Manaaki Whenua
Landcare Research

Landcare Research
DISCOVERY

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What's Inside:

Managing New Zealand's wildlife: balancing impact, value and use

In December New Zealand will host the largest meeting of wildlife managers and researchers ever assembled in the Southern Hemisphere. The Third International Wildlife Management Congress will see over 900 delegates from more than 50 countries gather in Christchurch to discuss a wide range of concerns relating to the conservation, use and control of the world's wild animals. An issue likely to dominate these discussions is how the increased public profile of wildlife has created an expectation of a greater public say in how it is managed. In this edition of *Discovery*, we look at several projects where Landcare Research is responding to this expectation by blending traditional research approaches with the interests and activities of different community groups and wildlife management agencies.

The decline of native birds such as tūī and bellbird in our urban and peri-urban environments has prompted a community-based project in Canterbury and Waikato on finding ways of getting these iconic songbirds back into our towns and suburbs. Early results highlight the importance of nectar- and fruit-producing native vegetation within urban areas. Another native bird at risk is the native pigeon, or kererū. To find ways of ensuring its persistence on Māori communally owned land, and surrounding forest and farmland, Landcare Research scientists are working with iwi in Northland, the central North Island, and Canterbury. Previous research demonstrated that kererū numbers increased dramatically following pest control. Given this success, the new phase of research focuses on how pest numbers can be kept low enough that these increases can be sustained.

Sustaining the benefits of pest control is also the focus of the adaptive management programme that Landcare Research is undertaking in collaboration with the Department of Conversation (DOC). The project monitors the effectiveness of DOC possum control programmes that employ different intervals between control operations. Also looking at the effectiveness of pest control, but this time focusing on deer, is a project on which scientists from several research organisations are working with DOC staff to better understand why the response of native forests to deer control is so variable. Early indications are that by overbrowsing the plant species they prefer, deer can produce an environment in which less preferred plants dominate the forest understorey. Under those circumstances, the forest cannot recover to its former condition, even when deer are removed from it.

The public is concerned not just about the impacts of these wildlife pests, but also about how they are controlled. Landcare Research scientists are evaluating the risks that commonly used control methods such as poisons and traps pose to the environment and to non-target species. At the same time, the comparative humaneness of various control methods is being assessed. The results will help management agencies respond to public concerns through their choice of control methods that pose the least risk and are most acceptable.

These and other Landcare Research projects will be featured at the congress in Christchurch. It will be a wonderful opportunity to showcase our innovative approaches to wildlife research and management, and to learn from those involved in this exciting field in other countries.

Dave Choquenot
Science Manager, Biodiversity & Ecosystem Processes

Dianne Gleeson

Photo credits: left to right, Harley Betts 1, 2, 6, 8, Dave Morgan 3, Landcare Research Slide Collection 4, 5, Peter Buchanan 7.

Research to help boost presence of native songbirds

Two of our sweetest songbirds may be coaxed back into our cities, towns and farms in greater numbers, thanks to new knowledge of their habitats, diet and behaviour.

The calls of tūī and bellbirds (also known as korimako) are music to most people's ears – but are not heard as often as many would like. The developed landscapes that people create can be inhospitable to these birds, which are most often found in native bush. A Landcare Research study is establishing what can be done to increase the birds' numbers, and make them more familiar figures in areas where people live.

Landcare Research scientist Dr Bruce Burns says the first steps were to find out where the birds do and do not live at different times of the year, what food they eat, and how they interact with other birds.

"We observed birds in two of their known habitats, Canterbury's Port Hills and Bank's Peninsula for bellbirds and central Waikato for tūī, and colour-banded 73 bellbirds so we could follow their movements. Also, we asked the public to help by reporting where and when they have seen the birds, and what they were feeding on."

The researchers found the birds had restricted distributions over the breeding season: bellbirds were based in bush in the Port Hills and tūī in native forest blocks fringing the central Waikato plains. However, in the non-breeding season, both species were nomadic, and were seen in both urban and rural areas feeding on a wide range of native and exotic plants.

"Tūī visit Hamilton City only from autumn to spring, outside their breeding season," says Landcare Research scientist John Innes. "Nobody has ever reported a tūī attempting to nest in Hamilton, even though exotic plants there provide nectar and fruit year round.

