.

We participate in a number of global programmes. This year, our Informatics Science Team Leader was invited to join the 10-person

Informatics Advisory Board for a new and ambitious US-based project called The Encyclopaedia of Life (EOL). Other informatics staff were asked to join the Catalogue of Life (COL) project, which is the first attempt to build a global database of all species names. This 'dictionary' will be important to numerous areas of conservation and biosecurity, including high profile projects such as the Global Biodiversity Information Facility (GBIF) and the EOL.

Our Integrated Catchment Management (ICM) programme contributes to UNESCO's global HELP (Hydrology for Environment, Life and Policy) programme, and is the only designated HELP catchment in New Zealand and one of only four in Australasia. The goal of these multi-agency, multidisciplinary, multistakeholder projects is to improve the management of land, freshwater, and near-coastal environments in areas with many interacting, and sometimes conflicting, land uses. The success of the ICM programme was highlighted in TVNZ's popular *Country Calendar* prime-time series earlier this year.

International collaboration often provides access to state-of-the-art technology and expertise that facilitates significant breakthroughs. For example, by working with the Oxford Radiocarbon Accelerator Unit at Oxford University, we were able to radiocarbon-date rat bones and a rat-gnawed woody seeds that had been preserved in peat and swamp sites throughout New Zealand. The seeds provide strong evidence for the arrival of rats (and therefore humans) in about AD1280–1300, not before.

Three years of collaborative work with the Los Alamos National Laboratory (USA) to develop new research techniques using carbon isotopes led to our purchase this year of a stable isotope Tuneable Diode Laser Absorption Spectrometer – the only one of its type in

the Southern Hemisphere. Our research approach is complementing that used by Northern Hemisphere colleagues. Working with a visiting scientist from the Macauley Institute (Scotland), we have already been able to differentiate and measure how much carbon respiration comes from the roots and how much comes from the soil in an undisturbed system – an achievement believed to be a world first.

Our biosystematics researchers have extensive international networks and regularly exchange information and specimens from our nationally significant biological collections and databases. For example, last year our Defining New Zealand's Land Biota OBI programme had links with more than 30 overseas organisations in 12 different countries. The 'in kind' value of this networking is estimated to be about \$455,000.

Similarly, our *Ecosystems Resilience* OBI programme had links last year with researchers from 16 different universities or research institutes in five countries; the collaborations were either co-funded work or in kind and do not include the additional subcontracts with New Zealand universities.

Secondments

Secondments help build networks between researchers and end-user organisations. This year, one of our scientists was seconded to the Ministry of Research, Science and Technology (MoRST) for three months to examine the links between climate change policy and science. Another scientist was seconded to Environment Waikato for one day a week to interact directly with regional council staff on policy applications and technical issues relating to modelling of land use change. One of our sustainable business scientists is seconded to New Zealand Trade and Enterprise (NZTE) in Singapore.



Andy Midwood from Macauley Insititue measuring carbon respiration rates at Lincoln



A Fiordland sunset

Prestigious Honours



David Whitehead and **Miko Kirschbaum** contributed to the Intergovernmental Panel on Climate Change (IPCC), which was awarded the 2007 Nobel Peace Prize, jointly with the former US Vice President Al Gore, for efforts in raising awareness of climate change. David and Miko both received certificates acknowledging their contribution to the IPCC's prestigious win.

The IPCC was established to provide decision-makers in climate change with an objective source of information. Its role is to assess the latest scientific, technical and socio-economic literature about the risk of human-induced climate change, the observed and projected impacts, and options for adaptation and mitigation. The IPCC is charged to undertake this task in an objective, open and transparent manner to provide decision makers with the best possible basis for understanding current climate change issues and assist them in developing optimal response strategies.

Both David and Miko have extensive involvement in global-change issues, and have worked with the IPCC, in particular. David was Lead Author for a chapter on the Regional Impacts of Climate Change in Australasia (1998). Miko's involvement with the IPCC goes back about 15 years when he was Convening Lead Author of two chapters of the Second Assessment Report in 1996 and also as Lead Author of two chapters of a special report on Land Use, Land-Use Change and Forestry in 2000. Miko's role as Convening Lead Author was

particularly challenging as he had the responsibility to collate, summarise and prioritise the information from hundreds of scientists from around the world.

