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Assessing the abundance of pest animals using DNA technology

Andrea Byrom[1], Dianne Gleeson[2], Kerry Borkin[1], Robyn Howitt[2]
[1]Landcare Research, PO Box 69, Lincoln
[2]Landcare Research, Private Bag 92170, Auckland

Predators such as stoats, ferrets and feral cats threaten the survival of native birds, invertebrates and lizards, and are responsible for widespread declines in New Zealand's biodiversity. Possums, too, wreak havoc on native bird and plant life, and spread bovine tuberculosis.

A critical first step in managing these pests is to obtain accurate information on actual numbers present in the field. For example, it is important to know how many animals might have survived a control operation. However, some species such as stoats and feral cats are notoriously difficult to catch. At present, estimates of the number of animals present 'on the ground' are based on numbers caught in traps, but some animals are trap-shy or, for some reason, do not encounter traps. This leaves an 'unknown' proportion of the population remaining in the field, making it difficult for managers to decide how much more money should be spent on pest control.

Advances in forensic DNA methods have enabled researchers to identify individual genetic 'fingerprints' from pests using samples of shed hair, tissue and droppings. This new tool is therefore invaluable in cases where it is not always easy to capture individual animals. So far, the technique has been applied to possums, feral cats, stoats, goats and ship rats in New Zealand, and we have found that DNA fingerprinting techniques are a useful tool for monitoring populations of pest animals when other methods may not be accurate. We present an overview of our research to date.

Andrea Byrom *has worked at Landcare Research for eight years as a vertebrate pest ecologist. She specialises in understanding the dynamics of small predators such as ferrets, stoats and feral cats, and in reducing their impacts on native species.*

Biosecurity Begins At Home

Barry O'Neil, Assistant Director-General, Biosecurity New Zealand

New Zealand currently retains a significant and unique native biodiversity and an economy based strongly on primary production. New Zealand stands to lose more than most other countries, through events such as SARS, avian flu, foot & mouth disease and BSE. Such events world-wide have served to highlight the risk to our country's biosecurity.

Biosecurity is defined as "the exclusion, eradication or effective management of risks posed by pests and diseases to the economy, environment and human health". However, in order for New Zealand's biosecurity programme to be successful, it is critical to gain the understanding and involvement of all New Zealanders.

Dr Barry O'Neil *was raised on dairy, sheep and beef farms in Manawatu and the Bay of Plenty, graduating from Massey University in 1978 with a Bachelor of Veterinary Science with distinction.*

Between 1978 and 1983 Barry worked in a private veterinary mixed practice in Tauranga. During his time as a clinical veterinarian he travelled extensively overseas and experienced veterinary practice in Asia and Europe. From 1983 to 1990 Barry held various MAF Veterinary positions in the Bay of Plenty and Wellington including positions in MAF's Meat, Animal Health and Head Office divisions.

In 1991 Barry accepted a four-year diplomatic secondment with the Ministry of Foreign Affairs and Trade as Veterinary Counsellor at the NZ Embassy in Brussels. In this position he was responsible for New Zealand's veterinary affairs in the European Community, Eastern Europe and the Middle East.

Moving back to New Zealand in 1994, he took up the position of Chief Veterinary Officer within MAF. Responsibilities in this position involved determining New Zealand's import standards for animals and their products, surveillance and response capability for exotic animal diseases, animal exports, and animal welfare.

With the formation of the Biosecurity Authority within MAF in 1999, Barry was appointed to the position of Group Director of the Authority. This position had responsibilities for MAF's animal, plant and forest health groups and animal welfare and involved a budget of $115 million and over 130 staff.

Following the release of The Biosecurity Strategy for New Zealand in August 2003, Barry was appointed as Assistant Director-General of the restructured Biosecurity New Zealand, from 1 November 2004. The organisational redesign moved from sectoral to functional based outputs. The new areas of responsibility

include Pre-clearance, Post-clearance, Policy & Business, Compliance & Enforcement, Investigation & Diagnostic Centres and Animal Welfare.

