



Issue 1 March 2002 ISSN 1175-7329

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Robert Lamberts - Crop & Food

Welcome to *Discovery*

Kia ora koutou katoa,

Welcome to the first issue of *Discovery*, the new newsletter from Landcare Research. *Discovery* provides updates on a range of projects, across the spectrum of our activities, in a single publication tailored to busy, leading people in environmental and resource management.

Our mission is to *make a difference for a truly clean, green New Zealand* through our research on sustainable development. Recently, the Government announced its commitment to sustainable development as a core strategy. The strategy will be presented in September at the Johannesburg Summit 2002 (also known as Rio+10).

I applaud the Government's decision to make sustainable development a core strategy. Our country has many hurdles to overcome before becoming sustainable. Here are a few major ones:

- The need to greatly reduce our dependence on pesticides to control pests that threaten our indigenous biodiversity. At present we are responsible for about 90% of the world's consumption of 1080 poison, but alternatives probably require the use of genetically modified organisms. Resolving the stark dilemma between the risks and benefits of using pesticides compared with the potential risks and benefits of using GMOs will be difficult.
- The CO₂ component of our greenhouse gas emissions, at least within New Zealand, can

probably be dealt with through managing the carbon stored in our soil and vegetation, as discussed in this issue. But we are not yet dealing with offshore emissions produced in transporting primary products to far-off overseas markets. The CO₂ emissions of in-bound tourism are also large. Our recent work with the tourism sector on its strategy has contributed to the industry's adoption of a carbon-neutral goal.

- Sustainable development has to be managed in a 'place-based' way, i.e. the place where people use resources. Resource-use goals and trade-offs must be developed at a local (town, district, city or regional) level. This is a huge challenge for the Government itself. If it is truly committed to sustainable development it will have to rethink the whole design of the machinery of government. The Local Government Bill before Parliament signals much greater involvement of communities in defining sustainable development outcomes for local government.

These are only a few of the major challenges on the road to sustainable development. In this and future issues of *Discovery* we intend to show how our research contributes to resolving many of these challenges.

I hope you will find this issue of *Discovery* interesting and that you will look forward to the next issue.



Dr Andy Pearce
Chief Executive
Landcare Research



Kōkako on the comeback trail

Innovative and patient research may enable the recovery of the endangered kōkako, arguably New Zealand's finest songbird.

The kōkako is known for its booming song and distinctive blue wattles, and it is thought that fewer than 500 pairs exist in the central and northern North Island.

Landcare Research scientist John Innes has been leading a team of dozens of field workers and Department of Conservation land managers in a 15-year project to determine the cause of the kōkako's decline, and then to reverse it. There have been some surprises, and some startling successes.

Mr Innes says much of the project work was done with a revolutionary technique called 'research by management', in which the team reduced key pests like possums and ship rats in some areas and not others, and then compared kōkako numbers. "The advantage was that we got our research results, and *at the same time* helped to boost kōkako populations," Mr Innes says.

"After eight years of pest control at Mapara Forest in the King Country, the total kōkako population trebled, and the number of breeding pairs increased eightfold."

Mr Innes says the team's success in boosting the numbers overturned traditional thinking that population decline could only be reversed on pest-free islands such as Kapiti and Hauturu (Little Barrier Island). "The kōkako programme was one of the first to demonstrate that this need not be so, and this has led to the establishment of 'mainland islands' throughout the country, where pest populations are kept down to allow native bird numbers to increase on the mainland."

The project employed other new techniques as well, including time-lapse video

photography to identify mystery nest predators.

"We knew something was preying on the kōkako up in the trees. On the very first night of filming we were stunned to see a possum eating kōkako eggs.

"Possums were not previously confirmed to be predators of wild birds, either here or in their native Australia."

John Innes says, thanks to this research, it is now known that predation is the major cause of the decline in kōkako numbers, rather than a shortage of suitable habitats or food supply.

"As well as that, we showed clear thresholds of pest abundances at which damage to kōkako populations increases rapidly.

"This will save huge amounts of money by showing land

managers that pest control spending is wasted unless the pest populations are reduced to certain small numbers."

The next stage in the kōkako research is a 10-year project to extend the scale of the recovery, and to return kōkako to parts of their former range around Wellington, Hawke's Bay, Ruapehu and Taranaki. Mr Innes believes the kōkako's future is now brighter.

"Clearly, the research will enable national recovery of the kōkako, if we can sustain the necessary level of pest control."

Funding: DOC (Department of Conservation), FRST (Foundation for Research, Science and Technology).

