



DISCOVERY

October 2007 ISSUE 18

New Insights into Climate Change



Dr Margaret Barbour is studying the exchange of carbon between vegetation and the atmosphere.

Cutting-edge technology is helping savvy Landcare Research scientists Dr Margaret Barbour and Dr John Hunt gain revolutionary insights into New Zealand's soils and leaves and the role our plants play in global climate change.

It's courtesy of the new stable isotope Tuneable Diode Laser Absorption Spectrometer – the only one of its type in the Southern Hemisphere – that's now up and running and supporting the work of Landcare Research's internationally respected Global Change Processes scientists.
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Celebrating Science Success



Recently I witnessed an inspiring display of tenacity, passion and energy from a cross section of business people attending an awards expo. On the face of it, many of them appeared to share little in common except a vision of success for their business or organisation.

It struck me that many of our scientists share these same attributes. Over the past year they too have been recognised and celebrated by industry and colleagues for the outstanding contributions they have made to business, government, society and their field of science.

Landcare Research scientists are deeply committed to a worthy cause – that of finding ways to enhance quality of life for New Zealanders, by protecting and restoring our unique biodiversity, helping businesses reduce their environmental impact and improve profitability, eradicating pest and weed threats, managing our natural capital as we approach its biological capacity, and addressing the risks posed by climate change. And, like Edison undertaking his 1000th attempt to develop the electric light bulb, they too have struggled and persisted with experiments, often in remote places and under harsh conditions, to obtain data that provide new insights into the way our land environments function. Their tenacity and ability to overcome the unforeseen is founded on a firm conviction that science can make a real difference to improve public policy, management practice, education, and environmental technologies.

Landcare Research has all the requirements for undertaking world-leading science: the people, the equipment and infrastructure, and the collaborations.

It is a pleasure in this issue of *Discovery* to celebrate some of our successful scientists and their work that is bringing tangible benefits to all New Zealanders. I hope their work inspires you to think and act differently with respect to sustainability.

Warren Parker, Chief Executive

Briefs



CarboNZero keeps on growing

Media interviews, like the one pictured above, are just part of the job for Professor Ann Smith (left) and the carboNZero programme team as public and business interest in carbon neutrality and sustainability continues to grow. There are now more than 350 organisations and individuals involved.

New waste management system

Lincoln site manager Gordon Burrows (second from left) has been busy establishing the waste minimisation programme. Recycling stations have been set up in each building to collect paper, mixed recycling, confidential documents for destruction, and waste-to-landfill. Furthermore, all office rubbish bins have been removed!

Key appointment

Lincoln scientist Dr Graham Nugent (centre) has been appointed to an independent panel by the Minister of Conservation to explore future management of wild deer, chamois, tahr and pigs. The panel was established to explore how the animals could be

managed to improve the conservation of native biodiversity but also recognise the value of the animals to recreational hunters and others.

Future Scenarios

Landcare Research's Scenarios Working Group has relaunched its popular forward-thinking book *Work in Progress* (Dr Bob Frame, second from right). It explores future scenarios to enable people to think about the long term impacts of decisions made now concerning natural resources, social structures and economic growth. Available from: www.mwpress.co.nz

Hot Science

The Hot Science series continues its meteoric rise in popularity (right). More than 3,000 people packed the James Hay Theatre over three nights to debate issues including climate change and water use. The aim is to increase public interest in key issues and highlight the role of science behind the topics.

Unveiling Secrets of the High Country

Molesworth Station, spread across almost 200,000 hectares of Marlborough high country, is slowly sharing its secrets.

Researchers from Landcare Research and the EpiCentre at Massey University led by Dr Andrea Byrom have made discoveries that could have big impacts on management of high country lands both in the northern South Island high country and further afield.

They've just completed a 3-year contract for the Animal Health Board studying the animals and habitats requiring control in order to cost-effectively eradicate bovine tuberculosis (Tb).

The requirement for this information was simple; Molesworth is too large to impose blanket coverage control – such as with aerial 1080 drops – and therefore managers need reliable information to target specific areas.

By studying where the vector species – possums, ferrets and wild pigs – live, as well as their movements between catchments and interactions, Andrea's team established that a pest control strategy targeting specific habitats and a narrow range of altitudes containing the highest densities of possums and ferrets would be successful.

That means a high country property like Molesworth, or other high country land, would not have to undergo broad-scale, extensive control operations. In the future, researchers will have the ability to advise land managers and farmers which habitats and species

to target, and in doing so save them significant money and management time.

'So you can pick and choose areas, and the entire aim of the project was to reliably identify those areas for managers so that they could focus on these habitats, altitudes and species,' Dr Byrom says.

