Landcare Research
Manaaki Whenua

DISCOVERY

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Protecting a Diverse Environment

Up close and personal; researcher Kate Ladley with a Central Otago common gecko.

Dryland environments – such as those in parts of Central Otago - contain some of the most transformed, least protected and most threatened native ecosystems and species in New Zealand. However, they're under threat with less than 2% of the estimated 50,000km^2 dryland zone being legally protected.

That is why research and field work like that pictured above is so important. (*continues page 4*)

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The Importance of Natural Capital

In the last edition of *Discovery* I introduced the concept of natural capital and briefly mentioned its critical importance to New Zealand's successful future. The term natural capital emerged during the 1990's and was extended through books such as *Natural Capitalis* (1999) and *Capitalism as if the World Matters* (2005). Natural capital in its simplest form compares natural resources and ecological processes to 'money in the bank'. Natural resources have biological limits – either because they are finite (i.e. non-renewable such as fossil oil and land) or because the biological processes for their renewal such as reproduction and growth restrict their rate of replenishment (e.g. fish, timber). Nature also provides ecosystem services; a forest, in addition to wood fibre provides water storage and habitat and helps in the regulation of the atmosphere and climate. A range of market-based instruments for ecosystem services – such as for carbon, water and nutrients – have been established to encourage better use and care of natural resources. This trend is set to accelerate.

New Zealanders until recently have enjoyed a relative abundance of natural resources and only modest restrictions have been applied to their use. Fishing quotas, introduced with much consternation in October 1986 were an early and world-leading attempt to manage New Zealand fisheries at a sustainable level. We now recognise the wisdom in this, even with still incomplete information about the dynamics of marine populations and the multiplicity of factors that influence these over time. We see more vividly problems of over allocation of water and the pressures of urban expansion on our, often highest quality, land. Constraining resource-use where previously only light or no regulation applied is contentious; reducing or reallocating the use of natural resources from those who first secured a right to their use to a higher value and/or more sustainable uses is typically fraught with legal challenge and vitriolic debate.

Despite these difficulties most people appreciate that continuing to manage our natural capital as we are now is neither equitable to future generations nor a sensible way to support a vibrant economy in the long run. Not surprisingly, industries dependent on natural resources increasingly appreciate that their "license to operate" with the wider public and the prices they receive from the market are dependent on the effective stewardship of all of the assets under their care.

These are some of the reasons why natural capital is central to the science undertaken at Landcare Research. The concept of natural capital builds a bridge between the environment, economy and community. It shapes our vision, "Quality of life and economic well-being from healthy land environments" and enjoins us to build strong links with business and communities. Effective stewardship of natural resources in the context of a modern, export-orientated economy requires an excellent understanding of how ecosystems work and how they respond to different policy instruments and management practices – all areas where we have world-leading science.

Balancing the conflicting demands of growth necessary to maintain an economy that provides a standard of living that makes New Zealand a most attractive place to live and work is very challenging. For that reason we continuously seek fresh ways to bring our best scientific talent together with those in the government and business sectors to find fresh solutions to, often old, problems. We are excited by the enormous increase in contact with companies and organisations through programmes such as carboNZero – they have brought new insights into where we should direct our science and how we can work more effectively to meet end-user needs. It is in this spirit that we always welcome your feedback and suggestions on any of the topics presented in *Discovery* or our website (www.landcareresearch.co.nz). In the next edition of *Discovery* I will elaborate further on the development of markets for ecosystem services.

Warren Parker
Chief Executive
Landcare Research

Re-defining the Big Ice

New Zealand scientists have taken a big step to ensuring ongoing protection of Antarctica.

Led by Fraser Morgan, Landcare Research scientists have undertaken a classification of the physical environment of the entire continent, which is now considered the leading environmental information database for the continent.

The classification, called Environmental Domains of Antarctica, highlights environmental variables that can be used for a range of management activities in Antarctica including prioritising sites for protection and ongoing environmental monitoring.

As a party to the Antarctica Treaty and its protocol on environmental protection, New Zealand is committed to the protection of Antarctica and its dependent and associated ecosystems.

However, until now there has been no environmental or geographic framework to identify and implement a representative network of specially protected areas.

The new classification builds on the success Landcare Research scientists achieved in developing a classification of New Zealand's terrestrial environments (Land Environments of New Zealand or LENZ) and utilised eight environmental variables including temperature, solar radiation, wind speed, geology, land cover and slope.

