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## What's Inside:

Urban surveillance key to tackling insect invaders	2
Beetles hold clues to climate change secrets	3-4
WW2 Search Theory leads to new ways of finding and counting animals	4-5
DNA helps map skinks' travels	5-6
Weed team seeks out double agents	7-8
The Mainland Touch	8-9
Researchers measure extent of mouse menace	9-10
New Zealand – scene for global biodiversity networking	11
Biodiversity Books 'R' Us	12

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## New Zealand's biodiversity: past, present & future

In this issue of *Discovery* we focus on recent work by Landcare Research scientists about how a wide range of native organisms respond to changes in their environment, now or in the ancient past, and how we might better protect New Zealand's biota from invasive species. New Zealand is populated by a vast number of species; some of which we like to see increasing in abundance, and others that we are less happy to see thrive! However, regardless of whether our aim is to promote or limit the abundance of different species, understanding how environmental changes influence our biota is critical to formulating sensible management actions, and in predicting how global phenomena such as climate change or increased trade will affect our biodiversity.

New Zealand has some of the strictest biosecurity measures in the world, but detecting all invaders at the border is impossible. Entry points for trade goods are high-risk sites, and Richard Toft's research demonstrates the value of focusing surveillance for new exotic species in urban areas around such sites, where modified environments and abundant introduced plants increase the risk of new pests establishing.

Shifting focus to native invertebrates that occur in New Zealand's fossil record, Rich Leschen and his colleagues describe an innovative way of using changes in the occurrence of different species to piece together a picture of how our forest cover has changed as glaciers have advanced and retreated across the South Island.

Attempts to find better ways to assist the Animal Health Board in detecting and eradicating the last few Tb-infected possums in an area have led Graham Nugent and his team to combine sampling approaches that originated from maritime warfare with the latest in high-tech radio-tracking technology, computer simulation modelling and a new method for measuring animal populations.

Dianne Gleeson and Oliver Berry have been using DNA profiles to examine how the isolation of the rocky outcrops grand skinks inhabit and the quality of habitat between these outcrops determines dispersal success. Dispersal capability will ultimately determine the extent to which skinks can interbreed and reoccupy outcrops where they have become extinct. In a totally different habitat, Wendy Ruscoe has been investigating whether introduced mice can remove all of the seeds produced in a beech forest. The abundance of mice is closely linked to the availability of beech seed, leading to eruptions in mouse density during mass seeding events called "mast years".

Using insects as biocontrol agents to control weeds is a benign alternative to chemicals, but only if the agents attack only their intended targets.

Fortunately, the first retrospective review of the behaviour of 20 well-established weed control agents by Quentin Paynter and his team confirms just a few, minor problems, and the value of modern host-specificity testing.

As these articles demonstrate, Landcare Research is at the forefront of efforts to protect and restore New Zealand indigenous biota. We will continue our research to expand understanding of our unique ecosystems, their inhabitants, and the threats they face, and to develop world-leading ways to ensure a sustainable future for native biota.



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Diana Leutkens

# Urban surveillance key to tackling insect invaders

The discovery of five previously undetected insect species in urban areas has prompted a recommendation to increase surveillance efforts for invasive invertebrates.

Tiny insect invaders can be a major threat to New Zealand's environment, and the volume of our international trade and travel means our borders cannot be made totally secure. Surveillance is usually targeted at **specific** pests such as the Asian gypsy moth. However, there is no **generalised** surveillance in urban areas that may harbour "sleepers" – species that have established but are not yet widespread.

Landcare Research scientist Richard Toft is researching the prevalence of introduced insects in urban habitats, and whether any have established here undetected. At the same time he has been trialling a range of traps, from sticky traps to tent-like "malaise" traps, to see which are most efficient and cost-effective for sampling invasive invertebrates.

Mr Toft and his team trialled traps at the Port of Nelson, and around The Warehouse distribution centre at Wiri in Auckland. He also coordinated malaise trap surveys in suburban gardens in Christchurch, Nelson and Wellington.

Two new introduced beetle species were discovered at Wiri, and are in the process of being identified. Three new introduced species of fungus gnats (small flies) were recorded in suburban gardens. One was very abundant, and is now believed to have been here for more than 20 years. It is not yet known what effect these gnats may have on native ecosystems.

In some typical backyard gardens, half of the moths and 80% of beetles found were introduced species.

At the Port of Nelson, a new ant incursion (an Australian ant, *Mayriella* sp.) was detected, reported to the Ministry of Agriculture and Forestry (MAF), and

subsequently eradicated. Invaders were also discovered in new places; for example, various ant species were recorded for the first time in Nelson or the South Island.