Alison Collins was recognised by the New Zealand Institute of Management as the Southern Region Young Executive of the Year. This is the first time a scientist has won the award. Alison leads a team of 45 staff and manages a science portfolio worth \$8m per annum. Judged criteria included innovative approaches to problem-solving, outstanding team leadership, technology utilisation, and contribution to profit and turnover of the business.

Peter Johnson was selected by the Society of Wetland Scientists as this year's recipient of their International Fellow Award in recognition of his extensive contribution to wetland science throughout a long career with Landcare Research and predecessor organisations. Accordingly, Peter attended the SWS Conference in Washington DC in May. Peter continues to work on wetlands as a Research Associate based in Dunedin.

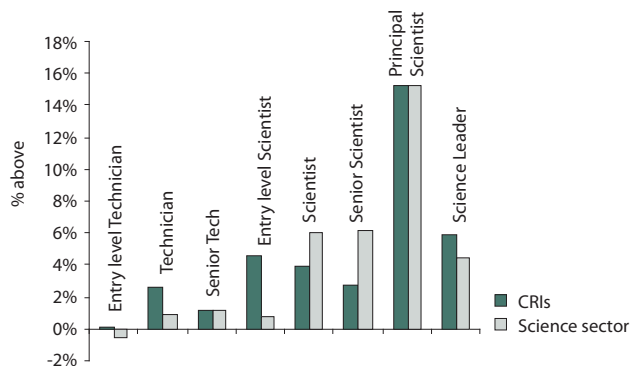
Gregor Yeates was made a Fellow of the Society of Nematologists, at their annual awards ceremony in San Diego, California, in recognition of his outstanding contributions to the field of nematology. Gregor has been an extremely productive scientist with over 260 scientific papers and a similar number of conference papers and reports. His studies have contributed to greater understanding of the role of nematodes in soil ecosystems in environments ranging from Antarctica to northern Europe and in habitats that include sand dunes, pastures, forests, agricultural fields and invertebrate intestines. He has described 105 new species in a number of unrelated genera.

Landcare Research has continued efforts to develop as a good employer delivering excellent science while minimising its environmental footprint. Sustainability is the thread that knits everything into a vibrant, dynamic organisation that staff are proud to work for.

In deciding strategic initiatives for the year, we balance economic, environmental, social and cultural factors. Key focus areas this year have been:

- Reinforcing our high performing workforce through training and development, rewards, and by recruiting excellent employees
- Continuing our development of 'smarter systems' that simplify administration and facilitate staff working across teams while reducing our environmental footprint by incorporating sustainability goals into operational activities such as travel
- Refurbishing our properties using sustainable materials and retrofitting with technologies to ensure greater energy- and water-efficiency, and improved waste management

Landcare Research total remuneration is generally higher than both the CRI and science sector medians



Highlights for the year are reported below – more detail can be found on our website where we report a comprehensive set of performance indicators.