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Kōkako with radio transmitter backpack before release. Transmitters greatly helped researchers to locate kōkako nests.

Scientists win first battles with ants

Scientists aiming to eradicate the infamous Argentine ant in parts of New Zealand have high hopes of success, with promising results from an experimental bait.

Argentine ants were first discovered in Auckland in 1990. They are known to swarm in their thousands through buildings, to damage crops, and to displace native insects. The ants have become a major pest in urban areas, especially around Northland, Auckland and the Bay of Plenty. They have most recently been found around the port in Nelson and on Tiritiri Matangi, an island refuge for threatened native species. No methods are currently available to effectively control Argentine ants. Insecticide sprays previously used successfully overseas proved to be highly persistent in the environment, and were withdrawn from use.

Landcare Research has been testing an experimental bait developed in Australia. The insecticide Fipronil, which is also highly effective in controlling wasps, was added to the bait in very low concentrations. Over the past year, the baits have been trialled at Mt Maunganui, Port Nelson and Tiritiri Matangi.

Landcare Research insect ecologist Dr Richard Harris says lines of bait were laid across the entire ant infestations, and ant numbers were monitored both before and after treatment.

"After only one treatment, we reduced Argentine ant populations to low levels at all three sites," Dr Harris says. "There will be ongoing work to kill the few remaining ants, and intensive monitoring for several years until we can be sure that eradication has been achieved."

This early success is a major breakthrough and attention has turned to whether attempts should be made to eradicate the ants from other areas.

"Eradication of Argentine ants has not previously been achieved with baits," Dr Harris says. "Our trial will have applications around New Zealand and internationally.

"Among other benefits, we hope a commercial ant bait can be introduced to the market. Also, an effective weapon against the ants will reduce the risk of New Zealand accidentally exporting them to ant-free countries, and provide a tool to combat Argentine ants should they be found on any other island conservation reserves."

Further research will involve testing baits with even lower concentrations of the poison, and developing effective methods



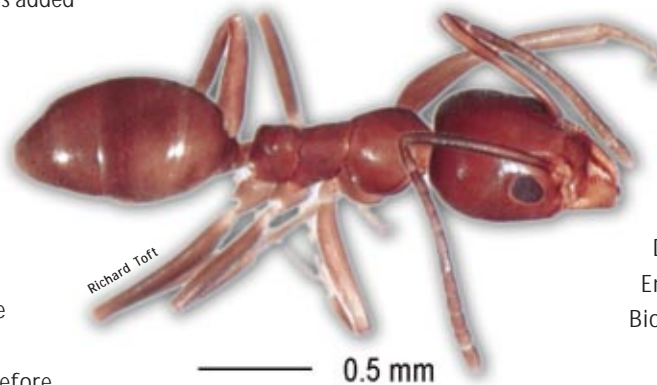
Chris Green/Richard Harris

Richard Harris laying bait for Argentine ants at Tiritiri Matangi.

other is here to stay, although it is not thought to be a threat.

"These discoveries, along with the recent find of fire ants at Auckland Airport, indicate how often ant incursions happen at our borders, and the need for regular monitoring to ensure they are detected early."

Funding: FRST (Foundation for Research, Science and Technology), DOC (Department of Conservation), Environment Bay of Plenty, MAF Biosecurity, and Port Nelson.



An Argentine ant

to mop up any survivors. However, Dr Harris warns that more vigilance is needed to detect other potential ant invaders.

"While we were doing surveys at Port Nelson and Mt Maunganui, we found two other ant species that were new to New Zealand. One of them was detected early enough for it to be eradicated, but the

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| System helps New Zealand report its greenhouse gas status

Landcare Research scientists have played a major role in developing the country's first comprehensive carbon monitoring system, which New Zealand can use in efforts to reduce its greenhouse gas emissions to 1990 levels, in line with the Framework Convention for Climate Change and the Kyoto Protocol.

New Zealand's indigenous forests, scrub and soils hold large stores of carbon, but these carbon stores can be affected by changes in land use, thereby affecting the amount of CO₂ being released into or absorbed from the atmosphere. For example, over the past millennium about 17 million hectares of New Zealand forests were cleared, releasing billions of tonnes of CO₂. The amount is roughly equivalent to half the annual fossil fuel emissions *worldwide* averaged over 1980 – 1998. Recent changes in forest condition as a result of pest damage may reduce the level of stored carbon further, while scrub regeneration on abandoned farmland is accumulating carbon at a rate of about one to three million tonnes each year, across New Zealand.