Mr Toft says the research shows the potential benefit of generalised urban invertebrate surveys.



Richard Toft at his microscope.

"It is clear that we need to be better aware of which insects are getting here. By way of further illustration, since MAF began surveillance around ports for red imported fire ants in 2002 they have discovered two new introduced ant species established here and have launched incursion responses against six others, as well as detecting an incursion of red imported fire ant at Napier.

"New Zealand has some of the strictest biosecurity measures in the world, but unless we search every square centimetre of every container, detecting all invaders at the border is simply not possible. We need better **post-border** surveillance, to detect any invaders that have made it past the border, most likely into surrounding suburban areas.

"As suburban areas are usually highly modified and have many introduced plants, they are ideal reservoirs for introduced

species, both known and unknown. If we can detect invertebrate pests in their 'lag' stage, we can still eradicate them before they threaten our native ecosystems."

Mr Toft says catching pests at this stage is usually far more cost-effective than battling pests that are well established. "For example, the current effort to eradicate fire ants around Brisbane is costing tens of millions of dollars per annum." Additionally, having a better knowledge of the variety of invertebrate invaders we have reduces the risk of unwittingly spreading these pests to other countries.

Plans for future research include further identification work on the insect specimens collected during the surveys and continued development of potential surveillance techniques. There will also be work on some of the existing urban "sleepers" to better determine their potential threat to the environment.

Mr Toft says the public can play a vital role in biosecurity by keeping an eye out for the unfamiliar.

"The public are actually very good at detecting larger invertebrate pests and the small ones that make a big nuisance. The painted apple moth, the tussock moth, the Australian saltmarsh mosquito, and the fire ant colony at Auckland were all first detected here by members of the public."

**Funding:** FRST (Foundation for Research, Science and Technology)

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## Beetles hold clues to climate change secrets

Beetles may not seem an obvious source of information on glaciers, but research on native beetles is helping scientists to solve an ancient mystery: when were our glaciers at their largest? The findings will increase our knowledge of the effects of climate change in the Southern Hemisphere.

Painstaking research in the Northern Hemisphere indicates that glaciers there were at their largest about 21,000 years ago. But in the Southern Hemisphere, there is contradictory evidence. University of Canterbury geologist Dr Jamie Shulmeister and his colleagues speculate that Southern Hemisphere glaciers were at their largest much earlier at around 47,000 years ago, corresponding with wetter and milder climates and wind circulation from the west that cause build-up of glaciers.

Landcare Research entomologist Dr Rich Leschen is leading research on the lineages of two native beetles, to determine the pattern and timing that these beetles recolonised glacial valleys as glaciers retreated. The findings will help pinpoint when our glaciers were at their maximum extent, and whether this was 21,000 years ago, or closer to 47,000.

The team, which includes Thomas Buckley and Helen Harman from Landcare Research, is scouring bush and forests for modern-day beetles, using new, more accurate genetic analysis methods to reconstruct beetle evolutionary history, and how quickly they colonised and dispersed.

"We expect to find that populations in lowlands will be older, and those in glacial valleys more recent," Dr Leschen says. "The age of the populations will provide a useful indicator of when glaciers were at their largest."

Two species of beetles were chosen for study because they are widespread in New Zealand, easy to collect in the field, and easy to



■ A drive-by beetle bash: Rich Leschen demonstrates an unconventional way to search for a tree-dwelling beetle.

extract DNA from.

"One, *Brachynopus scutellaris*, is restricted to feeding on wood-rotting fungi. The other, *Soronia hystrix*, feeds on sooty mould common on kānuka, mānuka and beech.

"We hypothesise that these species had to take refuge on lower ground during the glacial maximum, to retain access to the trees and habitats they relied on."

Study areas will include the South Island's

existing glaciated habitats, but presently focus on former glacial valleys in Marlborough, Canterbury, Otago, Southland and Fiordland.

While Dr Leschen and his colleagues are collecting beetles from these areas, geologists are sampling layers of sediments and peat trapped in time. Dr Maureen Marra, a Canterbury University geologist, is collecting and identifying fossil beetle fragments recovered from various sites, to help form a picture of which beetles were present and what past climates were like.

"This project involves a relatively rare meeting of geologists and entomologists," Dr Leschen says. "I predict this work will help build a stronger relationship between biologists and geologists both in this country and abroad, and help pave the way for related research in the future."