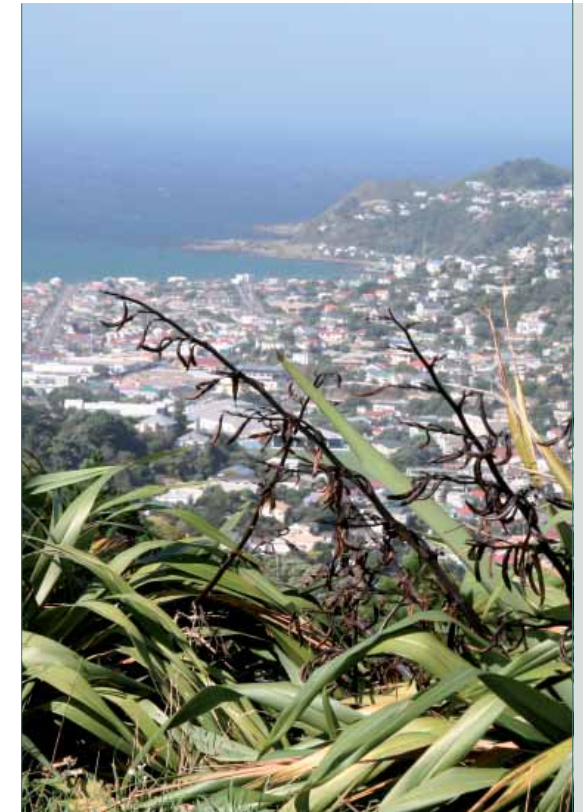
Our people

Planning for our future

Over the past year, Landcare Research implemented a number of future-focused initiatives to ensure our workforce has the capabilities required in the long term. They included a leadership and management development programme for middle and senior managers, and the adoption of workforce planning to enable us to proactively shape and recruit the skills, knowledge and attributes needed to take us into the future. Our workforce is multinational with 40% of staff originating from outside New Zealand. Last year, about one-third of new science staff were recruited from overseas despite the increasingly competitive international marketplace. Turnover across all staff was 10%, compared with 15.2% in the previous year.

Good employer

We endeavour to provide all staff with comprehensive guidelines, training, mentoring and support to ensure their well-being in the office and field. Staff and our union (the PSA) have input through site Health & Safety committees. We are part of the Accident Compensation Commission's programme for Workplace Safety Management Practices, and our level of achievement is assessed annually. We retained our Tertiary Accreditation, the highest level, reflecting our best practice framework and culture of continuous improvement. During the year, no Health & Safety incidents resulted in an absence of more than one week (average lost time was 16.4 hours).



Kilbirnie and Lyall Bay from Mount Victoria, Wellington



Gordon Burrow carrying out a waste audit at the Lincoln site

Socially responsible

Nearly 75% of our staff are part of Landcare Research-supported superannuation, student loan repayment and KiwiSaver schemes – a 58% increase on the previous year. We are committed to supporting the State Services Commission's Mainstream programme, which provides opportunities for people with disabilities; five employees on this programme worked with us last year.

Our bicultural toolbox (resources available on our Staffroom intranet) was updated during the year, and Te Reo Māori tuition is available at some sites. We maintain a confidential employee assistance programme to help staff whose work may be impaired by family, personal or work circumstances; this year 21 staff used this service, mostly for personal issues.

We support initiatives in local communities such as Lincoln Envirotown, BioBlitz (North Shore City this year) and the Hot Science with Kim Hill series of public debates in Christchurch. Staff give talks to primary schools (more than 20 this year) with spiders, insects and lizards being the most popular topics.

Our environment

Solid waste and water

Last year, we achieved a 54% reduction per FTE (12.78 kg down from 23.47 kg) in avoidable waste to landfill. This was achieved through a combination of removing all office wastepaper bins and concerted efforts to raise awareness by our site sustainability groups. Our target for next year is a further 10% reduction.

More than 30 operational PCs were donated to other organisations; 90% of the remaining waste IT equipment went to recycling organisations in New Zealand.

Water meters were installed at our six major sites and baseline data recorded for consumption of potable water. Our target for next year is to reduce consumption by 10%. Following the success of rainwater-harvesting features at our Auckland site, the refurbishment of Sirtrack's building at Havelock North included a system to collect rainwater for use in flushing toilets and irrigation.

Procurement

Landcare Research is a participant in the Govt³ programme led by the Ministry for the Environment (MfE). The most material procurement issues for us relate to office refurbishments, IT equipment and general consumables, particularly paper. For printed stationery we use 100% post-consumer recycled, chlorine-free paper that is produced by Mohawk with energy derived from wind-power. For general-purpose copying and printing office papers, we used 80% recycled paper manufactured in Australia; from 1 July 2008, we will have moved to 100% recycled Australian paper. We continued to recycle more paper (13.7 tonnes) than we purchased (9.2 tonnes).

Our preferred IT supplier is Hewlett-Packard because of its sustainability performance and reporting.

Building refurbishments incorporate materials such as Interface carpet tiles, and a move to open-plan offices that are more space and carbon efficient than traditional layouts.

