Landcare Research
Manaaki Whenua

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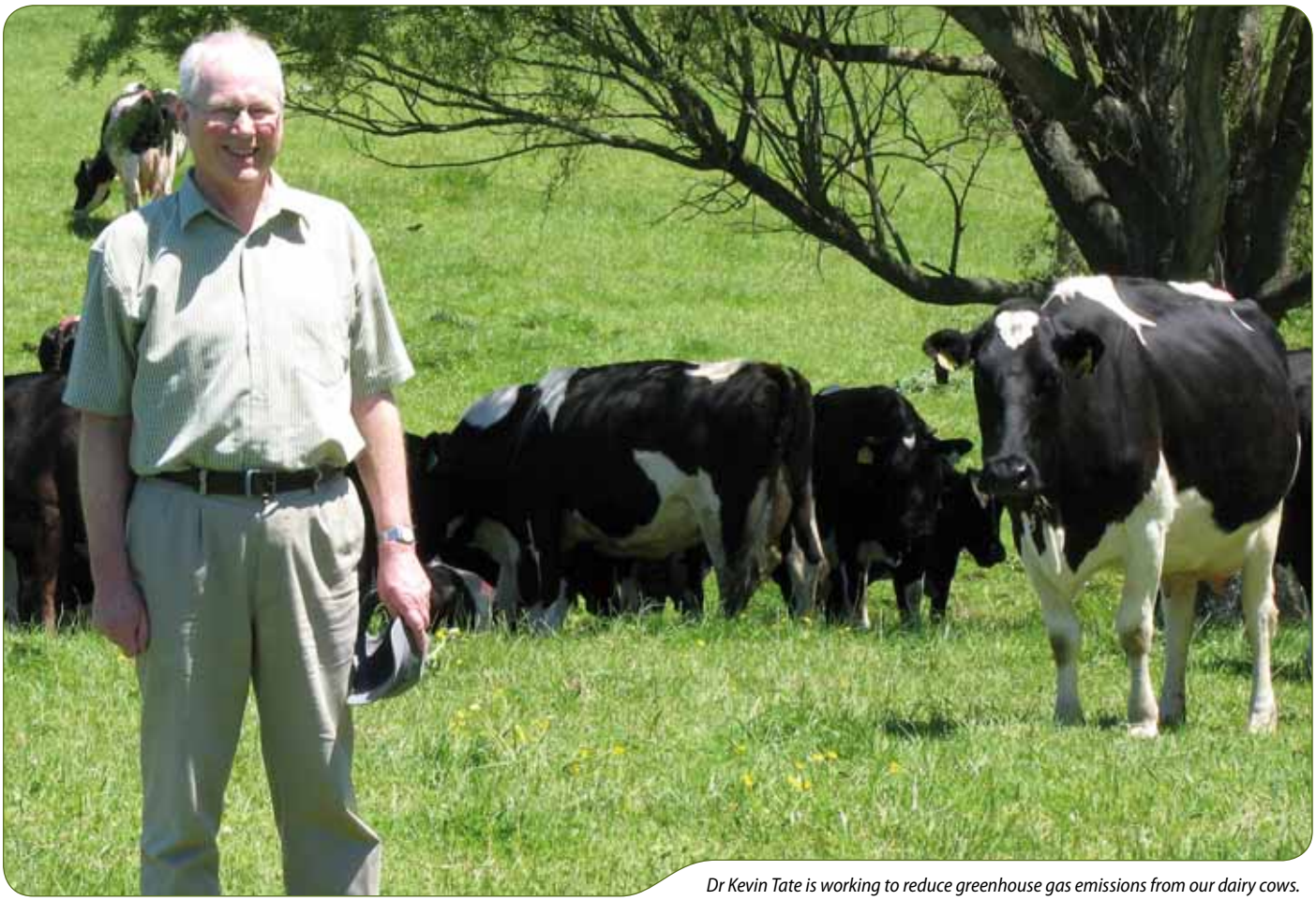
Is Soil The Saviour?



Dr Kevin Tate is working to reduce greenhouse gas emissions from our dairy cows.

Landcare Research scientists are undertaking innovative approaches to try and curb the country's agricultural greenhouse gas emissions.

The work, led by Dr Kevin Tate is combining new on-farm technology with advances in what we know about our soils.

This leading edge science has come through ongoing research with a molecular biologist from the Macaulay Institute in Aberdeen into methane absorbing soil bacteria known as methanotrophs. *(continues page 4)*

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Research To Meet Global Challenges

The burgeoning demands of the Indian and Chinese economies and concerns about energy security and impacts of climate change focussed my attention and, I hope yours, on the earth's capacity to continue to meet the apparently insatiable needs of a wealthier and more populated world.

