

Discovery 1

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Landcare Research
Manaaki Whenua

MOVING AHEAD

>> THANKS TO THE CROWN RESEARCH INSTITUTE (CRI) TASKFORCE AND ITS CONSULTATION DURING 2010, EACH CRI NOW HAS A CLEAR PURPOSE AND NICHE WITHIN THE SCIENCE SECTOR.

This was the first review of the CRIs and their contribution to New Zealand society since their creation 18 years ago. The taskforce's recommendations were widely welcomed, and adopted by the Government. They set the tone and context for our work over the next five years. Our purpose and contribution to national outcomes were documented in our Statement of Core Purpose, while our goals, strategies and key performance indicators have been published in our Statement of Corporate Intent, 2011–16.

The core purpose of Landcare Research is to drive innovation in New Zealand's management of terrestrial biodiversity and land resources in order to both protect and enhance the terrestrial environment and grow New Zealand's prosperity. We talk of 'driving' innovation because much of the science done in CRIs is designed to be adopted by stakeholders (in our case largely by government, industry, and Māori organisations). Our scientific insights, tools and services contribute to solving environmental challenges. To do this we must work closely with those stakeholders and ensure that our work is well integrated with theirs. That is one of the emphases in the recommendations of the CRI Taskforce, and one we welcome as we enhance our relationships with other organisations.

The Core Purpose statement talks of 'terrestrial' environments because we complement the aquatic environment interests and focus of our sister CRI, NIWA, and other research groups active in the aquatic sphere. Landcare Research focuses on biodiversity and land resources and the threats to them, including introduced weeds, pests and diseases that threaten both indigenous species (see article about biocontrol of weeds on page 8) and primary production (see scientific models to assist rabbit control on page 6).

Our work includes both defining state and trend in and pressures on biodiversity and land resources. We also provide insights, tools and services to assist the people who are charged with their management. Managers include landowners, farm managers, Māori kaitiaki (guardians), regional council staff, policymakers in government environmental and agricultural departments, and industries (e.g. mining, energy) whose activities impact upon biodiversity and land resources. In some cases managers need to know more about their land resources and how to get best value from them without damaging their ability to support society into the long term. Our work with Te Puni Kōkiri (the Ministry of Māori Affairs) and others has produced a special website (see page 10) where Māori land owners can view their land holdings in Google Earth style and see the land use capacity and special features of that land (e.g. soil type and properties).

Management cannot be informed only by the statement of problems – of biodiversity loss, climate change, water issues, and resource depletion. Our role goes beyond 'stating the problem' to finding solutions; and these solutions go beyond biophysical science to include social, economic and cultural insights and approaches. Increasingly our stakeholders require solutions that combine responses to social, economic, cultural as well as environmental aspects to a problem. The problems of our environment are typically complex, with competing views held by stakeholders, no 'right' answer, and often the stakes are high when property rights are involved or property is at risk. Our science therefore includes work on economic instruments, like reverse auctions, and resource credits and offsets, building on our staff's experience with trading mechanisms for pollutants and carbon.

We also develop different approaches for stakeholder engagement, bringing science to

the table with many other stakeholder voices in a way that science can be regarded as one, but not the only, valid source of knowledge on a challenging issue. Our work since the Christchurch earthquakes has included bringing urban researchers together for a workshop in Christchurch to share their insights about the challenge of recreating the city. We did this together with the Centre for Sustainable Cities (of which we are a member). The report from that workshop included insights and surveyed knowledge available in New Zealand about topics such as low impact urban design, mātauranga Māori (traditional knowledge and approaches), social capital and health, among many others. It was submitted to government, the city council and other stakeholders in June.

Landcare Research helped in the immediate aftermath of the September and February earthquakes by analysing satellite imagery of the city to identify damage to land and property. We were also pleased to enable our staff to volunteer during working hours to help with Civil Defence teams in the worst hit areas of the city's eastern suburbs. For us this was a natural thing to do, reflecting the manaaki tangata (care for the people) in our values.