Dr Leschen says the work will help us to understand the effects of climate change on

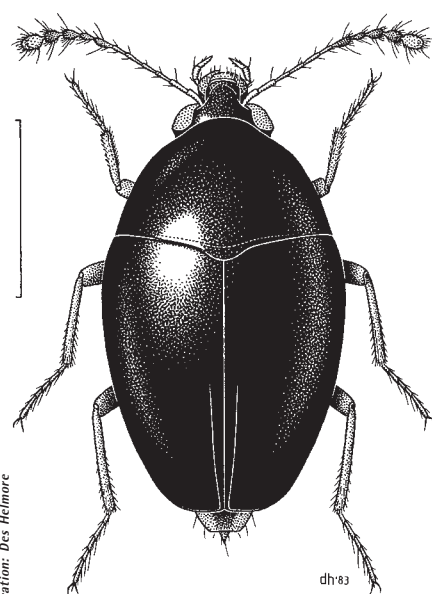


Illustration: Des Helmore

■ *Brachynopus scutellaris*. This native beetle is helping researchers to understand climate change.



the distribution of endemic New Zealand fauna.

"The work will help show where older and younger populations of plants or animals exist today. This will benefit current conservation efforts.

"If you are trying to preserve flora or fauna, it may be best to preserve populations that are further evolved, when you know where

they are, and when you have a choice.

"We will also be better able to answer questions such as how do the effects of climate change differ between the hemispheres and how sensitive is New Zealand to climate change?"

Preliminary results of the geological and entomological surveys will be ready later this year.

**Funding:** The Royal Society of New Zealand Marsden Fund, FRST (Foundation for Research, Science and Technology), National Science Foundation (USA)

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## WW2 Search Theory leads to new ways of finding and counting animals

Researchers seeking ways to help find elusive possums have been using ideas first developed during World War 2 to locate enemy ships and submarines. That Search Theory has provided a springboard for designing world-leading new ways of counting rare animals, and devising efficient surveys for all sorts of species.

Possums number in the tens of millions and spread bovine Tb, which threatens our beef, dairy and deer industries. Control operations greatly reduce overall possum numbers but can leave small clusters where Tb may persist. Trying to find these clusters is like looking for a needle in a haystack. Making it worse, we don't know what size of cluster poses a threat: 2-3 possums could perhaps be ignored, but could a cluster of 10?

Graham Nugent led a team of Landcare Research scientists who aimed to find efficient ways to locate these small groups of possums, so that the potentially troublesome ones could be eliminated.

"We wondered from the outset whether Search Theory might help as it focuses on detecting rare objects. We had hoped to come up with a way of searching that didn't require us to look *everywhere*. But one of the first lessons from ship-spotting is that reliability of detection depends on



■ Will this possum go undetected? Even a trap in the centre of a possum's home range has only a small chance of success on a given night.

completeness of coverage. If you don't look everywhere, you can't be sure you haven't missed anything!"

"Search Theory was clearly only part of the solution. What it did do was give us the understanding needed to design survey systems that give comprehensive coverage at the lowest possible cost."

A first step was to better understand how and when Tb persisted.

"We needed to know how many possums we could afford to 'miss'. Before this study, no one had seriously investigated the minimum size of possum clusters needed to maintain Tb.

"We built a new computer model of Tb, to better understand how the disease behaves when possums are patchily distributed in clusters.

"We concluded that Tb is **unlikely** to persist beyond five years in areas of less than 50 hectares with possum density reduced to low or moderate levels. This knowledge helps us to better target control, and thus save money.

"This new computer model has already been adapted to look at other questions such as whether a Tb vaccine might stop disease spread in possums. The model is also likely to be applied to other species, starting with Tb in whitetail deer in the United States."

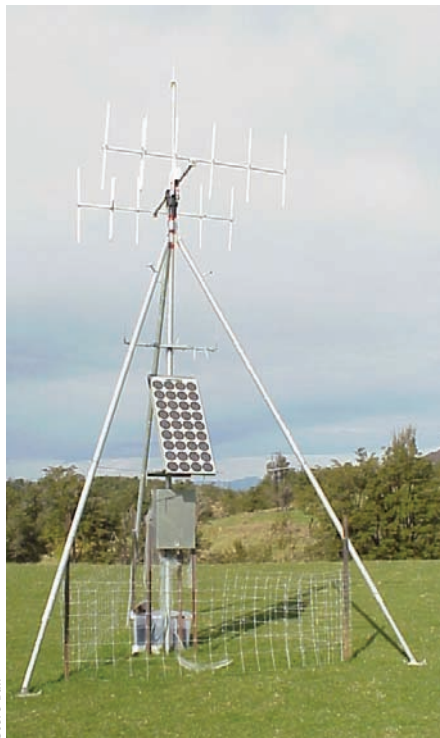
The next key step was to design better ways of finding possums. Currently, the most-used method for detecting possums in bush is to trap them in leg-hold traps along short,

randomly located lines. However, once most possums have been removed, too few are caught to give a reliable idea of where or how big remaining clusters are. Because trapping is expensive, field-testing the potentially large number of alternative survey designs would have been prohibitive, so the researchers again relied on computer simulation to come up with the answer.