Landcare Research and Forest Research, working closely with a steering group appointed by the Ministry for the Environment, developed the Carbon Monitoring System (CMS) over five years. The CMS is designed to monitor changes in our carbon stocks to help New Zealand meet its international obligations. It is also designed to collect valuable information on biodiversity, both for international reporting and for New Zealand's land management purposes.

The project leader, Dr Margaret Lawton of Landcare Research, says it is unclear at the moment whether, over the country as a whole, New Zealand is losing or gaining carbon from its land-based carbon sinks.

"However, the information gathered using the CMS, combined with good land management, will help direct this country's efforts to offset emissions from transport and industry."

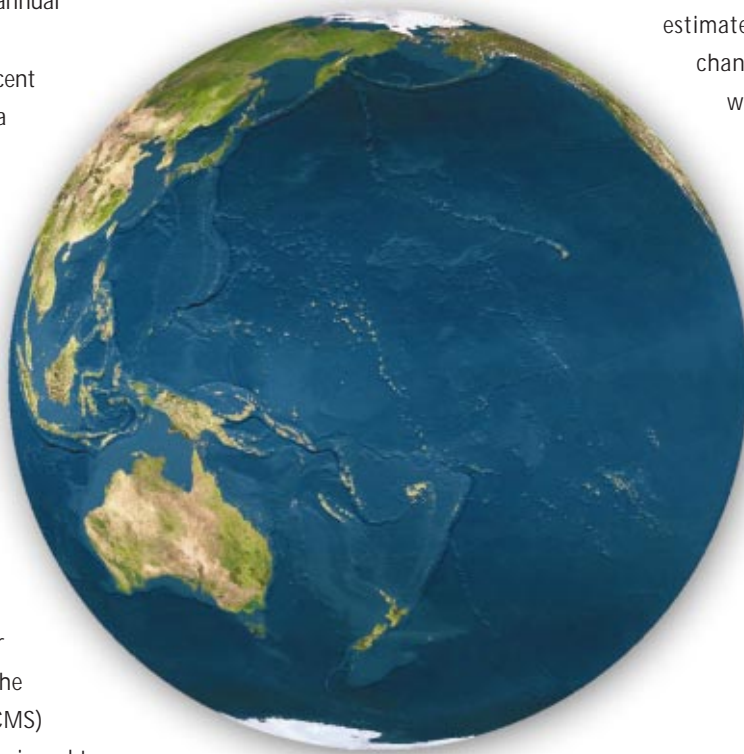
The research and development of the CMS made use of considerable existing data on soils, indigenous vegetation, and land

Ministry for the Environment has contracted Landcare Research to monitor indigenous vegetation and soil carbon over time, and to set up monitoring plots around the country.

"The information we gather will contribute very significantly to land information in New Zealand," Dr Lawton says. "It will provide accurate carbon estimates, is robust enough to withstand change over the long term, and can withstand international scrutiny.

"Also, because the system is designed to simultaneously collect information on biodiversity, it should aid the improved monitoring and management of our native plants, birds and insects throughout the country."

Funding: Ministry for the Environment, plus inter-agency Steering Committee



formations, as well as using remote sensing and various computer models. Over five years, systems were tested and refined, data accumulated and verified, maps produced, and methods and quality assurance procedures documented in a painstaking process.

Dr Lawton says the CMS is now ready to be implemented, although some further refinement of the system is needed. The

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Landcare Research serves up 'triple treat' for business

Landcare Research has been changing the way several important New Zealand companies look at their business – by giving them 3-D glasses.

Triple Bottom Line (TBL) annual reports analyse a company's environmental behaviour and degree of social responsibility, as well as providing the traditional analysis of financial performance. Landcare Research has won awards for its own TBL reports, and is now taking the lead by showing other companies new tools to 'do good' while doing well.

Since April, Landcare Research has worked with eight New Zealand organisations to help them with TBL reporting. Of these, The Warehouse, Meridian Energy and Metro Water have produced their first TBL annual reports, as has Hubbards. Hubbards generated considerable publicity with full-page ads revealing in all four major daily newspapers the 'three bottoms' of its cereals business. Landcare Research has also given TBL training to 30 organisations in workshops it has run in New Zealand and Australia.

Landcare Research Sustainable Business and Communities science manager Dr Richard Gordon says it is clear that businesses that do well for staff, the community and the environment also do well financially. "There is a subset of the Dow Jones Index that measures the performance of companies that have adopted sustainability principles. This group consistently outperforms the rest



past year, and our energy consumption by 4.6%. This reduction in energy use alone has saved us tens of thousands of dollars."

of the Index. For New Zealand businesses in increasingly competitive national and global markets, TBL reporting helps them meet overseas customers' demands for value and integrity.