"There may be a learned behaviour that prevents tūī from nesting anywhere but in native forests. Our next questions might be: could we break this pattern by rearing tūī in captivity in urban areas? Or, would significant native plantings in cities be sufficient to tempt them in?"

Meanwhile, bellbirds prefer to nest where there are relatively tall trees, either native or exotic, and with abundant plant food species nearby.

Landcare Research slide collection

Can the tūī be coaxed into Hamilton City?

Peter Reese

A male bellbird. Careful selection of garden trees may encourage bellbirds into urban areas.

"Our observations suggest that they remain in, or return to, the same Port Hills valleys from year to year," says Landcare Research scientist Heather North.

"To attract more bellbirds outside their usual haunts to areas such as your garden, plant nectar- and fruit-producing native trees like kōwhai and five-finger."

The research will continue for two more years, to gain further insights into the lives of these birds. This will include banding and possibly radiotracking of tūī in Waikato, and surveys of tūī within Hamilton City.

"The knowledge we gain will bring more birdsong to our cities and farms," says Bruce Burns.

"Also, there has been considerable collaboration with the general public in both studies, which inevitably leads to education and increased public enthusiasm for caring for the birds."

Funding and support: FRST (Foundation for Research, Science and Technology), Environment Waikato, Hamilton City Council, Christchurch City Council, Department of Conservation.

Contact: Bruce Burns, John Innes
Landcare Research, Hamilton
(07) 858 3700
BurnsB@LandcareResearch.co.nz
InnesJ@LandcareResearch.co.nz
Heather North
Landcare Research, Lincoln
NorthH@LandcareResearch.co.nz

Fight for kererū comeback gains momentum among Māori

The much-loved kererū is the key benefactor of projects making the best use of the scant conservation resources available to Māori to boost native bird populations on their land.

Kererū (also known as kūkupa or native pigeons) are widespread, but their numbers are declining, mainly because their eggs and young chicks fall prey to ship rats and possums. Most Māori want to restore kererū in their forests. However, the land is often communally owned and not in productive use, so there is little or no funding to tackle pest problems. To overcome this Māori increasingly collaborate with agencies such as Landcare Research and the Department of Conservation to find affordable ways to achieve their conservation goals.

Landcare Research scientist Graham Nugent says a project based at Motatau Forest in Northland helped lay the foundation for two further projects in the central North Island and Canterbury. The Northland project had crucial research findings.

"In 1996, we joined DOC staff and Ngāti Hine tangata whenua in a mission to find out how well birds and vegetation recover after pest control," says Mr Nugent.

"We showed for the first time that kererū thrived when possums and rats were maintained at very low numbers. Within four years, kererū numbers had more than doubled. Iwi have continued to protect the birds, and the project has recently evolved to include the Northland Regional Council and local landowners including Carter Holt Harvey.

Ngāti Hine prepare to fill bait stations at Motatau, using transport modes old and new.

"The question now is not whether kererū can be restored, but whether the substantial effort required to keep pest numbers at sufficiently low levels can be sustained in perpetuity.

"The commitment shown by Ngāti Hine towards the concept of kaitiakitanga or Māori stewardship of the forest and native birds indicates that for Motatau the answer is probably yes."

The success at Motatau helped spark a new partnership involving Landcare Research and the Tūhoe Tuawhenua Trust, which aims to restore podocarps (rimu, mataī, toromiro) and kererū in a large Māori-owned forest tract in the Urewera Range, central North Island.

Landcare Research scientist Dr Phil Lyver is helping the trust with the kererū restoration part of this work. "We are in the first year of a six-year study looking at the effects logging and commercial hunting have on the complex interactions between pests and kererū in this forest. We have seen from other studies that removing one pest can cause other pests to increase. Possums, deer and pigs are harvested by the Tuawhenua landowners for food or money. An aim is to try to find a way to maximise the benefits of these harvests for kererū .

Dr Lyver says another important goal is to include mātauranga or Māori traditional knowledge in our understanding of the workings of this forest.

A third related project now involving Landcare Research is the Kaupapa kererū initiative started by Ngai Tahu.

Still in its infancy, this project is steadily expanding to include many agencies and institutions. "Unlike the other two projects, its aim is to restore kererū in a highly fragmented and mostly deforested landscape – that surrounding Lyttelton Harbour," Mr Nugent says.