"Protected areas are important worldwide, Antarctica included, and we are increasingly developing a systematic approach to ensure they truly represent values we need to protect," Dr Harry Keys from the Department of Conservation says.

"We need a good, solid scientific rationale to make protected areas fit into a wider system."

While the idea of an environmental classification for Antarctica is not new, the ability to create an objective classification has come about in the last 5 years through the combination of increased computing power and access to a variety of climate and geology databases. Mr Morgan says two key differences are apparent with the new approach.

"Firstly, numerical data layers are used to describe various fundamental aspects of Antarctica's climate, ice cover and geology. Secondly, a computerised classification procedure is used that allows similar environments, including small distinctive environments that are otherwise easily overlooked at the continental scale, to be grouped based on their environmental character regardless of their geographical location."

Antarctica New Zealand's Environmental Manager Neil Gilbert says the framework solves a "nutty" problem – developing a consistent framework for protected areas - that had perplexed the Antarctic community for a decade. Treaty members will decide in June whether to adopt the framework.

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The grandeur of Antarctica, worthy of greater protection

Protecting a Diverse Environment (continued from Page1)

Today's mixed native-exotic dryland communities have been created in the past 800 years, are unstable, and derived from fire-sensitive shrubland and dry forest ecosystems. With reductions in fire and grazing, many naturally revert to a variety of woody states, generally without passing back through tussock grassland. These new woody communities are mixtures of native and exotic species with variable seed sources, dispersal agents, pests and weeds.

Landcare Research leads a dryland research programme that aims to build an understanding of the ecology of dryland woody plant species – such as present distributions, succession pathways and rates, traits, and factors that control and limit their spread. Researchers want to apply this knowledge to develop and test low input methods for facilitating indigenous woody plant succession in the field.

The programme is also investigating effects of re-establishment of woody plants on the security and abundance of native species. The recovery of woody vegetation may provide native species with increased food sources, shelter from climatic extremes, and refuge from predators. Lower rabbit numbers than in grassland might mean fewer large predators, and the need for conservation intervention to maintain many threatened species may be reduced. To test these ideas, biodiversity surveys like the one pictured above are a key strand of the project.

These surveys aim to quantify the bird, lizard, invertebrate, and plant biodiversity associated with different woody communities in the dryland zone, so researchers can better understand benefits and drawbacks of woody succession, and predict some of the changes that will occur in indigenous communities as succession proceeds. Each survey of the biodiversity is a big undertaking, says researcher Dr Deb Wilson.

"We generally have eight staff for eight or nine days at each site and because we're looking across different biotic groups we require a variety of specialist skills and expertise. The terrain is rugged and the sites need to be extensive in order to adequately sample the different groups of animals, particularly birds with their large ranges. Therefore the logistics of such a survey are considerable."

Project leader Dr Susan Walker says the dryland research programme is hugely important.

"Many indigenous species are regionally threatened, concentrated in small refuges, with reduced regeneration, compromised genetic structure, and limited resilience, and are progressively disappearing from regional gene pools. Although strongly modified from their original states, remaining dryland communities and species are of major significance, representing all that remains of a unique and diverse ecological zone and its potential for restoration," she says.

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A Central Otago ground weta.

Kate Ladley & Kev Drew talk tactics.

Ground-breaking 1080 Research

New work by Landcare Research shows that in future 1080 application levels could potentially be reduced by 80%. Two years of field trials in central North Island managed good possum control using only a few hundred grams of poison bait per hectare.

Further work is required to refine the innovative approach, but the results have immense significance for aerial control operations, including substantial reductions in the amount of toxin being applied to the environment, which in turn could greatly reduce costs and non-target deaths.

In the 1980s, it was not uncommon for control operators engaged in aerial poisoning of possums to use 10 kg or more of bait per hectare. Landcare Research, funded by FRST, DOC, and AHB, showed that this could be reduced to between two and five kilograms of poison baits per hectare through using GPS in aircraft to ensure more uniform ground coverage along with better quality control of baits.

The recent success with several hundred grams of bait per hectare stemmed from research identifiying the likelihood that some pests survived after eating small pieces of bait – pellets that had broken during sowing, on impact, or had been partially eaten by another animal. It's also likely that some pests were chased away from bait they were eating by other animals.

Previous observations showed a possum that had consumed a small sublethal amount of 1080 would need to find and eat another piece of bait within about half an hour or so for the poison to be effective.