Energy

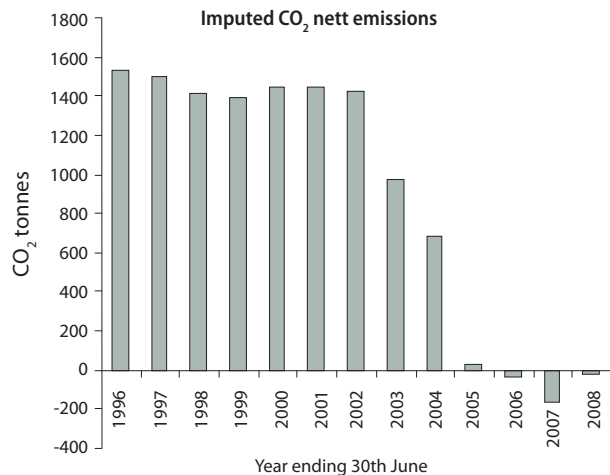
Our goal is to reduce energy consumption overall and increase the portion of electricity sourced from renewable supplies. This year, 47% (43.32% in 2006/07) of all energy purchased was renewable electricity from carboNZero^{Cert™}-certified Meridian Energy, with the target at 55% (70% of all electricity). Compared with 2006/07, total energy use

across the company increased by 4%, but per FTE it decreased by 2%. Our target for next year is a reduction of 10% per FTE.

Grants totalling \$11,800 from the Energy Efficiency and Conservation Authority (EECA) enabled us to install solar water heating at Hamilton, Palmerston North, Lincoln (Godley Building plus an additional panel on the Fleming building) and Dunedin. EECA will also be working with us on an implementation plan for other energy-saving initiatives identified this year by an energy audit at our Lincoln site and the Building Management System Audit at our Auckland site. Our target is to reduce energy use by at least 5% at these two sites.

Greenhouse gas emissions

Each year, we impute our CO₂ emissions from all our travel and energy use across all sites, and purchase carbon credits to take us to a carbon-neutral position for the year. Domestic and international air travel, overall and per FTE, decreased slightly from the previous year but is still responsible for more than half our total greenhouse gas emissions.



Our total imputed CO₂ emissions were 2389 tonnes – the significant increase from the previous year being predominantly due to new emission factors for air travel. The new emission factor of 1.9 takes into account oxides of nitrogen and water vapour produced during flight; the previous factor of 1 only included CO₂ emissions. Our supplier of renewable electricity (Meridian Energy) offset 380 tonnes and we purchased 2010 carbon credits to make us carbon neutral for the 2007/08 year. Last year, our subsidiary Sirtrack began measuring CO₂ emissions (63.5 tonnes) and purchased 35 tonnes of carbon credits to begin offsetting its emissions.

Landcare Research and Sirtrack purchased all the EBEX21 credits available (472 credits from Coatbridge in Marlborough and Hinewai Reserve on Banks Peninsula) with the rest coming from landfill (690 credits) and wind farms (883 credits).

ISO 14001

Our Environmental Management System was audited by Telarc and we retained our ISO 14001 certification. To quote the report:

The system as currently operating is extremely well managed and the organisation is to be complemented on the manner in which it has been implemented. One very pleasing note is that Landcare Research is not only wishing to comply with current Resource Management requirements, but is also implementing some very innovative systems to further improve its approach to environmental issues. Examples of this are the calculation of CO₂ emissions and the investigation of further alterations to existing buildings to provide a more eco-friendly environment.



Field staff being trained in safety around helicopters



Fungi in Westland beech forest

Crown Research Institutes have a wide range of performance and reporting responsibilities under the Operating Principles of the CRIs Act 1992. These are monitored by the Crown Company Monitoring and Advisory Unit (CCMAU). The performance measures set out in summary on these two pages have been developed in consultation with CCMAU.

Under the CRIs Act, we have a statutory obligation to also present a set of audited financial accounts by the 30th September. Because of the length and detail of these accounts, we have presented these as a separate document to CCMAU (along with this document), which is available in full on our website. Our use of Capability Fund revenue is also covered in that report.

Approach to external verification

This year, we have not had our non-financial reporting externally verified. We were reluctant to make this decision but the significantly increased cost proved prohibitive, particularly considering some areas of our science are underfunded. Nevertheless we have continued to apply the same rigour to data management and quality assurance protocols, which have been the backbone of external verification in past years. More explanation of our reporting protocols and external scrutiny is available on our website.