Barry is also currently Vice President of the Administration Commission with the Office International des Epizooties (OIE – World Organisation for Animal Health).

High Risk Site Surveillance

Brendan D. Murphy, Biosecurity New Zealand

New Zealand's first line of defence against plant pests is provided by the BNZ High Risk Site Surveillance (HRSS) programme. HRSS has multiple functions, including effectively detecting new organisms, and collecting distribution and host records for extant species. HRSS provides a broad-spectrum surveillance approach, so is capable of detecting a wide range of plant pests. Where required, it is augmented by pest-specific surveillance programmes deployed around high risk sites.

HRSS has recently been reviewed and a new design developed to provide increased flexibility and responsiveness. Different types of high risk sites such as ports, transitional facilities, or locations of suspected post-border incursions are now handled with the same methods, so consistency is achieved across the country. HRSS combines both intensive and extensive vegetation inspections across a broad range of plant species. Areas of vegetation richness such as parks and arboreta are also targeted to increase the scope of plant species surveyed. Where specific information is required, or in response to post-border incidents, special instructions can be issued to target particular organisms or plant hosts etc. The programme is managed from a GIS system, allowing accurate recording of the types of vegetation inspected and inspection histories.

*Previously trained as an entomologist, **Brendan Murphy** has been working at MAF for two years as a Senior Advisor, managing programmes such as HRSS, national gypsy moth surveillance, and so on.*

The Future of Weedbusters: controlling snowballs and managing avalanches

Carolyn Lewis, Weedbusters

Since its launch in 2003, Weedbusters New Zealand has grown into a strong national, interagency weeds awareness programme that is living up to its vision of involving the community in weeds issues in their areas. In the words of Amber Bill, the original national Weedbusters coordinator, a 'controlled snowball effect' continues to be seen, with Weedbusters gaining momentum and growing in size and impact. The challenge ahead for Weedbusters is to maintain the momentum

of that ‘controlled snowball’, keep it travelling in the right direction, and ensure that any resulting avalanches are pre-empted or managed in such a way that the expectations that Weedbusters is creating, both within weeds agencies and organisations, and in the community, are not disappointed. The future for Weedbusters, therefore, is going to require continual ‘re-creation’ to keep the programme fresh and responsive to the needs of partner organisations and communities, the involvement of more organisations and individuals at ground level, the increasing support of key organisations at a management level, and an increasing profile both in the media and with potential national and local sponsors.

Carolyn Lewis *has been involved in Weedbusters since 2003 as the New Zealand Biosecurity Institute representative on the national Weedbusters management committee. She is currently the acting national Weedbusters coordinator. Since 1992, Carolyn has also contracted to Environment Waikato as a Plant Pest Officer. She is also the editor of the NZBI’s members’ magazine, Protect, and the national Vice-President of the Institute.*

The benefits of actively involving the community in pest control operations.

Dale Williams, Kaharoa Kokako Trust / Department of Conservation.

This paper highlights the benefits of forming partnerships between pest control agencies and the community and discusses the success of a community based pest control programme at Kaharoa in the Bay of Plenty.

The Kaharoa project has been an outstanding success in terms of conservation benefits. Since 1997 kokako numbers have increased from about 30 birds to around 130. Through seeing first hand the positive effects of their efforts, members of the community have also gained a greater understanding of pest control issues and methods.

For the Department of Conservation the benefits have been twofold: a successful conservation project carried out on land they administer at very little direct cost; and, by providing logistic support and technical advice, they have built a positive working relationship with the community.

The paper discusses theories from Peter Sandman’s book “*Responding to Community Outrage: Strategies for Effective Risk Communication*” and explores the wider implications of community involvement in pest control. It concludes that handing over some of the power and decision making to community groups is the best way for pest management agencies to build trust.

Without trust from the public it is highly likely that pest managers will lose access to valuable pest control tools, such as 1080, in the very near future.