A further response to the earthquakes (which affected most of our 200 Lincoln-site staff) was to host an online forum to discuss ideas for the future of the city. The event, called Magnetic South, asked people the question 'In 2021, when talent and investment are in even shorter supply than clean energy, what will you do to attract them to Christchurch?'. Over 850 people from 18 countries joined the conversation, submitting nearly 9000 contributions (see page 4 for the full story).

Landcare Research entered its 20th year optimistic about its ability to contribute to four major outcomes:

- Improve** measurement, management and protection of New Zealand's terrestrial ecosystems and biodiversity, including in the conservation estate
- Achieve** the sustainable use of land resources and their ecosystem services across catchments and sectors
- Improve** measurement and mitigation of greenhouse gases from the terrestrial biosphere
- Increase** the ability of New Zealand industries and organisations to develop within environmental limits and meet market and community requirements.

While many of the issues involved in these outcomes have proved to be intractable in the past, for example the ongoing loss of lowland habitat for indigenous biodiversity, we are seeing signs of a sea change in the views of New Zealanders. There is a growing recognition of the need to conduct our affairs within environmental limits, driving innovation both in productivity and in reduction of our environmental footprint.

New Zealand has a role to play in feeding the world's population. We have a reputation for doing so within a clean green environment. It is a vulnerable reputation; but it gives us the opportunity to develop technological, economic, social and cultural approaches that are useful both in New Zealand and overseas – approaches that people would expect to come from New Zealand.

Landcare Research stands for the science to underpin those approaches and the development of the approaches themselves. It is something that we cannot do alone, but can do in partnership. That will be a hallmark of the next 20 years of this institute – partnership for outcomes – that complements our vision: science and environment for a better New Zealand.

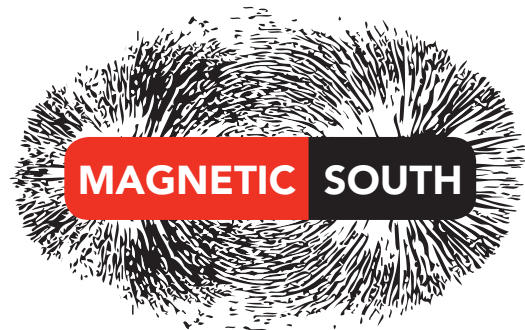
Dr Richard Gordon
Chief Executive



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EVENTS ASSIST IN CANTERBURY REBUILD



“THE EARTHQUAKES THAT HAVE ROCKED CANTERBURY OVER THE LAST 10 MONTHS HAVE HAD A PROFOUND IMPACT ON THE REGION’S RESIDENTS, INFRASTRUCTURE AND LANDSCAPE”

>>THESE MOMENTOUS EVENTS WERE THE BACKDROP FOR AN INNOVATIVE NEW PUBLIC-DRIVEN ONLINE ‘GAME’ THAT DISCUSSED HOW CHRISTCHURCH COULD LOOK IN THE FUTURE.

The Magnetic South event, managed by Landcare Research, used an online tool developed in Silicon Valley, California, by The Institute for the Future and ran for almost 30 hours.

Participants could play for just five minutes or for as long as they wished and Magnetic South allowed them to explore the future together by drawing on the collected knowledge of the crowd. And, as well as spotlighting unexpected challenges, it helped reveal new ideas and solutions to keep Christchurch vibrant and thriving in the next few decades.

It posed the question ‘In 2021, when talent and investment are in even shorter supply than clean energy, what will you do to attract them to Christchurch?’

Project Director Bob Frame says it was a critical question that captured the fast-changing world in which the future Christchurch must be a destination of choice for the talented if it is to be the success it so dearly desires.

‘The event encouraged people to think about life in the future. A lot of the ideas bouncing around at the moment are based on people’s current lifestyles and preferences – naturally. But many of the redevelopment decisions about to be made in Christchurch will impact people for generations to come, so it is useful to think about the longer term.’