Landcare Research slide collection

Māori and Landcare Research are helping to build a brighter future for kererū.

"So far, the main focus has been to gather information on kererū distribution and abundance, using a "sighting calendar" distributed through primary schools. This also helps increase the interest of children and their parents in kererū, which in turn helps get the whole community impassioned for the cause.

"Increasingly, conservation is no longer seen as solely a government prerogative. Māori are leading the way in directing research, and developing their own effective stewardship.

"The future of kererū in several parts of the country is looking much brighter because of the knowledge gained and changes made as a result of this work."

The Chair of the Tūhoe Tuawhenua Trust, Jim Doherty, agrees that the future looks bright.

"Tūhoe's long-term vision is to be able to restore kererū as taonga for very special occasions.

"We hope to achieve this through the restoration of our podocarp forest, and we are working strenuously together with Manaaki Whenua."

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

Contact: Graham Nugent
Landcare Research, Lincoln
(03) 325 6700
NugentG@LandcareResearch.co.nz

DNA gives stoats and possums away

Stoat hairs, possum droppings and DNA detective work are helping Landcare Research to get a fix on numbers of our two most "Wanted" pests. The research has already provided the first direct estimate of stoat population density obtained in New Zealand.

Stoats are ferocious predators. They kill up to 60% of all North Island kiwi chicks, and are notoriously difficult to catch. Possums also wreak havoc on native birds, spread bovine Tb, and defoliate forest canopies.

To help manage the threat of these pests, accurate information is needed on the actual numbers present in the field, particularly the numbers surviving control operations. At present, official estimates are based on the number caught in traps, but some animals have become trap-shy or, for some reason, do not encounter traps. This new tool is therefore invaluable in such cases.

Landcare Research scientist Dr Dianne Gleeson says advances in forensic DNA methods have enabled researchers to identify individual stoats and possums from genetic "fingerprints" using hair samples and droppings, respectively.

"Entire hairs with the follicles attached are the ideal samples to extract DNA from.

"To get our stoat hairs, we developed a 'hair trap', made from a PVC tube wide enough for a stoat to enter. The tubes were equipped with rabbit meat to lure the stoats in, and an adhesive-coated rubber band to pull out some hairs."

Research in a southern beech forest near Murchison, using baited tubes placed in a grid pattern, obtained a very high "hit" rate. About 60 hair samples were collected in each of the four weeks of sampling with 98% of these hairs originating from stoats.

"From these data, we were able to estimate a population of 30 stoats in the 9 km^2 area sampled, the first such estimate in New Zealand."

"Unfortunately, possum fur is downy and breaks easily, so hairs do not pull out with the DNA-containing follicles attached. Therefore, we had to use droppings instead," says Dr Gleeson.

"Possum droppings are not ideal, as they contain less DNA. However, they are numerous and far easier to collect, and we found that useable DNA remained in them for up to 27 rain-free days."

Field tests were held in the Hokonui Hills and Catlins Forest, at sites with low possum densities. Leg-hold traps were set for nine nights, and fresh droppings were collected immediately before and after trapping.

"Only one-third of the unique genetic profiles from faecal samples matched profiles from trapped possums, indicating that there were three times as many possums present than were caught in nine nights' trapping. Thus the method gives us a way of translating trap-catch data into an estimate of the actual number of possums left in an area after control.

"Our DNA fingerprinting techniques are a useful tool for monitoring populations of pest animals when other methods may not be accurate or reliable. One of the real positives of the technology is that it may actually be more effective when animal numbers are very low because the same animal is likely to occur in multiple samples. Most other counting techniques become very imprecise at low animal density."

Dr Gleeson says the techniques also have the potential to be applied in other situations.

"For example, we could determine the diet of threatened native species when it may not be obvious through gut content analysis.

"These methods could also be used to assist in identifying the origin of timber suspected to have been poached from protected areas."

Paul Horton

A stoat-hair-collecting tube, showing sticky rubber band to catch the hair.

Bruce Warburton

A stoat entering a hair-collecting tube.

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

Contact: Dianne Gleeson

Landcare Research, Auckland
(09) 815 4200
GleesonD@LandcareResearch.co.nz

Andrea Byrom, Graham Nugent

Landcare Research, Lincoln
(03) 325 6700
ByromA@LandcareResearch.co.nz
NugentG@LandcareResearch.co.nz

Welfare focus helps improve humaneness of pest control

Landcare Research scientists have been assessing the welfare impacts of traps and poisons that are commonly used to control vertebrate pests. The results are helping policy makers decide which traps and poisons are most acceptable, as well as encouraging researchers and manufacturers to design pest control tools which are more humane.