Invasive insects established in New Zealand's forests or knocking on the door

Eckehard Brockerhoff, Ensis*
PO Box 29237, Fendalton, Christchurch, New Zealand
E-mail: eckehard.brockerhoff@ensisjv.com
* *Ensis is a joint venture between CSIRO and SCION/New Zealand Forest Research Institute*

Several recent incursions of insects considered to be significant threats to our forests and trees resulted in high-profile eradication programmes. Some of these insects were considered predictable arrivals but others were rather unexpected because they were not known to be significant pests of trees that are widely planted in New Zealand. In this presentation I will give a brief overview of the insects that have become established here, with a focus on species affecting our plantation forests. This will be followed by an analysis based on a database of incursions of wood borers and bark beetles assembled by the Forest Research Institute from about 1950 - 2000. Several hypotheses about which species are considered more or less 'invasive' can be tested with such information, and some examples will be given, such as the assumed relationship between arrival rate and success of establishment.

'Ecki' Brockerhoff *worked on several forest entomology projects in Germany, Switzerland and Canada before settling in New Zealand. Since 1998 he has been with the New Zealand Forest Research Institute - now SCION/Ensis - where he is a senior scientist and works on several forest biosecurity and biodiversity projects.*

Application of potential distribution models of weeds in weed management

G.W. Bourdot [1] and D.J. Kriticos[2]
[1]AgResearch Ltd, PO Box 60, Lincoln, New Zealand,
Graeme.bourdot@agresearch.co.nz
[2]Forest Research PB 3020, Rotorua, New Zealand,
Darren.Kriticos@forestresearch.co.nz

The theme of the New Zealand Biosecurity Institute's 2005 National Education and Training Seminar, "In your neighbourhood - Biosecurity begins at home and influences regional, national and global outcomes", reflects that fact that weeds, and other biosecurity pests, have a strong tendency to spread beyond their places of naturalisation to infest susceptible environments throughout the country. Stopping this spread is a key focus of any biosecurity programme, and knowing whose "neighbourhood" to look in is crucial. Climate-based models of the potential

distribution of weeds, presented as maps at suitable scales of resolution, can help focus surveillance programmes on sites most at risk to invasion. These maps can also be used to identify potential strategic control efforts designed to protect uninvaded land by halting the spread of weeds. By identifying regions that are presently uninvaded, but susceptible to invasion, these maps can contribute to coordinated, mutually beneficial action by weed control authorities, and discussions about cost-sharing arrangements amongst beneficiaries. We use a recently completed model for nassella tussock (*Nassella trichotoma*) in New Zealand as an example.

Graeme Bourdot *completed his PhD in plant ecology in 1980 at Lincoln University [Bourdôt, G.W. (1980) A study of the growth and development of yarrow (Achillea millefolium L.). PhD, Lincoln College, Lincoln] and have worked since then in the field of weed ecology. He have a strong research interests in (1) applying plant population dynamics concepts in weed management and (2) in the potential of plant pathogens as biological herbicides. He is employed by AgResearch at Lincoln.*

Modelling the spread of wilding conifers

Heather North (Landcare Research) and Nick Ledgard (Forest Research)

The spread of conifer seeds from existing shelterbelts and plantations has lead to serious weed problems in several regions including Canterbury and Marlborough. Although conifers are a significant component of New Zealand's economy, some species can disperse seed widely, and, in certain environments, wilding trees are invading unique native ecosystems and disrupting existing land uses and visual landscapes. Wildings can establish easily on lightly vegetated land unless it is developed or subjected to moderate or heavy grazing. If the source trees are on flat ground, seed can typically travel only about 100 m before falling to the ground. But seed from conifers planted on exposed take-off sites such as ridges can travel many kilometres on the wind.

Resources for wilding control are limited compared to the scale of the problem, and it is important that they are spent as cost-effectively as possible. Modelling of conifer spread and control has the potential to support prioritisation decisions. In this presentation, we describe how GIS is being used to predict areas at risk of wilding invasion, and how a spread/control simulation model (Ben-Tal/Laing) has been used to test wilding spread scenarios with various control strategies, control frequencies, start dates and budget limitations. Results to date indicate a satisfactory degree of realism.