This required simulating how possums encounter traps or poison, something that Dr Murray Efford realised also provided a new way of estimating the population density of animals. The spin-off result, Program DENSITY, is a world-first.

"DENSITY is downloadable from the Internet," Dr Efford says. "It uses information on how many animals were captured, how many were recaptured, and the distance between capture points, and simulates how many animals are likely to have been present to produce the pattern of capture observed."

Applying the same thinking to **trapping** possums, Dr Efford and Dr Dave Ramsey developed another computer model – appropriately named TRAPSIM – for comparing possum survey designs. To check that the model matched reality, the trappability of possums was measured by Dr Steve Ball at Mt Somers, Canterbury, using a prototype automatic radio-tracking station, developed by Graham Digital



Steve Ball

■ One of three towers comprising an automatic radio tracking station, at work at Mt Somers.

#### Design and Data Beam Systems.

"This is yet another world-leading development," Mr Nugent says. "Radio-collared animals have traditionally been monitored through manually operated radio-tracking stations. That requires a huge amount of staff time. In contrast, the automatic tracking stations can store thousands of locations that can be quickly downloaded onto computers."

The field study showed that a possum with a trap in the centre of its home range has only a 7% probability of being detected on any one night. This helps explain why leg-hold trap-catch rates are so low.

"When we used trappability values like that in TRAPSIM, it showed systematic coverage on transects a few hundred metres apart was needed to detect possums in areas where Tb might persist. There was no easier way. What we did realise, however, was that annual possum control could be combined with systematic survey to both reduce the populations **and** tell us where the clusters were.

The Animal Health Board is now looking at using that system in Southland. "This 'monitoring-by-control' approach has the potential to give us more reliable information about when it is safe to stop possum control. That gives us a much better chance of being able to quickly eradicate Tb nationwide."

DENSITY: [www.landcareresearch.co.nz/services/software/density/](http://www.landcareresearch.co.nz/services/software/density/)

**Funding:** Landcare Research investment, FRST (Foundation for Research, Science and Technology), Animal Health Board

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## I DNA helps map skinks' travels

**An endangered skink's DNA has given researchers vital clues to its dispersal patterns and a shortcut to finding how best to manage its habitat.**

Like many native animals, the grand skink (*Oligosoma grande*) persists in small groups in a highly modified landscape. Clusters of up to 20 skinks live on rocky outcrops, separated from similar groups by 50–150 metres of either native tussock grass or pasture, depending on land use. Their long-term survival depends in part on their

ability to disperse between patches of habitat.

Maximising connections between these patches requires an understanding of animal dispersal behaviour. Unfortunately, dispersal is difficult and time-consuming to measure by traditional methods, which usually involve ongoing observation. Genetic approaches to

measuring dispersal are emerging as potentially less expensive and time-consuming.

Landcare Research scientist Dr Dianne Gleeson and PhD student Oliver Berry studied grand skinks at Macraes Flat, inland from Palmerston in North Otago. In a project





Oliver Berry

■ Dianne Gleeson and her "catch of the day": an elusive grand skink (right).

requiring "rock-climbing skills and cunning", they caught the skinks and collected skin samples from their tails. Mr Berry then used the DNA to identify the skinks that were dispersers or non-dispersers.

Dr Gleeson says although skinks are long-lived, results showed that most individuals dispersed less than a few hundred metres in their lifetime.

"This means they often lived on the same rock outcrop as close relatives, and, as our previous research shows, sometimes bred with them.

"Immigrant individuals can be identified by their distinctive genetic fingerprint. We used a database containing genetic information from all the candidate groups that a skink might have originated from, to match skinks to their group. If a skink was more typical of a group it was **not** captured in, then it was probably a disperser.

"In other words, we could show whether Skink A came from Rock A, B or C. Using traditional field methods, we would normally try to catch the skinks as they run between rocks, which is fairly 'hit and miss.'"