Performance against targets

Use of databases & collections	2007 Actual	2008 Target	2008 Actual	2009 Target
Data sets & specimens supplied	>10,860	>6,970	>12,300	>10,000

Publications & presentations	2007 Actual	2008 Target	2008 Actual	2009 Target
Commissioned reports	145	>145	200	150
Contracted reports to clients of the EnviroSmart & carboNZero programmes	-	150	>229	-
Presentations about our work	300	>300	557	330
Publications on technical information	250	> 250	165	255
Peer-reviewed scientific papers – published & accepted for publication	320	>300	338	300
Keynote & plenary presentations	12	>12	18	12

Research application	2007 Actual	2008 Target	2008 Actual	2009 Target
Improved products, processes & services	47	>50	81	50
Patents granted	2	2	0	2
Licensing arrangements	1	2	2	3
Joint ventures	4	1	0	2

Strategic relationships	2007 Actual	2008 Target	2008 Actual	2009 Target
Invited technical expertise (Includes staff invited to participate on NZ & overseas groups, meetings and workshops)	>85	>85	329	>150
Partnership initiatives (Includes collaborative projects, EnviroLink projects, MoUs, secondments, co-locations)	>250	>90	365	>180
Revenue from public & private sector (Excludes FRST, MoRST, universities, Sirtrack)	\$10.7m	\$10.0m	\$13.7m	NT

Environmental performance	2006 Actual	2007 Actual	2008 Target	2008 Actual	2009 Target
Total travel (km/FTE) ¹	21,340	17,750	<15,000	15,570	<15,000
Total energy (KWh/FTE)	9422	9220	-	9019 ²	<8117
Imputed CO ₂ (tonnes) from our activities	1763	1432	<1675	2389 ³ (1729 ⁴)	<2389
CO ₂ offsets (tonnes) purchased	1625	1600	1675	2390 ⁵	NT
Native birds killed through by-catch ⁶	9	0	<30	6	<25

¹ Includes motor vehicle, domestic and international air travel; targets exclude motor vehicle travel.

² Includes electricity, reticulated gas and coal.

³ The sharp increase in imputed emissions is due predominantly to use of new emission factors for air travel adopted by the carboNZero programme to align to international standards. On 1 July 2007, the emission factor increased from 1 (based on carbon dioxide emissions only) to 1.9 (which also takes into account oxides of nitrogen and water vapour). More information can be found on the carboNZero programme website (www.carboNZero.co.nz)

⁴ Imputed CO₂ emissions calculated using the old emissions factor; for prior year comparisons only

⁵ Includes 380 tonnes offset by our carboNZero-certified electricity provider

⁶ Animal use is reported per calendar year, as required by MAF

Human resources	2006 Actual	2007 Actual	2008 Target	2008 Actual	2009 Target
Total staff	367	370	<385	394	408
- in science teams	275	273	278	288	295
- with postgrad quals	190	192	NT	225 ¹	NT
- in science support	40	43	<49	46	50
- in general support	53	54	<58	60	63
Sirtrack staff	28	32	33	44	42
Women (% of science team staff)	35%	-	>37%	34%	>40%
Women recruited (% of science team staff)	57%	-	>50%	40%	NT
Lost-time injuries	11	8.3	<4.0	7	NT
Days lost per time accident	19.5	8.6	<5.0	2.2	<5
Staff turnover	13.8 ^b %	15.5% ^b	NT	10% ²	8-10%
Turnover of key staff	-	-	<5%	-	<5%

¹ 25 science support and 11 general support staff also have postgraduate qualifications.

² Turnover for science teams = 8.3%, science support = 6.1%, general support = 21%.
- = Data not collected.

NT = No target. (Note: the number of performance measures required by CCMAU was reduced for 2009.)