Heather North *received the Bachelor of Technology degree from Massey University in 1992, and then a PhD in optics/image processing in 1998. She has been working since 1997 at Landcare Research, Lincoln, in the remote sensing*

group. During this time she has worked with both synthetic aperture radar (SAR) and optical satellite images. Her current applications of satellite image processing include mapping urban green-ness, agricultural land use and shrubland succession. She has also mapped wilding conifer locations from aerial photography and contributed to modelling their spread and control.

Fertility control technologies for possums

Janine Duckworth, Landcare Research
PO Box 69, Lincoln 8152

New biotechnologies, such as immunologically based fertility control (immunocontraception), offer effective, humane and publicly acceptable approaches to possum management. Successful immunocontraception relies on identification of suitable target antigens and the development of cost-effective and practical methods for delivering vaccines to wild possums.

Immunisation against proteins derived from the possum egg coat, or zona pelludica (ZP2 and ZP3), reduced the fertility of female possums by 72–80%. Several regions (called peptides) within the ZP2 and ZP3 proteins have been identified that may be possum- or marsupial-specific and cause infertility. Immunisation with two ZP peptides reduced the fertility of immunised possums by 60–64% but had no effect in model bird and mammalian species.

Bacterial ghosts are potentially a cost-effective and practical technology for delivering anti-fertility vaccines in oral baits to wild populations. Bacterial ghosts are the empty cell envelopes of bacteria with a ZP antigen fused within the cell wall. When applied to mucosal surfaces of the eye and nose or administered orally, bacterial ghost vaccines expressing possum ZP2 and ZP3 proteins stimulated antibody responses in serum and reproductive tract secretions of female possums. Bacterial ghosts containing possum ZP2 protein applied to the eyes and nose of female possums significantly reduced the proportion of eggs fertilised. Research to improve the immune response to oral vaccines and to optimise the formulation of ZP bacterial ghosts is ongoing.

Contracted research for Foundation for Research, Science and Technology, Marsupial Cooperative Research Centre, Animal Health Board and Landcare Research.

Janine Duckworth *has worked at Landcare Research for 12 years as a reproductive physiologist and immunologist. She leads the Possum Biocontrol Development Programme at Lincoln, developing reproductive control technologies for possums and investigating biotech-based solutions for a range of vertebrate pests.*

Forecast: weeds

Jon Sullivan and Hazel Gatehouse, Lincoln University, Canterbury
sullivaj@lincoln.ac.nz

Together with other students and staff at Lincoln University and Landcare Research, we have been collating information on all naturalised plant species in New Zealand. Our aim is to better understand the ecology of when and where these species first appeared and how quickly and to where they spread.

There are three general findings that dominate our results nationally. Invasions take many decades to centuries. The invasion is not slowing (yet). And, where new plants naturalise and how quickly they subsequently show up around the country are mainly driven by where people put them and move them, either on purpose or accidentally.

At a finer spatial scale within Auckland city, recent new plant naturalisations have occurred disproportionately often in older, socio-economically affluent suburbs, especially those that were most heavily populated in the early part of last century. Again, invasions take time and new naturalisations appear near where people plant them.

Rates of naturalisation of new plant species in New Zealand continue unabated, with over 16 new species naturalising per year through the 1990s. While the rate of naturalisation of European annual species shows signs of slowing, naturalisation rates are increasing for species from regions like Asia and for woody species. Half of the species that naturalised in the 1990s were shrubs and trees, compared with a small minority in the early decades of the 1900s. It seems inevitable that future weed lists will contain many more woody species than currently. It's time to get better at eradication.

Jon Sullivan *is a plant ecologist based at Lincoln University. His interests are in plant invasions and insect herbivory. Before Lincoln, Jon was a weed ecologist at Landcare Research in Auckland. Jon has a PhD from the University of Pennsylvania (USA) and a BSc(Hons) in botany from the University of Canterbury.*

Hazel Gatehouse *is a current PhD student at Lincoln University, supervised by Richard Duncan and Jon. Hazel's thesis is taking an ambitious, large-scale view of the whole naturalised flora of New Zealand. Both Hazel and Jon are graduates of North New Brighton Primary School.*

Didymosphenia geminata – “But You Can Call Me Rock Snot or Just Plain Didymo.”