'Therefore managers can get the "best bang for their buck" in reducing prevalence of Tb and transmission of the disease back to livestock.'

The information has been collated onto a 3-D terrain model on DVD that allows managers to literally fly through every valley on their property and look at where the high-risk areas are.

Dr Byrom says the findings have profound implications for land managers because for first time they can make fully informed decisions about which areas are at greatest risk of containing Tb and can therefore target them first.

'With any resources remaining, they know where else to target to increase the chances of reducing vector numbers.'

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Landcare Research staff take a break to admire the Molesworth Station study area.

New Insights into Climate Change (continued from Page 1)

The device accurately measures the exchange of carbon between vegetation and the atmosphere, using naturally occurring, non-radioactive isotopes of carbon and oxygen as tracers. It provides this information in unprecedented detail and in real-time.

And the machine is quickly proving its worth, says Dr Barbour. Previously, measurements of this type were made off-line in the laboratory, with the cost of analysis severely limiting the number of samples able to be taken. The new instrument will increase this by at least 1,000 times and vastly improve our understanding of ecosystem carbon dynamics.

Because the carbon exchange of individual leaves and soil can be measured as well as the exchange of entire ecosystems, the technology provides significant information on processes at a range of scales. That means the laser will help us construct carbon

budgets for different types of vegetation, which will provide more certainty for greenhouse gas accounting.

'It can measure carbon being released by an ecosystem and determine whether it is old or new carbon.'

'For example with climate change, we would expect that an increase in temperature would bring about an increase in plant and soil respiration rates. By carrying out tests at different temperatures we'll be able to tell whether plants in the ecosystem are cycling carbon faster or if we're losing old carbon from the soil.'

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Government Rewards R&D

New Government legislation, due to take effect in April, will make it more attractive for external clients to utilise Landcare Research's extensive science and knowledge base.

At the most basic level many companies will be able to claim as a tax credit or cash refund 15% of their R&D costs. To qualify, the research and development activities must be systematic, investigative and experimental. They must seek to resolve scientific or technological uncertainty or involve an appreciable element of

novelty and be directed at acquiring new knowledge or creating new or improved products or processes.

The changes are intended to increase the overall intellectual property pool in New Zealand, and improve productivity and international competitiveness.

For more information:
<http://newzealand.govt.nz/>



Scientist Dr David Whitehead speaking to the Hot Science forum. New rewards will make it easier to utilise Landcare Research knowledge and skills.

Wildlife CSI

Scientists have perfected the use of DNA to identify the perpetrators of serious crime – including murder – in the animal kingdom.

It sounds like the basis of a Hollywood blockbuster but it's happening in New Zealand and can significantly enhance efforts to protect our most threatened species.

Scientists at Landcare Research now have the ability to use a range of DNA tests, adopted from human forensics, to establish what species was responsible for the killing. Field samples from which DNA is extracted include feather fragments, eggshell remains, snagged hairs and even saliva remnants on a carcass of a dead animal. And, in some cases, the scientists can identify exactly which individual animal undertook the crime.

'This is a useful application when it's not known whether the predator is a dog, cat, rat or stoat – which is often difficult to determine from the remains,' Research Leader Dr Dianne Gleeson says.

Until now, it was only possible to determine cause of death and then make assumptions about what was responsible. However, through collaboration with the Wildlife Health Centre at Massey University these new techniques can be used to validate post-mortem analyses of native species.

Dr Gleeson says knowing the identity of the predator can be extremely useful in situations where the death of a native bird has

occurred in an area that is undergoing intensive pest management or in an area previously thought to be free of pests.

'This can inform managers about whether those control operations are being effective against the target pests or whether the deaths are due to a new or unexpected predator.'

Scientists have developed DNA methods to genetically 'fingerprint' pest species such as possums, stoats and feral cats, using non-invasive methods. Special sticky 'hair traps' are used for mammalian pests to pull out strands of hair with DNA-rich follicles attached, while DNA derived from faecal samples is being used from possums.

The information is then added to a database that provides information on what the pests have been doing, where they're moving to, and potentially, whether they've been dining out on other species.

These genetic methods also provide opportunities to obtain further information about pest populations, such as dispersal rates and mating systems (relationships between individuals). These data help in designing better control strategies as well as in monitoring the effectiveness of current pest control programmes.

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Crime scene scientists Dr Dianne Gleeson (Left) and Dr Robyn Howitt.

Research into Alternative Possum Control Methods Vital

Landcare Research's studies into alternative methods of possum control have been given a significant boost following the Environmental Risk Management Authority's (ERMA) review of the ongoing use of 1080 poison.