And, the answers came in thick and fast – almost 900 participants in 16 countries took part generating more than 9,000 ideas.

‘That’s an average of six a minute, though at times it was many more. It highlights a genuine community commitment to engage in the exciting opportunity to rebuild the city in a way that will continue to attract talent and investment,’ says Bob. Some ideas spanned as many as 10 secondary ideas and one conversation went on for more than 25 exchanges.

All the data is freely available online at <http://blog.magneticsouth.net.nz/> and can be analysed by anyone and unique visualisation created by Landcare Research’s Chris McDowall enables every conversation to be examined in depth.

Christchurch Mayor Bob Parker, who was supporting the event, said Magnetic South was a great addition to the City Council’s successful ‘Share an Idea’ website and community expo initiatives.

‘What makes Magnetic South different is we’re looking at the city from a future perspective. The decisions our forebears made in the 1800s, creating Hagley Park and the grid layout of our streets for example, continue to impact us today, and it’s important the decisions we make in redeveloping Christchurch also stand the test of time,’ Mr Parker says.

This unique event – only one of a handful tried

in the world – utilised new technology, and its limitations were exposed. Two hours before the event was meant to end, the US-based system crashed due to very heavy interest following an interview about the event on Kim Hill’s ‘Saturday Morning’ radio show on Radio New Zealand.

‘While the event was forced to end a little earlier than expected it still generated almost 9,000 “ideas” on how to shape the city following several devastating earthquakes in the past nine months. This is an exceptional result that highlights a genuine community commitment to rebuild the city in a way that the community wants and in a way that will continue to attract talent and investment.’

Support for similar events has already been voiced by authorities leading the earthquake recovery as well as from other councils throughout New Zealand who are grappling with other challenging issues.

‘Future events of interest to Landcare Research include more boutique crowd-sourcing events with perhaps no more than 500 people on quite specific issues in more focused environments. We will be discussing this with Christchurch City Council and the Christchurch Earthquake Recovery Authority,’ Bob Frame says.

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MEANWHILE, Landcare Research staff were among some of the best design brains who went into ‘lockdown’ to focus on generating viable plans for the city’s red zone.

For Colin Meurk, Ian Lynn and their team-mates including former Landcare Research social scientist Will Allen, Lincoln University’s School of Landscape Architecture was home for the 48-hour challenge where 15 teams of seven each, comprising landscape architects, engineers, architects, urban planners, ecologists, health professionals and/or social scientists, designed alternative visions for the way the city’s CBD could look in future.

The Christchurch City Council selected five key sites in the CBD and assigned three design teams to each of them in an effort to gather ideas on how to rebuild the damaged central city. The council has been canvassing ideas for months, receiving more than 90,000 submissions from the public through events like ‘Share an Idea’, ‘Magnetic South’.

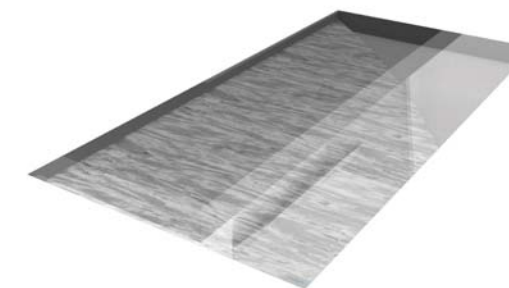
Two members from each team were taken into the city’s ‘Red Zone’ so they could view their designated site, its context and the issues that come with it.

Colin and Ian’s team were given a small, challenging 880-m² section in Gloucester St, in the midst of the Red Zone adjacent to Cathedral Junction and opposite the New Regent Street historical precinct.

‘We were really happy with how the building looked because it was a Roman-esque fit with the wider theme that continues along New Regent Street. We utilised high-tech wood materials as well as other LIUDD (low impact urban design and development) features including solar panels, water features, pedestrian and bicycle friendly aspects, green roofs and swales,’ Dr Meurk says.

‘It was certainly a challenging event given the time constraints but it was another novel way in which ideas are generated to scope the future of the city.’