The UNEP Global Environment Outlook report, released in October, notes persistent environmental problems of climate change, deteriorating fisheries and extinction of species. These themes were reinforced with mid-November's release of the final UN Inter-governmental Panel on Climate Change (IPCC) update. Both reports concluded that if these huge challenges are not addressed then our survival may well be threatened.

The pace and extent of change since 1987 is enormous: the world population has grown 34%, average incomes have increased 40%, trade has trebled, annual global emissions of CO^2 have risen by about one third, and one in 10 rivers now fail to reach the sea because of upstream drawoff. And, if current trends continue to 2025, 1.8 billion people will face intolerable water shortages.

Food demand is projected to increase 2.5-3.5 times, energy supplies have become more 'inadequate and insecure' and their consumption is contributing to global warming to the extent 'the Earth's climate has entered a state unparalleled in recent history'. Many more sobering statistics and trends are covered in the report - but there are also great examples of initiatives to improve the environment.

The UNEP report indicates that radical change will be necessary and it is in this context that research organisations like Landcare Research have a critical role to play. In this edition of Discovery you will read about some of the things we are doing; more are described in our 2007 Annual Report. (www.landcareresearch.co.nz/publications/annualreport_0607)

The work on biodiversity is of particular significance. While much commentary has been about climate change we need to pay at least equal attention to biodiversity and the vital role it plays in sustaining healthy ecosystems and in providing the food, fibre and other vital services on which we depend. New Zealanders enjoy one of the world's richest sources of biodiversity but the UNEP estimates biodiversity is now declining 100 times faster than in the past.

In the next edition of Discovery I will comment more about the implications of this for our bio-dependent economy and the link between biodiversity and natural capital. In the meantime happy reading, Merry Christmas and please feel welcome to contact us about any of the matters raised in this issue.

Warren Parker, CEO

Briefs

Trent Bell

Scientist Trent Bell (above left) was guest speaker at this year's Mainstream Programme Employer of the Year Award. Mainstream assists people with disabilities find jobs in the state sector. Born profoundly deaf, Trent has had to overcome many obstacles to become one of the country's leading experts on native lizards.

International Meeting of Minds

Young British and New Zealand scientists researching Sustainable Consumption and Low Impact Urban Design and Development will meet in New Zealand in March as part of a new British Council research project in conjunction with Landcare Research.

Climate Change Centre

Study on the implications of climate change have been given a boost following the creation of the New Zealand Climate Change Centre. All nine Crown Research Institutes and Canterbury and Victoria Universities are collaborating to establish the "virtual" centre.

New Collaboration

Landcare Research has signed a new collaboration with HortResearch to work with the horticultural industry to almost double the value of export earnings to $4b by 2010/11. Landcare Research will provide science and technology to assist them in achieving carbon neutral horticulture products with low residues. (above right Warren Parker and Paul McGilvary, CEO HortResearch sign the deal)

Getting The Water Balance Right

Water is a precious commodity and one that New Zealanders often take for granted. But the United Nations estimates one billion people across the globe lack access to quality water supply while 2.6 billion people lack access to basic sanitation.

There are huge challenges in rectifying this situation but a new Landcare Research study has shown how simple it is to gain significant reductions in water use at local scale. And, it has big implications both here and overseas.

In a study funded by the Foundation for Research Science and Technology, scientist Dr Sam Trowsdale has found Landcare Research's Auckland building which opened in 2004 is one of the best-performing in the world for water use – despite the water requirements of research laboratories and glasshouses.

When the building was planned staff wanted to demonstrate how it might be possible to be more environmentally friendly than usual. The building's design therefore considered four urban waters: mains, storm, waste and natural.

Water use is reduced in three key ways, by rainwater harvesting and use of low flow fittings and composting toilets. These are simple techniques that can be employed world-wide, and the results have far reaching implications. In Auckland, the region's water reservoirs are operating near capacity and to supply the growing population other sources will have to be considered.

The key to minimising discharges to the city's sewer and wastewater system was the use of composting toilets. They provide a cheap, low-tech sanitary solution. Compared to a conventional flush toilet they use less water and produce a potentially useful product from a waste material, in line with the principles of sustainability. Composting toilets may better embody traditional views of Maori, who regard land-based disposal of human excrement more appropriate than disposal to waterways.

The building shows what can be achieved to address polluted stormwater runoff. A series of treatment devices manage stormwater from the buildings carpark. Water drains to a bioretention strip which in turn drains to a raingarden. These reduce runoff volume, slow peak flow and remove contaminants.

And two-thirds of the roof area drains to storage tanks reducing stormwater volume and peak discharge to the city's infrastructure. The water collected in the tanks is used in the building to reduce reliance on the city water supply and building a resilient system.

'This is nothing fancy – we often say "keep it simple" - and this could all be translated to other commercial buildings or homes,' Dr Trowsdale says.