Pests such as possums, stoats, ferrets, feral cats and rats cause extensive harm to our native flora and fauna, and all of these pests are controlled using traps and poisons. However, as Landcare Research scientist Bruce Warburton points out, pest managers have an ethical duty to use the most humane control methods available.

"In future, we can expect increasing pressure for us to develop and use pesticides and traps that minimise unnecessary suffering.

"Our research is assisting the pest control industry to identify the control tools that cause the least pain and distress to the target animals."

Mr Warburton's team used ISO standards and a National Animal Welfare Advisory Committee (NAWAC) guideline to assess the performance of traps. One requirement is that kill traps should render the target animal unconscious within three minutes.

"Most possum kill traps currently available do not meet this requirement. However, excellent advances in kill trap development over the past two to three years mean that traps are now available that can kill a possum in a minute or less. Three of the best new ones, the 'Sentinel', the 'Warrior' and 'Set & Forget', are also very compact and portable – important practical features that traps must also have. These traps are in the early stages of commercialisation, and are expected to sell at similar prices to currently available kill traps.

"Also, in the last six months, several traps have been developed that kill ferrets, stoats and rats almost instantly. These traps represent a significant advance in humaneness, but are not yet commercially available."

Diana Leufkens

Landcare Research technician Nick Poutu sets the "Thumper", a recently developed stoat trap. This trap successfully met animal welfare standards.

The humaneness of restraining traps such as leghold traps has also been assessed, looking at the number and severity of the injuries they cause.

"As a result of these tests, NAWAC has recommended to the Minister of Agriculture that the Lanes-Ace gin trap and larger double-coil spring traps be prohibited."

Landcare Research scientist Dr Cheryl O'Connor's research team has focused on the welfare impacts of vertebrate pesticides.

"Determining the relative humaneness of pesticides is difficult, because each pesticide affects animals in different ways, and therefore each has different welfare implications," Dr O'Connor explains.

"Because of this complexity, we developed a five-step process. We assessed the capacity of the animal to suffer, the anticipated likely effects of the pesticide, the actual effects and their prevalence and duration, and the degree of welfare compromise caused by each effect. Then we compared the relative humaneness of the pesticides.

"Our results show that cyanide is the most humane possum poison, followed by 1080 and cholecalciferol, with phosphorus and brodifacoum being least humane.

Pesticides are selected according to complex criteria including the severity of the pest problem, the target pest, the type of environment, and previous pest control used. However, the new information about the humaneness of each poison can now be factored into decision making," Dr O'Connor says.

"These results have gone a long way towards achieving the objective of finding control tools that cause animals the least pain and distress."

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

Contact: Traps: Bruce Warburton,
Pesticides: Cheryl O'Connor

Landcare Research, Lincoln
(03) 325 6700
WarburtonB@LandcareResearch.co.nz
OconnorC@LandcareResearch.co.nz

Fresh insights reveal extent of deer dilemmas

Can we undo what deer have done?

A fresh synthesis of research into deer impacts on New Zealand forests has provided valuable insights into how deer alter forests, and the extent to which these impacts are reversible. The information helps make sense of why some forests revert to something close to their previous state when deer are removed, while in others, removing deer has minimal conservation benefits.

Seven species of deer have been introduced to New Zealand. The most prevalent species, red deer, now occupies much of the 6.5 million hectares of native forest, while the other six species have more restricted distributions. Deer in New Zealand are without many of their natural predators, and feed on native plants that evolved without specific defences against mammalian herbivores. Their selective feeding on palatable plant species has dramatically changed the composition of some forests.

In response, various governments have invested heavily in reducing deer numbers in the hope of restoring forests. However, the synthesis outlines several situations in which deer impacts may be irreversible.

"One situation is where deer have removed highly palatable species in the forest understorey, enabling the spread of unpalatable species," says Landcare Research scientist, Dr Rob Allen. "Once these occupy the space, they may effectively prevent the re-establishment of preferred species following deer control.

"These effects will last for a long time, because some of these unpalatable species may live for centuries."