Ideas from both the public and professionals will become part of the new central city plan due out on August 22.



Proposed new development at Cathedral Junction.

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RABBITS ON THE RISE

>> IT'S ALMOST 15 YEARS SINCE THE RELEASE OF THE RABBIT HAEMORRHAGIC DISEASE VIRUS (RHDV), WHICH DECIMATED RABBIT NUMBERS OVER LARGE AREAS OF NEW ZEALAND. HOWEVER, IN THE INTERVENING YEARS RABBITS HAVE DEVELOPED INCREASING IMMUNITY TO THE VIRUS AND THEIR NUMBERS HAVE STARTED TO RECOVER.

Increased rabbit densities have led to resurgence in the use of conventional control tools, including baiting with either 1080 or pindone. Landowners are required to control rabbits when numbers exceed specified population levels and some landowners are again incurring high rabbit control costs.

Due to growing concern about the numbers of rabbits infesting our drylands, for the first time in more than 10 years Landcare Research scientists, led by Bruce Warburton, have received funding from the Crown to extend recent research on possum control to the control of rabbits.

The research has three main strands: (1) reducing the cost and amount of toxic bait used in aerial baiting, (2) identifying cost-effective strategies currently used by farmers for secondary control, and (3) understanding the toxicology of pindone poisoning in order to reduce the cost of application and its potential impacts on non-target species.

As a first step, published papers and reports from previous relevant research were catalogued within a searchable web-accessible bibliography (<http://rabbits.landcareresearch.co.nz>). The catalogue helped identify key research that could be used to update current best practice for controlling rabbits with aerially sown 1080-carrot bait. Such control typically involves sequential

sowings of 20–40 kg each of prefeed (non-toxic) and toxic bait per hectare (depending on rabbit density) and costs up to \$100 per hectare. Based on research into baiting for possums, Bruce believes that current bait sowing rates and associated control costs for rabbits can be significantly reduced.

To test this hypothesis, Bruce and his team are working with Otago Regional Council staff to develop and run a series of trials this winter to test a range of different bait sowing rates and applications that could reduce costs by as much as 50% and the sowing rate of bait by 66%.

Some farmers undertake secondary control of rabbits to slow or halt population recovery. To determine how control is currently being carried out, farmers are being interviewed to identify the control methods they use based on variations in habitat, percentage cover, farming practices, and the density of rabbits on their property. Preliminary results show that investment in rabbit control varies greatly; some farmers have long-standing control programmes costing tens of thousands of dollars per year, whereas others invest very little, instead relying on the RHD virus and even the efforts of meat shooters to suppress rabbit numbers.

Farmers and rabbiters engaged in control use a wide range of tools to limit rabbit populations. Shooting is the most common control method used, though its application varies. For example, in areas where access by 4WD or motorbike is possible, night shooting is effective when rabbit densities are low. On steeper, less accessible country, rabbits are shot from helicopters. Other complementary methods include fumigation of burrows and patch-poisoning with pindone.

Pindone (a first-generation anticoagulant toxin) is used by some farmers and contractors to control rabbits because of the regulatory and stock-withholding-period requirements when using 1080. However, as with other pesticide

uses, baiting with pindone raises concerns over toxin residues and risk to non-target species, but far less is known about these aspects of pindone use in comparison with 1080 use. Landcare Research toxicologist Penny Fisher has been assessing the residue concentrations of pindone in tissues from caged rabbits after they have eaten a lethal amount of pindone and has found relatively high levels of the toxin in rabbit liver and fat. Tissue testing is ongoing, and the final results will be used to review assessments of risk to non-target species that prey on or scavenge rabbits and to help optimise the application of pindone baits to minimise both costs and secondary poisoning risks.

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BIOCONTROL

AGENTS BATTLE TRADESCANTIA

>> THE FIGHT AGAINST ONE OF THE COUNTRY'S MOST PROLIFIC PLANT PESTS HAS STEPPED UP WITH THE INTRODUCTION OF THE FIRST BIOCONTROL AGENT AND THE PLANNED RELEASE OF TWO MORE BY THE END OF THE YEAR.