'It shows that by using simple techniques we can have resilience in the system and can start to manage our needs and impacts ourselves rather than pass them onto someone else.'

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Landcare Research's Tamaki Auckland building - utilising innovative approches to save water.

Is Soil The Saviour? (continued from Page1)

Dr Tate is now investigating the possibility of establishing bio-filters which will absorb methane emitted from the dairy cows in herd homes.

Herd home shelters can house cows over several weeks such as during a wet spring to avoid pasture damage and soil pugging, and they ensure easier effluent recovery. They are increasingly popular with New Zealand farmers.

Dr Tate's team wanted to apply their knowledge on methanotrophs to the dairy industry, testing whether they could be used in filters to capture methane emissions during milking.

Calculations based on our national dairy herd of about 4 million cows suggested the potential was quite small but the introduction of herd homes could change that.

A Canadian research group in Vancouver at the University of Victoria has offered to collaborate to develop a bio-filter and as part of this have provided unique laboratory-based incubation chambers and an associated analytical system to "farm" methanotrophs for possible application on New Zealand dairy farms and their winter feedlots.

The capacity of biofilters to capture this animal methane is unknown, but a study using a similar approach in Europe recently reported 85% removal of the methane released from a farm effluent pond.

"The aim is to develop prototype biofilters containing active methanotroph for possible future deployment in herd homes on dairy farms, and barns (such as in the Northern hemisphere), to capture animal and effluent methane emissions," Dr Tate says.

So, with this new system now fully automated and in place in Palmerston North, Dr Tate's team are just beginning their next research phase.

Methane produced by cows, sheep and deer contribute about 37 % to our national greenhouse gas emissions and it's a problem because there is currently no practical viable technology available to reduce that figure.

The agricultural sector has just six years before it will be included in the New Zealand government's recently announced emissions trading scheme (ETS), aimed at reducing our greenhouse gas emissions.

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Herd homes are increasingly popular with New Zealand dairy farmers.

The TFBIS Connection

TFBIS is an acronym for a little known science programme that's providing significant benefits for New Zealanders.

The Terrestrial and Freshwater Biodiversity Information System was established as part of the Biodiversity Strategy 2000 and aimed to consolidate and share information about indigenous bidoversity. Landcare Research scientists have made a large contribution to its success.

The Department of Conservation administers the TFBIS programme and since its inception TFBIS has supported over 100 projects. This has enabled the digitisation of many thousands of collection and observation records and of many books and journal articles, supported the information management needs of volunteer-based NGO's and contributed to the development of a number of important biodiversity information systems.

The idea behind it is simple, with a lack of awareness of existing information about indigenous biodiversity, how to manage it and relevant projects and programmes. There has been difficulty accessing the data and information resources that are known to exist due to format and/or the way it is managed. Landcare Research scientists have undertaken TFBIS contracts on databases as diverse as pest plants, fungi and alpine vegetation plots. They've updated the information and made it accessible to managers and the wider public and have done so by good old fashioned detective work.

This includes accessing personal computers and Internet servers, libraries (public and personal), old paper files and datasets, and conversations with others. The information includes books, survey reports, restoration guides, scientific papers, datasets and databases, and personal memories, knowledge and experience. www.biodiversity.govt.nz/land/nzbs/tfbis/tfbis/

Alpine Biodiversity Case Study

Knowledge of New Zealand's alpine biodiversity has taken a big leap forward with the completion of a TFBIS project by Landcare Research scientists.

Led by Dr Claire Newell, the work has improved accessibility to and quality of data held on alpine vegetation plots throughout New Zealand.

More than 3500 vegetation plots were established between the 1950s and 1970s in alpine grasslands and herbfields across the country to monitor contentious environmental and management issues of the day. Biodiversity information was collected on these permanently marked plots and the data are archived in the National Vegetation Survey databank (NVS) which holds vegetation data for more than 60,000 plots in New Zealand's indigenous ecosystems.
(continues next page)

Ellen Cieraad undertaking TFBIS field work in the Waimakariri River basin.

Improving Knowledge in The Pacific

Soil, plant and water analysis throughout the Pacific is being boosted by Landcare Research expertise.

Palmerston-North based laboratory manager Brian Daly who is also secretary of the Australasian Soil and Plant Analysis Council (ASPAC) recently hosted three Fijian laboratory technicians at an ASPAC sponsored training course in Brisbane.

The Fijians are part of SPACNET (South Pacific Agricultural Chemistry Laboratory Network) which is funded by NZAID and SPC (Secretariat for Pacific Communities) and aimed at assisting agricultural chemistry laboratories in the region.

Mr Daly, who has been the coordinator of SPACNET since its inception in 1998 says the aim of the network is to improve the quality of soil, plant and water analyses in eight laboratories in five countries.

'This is important to particularly improve the quality of decision making for fertiliser use to avoid wasting expensive fertilisers and environmental problems caused by overuse,' he says.