Keith Crothers, Environment Southland

This presentation will briefly introduce an organism that is new to New Zealand having been found initially in the lower Waiau River and then in the Mararoa River in October 2004. It will outline the initial and subsequent responses of Environment Southland, Biosecurity New Zealand and other agencies over the last nine months. Options being considered for the future management of Didymo will be outlined.

Didymo is a northern hemisphere diatom (a single-celled freshwater algae). It is a microscopic organism that cannot be seen by the naked eye unless in large clumps. The Didymo incursion in Southland was the first documented example of the algae in the Southern Hemisphere. Didymo is an established invasive organism overseas and no attempts have previously been made to control or eradicate it. Didymo has been assigned with an "unwanted organism" status by Biosecurity New Zealand.

Keith Crothers *is the Senior Biosecurity Officer (Pest Plants) at Environment Southland. Despite being a born and bred Cantab, Keith has been working in pest plants management in Southland local and regional government for 26 years. Based in Invercargill, Keith has worked for Environment Southland since 1993.*

Eco-climatic assessment of the potential establishment of exotic insects in New Zealand

Lora Peacock & S.P. Worner, Lincoln University, Canterbury
Bio-protection and Ecology Division, P.O. Box 84, Lincoln

To refine our knowledge and to adequately test hypotheses concerning theoretical and applied aspects of invasion biology, successful and unsuccessful invaders were compared. This study investigated insect establishment patterns by comparing the climatic preferences and biological attributes of two groups of polyphagous insect species that are constantly intercepted at New Zealand's border. One group of species is established in New Zealand, the other group comprised species that are not established. Multivariate analysis and modelling techniques were used to compare differences in the two groups of insect species. Finally the results of the studies were drawn together to provide a framework for a prototype pest risk assessment decision support system. Future research is needed to refine the analyses and models that are the components of this system.

Lora Peacock *has recently completed a PhD in the assessment of eco-climatic techniques for insect pest prediction. Research interests include effects of climate and environmental change on animal population dynamics and distribution, and ecological modelling of biological systems to develop solutions to environmental problems by incorporating a variety of technological tools, for example GIS spatial analysis and artificial neural networks. Lora Peacock now works for Biosecurity New Zealand, Ministry for Agriculture and Forestry as a technical advisor.*

Dr S.P. Worner *is a senior lecturer and researcher at Lincoln University, New Zealand. Her experience is in ecological data analysis and modelling, particularly the prediction of insect population timing and abundance Other research has involved the analysis and modelling of climatic influences on invasive insect populations to predict potential distribution and abundance. Dr Worner's recent research interests have extended to the use of geostatistics to model insect dispersion for spatial analysis, but particularly the application of new developments in artificial neural networks and machine learning to modelling and predicting ecological data. Dr Worner is a project leader in the National Centre for Advanced Bio-Protection Technologies, a Centre of Research Excellence (CoRE) hosted by Lincoln University. Dr Worner's research within the CoRE, involves the application of neurocomputing to the development of intelligent systems for the prediction and detection of pest invasions.*

Exotic ants in native ecosystems: at-risk habitats

Margaret Stanley[1], Darren Ward, Willow Allison-Maxwell
[1]Landcare Research, Private Bag 92170, Auckland

There are currently 28 exotic ant species established in New Zealand and some of these pose a significant threat to native ant species, native invertebrate communities and ecosystem functioning in general. New Zealand is particularly prone to the ecological impacts of exotic ants because our native flora and fauna has evolved without a large and ecologically dominant ant fauna. New Zealand has only 11 native ant species, all of which are cryptic, and occur naturally at very low densities. In the last few years there have been a number of incursions of exotic ants at New Zealand ports and several new species have established. The vulnerability of different ecosystem types to invasion by exotic ants is poorly understood. Most information on the risk posed by exotic ants to New Zealand ecosystems is inferred from overseas research. However, a recent Auckland study found that several exotic ants species had penetrated more than 100m into forest with canopy cover >75%. The impact of these exotic ant species on native ecosystems is unknown, although they are clearly capable of invading sites of high conservation value. Managers urgently need a means of prioritising effort in controlling key ant species and assessing the consequences of action or non-action for both well-established and recently established ant species.