To test the reliability of this genetic approach, the researchers compared their results with known records of dispersal from a Department of Conservation field study, based at the same site.

"Once we were satisfied with the accuracy of the method, we compared rates of dispersal between skink groups in native tussock grassland and in pasture.

"Dispersal rates of skinks separated by pasture are roughly half of those separated by tussock, and skinks in pasture were less genetically varied. Previous studies have shown that populations in pasture are less abundant and more extinction-prone than populations in tussock, possibly because pasture inhibits dispersal and recolonisation of rocks.

"However, this is the first time we have been able to see the actual patterns of dispersal."

Dr Gleeson says it is clear that the type of agricultural land use surrounding the skinks

does influence dispersal.

"This knowledge will help land managers to minimise impacts on skinks without necessarily excluding agricultural development."

Another key outcome from the research was the fact that the genetic approach to measuring dispersal produced similar data to the more time-consuming and potentially more expensive observation approaches traditionally used.

"The fieldwork for the genetic project took three months, while the traditional fieldwork (using marking and recapturing methods)

took more than seven years to collect equivalent data.

"This has implications for how ecological questions are addressed by scientists in future. Genetic approaches to measuring

dispersal are a major area of ecological research internationally."

University of Canberra senior lecturer in ecology Dr Stephen Sarre co-supervised Mr Berry's project, and provided expert advice.

Future research will include examining the degree of inbreeding among grand skinks, and the dispersal patterns of other endangered skinks.

**Funding:** FRST (Foundation for Research, Science and Technology), the Miss E.L. Hellaby Indigenous Grasslands Trust, Massey University Institute of Molecular Sciences



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## Weed team seeks out double agents

In the first survey of its kind in the country, Landcare Research weed ecologists have set out to find which (if any) weed biocontrol agents are attacking plants other than their specific weed targets. The results so far are reassuring.

Biocontrol agents are insects imported to damage or destroy specific weeds. These days, insects are released into the wild only after exhaustive specificity tests to ensure they will eat only weeds, and not native or commercially valuable plants. These tests give crucial insights to help assess the degree of risk these insects may pose to desired plants under any and all field conditions.

However, some past testing is now considered flawed. Some early releases of agents were made in the days before the importance of protecting desirable plants was fully recognised.

The Weeds Group at Landcare Research has conducted a major retrospective analysis of the weed specificity of all 20 well-established biocontrol agents. "We surveyed plants that were most closely related to the target weed, as these were the most vulnerable to attack," Landcare Research weed ecologist Dr Quentin Paynter says.

"For most of these 20 agents, testing was considered good by modern standards, and we were proved correct in our prediction of no non-target attack. For example, we confirmed that gallflies released to attack mistflower and Mexican devil weed were only attacking their target weeds.

"Minor non-target attack by heather beetle, gorse spider mite, and ragwort flea beetle was anticipated from testing, but this was not evident in the field.

"However, we did discover the Scotch broom seed-beetle attacking tree lucerne, a very



■ Quentin Paynter, agent provocateur.

■ Spot the difference: the two leaf miners, the native on the left, and the old man's beard leaf miner on the right.

closely related fodder crop; and the gorse pod moth attacking other introduced legumes such as Scotch broom and tree lupin. These impacts are minor, and extensive surveys have shown that no native legume species are attacked.

"A further complication is that since the gorse pod moth was introduced into New Zealand, taxonomists have split the species into two. We may or may not have two different moths here."

Host specificity testing indicated a risk that the old man's beard leaf miner might in rare instances attack the native climber *Clematis foetida*. "We did find it under attack at one site, on Banks Peninsula, but the damage was negligible," Dr Paynter says. "No attack was recorded at any of six North Island sites, or two other South Island sites."

The *Clematis* study was one of the more exacting projects. "The old man's beard leaf miner is almost identical to the native clematis leaf-miner, *Phytomyza clematidi*. We collected and reared hundreds of leaf miners from native clematis plants, and examined them under a microscope to determine whether the third antennal segment was yellow or black, the only visible difference between the two species."

"Another smellier project was wading around in the Kaitia oxidation ponds, looking for *Alternanthera sessilis*, a plant closely related to alligator weed, to check that the alligator weed agent was not attacking it. After all that, we didn't even find the plant.

Other tests were much less arduous. "There was a risk that biocontrol agents for thistles might attack the commercially grown globe artichoke, which is closely related. "An

Chris Winks



external examination of artichoke flower heads was all that was required to find the thistle agents' eggs," Dr Paynter says.