The Landcare Research scientists investigated ways of ensuring almost every pest encounter with toxic bait was a lethal one. They found that both trickle-sowing of bait in strips, and placing it in clusters within strips resulted in as good or better kills of possums, rats and mice than the current aerial method of broadcasting the baits over a wide area.

Landcare Research scientist Dr Graham Nugent says the trials confirmed that with current broadcast sowing methods, pre-feeding and higher sowing rates were needed to get good control of possums and rats. But, more importantly, the trials indentified that the likely reason for that was the need for some pests to quickly find more than one piece of bait to be killed.

"Because 1080 acts quite quickly, some possums and rats needed to find a second bait in not much more than half an hour to get a full lethal dose. Obviously, sowing more bait helps with that, and prefeeding does too by teaching them where to look for bait," Dr Nugent says.

"The problem is largely bait fragmentation. Although baits start out with each one being big enough to kill even a large possum, some break into bits when spun out of the aircraft, or when they hit a tree trunk or the ground. Possums often only eat part of a bait, so you end up with some bait fragments that cannot by

Continues next page

Possums will come under added pressure with new 1080 research

themselves kill the next pest that comes along. Possums and rats may also survive when they get chased away from bait by another animal before they have had time to eat enough bait to kill them."

Dr Nugent and his colleague Bruce Warburton now believe that rather than making sure pests can find two or more baits should they need to, a better solution may be to ensure that every encounter with toxic bait is with an amount guaranteed to be lethal.

To test this idea they compared control effectiveness when bait was broadcast evenly and when it was placed in a small number of precisely sown bait strips or clusters, and found they got as good or better kills of possums, rats, and mice even when the amount of precisely sown bait was 80% less than in typical aerial operations.

"The big advantage of using very little toxic bait is that almost all of it goes into the pests, leaving hardly any to affect other species, which would allay many of the social concerns about 1080. We think this is the future for 1080 over the next decade or so, while we progress our research on new alternatives to further minimise 1080 use," Dr Nugent says.

The latest breakthrough is underpinned by many years of comprehensive research by Landcare Research into possum behaviour and ecology, control strategies and technologies, toxicology, bait quality, and mathematical modelling.

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The Importance of Islands

A leading conservation scientist is urging New Zealanders to think more about the importance and care of our many offshore islands as they fish, dive, boat, sail and swim this summer.

Dr Peter Bellingham says the importance of our islands and seabirds and the role they play in biodiversity, conservation and ecosystem processes is underestimated by many New Zealanders and he's urging some reflection over the summer.

He refers to our islands as the "cradle of New Zealand civilisation" and seabirds as "ecological engineers" due to their crucial yet largely ignored importance.

Islands were historically centres for Maori culture and resource use and over the years have become an important focus for conservation biology such as pest eradications, species transfers and restoration techniques.

Most recently islands have become very important for conservation and research.

That research includes collaboration with Hauraki iwi on management of petrel, studying the ecosystem consequences of rat invasions, better understanding the role of seabirds as ecological engineers and studying the concept of nutrients being spread by seabirds from the sea onto land.

Some facts:
New Zealand is the "seabird capital" of the world.

- **Of the 350 seabird species around the world, New Zealand has 140 .**
- **84 species breed in New Zealand making this the largest seabird fauna anywhere.**
- **35 species breed nowhere else but New Zealand.**

Our islands face ongoing threats including new invasions, growing tourism pressure, depletion of fisheries and global change with its effects on sea temperature and sea levels.

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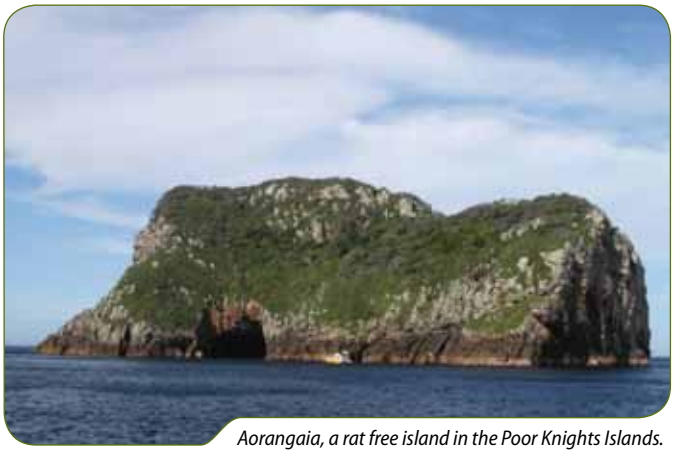

Aorangaia, a rat free island in the Poor Knights Islands.