ERMA announced it will impose a new management regime for the use of 1080, including a requirement that all aerial operations using the poison be reviewed on completion by ERMA staff.

Dr Phil Cowan, leader of Landcare Research's Pest Control Technologies Team, says ERMA's call for further research to be undertaken into alternative methods of possum control, methods of application of 1080, and into some of the effects of 1080 is highly significant.

Landcare Research scientists are already undertaking a range of world-class projects to reduce possum numbers and minimise any negative impacts of 1080.

These include studying different methods of spreading 1080, and just how much needs to be applied.



Andrea Byrom

Alternative methods to reduce possum numbers are back in the spotlight.

Landcare Research, as part of the National Research Centre for Possum Bio-control, is also undertaking studies into fertility control of possums that, if successful, could potentially reduce the extent to which toxins such as 1080 are required.

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Science Supports Forest Regeneration

Research in Tūhoe forests in the central North Island is delivering valuable knowledge about indigenous forest ecosystems and giving Māori landowners tools to restore and preserve their native forest resource.

Landcare Research scientists have been working with the Tuawhenua Trust and the Foundation for Research, Science and Technology to investigate why some canopy tree species in the 10,000 hectares of land dotted through the Urewera National Park and managed by the Trust are not regenerating adequately.

With around half the Trust's forests previously logged and half intact, researchers had a unique opportunity to make comparisons. The forests are characterised by an abundance of tawa, with occasional other species, many of which were milled when demand for native timber was high.

Researchers have been studying what influences podocarp regeneration in logged forests. This includes determining the fate of seeds in the forest, examining how seedling distribution relates to soil, the influence of light and competition from other plants,

and the effects of a dramatic decline in the number of seed-dispersing kererū.

The results so far, says science team leader Dr Rob Allen, indicate that once tall trees like rimu were logged, tawa grew into the space and it is now often too dark on the forest floor for podocarp seedlings to thrive.

Other factors compound the problem, such as a proliferation of predators like possums and rats that eat the seeds and seedlings. Work is being undertaken to study this.

Dr Allen says a number of restoration measures are planned or under discussion, while the research continues. Measures include planting podocarp seedlings in places with the right mix of conditions for them to survive and a possible trial removal of selected tawa trees to enhance regeneration of other species.

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Recognition of Leadership

Landcare Research scientist Dr Alison Collins has made history by becoming the first scientist to win the Southern Region Young Executive of the Year, an award presented by the New Zealand Institute of Management.

And now the Palmerston North based science team leader is preparing for the national final next month.

The contestants were judged on their outstanding qualities, innovative approaches to problem-solving, along with team leadership roles, technology utilisation, and contribution to profit and turnover of the business.

Alison leads a team of 40 scientists throughout New Zealand and manages a science portfolio worth \$8 million per annum. Her work provides new insights in an area of critical importance: what influences the health and productivity of our soils and landscapes? These underpin about \$20 billion of exports in the primary sector and tourism.

'I am passionate about doing excellent science, especially in the

soils and landscapes area, and leveraging from this to make a difference to New Zealand's future,' Dr Collins says.

'It is sometimes a challenge to get our science into the conscience of the public, policy or industry communities, but it is something I thrive on, because ultimately I know our science can protect and enhance our environment, economy and society.'

Reg Gartners, Chief Executive of the Institute of Management, says he was impressed with Alison's leadership and success.

'Our region has won the national award eight times out of the last 12, and we are hopeful Alison with her outstanding track record can take the top prize for us again this year.'

We'll find out on November 29.

Dr Alison Collins

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Dr Alison Collins, recognised for outstanding science and leadership.

Climate Change Pioneer Honoured

A long-standing Landcare Research staff member who pioneered greenhouse gas research has been honoured for his work.

Dr Francis (Frank) Kelliher has been appointed to the newly created position of Professorial Research Fellow, Soil and Environmental Sciences, at Lincoln University.

The research secondment means Dr Kelliher will work for the university one day a week to develop and pursue collaborative research, undertake soil and environmental physics lectures, and supervise postgraduate students.

He will continue to be employed by Landcare Research, conducting ongoing research on the measurement of ruminant

animal methane and nitrous oxide emissions from farms and carbon exchange between land and the atmosphere.

Dr Kelliher has worked at Landcare Research since it began 15 years ago and for the past 13 years as a contracted lecturer at Lincoln University.

Dr Kelliher says he was taken aback when informed of the position, but thrilled at the honour.

'I think it is an acknowledgement of the many connections between Landcare Research and Lincoln University. Greenhouse gas research has been a longstanding and valuable focus for us.'

Dr Frank Kelliher

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Dr Frank Kelliher, equally at home on the farm or in the lab.

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