The releases of the beetles to battle tradescantia also represent another significant highlight for Landcare Research's world-renowned biocontrol team.

Tradescantia – or wandering Willie or wandering Jew as it is often known – has become widespread in frost-free parts of New Zealand, particularly in the North Island. Thriving in shaded areas of gardens and bush, tradescantia grows densely on the ground preventing regeneration of desirable plants. Earlier research has shown that this weed is a threat to the regeneration, and hence long-term survival, of indigenous forest in northern New Zealand.

The plant is also possibly the most widespread and troublesome weed of gardens throughout New Zealand. Tradescantia is very difficult to control as it breaks into many pieces when pulled, with even tiny stem nodes capable of resprouting. The plant can also cause canine allergic dermatitis, an itchy reaction in dogs.

In early March staff from Landcare Research and the Auckland Council undertook the first release in New Zealand of the tradescantia leaf beetle (*Neolema ogloblini*), in an effort to control the pest plant. It was also just the first agent released in New Zealand for tradescantia control.

As its name suggests, the tradescantia leaf beetle feeds on the foliage of the weed.

And, in July ERMA approved the release of two further biocontrol agents from Brazil, the tradescantia tip beetle (*Neolema abbreviata*) and

the tradescantia stem beetle (*Lema basicostata*). Adults of both species attack tradescantia leaves while, as their names suggest, larvae burrow into either the growing tips or mature stems. Both these beetles should be released for the first time this coming spring.

The releases are the result of a significant collaborative project with the Auckland Council, who applied to ERMA to release all three species of beetles.

'Tradescantia is a nasty weed across the Auckland Region, including in our regional parks, and anything that helps control it is a fantastic step forward,' says Cr Sandra Coney, Chair of the Auckland Council Parks and Heritage Forum.

Researcher Simon Fowler says the release of biocontrol agents in New Zealand is subject to stringent procedures imposed by the Environment Protection Agency, formerly known as the Environmental Risk Management Authority (ERMA).

'It's an open, obvious and honest process. All prospective agents must be thoroughly tested to prove that they are 'host-specific', that is, they cannot predate other plants and also that they won't impact on human health, the environment, conservation values, primary production or Māori values.

'The same stringent approach is taken whether the biocontrol agent is aimed at a pest plant or any other organism.'

This stringency is highlighted by the longer than expected time to introduce the tradescantia leaf beetle.

While permission was gained from ERMA to introduce the beetle in 2008 its release was delayed when standard pathogen screening revealed a gregarine gut parasite infecting the beetles held in containment.

However, towards the end of 2010 three generations of gregarine-free beetles were achieved, resulting in MAF giving permission to release the beetles from containment.

Researchers beat the disease by adopting even higher levels of hygiene for adults and newly laid eggs, reducing the likelihood of infection, and low levels of hygiene for developing larvae kept in strict solitary confinement.

'By not keeping things too clean at this point any parasites that may be present are given the opportunity to build up to detectable levels in individual beetles, so we minimise the risk

of failing to detect very low levels of infection,' says researcher Lindsay Smith.

'Any eggs or offspring from infected adult beetles can then be culled. All this information is recorded. We have full family trees for all of the leaf beetles and can trace each back to their great-great-grandparents. This knowledge also helps us to reduce inbreeding by making selective crosses between different lines before release.'

The ERMA process and HSNO Act that determine the suitability of biocontrol agents are both very highly regarded around the world

because of their stringency, Dr Fowler says.

Biocontrol agents can be some of the most cost effective and environmentally responsible methods of controlling weeds, and Landcare Research staff are internationally renowned for their skill in this field.

While biocontrol agents don't eliminate weeds – because they can't find or kill every plant, their presence is more likely to result in smaller, weaker plants that are less likely to spread and can be more easily out-competed by other plants. Weed infestations may be reduced to a level that we can live with or eliminate effectively and economically by other means.