"However, in the interests of science, we did dissect and eat several artichokes, to confirm the absence of beetle larvae!"

Dr Paynter says, all in all, the results indicate that we do have a generally good track record of predicting safety. "The non-target impacts of the gorse pod moth, the Scotch broom seed beetle and the old man's beard leaf miner were predictable, and their impact insignificant.

"However, this review has taught us a couple of lessons for the future. It has reinforced the importance of ensuring a full range of host specificity tests are performed.

"Also, if the gorse pod moth *is* found to be two different species, DNA tests may become routine for all future insect introductions, to confirm their identity and reduce the possibility of a similar situation arising in future."

Dr Paynter says the review's findings should inspire high confidence in the results of modern specificity testing.

"Using insects to control weeds is a benign alternative to chemicals, and we have ample care and knowledge to protect desired plants in the process."

**Funding:** FRST (Foundation for Research, Science and Technology)

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## I The Mainland Touch

In the previous issue of *Discovery*, we profiled our new Board Chairman, prominent environmental businessman Rob Fenwick. This issue, we profile Julian Raine of Nelson, and Anne Urlwin of Wanaka, who also bring valuable "green" business nous to our board.

Landcare Research Board Deputy Chairman **Julian Raine** jointly founded and runs Nelson company Wai-West Horticulture, which controls substantial crop plantings including berry fruit, apples, grapes, kiwifruit and hops. It employs 30 full-time staff and up to 300 casual workers throughout the growing season.

Mr Raine was a Nuffield Farming Scholar and studied Integrated Fruit Production, a system that avoids broad-spectrum chemicals and organophosphates in favour of new, more selective chemicals, and natural enemies of plant pests.

"As a result of my study, I changed the way we produced our apple crop, and developed 'Greengro', which combines traditional fruit-growing methods and organics.

"'Greengro' delivers fruit with no spray residue, grown in an environmentally friendly way using strict food safety systems. It led to my winning the Tasman District Council Environmental Award for Primary Industry in 2001."

Mr Raine also owns two farms (dairy, drystock and forestry). He has fenced off



Ian Whitehouse

Julian Raine in a close encounter with a Holden tunnel trap for capturing ferrets and stoats.

more than 40 hectares to protect streams, lakes and regenerating bush, and is extending these reserve areas. "I find it refreshing to see the return of bird life and native flora through my regeneration projects."

Mr Raine says he feels privileged to be a board member of Landcare Research, and to have the opportunity to make a difference for a clean, green and sustainable New Zealand.

"Landcare Research has a huge reserve of resources and expertise and much to offer New Zealand society, showing the way forward, and leading by example.

"You can't be in the green when you're in the red. For me, sustainability is about helping society work through the seemingly opposing values of conservation and economic progress."





As well as being a director on Landcare Research's Board, Mr Raine has experience on various boards in the dairy and horticultural sectors, and exporting, marketing and service provision firms.

Mr Raine, his wife Cathy and three teenaged children live on their family farm between Stoke and Richmond.

Company director and chartered accountant **Anne Urlwin** has recently been reappointed to the Landcare Research Board for a second term. Ms Urlwin is based in Wanaka, but work commitments often require travel to Christchurch and Wellington. Ms Urlwin is Chairman of the Christchurch City Council's Red Bus Ltd, a company with a strong focus on environmental sustainability. She is Deputy Chairman of the New Zealand Domain Name Registry, a director of Airways Corporation of New Zealand and of New Zealand Cricket, and a member of the Council of the Christchurch College of Education and of the New Zealand Racing Board.

Ms Urlwin says her directorship at Landcare Research has taught her a great deal about



■ Anne Urlwin.

this country's environment, its biodiversity, and its pest management challenges. "I particularly look forward to Board field trips, where we see first hand the work being undertaken."

Ms Urlwin says she is pleased to see an increasing appreciation by many New

Zealanders of their own environment.

"Many are only just starting to appreciate what visitors have been telling us for a long time – that this is a very special place.

"My wish is that this growing mainstream appreciation of the environment will enable the country to focus more and more on *sustainable* development, successfully blending the concepts of environmental, social, economic and cultural sustainability.

"Landcare Research has a leading role to play in the provision of science information, to inform and influence public debate on sustainable development."

Ms Urlwin is excited about her reappointment to the Board. "For me, it's a real privilege to see the excellent science being undertaken by Landcare Research staff, and the absolute commitment to that science making a difference. And all this within a business model that requires the company to strive for success in financial as well as scientific terms."