Developing Rural Māori Tourism

Tūhoe tourism is taking off thanks in part to the contribution of Landcare Research staff.

Several businesses that showcase Te Urewera National Park's natural beauty and strong Māori heritage have been established and supported during a four-year programme funded by the Foundation for Research, Science and Technology (FRST) to help rural iwi develop new Māori tourism products and businesses. Another two businesses in the area have used the programme to strengthen their own business opportunities.

The project, led by Dr Chrys Horn, focuses on fostering the development of Māori tourism through learning how to work with businesses to understand their needs and researching demand for Māori tourism and demand for products with some Māori "flavour".

The work had two key components; establishing what activities tourists are interested in, and overcoming barriers to Māori participation in tourism ventures.

"Initially we explored the issues they are facing and the problems they have encountered in trying to develop business," Dr Horn says.

Dr Horn says those barriers include the extreme isolation of Te Urewera National Park and poor infrastructure such as lack of phone coverage and poor roading.

"It is clear that it takes more to run a business in an isolated rural area than in city because simple issues that many of us take for granted become major impediments – lack of access to lawyers, accountants, agents and marketing professionals. It's also difficult to participate on training courses because that involves travel to distant centres like Rotorua and Whakatane."

Researchers also aimed to help individuals plan and establish tourism businesses. They evaluated how to help businesses deal with the information being produced and sought to understand more how people learn about business and to see what strategies are needed to get people through the problems they strike.

"Anyone who has capacity gets a lot landed on them. If you're a natural leader and if you have good networks you'll be asked to do a great deal. You'll be the person people come to for help and it's quite hard for those people to say no."

Already there's interest in the research from other Māori groups investigating the establishment their own tourism initiatives and Dr Horn believes that signals a positive future.

"It's not just development of a business, it's development of a network and helping them think about bringing people together to get the word out and bring customers in."

http://www.teurewera.co.nz/index.htm

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Exploring a quiet spot in Te Urewera National Park

Scientist Releases 'Bible' of New Zealand Lichenology

The Flora of New Zealand Lichens, revised second edition, is the result of 11 years' work by scientist Dr David Galloway and provides an updated and definitive guide to one of the country's most prolific, important and yet least understood part of its terrestrial biota. The two volumes supersede the earlier version he published in 1985 and to the scientific community the new edition is the bible of New Zealand lichenology.

Lichens are fungi that have evolved a specialised mode of nutrition and are primary colonisers. They are common in all New Zealand landscapes, from inner-city footpaths to the summit rocks of Aoraki Mt Cook and cover surfaces as diverse as rock, tree bark, and buildings.

Lichens are extremely sensitive to atmospheric and terrestrial pollution and have an important use as biomonitors of environmental health and change. They are also important in grassland and forest ecosystems as major nitrogen fixers, acting as biological fertilisers, and they have potential value in processes of ecological repair and restoration.

Dr Galloway has spent his working life studying lichens of New Zealand and the cool temperate Southern Hemisphere and is renowned throughout the world for his expertise. The revised information is also available free online.

Dr David Galloway and his wife Patricia (R) with Ilse Breitwieser at the book launch

Available from

Manaaki Whenua Press
mwpress@landcareresearch.co.nz
Price: $79.99 plus p + p

Iconic Native Species Takes Important First Foothold

Scientists from Landcare Research have discovered what they believe is the first tui chick to hatch and fledge within Hamilton for several decades.

The discovery follows ongoing research into the popular and iconic native bird which usually only visit Hamilton during winter months before disappearing from the city to nest in large native forest areas around the Waikato over the summer months.

But, a female nicknamed Casper has bucked the trend and not only established a successful nest in the Hamilton Gardens but successfully fledged the chick. Scientist Corinne Watts says it is an exciting find and one that holds significant promise for more tui to return to the city to nest.

During winter 2007, tui were caught in Hamilton city and fitted with coloured leg bands and miniature radio-transmitters to follow their movements, observe their diet and discover which native forest areas they returned to nest in.

"In June Casper was caught in the Hamilton East Cemetery and over the next 5 months her movements were studied as she fed on Banksia, camellia, kowhai and flax around Hamilton," Dr Watts says.

"Unlike all the other tui followed during the study, this female and her unbanded mate stayed in town and were subsequently found to be nesting in Hamilton Gardens. Recently, we checked the nest and found the chick had fledged."

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