"The best managers know that it is not enough to focus only on the financial bottom line. Shell learned this lesson in 1995, when they were involved in the Brent Spar scandal and linked to the execution of Nigerian environmental campaigner Ken Saro-Wiwa. Also, Nike in 1996 became a lightning rod for protests over child labour."

Dr Gordon says that as well as meeting ethical requirements, TBL reporting highlights opportunities to reduce costs and liabilities that would not otherwise have been identified. "For example, Landcare Research has reduced the amount of CO₂ emitted from our activities by 5% in the

Landcare Research has produced two TBL reports that have both gained praise and recognition. Our first report was ranked 14th out of 202 entries in *The Global Reporters*, an international survey of best corporate practice for TBL reports. It also won the 2001 Institute of Chartered Accountants / Gilkison O'Dea environmental reporting award.

The Warehouse founder and chair of the New Zealand Business Council for Sustainable Development, Stephen Tindall, says that our second report, the 2001 TBL Annual Report, "sets the standard for other companies."

Funding: Commercial income, Ministry for the Environment

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Invasive Weeds

Landcare Research has developed a framework for regional councils to monitor in the field the extent to which their plant pest management plans are being met. A flow chart takes users through a series of questions about the pest species, its distribution in the landscape, and the control strategy being implemented. The emphasis is on reporting at a regional rather than site-specific level. The methodology was successful in tests on four plant pest species, in four different regions. Landcare Research scientists are now advising staff at several regional councils on the use of the flow charts.

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Putting the brakes on road runoff

A Hamilton-based Landcare Research team may have the solution to contaminated road runoff – one of the major causes of stormwater pollution worldwide.

Road runoff is a toxic cocktail of contaminants containing heavy metals and organic chemicals. It results from fuel deposits from everyday motor vehicle usage, fuel spills, paint and stock truck effluent that are washed from road surfaces by rain or snow melt. Road runoff finds its way into the stormwater system and often ends up in rivers, lakes and estuaries, posing a threat to aquatic plant, fish and bird life.

A research team led by Dr Surya Pandey has created permeable 'treatment walls' which can be inserted along edges of existing roads, or incorporated in construction of new roads. These walls allow water to pass through, but trap contaminants before they reach the stormwater discharge system.

Dr Pandey says laboratory tests show that walls containing low-cost materials such as sphagnum moss, crushed limestone, waste wood pulp, waste wool felt and fly ash can trap various contaminants. A test wall installed at the corner of River Road and Wairere Drive in Hamilton to intercept and

filter road runoff has proved just as effective as the walls in the laboratory tests. As a result of interest from local authorities, two more treatment walls will be installed shortly, one at a busy intersection in Henderson, Waitakere City, and one by State Highway 1 in Cambridge. Another may soon be built in Tauranga.

"Eventually, treatment walls could be an environmentally sensitive way to treat discharges from areas such as busy roads, car parks, service stations, contaminated sites, stock truck effluent sites and landfills," Dr Pandey says. "They could be used wherever you have rainwater in contact with pollutants."

"A source control such as the treatment wall is desirable because once the runoff reaches the receiving environment, it is too diluted to treat at low cost.

"In future a higher proportion of costs may be passed on to polluters or road users, in the form of a tax based on the amount of pollutants produced. A low-cost technique to treat pollutants would help keep these costs to a minimum."

Landcare Research's Science Manager for Urban Environmental Management, Dr Charles Eason, says along with initiatives like cleaner fuels, treatment walls are a cost-effective way to reduce the level of pollutants in waterways near busy roads in towns and cities.

Treatment walls can be built either above or below ground. The filter substances would become saturated in five to ten years, and



Angela O'Reilly

Surya Pandey and Matthew Taylor of Landcare Research, preparing the ground for monitoring equipment to be installed next to an experimental treatment wall.

could then be disposed of at landfills, and replaced with new filters.

The treatment wall research won the Degussa Innovation Award at the 2001 Waikato Environmental Business Network Awards and was nominated for the Ministry for the Environment's Green Ribbon award. The project was also discussed in very positive terms in the Opinion Diary of the international journal *New Scientist*. Dr Pandey says the Ministry of Transport and many local authorities have expressed interest in the continuation of the project.

Funding: Transfund New Zealand, Foundation for Research, Science and Technology (NSOF), Hamilton City Council, Waipa District Council. Environment Waikato loaned equipment and provided stormwater data.