## I Researchers measure extent of mouse menace

**Scientists researching the threat mice pose to beech forests have found the damage may be less to beech than to other native species.**

More than 70% of New Zealand's indigenous forest is either dominated by or otherwise contains beech trees. These trees may be particularly susceptible to seed consumption by mice due to "masting", the production of large quantities of seed on an irregular 2–4 year basis. Many believe that beech trees use masting to swamp the capacity of seedeaters to eat all seeds before germination can occur. But our beech trees evolved in the absence of mice.

To determine whether mice could regularly consume all beech seed produced in a masting year, Landcare Research scientists headed to beech forests in Canterbury, and in Fiordland, where they battled dramatic

extremes of weather, fleeing rising floodwaters and measuring mice in traps under a foot of snow! They monitored how many seeds mice could find and eat, and the rates of increase and decrease in mouse abundance as seed availability rose and fell.

Landcare Research scientists Dr David Choquenot and Dr Wendy Ruscoe initiated the project five years ago. Dr Ruscoe says that regardless of whether alternative food sources are available to mice, they continue to search for and consume beech seeds until (local) availability reaches zero.

"This means they are *theoretically* able to

eliminate seed reserves in beech forests, whether or not alternative food such as native moth larvae is available.

"The rate of change in mouse abundance is closely related to seed availability, and abundance erupts in years of high seedfall. However, this rise is substantially reduced when mouse density is already high.

"The reason for this is unknown. It may be territorial behaviour, or the effects of disease."

Dr Ruscoe says that when combined and built into an especially developed mathematical model, these factors indicate





Keven Drew

■ Wendy Ruscoe fitting a singularly unimpressed rodent with an ear tag.



Wendy Ruscoe

■ A seed trap measures the amount of seed rain that falls in the forest. This is used to estimate food supply to rodents, which is a principal driver of mouse population models.



Richard Heyward

■ Mouse showing an ear tag that will identify him on subsequent captures.

likely to erupt, and will help refine our ideas on how to target control measures for them."

The research also highlighted a lack of understanding of the role mice play in forest ecosystems.

"The results raise critical questions about the impacts mice may have through consumption of other native plants, insects and fungi. By consuming these species as secondary food items, mice may be having a more insidious effect on forest biodiversity than their consumption of beech seeds alone may suggest.

"Given the pervasive nature of mice in beech forests, and difficulties associated with their control, there will be further research on understanding and managing their effects."

**Funding:** FRST (Foundation for Research, Science and Technology)

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that mice would **rarely** be able to consume all beech seed produced during moderate to heavy masting years.

"Therefore, mice are not a likely threat to the continuous presence of beech trees.

"However, seed availability appears to be important to mouse dynamics. The regular

eruption of mouse abundance in high seedfall years has important flow-on effects on the numbers of mouse predators, notably stoats; and the prey they subsequently consume, notably our forest birds.

"Our research provides a more reliable basis for predicting when mouse abundance is



## New Zealand – scene for global biodiversity networking

Landcare Research is to host a meeting with delegates from around the globe who are striving to make the world's biodiversity data freely available.

About 200 international visitors are expected at the Global Biodiversity Information Facility (GBIF) Governing Board Meeting in October. GBIF is a new international organisation, which aims to establish free access to the vast storehouse of biodiversity data and information currently held in museums and research institutions.

Already in its three-year life GBIF has established a Web-based data entry point with links to more than 40 million digital records of species and specimens. By the end of the year GBIF expects more than 100 million records to be freely available.

The Governing Board Meeting will bring together representatives from 40 countries and more than 25 other organisations. Participants are from major museums, research institutes, government ministries and non-governmental organisations.

The meeting will also launch the Pacific Biodiversity Information Forum (PBIF), a new member of the GBIF family. PBIF will deliver biodiversity information to the Pacific Islands. Many of the developed countries around the Pacific Rim hold significant data



GBIF Governing Board delegates meet in the Ethnobotanical Garden in Oaxaca, Mexico, the site of the April 2004 meeting.

and collections from nations where access to databases (and the computer hardware and software they require) has been a major constraint. PBIF will allow access to that information while collections remain in secure storage.

GBIF has an ambitious five-year agenda to make knowledge on species available for varied uses. These include support for conservation, biosecurity, education, biotechnology and sustainable development.

Landcare Research scientist Dr David Penman is the head of New Zealand GBIF's Governing Board delegation. Dr Penman says the meeting is an opportunity to showcase New Zealand's leading role in managing biodiversity information for a wide range of purposes, and will put our work on databases

and collections in the spotlight.