Dr Allen says such browsing may eventually eliminate palatable species from patches of forest, and without local seed sources, these species may be unable to re-establish.

"Many of our native trees do not have particularly long-lived seeds, which limits their ability to regenerate from buried seeds.

"Seed limitation may also be exacerbated by the loss of native pollinators and seed dispersers, for example, birds, as a consequence of predation."

Dr Allen says evidence is accumulating that introduced deer also modify below-ground processes and fauna.

"These effects result from deer tending not to eat leaves with high tannin levels and low nutrients. Because of this, a large proportion of these leaves end up in leaf litter.

"These leaves tend to decompose more slowly. This slows down nutrient cycling in forest soils, and changes the composition of insects in leaf litter.

"Such changes may take centuries to reverse."

Although there is great interest in restoring ecosystems, in many cases merely reducing deer numbers below a certain level may have limited conservation benefits.

"In some cases, a greater level of intervention may be required, such as physically removing the unpalatable plant species that have increased because of deer browsing, or overcoming seed limitation by planting seedlings.

"Even then, deer impacts may still be irreversible in some situations."

Dr Allen says reviewing this complex web of interactions between deer and their environments is helping to move the emphasis of conservation from focussing on reverting to the past, to setting realistic goals for the future.

"Researchers are now intensively collecting data to demonstrate the effects of deer in various situations, so that we can better predict the best approaches for different environments."

Funding: Landcare Research (retained earnings), United Kingdom National Environmental Research Council, FRST (Foundation for Research, Science and Technology) including NSOF (Non-Specific Output Funding), Department of Conservation, Institute of Ecosystem Studies (New York).

Contact: Rob Allen

Landcare Research, Lincoln
(03) 325 6700
AllenR@LandcareResearch.co.nz

Landcare Research Slide Collection

Red deer are the most prevalent species of deer in New Zealand, and have changed native forests dramatically – in many cases, irreversibly.

Possum control – getting the balance right

Pest managers usually have more problems than their budget allows them to address, and so face a dilemma. Should they focus their efforts and get the best result at a few places or spread their efforts more widely and get a lesser benefit at many places? Landcare Research is helping the Department of Conservation's pest managers to refine this decision-making process.

The Department of Conservation spends about $12 million a year controlling introduced Australian brushtail possums over one million hectares of native forest. Possums browse native forest plants, prey on birds, and act as hosts for bovine tuberculosis. DOC's principal strategy is to markedly reduce possum numbers in one hit, usually through aerial 1080 bait operations, and then periodically apply further control to sustain the benefits. This involves complex trade-offs between the frequency and intensity of possum control at a site, and the total area of forest that can be treated.

Landcare Research scientist John Parkes says DOC managers currently carry out maintenance control anywhere between continuously to once every seven years. "The decisions on how often are made by monitoring either the extent to which possum numbers recover after control, or the trend in the condition of the forest canopy trees that possums love to eat. In some cases, however, control operations are conducted according to a set timetable."

Landcare Research is helping DOC managers to identify the net consequences that flow from these key decisions.

"Our project compared the results of these different management approaches to deciding on the frequency of control. We looked at the cost of control and monitoring and compared this with the net benefit: the proportion of canopy in an acceptable condition, over how large an area."

Mr Parkes says this research approach, called adaptive management, uses differences in current management as though they are treatments in an experiment. Landcare Research scientists have developed a computer model that predicts the effect of possum control on possum densities and their effect on forest canopy condition. These predictions will then be compared against what really happens in 14 large-scale possum control operations managed under the different control strategies.

Mr Parkes says possum densities over 14,000 hectares of native forest at Mt Pirongia southeast of Raglan were measured before possum control. When researchers returned four years later to count the possums again, they found that densities exceeded those before control was applied.

"This suggests that possum numbers fluctuate more than expected, or that the post-control estimates were too low, or that the predicted rates of increase in our model were too low, or that the monitoring system was inadequate, or some combination of these. Our failure to accurately predict the densities and effects of possums has identified key areas where we need more information about possum populations and their response to control.

Landcare Research slide collection

The pesky possum. Work by Landcare Research will help DOC Managers identify optimum approaches to possum control within their budgets.

"These uncertainties reflect the real uncertainties that lead managers to apply different control strategies to apparently similar problems. These questions point the way to things we need to measure to understand why forest ecosystems do not always behave the way we expect.