However, insect biocontrol isn't a quick fix because it takes many years for suitable agents to be found, tested, approved, reared, released and established and then for the agents to spread.

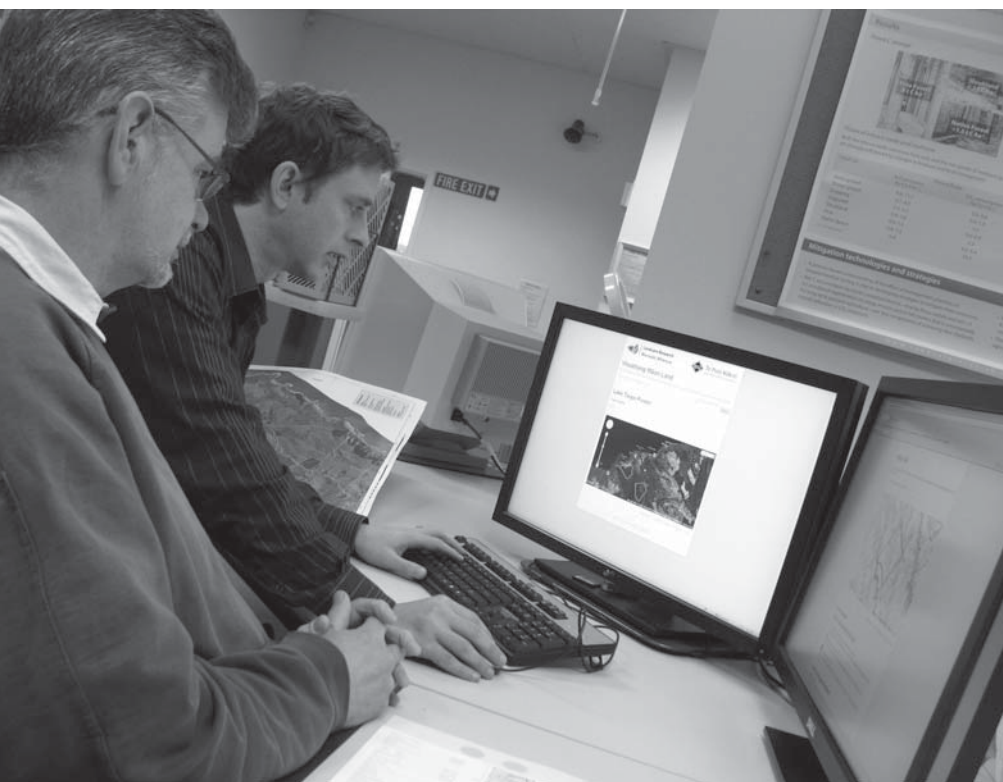


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NEW TOOLS IMPROVE ACCESS TO LAND RESOURCE INFORMATION



>> A NEW LAND VISUALISATION TOOL HAS BEEN DEVELOPED TO PROVIDE CONVENIENT ACCESS TO EXTENSIVE INFORMATION ABOUT MĀORI LAND.

The tool has been designed and developed specifically for Māori land owners and land managers searching for their land blocks, and then wanting to know about the land's resource characteristics and potential.

The tool (<http://whenuaviz.landcareresearch.co.nz>) is available to everyone who has an interest in Māori land. It combines updated block (property and legal) data from the Ministry of Justice (Māori Land Online: <http://www.maorilandonline.govt.nz/gis/>) with environmental and land resource data from Landcare Research.

The tool can create a customised report of the environmental characteristics for any Māori land block in New Zealand, with land located either by using an interactive map or by searching for a block name or place name.

The tool generates a series of resource maps, statistics, and descriptive information detailing land resources and presents this information to

the user as an interactive webpage. The data is displayed over topographic maps, satellite imagery and aerial photographs.