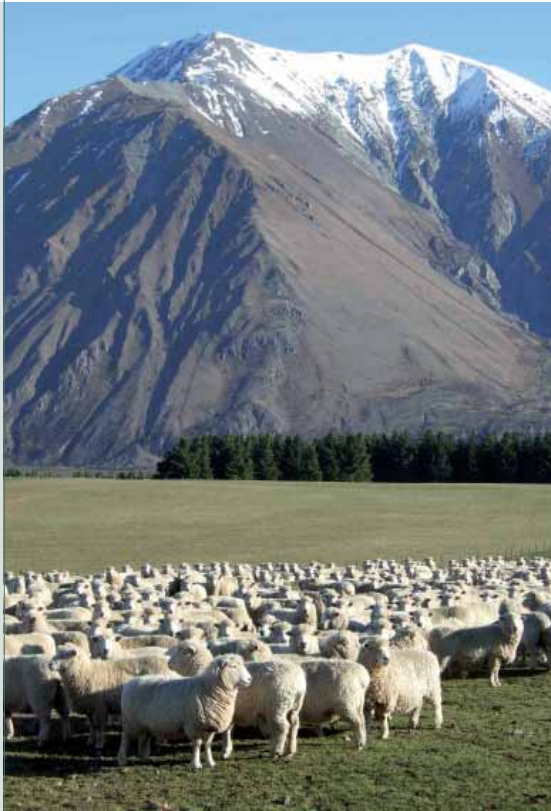
Applying the GRI framework to our reporting

The Global Reporting Initiative (GRI) framework provides an internationally accepted protocol for sustainability reporting, and Landcare Research is an organisational stakeholder. While we believe there are limitations to the overall applicability of GRI indicators to reporting by New Zealand-based companies,

particularly environmental research organisations, we believe that in principle they are a useful guide to best practice. We have comprehensive management policies and monitoring systems covering all aspects of our environmental impacts and good employer responsibilities but have not reported on these here. More information is available on our website.



Peter Williams and Bev Clarkson examining leaf sheaths at Te Pahi, Northland



Rakaia Gorge, Canterbury

This year, we adopted International Financial Reporting Standards (IFRS), and our accounts were audited by Audit New Zealand. The accounts (for parent and consolidated group) and audit report are available in full on our website. A limited number of these accounts were printed for tabling in Parliament. Those accounts plus this summary sustainability report constitute our statutory annual reporting responsibilities.

Key financial viability indicators & targets for consolidated group

	2006*	2007*	2008**		2009
	Achieved	Achieved	Target	Achieved	Target
Revenue, \$m	51.81	52.76	57.91	56.07	57.49
Net revenue, \$m	45.94	46.43	51.06	49.52	50.31
EBIT, \$m	1.07	1.70	1.87	1.43	0.8
EBIT margin (after commercialisation/investment)	2.1%	3.2%	3.2%	2.5%	1.4%
Total assets, \$m	41.46	42.28	44.06	44.58	45.41
Return on equity (NPAT)	2.8%	3.4%	3.8%	2.5%	1.2%
Equity ratio	58%	56%	54%	60%	59%
Gearing	18%	19%	21%	13%	13%
Interest cover	3.3	4.6	4.3	3.4	2.2

* Prepared under previous generally accepted accounting practice.

** Prepared under NZ IFRS

Revenue: Includes science research, contract work for the government and commercial clients, royalties, licence fees etc., plus income from the sale of product and the lease of assets. It excludes income from interest on investments and from finance leases.

EBIT margin: Earnings before interest and tax, and after committed

business development expenditure and commercialisation expenditure. It excludes restructuring costs.

Return on equity: Return on equity = NPAT ÷ average shareholders' funds, expressed as a percentage. NPAT is net profit after tax. Shareholders' funds include share capital and retained earnings.

Equity ratio: Equity ratio = average shareholders' funds ÷ average total assets.

Gearing: Financial debt includes all interest-bearing liabilities. Gearing = financial debt ÷ financial debt plus shareholders' funds, expressed as a percentage. (The Minister of Finance and Minister of Research, Science and Technology each hold 50% of the shares on behalf of the public.)

Interest cover: Interest is the cost of debt and financial leases. Interest cover = EBIT ÷ interest.

The following graphs are not part of the audited financial statements and have not been reviewed and verified by Audit New Zealand. We include the information for stakeholder interest only.