Dr Margaret Stanley *is an ecologist at Landcare Research, Auckland. She has been involved in biosecurity issues through her research on weeds and invasive insects. Margaret also has interests in improving public awareness of biosecurity issues and has developed a bilingual weeds education website.*

Human Dimensions;changing beliefs and future challenges

Mike Harre, Auckland Regional Council

All environmental programmes impact on people in some way. In order to achieve better environmental outcomes we need to understand how to develop and sustain partnerships across agencies, community groups, and business, social and cultural groups within our communities. Identifying what motivates and drives the partners is an important component of establishing a successful program. This presentation uses overseas and New Zealand examples to look at what are the factors in creating successful partnerships.

Originally trained as a landscape designer, and with a background in the nursery and garden centre industry, ***Mike Harre*** *eventually got tired of selling ecological weeds and got a job as noxious plants officer with Waitakere City Council, making sure people remove them. He then moved to the Auckland Regional Council and became the Biosecurity Officer for Auckland City and the Hauraki Gulf. Mike is now the Biosecurity Officer (Response) for the Council, which usually involves dealing with any difficult problems or queries that ratepayers, managers or councillors come up with. He is the Weedbusters Co-ordinator for the Auckland Region and a member of the Council's Eco-care strategy team, which deals with community partnerships of many types.*

Palmerston North Weed Awareness Campaign

Neil Mickleson, Horizons Regional Council

The focus of this talk is

* Taking a new approach in managing urban weeds,
* Getting people to take ownership to responsibly control pest plants
* Changing behaviour by education and fostering cooperation
* Capitalising on a number of opportunities with in the one project
* Sharing resources. Regional and City Council project partnership
* Weedbusters as the projects driver
* 0800 WEEDBUSTERS project hot line

Neil Mickleson has 20 years experience in pest plant management, 13 of which involved working in the predominant sheep and beef hill country farming area of Taihape and the native tussock grasslands of Waiouru and the Desert Road region, focussing in both areas on production and environmental pest plants. The last seven years has been involved in the urban environment of Palmerston North City which includes lifestyle blocks and the agricultural production units of the Manawatu plains.

Internal Borders: are they feasible?

Peter Johnson

A general premise: internal borders are not only feasible, but also desirable for many plant and animal pests. As an introduction to this workshop session I shall describe and illustrate border considerations from three examples at different scales: 1. Islands (real) and 'islands' (environmental) with emphasis on Chatham Islands biosecurity; 2. A large land area (Otago) and its newly arriving weeds; and 3. Lessons learned from the finer-scale management of a garden and its border-crossing insurgents. Be prepared to repel boarders!

***Peter Johnson**, Research Associate, Landcare Research, Dunedin. Botanist and plant ecologist, Peter is the author of books on New Zealand wetland plants, wetland types, wildflowers, and flowering plants. Research interests include wetlands and weeds. Biosecurity involvement includes protection of Chatham environments from weeds and pests, as a member of the Chatham Islands Conservation Board.*

Education: Weed awareness in schools

Richard Goldsbrough

Richard Goldsbrough, 2004 New Zealand Science, Mathematics and Technology Teacher Fellow, will briefly review the work done during his fellowship, to introduce the concepts of environmental weeds and biological weed control to primary school students and their teachers. This work was done in collaboration with Julia Wilson Davey of Landcare Research and 'Weedbusters' National coordinator, Amber Bill. The question; is this a useful approach and if so who will carry it on?

Involving communities in weed detection ["The Queensland Project"]

Jane Morton (presented by Sally Vidler)
Cooperative Research Centre for Australian Weed Management (Weeds CRC)

The Cooperative Research Centre for Australian Weed Management (Weed CRC) and the National Heritage Trust are funding The National Weed Detection Project (NWDP) for a period of four years with the aim of testing a model for a community-based weed detection network. Early detection of new weed incursions at a stage when eradication or containment is possible minimises both control costs and the impacts on environmental, social and economic values.