'This will provide landowners with an idea of the potential of their land blocks, including a "first cut" land assessment showing areas at national scale suitable for horticulture, cropping, pastoral farming, forestry and areas needing long-term protection,' says Landcare Research scientist Garth Harmsworth.

'There has been huge interest in the tool when we have demonstrated it at conferences and workshops around the country, especially from Māori land owners and Māori organisations such as trusts and incorporations, and many government departments.

'Māori have been waiting a long time to gain better and easier access to land resource and environmental data of their blocks.

'In future Māori land data can be linked to relevant data from many other sources. Already we have linked the tool to the National Library's Digital NZ records, giving a wealth of historical and archival information for each Māori land block.'

Development of the tool was funded by Te Puni Kōkiri (Ministry of Māori Development).

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INNOVATIVE TOOLS FOR WATER MANAGEMENT

>> AN INNOVATIVE NEW TOOL – THE WATERWHEEL – WILL BE AN IMPORTANT COMPONENT IN A NEW PROJECT RECENTLY FUNDED BY THE MINISTRY OF SCIENCE AND INNOVATION.

The Waterwheel project is a partnership between Aqualinc, Landcare Research, AgResearch and Tipa Associates which aims to capitalise on the power of collaborative approaches for managing water allocation and protecting water quality.

Regional and unitary councils are increasingly setting limits on river flows, bulk water allocation and water quality at the scales of catchment, sub-catchment and water management zone. The Waterwheel project examines how to set and implement such limits collaboratively with water users and stakeholders, and how to sheet home the responsibility to individual water and land users, while achieving acceptable cultural, economic and social outcomes.

The WaterWheel itself is a single, visual representation of the 'health' of a catchment or water management zone with each spoke of the wheel representing an indicator of environmental, social, cultural or economic variables. The idea is a visual tool which can be used by water users at a sub catchment level, community groups at a catchment scale, industry bodies such as energy companies, and agribusiness and policy agents at the catchment, region and national scale.

Landcare Research scientist Andrew Fenemor says at present there is no real means for water users at a sub catchment scale to understand,

and therefore actively manage, the impacts of their decisions on both flow and quality states.

'The cumulative impact of many users requires both individual and collective responsibility for actions. At present there are few examples of collective institutions in place at nested scales to deliver agreed catchment outcomes. Most decisions around water use will still be taken to optimise an economic output with little understanding of the flow-on consequences of these actions for environmental as well as social and cultural outcomes,' he says.

This programme aligns with Land and Water Forum recommendations, SWIM and MfE targets, and addresses Ground Water Forum critical issues by designing improved institutional arrangements. It fills a research gap by developing a tool and process for setting limits which balance the values of communities, and improve water use and quality at a variety of scales.

The programme was developed through an equally innovative initiative, the 'Freshwater Sandpit' research planning process last March and imported from Europe. The 'sandpit' was an intensive, week-long brainstorming session to develop creative research projects.

As the proposal notes "The distinguishing feature of this research is that we are aligning and integrating institutional behaviour to our understanding of the physical dynamics of water movement through the medium of a tool and process that will allow feedback between collective actions and the meeting of environmental, social, cultural and economic states. Matauranga Maori is integral to the institutional design and the development of the tool. The research will be informed by

literature, analysis of existing case studies and workshops, and a proof of concept will be tested in two sub catchments (yet to be determined).

The outputs will be unique and innovative because they are the product of an interdisciplinary research approach integrating social science with economics, political governance, collective learning and environmental science. A new collaborative governance design will be developed to manage water and land to meet acceptable standards in line with environmental, social, economic values."

The Waterwheel research team includes John Bright (Aqualinc), Andrew Fenemor (Landcare Research), Liz Wedderburn (AgResearch) and Gail Tipa, plus international input from scientists from Europe who attended the Sandpit. The programme builds on research completed in integrated catchment management (ICM), the Pastoral 21 environment programme and various regional council catchment projects.

As Andrew Fenemor notes "We'd like to get to the point where catchment landowners think about doing their Waterwheel accounts when they do their GST reconciliations every 1-2 months".

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