With more than 40 years in soil and plant laboratories, Mr Daly brings experience of the simpler methods and instruments that are suitable for laboratories with fewer resources.

The aim of the two-day training course and three day laboratory secondment was to improve performance of a few methods that consistently show a wide spread of data in proficiency testing rounds, remove some of the mystique surrounding soil analysis, provide 'between the lines' information for methods that are notoriously problematic and define the critical steps for ensuring accurate results.

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Participants at the ASPAC training course in Brisbane.

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The profile of alpine vegetation in New Zealand conservation management has been raised significantly by the acquisition of high country land into the conservation estate and growing recognition of environmental issues such as climate change and increasing densities of introduced animal and plant weeds. Understanding the ongoing impact of these issues on our biodiversity is paramount and remeasuring existing permanent alpine plots can contribute to this understanding.

The project addressed three key problems; gaps in the key supporting information archived with each set of plots (metadata) preventing accurate assessments of biodiversity, varying accuracy of plot mapping co-ordinates preventing fast plot relocation and uncertainty over just how representative the plot network was of the country's alpine region.

Dr Newell says significant improvements were made. The metadata upgrade improved and standardised key supporting information archived for all alpine plots. Map co-ordinates were upgraded for key survey areas.

The research also showed plots represented four of the five major alpine land cover classes. Plots were also well represented in two of the three major alpine LENZ (Land Environments of New Zealand) classes but were under-represented in the mountains of Central Otago and the southeastern South Island.

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New Tool in Fight Against Farming Pest

A farming pest that costs millions of dollars in control and lost production every year is about to find life a lot tougher.

A new bio-control - the Californian green thistle beetle - has been released at two sites in Otago and Southland and will target Californian thistles which are acknowledged as one of New Zealand's most invasive and damaging weeds for pastoral farmers.

The thistle is estimated to cost farmers around $32 million every year in control and lost production in the Otago/Southland regions alone through sprays, tractor time and loss of pasture.

Landcare Research scientist Hugh Gourlay says the release of the beetle is not a "quick fix", instead its introduction will need to coincide with ongoing and wider on-farm thistle control.

'I like to compare this to the hare and tortoise. The Californian thistle is like the hare, it arrived and established itself very quickly and has leapt out to a big lead whereas the beetle is like the tortoise; it will act slowly but eventually it may help to win the race.

'The Californian green thistle beetle has the potential to have a major impact on Californian and other thistles because both stages (the adult beetle and larvae) consume so much leaf material. Previous work has shown that if you remove the foliage of the thistle then you also reduce the amount of root material growing below ground.'

Californian thistle spreads via its extensive root system and it's not uncommon to have some roots spreading several metres from a single plant.

Hugh Goulay (centre) talks with land managers at the biocontrol release.

The release marks a significant milestone in the ten-year battle by the Community-based Californian Thistle Action Group (CalTAG), which, alongside the Clutha Agricultural Development Board and Landcare Research, has led the move for improved biocontrol of Californian thistle in New Zealand.

This project has received substantial support from the MAF Sustainable Farming Fund and also from the Foundation for Arable Research, Horizons Regional Council (Manawatu/Wanganui), FRST, Clutha District Council and Environment Southland.

The beetle has been thoroughly tested and accepted as safe by the Environmental Risk Management Authority (ERMA), and Mr Gourlay hopes it will also be introduced to other sites throughout New Zealand.

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The Californian green thistle beetle.

Health And Safety Training

Working around a hovering helicopter was just one task undertaken by field staff during advanced helicopter training on recent health and safety training days.

Over four days, more than 30 staff from different science teams across New Zealand undertook theoretical as well as practical training on a wide range of issues that regularly face parties who undertake fieldwork in a diverse range of locations and environments.

Compliance and Risk manager Celia Pruden says the training is part of the company's commitment to continually improving our health and safety performance and is tailored to suit the specific needs of Landcare Research staff.

'In most workplaces the hazards are reasonably controllable because you're in the confines of a building or factory whereas we're sending people out into places where the conditions are out of our control so we're very reliant on the capability, competence and good judgement of our field staff.

'Our training has to be wide ranging. Topics covered included advanced first aid, field communications, emergency management, rope climbing and the use of four-wheel 'Quad' motorbikes. Some of the tutorials were provided by guest speakers, with others taken by internal staff experts.'

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Helicopter operations and first aid - just two components of Health and Safety training.

Men of Movember

Blokes from all Landcare Research sites proudly took part in this year's 'Movember' movement that encourages men to grow moustaches for the month. Sponsorship of their efforts raises funds for prostate cancer research.

More than $700 was raised by those involved, including Adam Thomas (left), pictured here trying to make a final impression with the judges. He failed, the awards instead going to Gordon Burrows and Chris Phillips.

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