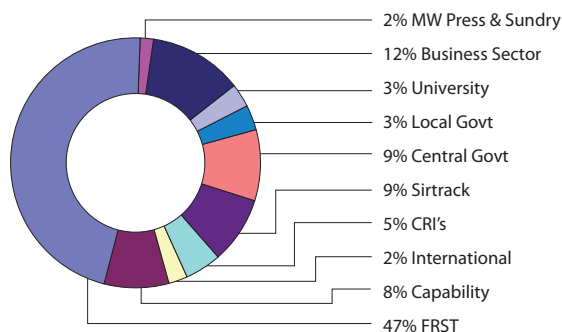
Where our revenue comes from (for year ending 30 June 2008)

- **Foundation for Research, Science and Technology (FRST) 46%** – contestably funded research programmes, negotiated funding and long-term OBIs
- **Capability Fund 8%** – MoRST funding used to maintain existing and develop new science & technology capability
- **CRIs 5%** – research subcontracted to us in collaborative programmes
- **Universities 3%** – contracted services, some paid lecturing by our

- staff, and rentals for university staff located in our buildings
- **International 2%** – development projects funded by donor agencies, international consultancy projects
- **Central government 9%** – services contracted by government departments including DOC, MfE and MAF
- **Local government 3%** – contracted work for regional, district and city councils
- **Private & business sector 12%** – principally contracted work for businesses and private organisations including the Animal Health Board
- **Sirtrack 9%** – wholly owned subsidiary, which develops and produces telemetry equipment for tracking wildlife
- **MW Press & sundry 2%** – Manaaki Whenua Press is our natural history and science book publishing and retailing business centre

- **Staff training 2%** – includes conferences, training courses and support for postgraduate study (3.1% of the total payroll)
- **Subcontracts 12%** – research subcontracted to other research providers, including CRIs and universities in collaborative research programmes
- **Investment & commercialisation 4%** – support for technologies and services including those advancing through our commercialisation pipeline
- **Travel & vehicles 6%** – all vehicle and air travel by our staff, including the cost of leased vehicles. Landcare Research runs a mixed fleet of vehicles including 4WD and quad bikes for fieldwork, and cars and vans for road use
- **Other operating costs 17%** – includes electricity, carbon credits, software licences, insurance, consumables, and lease costs
- **Interest & non-operating costs 1%**
- **Depreciation 7%** – includes depreciation on buildings, science equipment and computers
- **Taxation 1%**

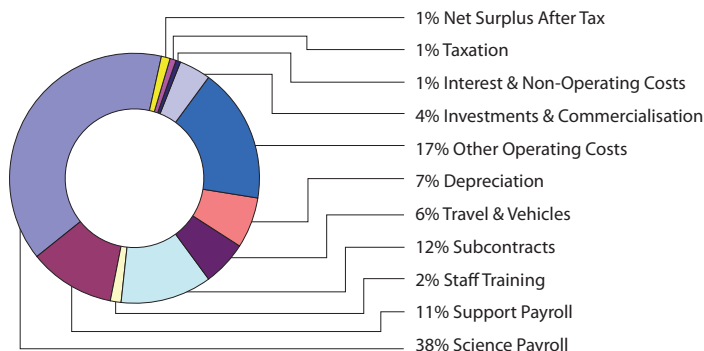
Where our revenue comes from



Where our revenue goes

- **Science payroll 39%** – includes staff in science, technical and science support roles
- **Support payroll 11%** – includes staff in management, information services, administration, HR, finance and communication roles

Where our revenue goes



A Papua New Guinea project assessing a stream affected by oil exploration drilling gave keen photographer Stephen Moore the chance to meet some of the locals



The Fleming building reception at our Lincoln site

Directors

Jo A Brosnahan (Chair)
 Anne J Urlwin (Deputy)
 Graeme S Boyd
 Alastair R Lawrence
 Robin Pratt (from 1 July 2008)
 William S Te Aho
 J Jill White

Senior Management Team

Dr Warren Parker	Chief Executive Officer
Carol Bellette	Chief Financial Officer
Mike Lee	General Manager Business
Terry McCaul	General Manager Organisational Development
Dr David Choquenot	General Manager Biological Systems
Dr Richard Gordon	General Manager Environment & Society

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Bankers

The National Bank of New Zealand

Auditors

Audit New Zealand on behalf of
 the Auditor General

Solicitors

Buddle Finlay

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21, 22, 23, 28