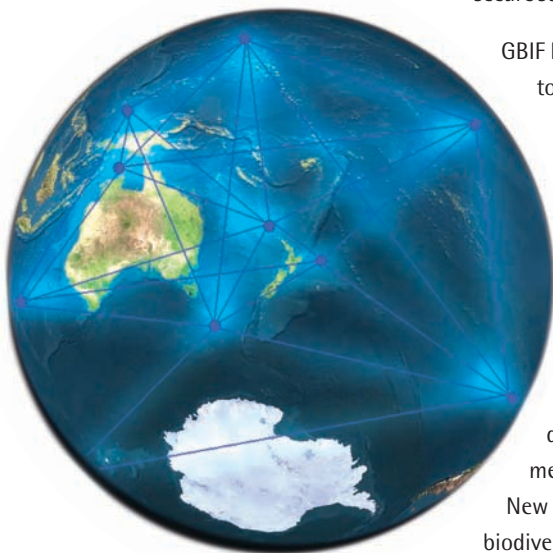
Displays and demonstrations will feature during the week of the meeting.

**GBIF Governing Board Meeting, Museum of New Zealand Te Papa Tongarewa, Wellington, October 4–8**

**Sponsors include MORST (Ministry for Research, Science and Technology) and the Department of Conservation.**

**For more information on GBIF, see *Discovery*, Issue 9, April 2004 or contact the editor.**

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## Biodiversity Books 'R' Us

Taxonomic books are the definitive references for naming and identifying plants and animals. They are essential tools for much of the biodiversity and biosecurity work done in New Zealand. Landcare Research has a dedicated section called Manaaki Whenua Press that produces, publishes and distributes New Zealand's foremost taxonomic works on plants, fungi, and invertebrates.

Manaaki Whenua Press inherited the taxonomic publishing tradition from DSIR, along with the first seven *Flora of New Zealand* volumes and 25 issues of the *Fauna of New Zealand* series.

The work on these ongoing catalogues of New Zealand's biodiversity has continued over 12 years, and there are now 51 issues in the Fauna series, eight titles in the Flora, and three in the new *Fungi of New Zealand* series. All three series have more titles being written or in production.

New Zealand's unique flora and fauna attract leading experts from all over the world who want to study our wildlife and contribute to the Flora and Fauna series. Readers of these authoritative publications

include Ministry of Agriculture and Forestry officers needing to identify potential pests, Department of Conservation fieldworkers undertaking ecological surveys, and keen amateurs simply wishing to find the correct name for a plant.

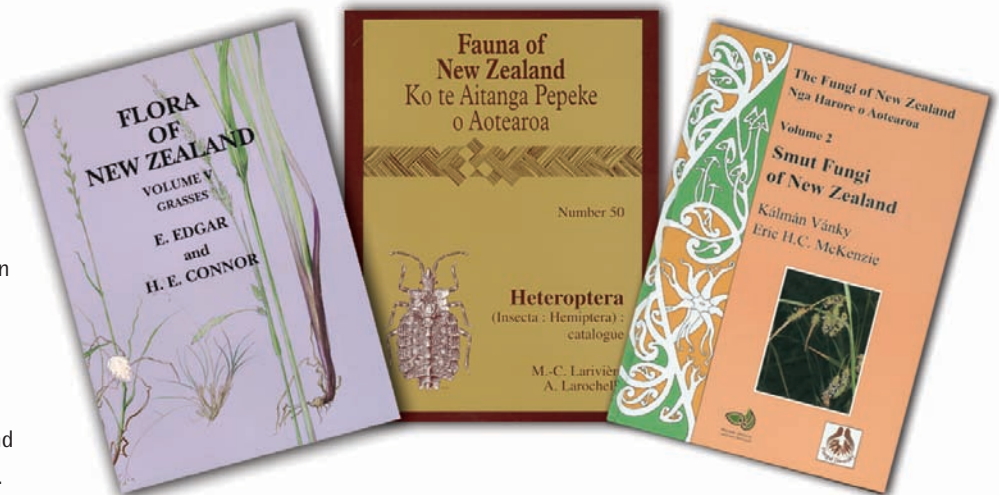
New Zealand Flora series online:  
<http://floraseries.landcareresearch.co.nz>

New Zealand Fauna series online:  
<http://faunaseries.landcareresearch.co.nz>

Manaaki Whenua Press has an online bookstore at [www.mwpress.co.nz](http://www.mwpress.co.nz), or contact Greg, Cath or Gail at the Lincoln office: (03) 325 6700.



Manaaki  
Whenua  
P R E S S



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