Road run-off discharging into the treatment wall structure.

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Clark's beetle

— our Prime Minister's namesake

It is the size of a pinhead and lives under piles of leaf litter in Marlborough. But despite its apparent reluctance to face the glare of publicity, a newly described native beetle has already made headlines, and may yet play a conservation role.

After a four-year process, Landcare Research entomologist Dr Rich Leschen has described a rare flightless beetle with minute wings, identifying where it fits in the evolution of insect families. He has placed it under a new genus: *Ostreacryptus* (the prefix, *Ostrea*, is Greek for oyster; Dr Leschen's favourite food), and a new species: *clarkae*, in honour of Prime Minister Helen Clark's contribution to conservation and environmental issues. Media reports show that Miss Clark is amused and pleased to have a new namesake.

Dr Leschen says that Clark's beetle is unusual, as it is 'the missing link' between flying and flightless beetles of this group.

"Finding the beetle may be the equivalent of finding a kiwi with the ability to fly. It is an example of one of the Southern Hemisphere's most ancient organisms."

Dr Leschen believes the beetle has been losing its wings over time. "Organisms evolve to lose their wings for many reasons. It could be that food resources are abundant, and they do not need to disperse to seek more food. Also, it is a trait of island dwellers to become flightless, as have a number of our native birds."

Dr Leschen says that in future, the little beetle could play a conservation role as an indicator of a healthy ecosystem.

"Clark's beetle requires a pristine and undisturbed forest. Its presence indicates an environment that deserves special protection. If the beetle is surviving in a forest, you can be

sure it is a healthy forest. We would want to protect both the forest, and the beetle.

"So far we have found about 20 specimens in a restricted area of Marlborough, but we plan to look for it in other areas as well."

Funding: NSF (National Science Foundation of the United States) and FRST (Foundation for Research, Science and Technology).

Reference: Leschen, R.A.B. 2001: A new genus of Cryptosomatulini (Coleoptera: Cryptophagidae: Cryptophaginae) from New Zealand. *New Zealand Entomologist* 24: 7-9.

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■ A shy celebrity — Clark's beetle (*Ostreacryptus clarkae*).

Image compiled by Birgit Rhode, using the Auto-Montage system in Auckland.
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News in brief

Rabbits and skinks

Landcare Research scientists have found that rabbits play a major role in the decline of native grassland skinks. Rabbits graze the grass that skinks live in, thereby reducing skink refuges from predators. Also, rabbits, which are the main prey for feral cats and ferrets, enable populations of these predators to increase when rabbit numbers are high. A sudden decline in rabbit numbers makes these predators switch to skinks. Landcare Research wildlife ecologist Grant Norbury says several skink species could become extinct if rabbit numbers, and therefore predation by feral cats and ferrets, are too great. Dr Norbury says the best tactic for sustaining grassland skink populations is to maintain rabbit numbers at low, stable levels.

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New infobase

Information on traditional uses of native plants is now available online. Landcare Research's new Ngā Tipu Whakaoranga infobase contains annotated references and detailed facts including Māori plant names and the uses of native plants.

"The infobase contributes to our objective of maintaining traditional Māori knowledge of culturally significant plants," says Landcare Research ethnobotany programme leader, Sue Scheele. "Publishing the infobase online has vastly increased the accessibility of this valuable resource to anyone with an interest in native plants. This includes Māori students, and Te Taura Whiri I Te Reo Māori (Māori Language Commission) and Waitangi Tribunal staff." Ngā Tipu Whakaoranga can be found at <http://peopleplants.LandcareResearch.co.nz>

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Fungi website

Meanwhile, a national database on fungi has also debuted in cyberspace. The new NZ FUNGI website, hosted by Landcare Research, holds details of about 5,500 named and currently accepted fungi, a figure thought to represent about 30% of this country's fungi. The remaining 70% have yet to be recorded! To encourage ease of use, the database includes the thousands of alternative names these fungi are rightly (or wrongly) known by. It also makes available all 68,000 records of fungi held by the New Zealand Fungal Herbarium at Landcare Research in Auckland (about 42,000 of these were collected in New Zealand). The site will be bilingual (Māori and English) within six months. NZ FUNGI can be found at <http://nzfungi.LandcareResearch.co.nz>

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Editor: Diana Leufkens

Layout: Denice Webb

Published by: Manaaki Whenua - Landcare Research

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All photographs contributed by Landcare Research staff unless otherwise indicated.

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