"With these uncertainties resolved, DOC managers will then be in a position to choose the optimum control strategy for future operations."

This research is the first major adaptive management experiment on vertebrate pest control in the world. It has already led to a similar large-scale experiment on fox control in the Australian state of Victoria.

Funding: Department of Conservation.

Contact: John Parkes
Landcare Research, Lincoln
(03) 325 6700
ParkesJ@LandcareResearch.co.nz

Research helps reduce vertebrate pesticide use

Research into the risks and benefits of pesticide use and detecting pesticide residues in the environment is helping to reduce the risks associated with the use of pesticides, and to reduce the amounts used.

Pesticides are essential tools for protecting our native flora and fauna from vertebrate pests. Chemical analysts at Landcare Research's Toxicology Laboratory test bait, water, soil, plant and animal tissues for residues of a wide range of pesticides including 1080 (sodium fluoroacetate), brodifacoum, cholecalciferol, and cyanide. Landcare Research neither promotes nor

opposes the use of any vertebrate pesticide. Our research allows the pest control industry to make more informed choices about pesticide use to maximise efficacy and minimise environmental contamination.

Landcare Research scientist Penny Fisher says we need to know how long a pesticide takes to degrade and how long it persists in animal tissues, soil and water if we are to understand the risks of secondary poisoning and contamination entering the food chain. "Often these characteristics had not previously been measured, or users are not aware of research results in this area.

"We have developed reliable and sensitive tests for vertebrate pesticides in the environment. For example, we can detect brodifacoum at 0.02 parts per billion in water, and 1080 at 0.1 parts per billion.

"The impact of our work is often to substantially reduce the use of vertebrate pesticides. For instance, aerial 1080 operations now use rates of 3.5 kilograms of bait per hectare, compared to up to 35 kilograms per hectare previously. This is a direct result of our research and our advice to industry. Landcare Research was also a major collaborator in developing the encapsulated cyanide bait Feratox® which has proved highly palatable to possums and of little risk to native birds and insects.

"Pesticides also potentially pose a hazard to manufacturers and users. We have recently been involved in monitoring risks of exposure of people working with 1080.

"We developed a urine test that indicates exposure to 1080. Our results have encouraged industry to enhance their safety procedures and to confirm that protective gear and procedures used by workers to avoid exposure are effective."

Research in the Toxicology Lab has also been instrumental in reducing the amount of brodifacoum used for control of possums and rodents.

"Brodifacoum is an effective anticoagulant poison, but our research has revealed that it is highly persistent in animal tissue, and therefore poses a relatively high risk of secondary poisoning," Ms Fisher says.

"Because of this, brodifacoum is now used mainly in one-off operations, for example, killing rats on island reserves.

"We are now looking at alternative anticoagulants to brodifacoum, to see if any are less persistent. The results are promising."

After a truck overturned, dumping 18 tonnes of brodifacoum poison into the sea near Kaikoura in May 2001, Landcare Research helped in environmental monitoring. The massive spill polluted the water and potentially endangered marine and bird life.

"We tested samples of shellfish, water and sediment for brodifacoum residues. Residue concentrations have dropped with time and we anticipate that current tests on samples taken two years after the spill will show no detectable contamination. Two clear tests will result in the lifting of the current shellfish ban."

The toxicology researchers are constantly developing and analysing methods to maximise efficiency and minimise the risks of contamination from the use of poisons.

Diana Leufkens

Landcare Research scientist Penny Fisher in the Toxicology Laboratory, analysing an animal tissue sample for 1080 residue.

Funding: Various clients including Department of Conservation, Animal Health Board, regional councils, pest control contractors, NIWA and overseas agencies.

A symposium on wildlife toxicology and persistence of pollutants and contaminants will be held at the 3rd International Wildlife Management Congress, Christchurch, 1-5 December 2003.

Contact: Penny Fisher, Dave Morgan, Geoff Wright (Toxicology Laboratory Manager)
Landcare Research, Lincoln
(03) 325 6700
FisherP@LandcareResearch.co.nz
MorganD@LandcareResearch.co.nz
WrightG@LandcareResearch.co.nz

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If you wish to be included on the mailing list for *Discovery*, contact Sarah Stokes, Landcare Research, Lincoln (03) 325 6700 StokesS@LandcareResearch.co.nz

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