The proposed network is comprised of volunteers who spot new incursions and provide reference points in the form of specimens that are forwarded to state herbaria for taxonomic verification. Volunteers are supported by a paid co-ordinator. Community-based weed detection networks use fortuitous surveillance,

where volunteers find weeds in the course of doing something else rather than where people are employed to actively look for weeds. Volunteers inadvertently cover a range of local habitats, including areas prone to weed invasion (vulnerable sites) or sites that have high conservation value such as national parks (valuable sites).

The community-based weed detection network is not a new concept nationally or internationally. The Weeds CRC NWDP began in July 2004 and has links to other state weed detection networks. This paper describes the history of weed detection networks in Australia and discusses the components that the NWDP has adopted to pilot a community-based weed detection network in two Queensland regions.

Sally Vidler *will be presenting this talk on behalf of the National Weed Detection Project Officer Jane Morton. Sally has been the Communication Officer for the Cooperative Research Centre for Australian Weed Management (Weeds CRC) for three years. In that role she is the editor of Weed Watch (the Weeds CRC's newsletter), coordinates the production of CRC research and extension publications, and manages communication plans for about 30 research projects. Sally has a degree in Environmental Management but somehow ended up in communications, probably because she talks a lot. After eight years of living in Adelaide she has recently moved to Brisbane and has spent several weeks stocking up on thermals for her trip to New Zealand.*

Biosecurity Challenges in the Pacific

Sidney Suma, Secretariat of the Pacific Community

The Pacific Community consists of thousands of small islands scattered over the Pacific Ocean which make up a third of the earth's surface. The nature of this geographical isolation means the Pacific islands are relatively free of major pests and diseases. Maintaining this relatively free pest status whilst facilitating much needed trade poses the greatest challenge to biosecurity (quarantine) services in the region.

Countries and territories in the region can be group into four groups based on their size, capacity and ability to implement biosecurity services. These arbitrary groups are (i) big, (ii) medium, (iii) small sized services, and (iv) the American and French territories.

The brief overview highlights the challenges faced by biosecurity services in the region and what we are doing to address these challenges. It also highlights the assistance given by the Secretariat of the Pacific Community and other regional organisations to the PICTs in this area.

SPC supports national capacity to facilitate trade and tourism by providing services to strengthen and harmonise quarantine services, improve border operations, prevent introduction and spread of new pests, efficiently respond to eradicate or contain incursions of pests and diseases. SPC endeavours to facilitate trade and tourism whilst reducing the threat to biological diversity, agricultural production, food security and public health from exotic pests.

Sidney Suma *works for the Secretariat of the Pacific Community (SPC) Land Resources Division as Coordinator: Biosecurity and Trade Facilitation. He has a Masters of Agriculture (Plant Pathology) degree from the University of Sydney, Australia and Bachelor of Science in Agriculture from the Papua New Guinea University of Technology in Lae, Papua New Guinea.*

Sidney has over 10 years experience in field research in plant pathology most part of which was spent on conducting field research on sugarcane in Papua New Guinea. Since 2000, Sidney has been involved in biosecurity and trade facilitation starting in PNG where he worked as the import manager in the PNG national agriculture quarantine and inspection authority.

In his current post he has been involved coordinating and providing technical assistance to 22 Pacific island countries and territories in the areas of biosecurity and trade facilitation. These includes technical advice and resource supplementation in quarantine operations, biosecurity legislation, international standard setting and implementation, import risk analysis and market access negotiation.

Sidney also oversees the Secretariat functions of the Pacific Plant Protection Organisation (PPPO) and manages the day to day activities of the PPPO Secretariat.

Stephen Goldson

Dr Goldson is AgResearch's Chief Science Strategist and is responsible for the company's overall scientific direction. Dr Goldson has been involved in research into weevil pests since the mid-1970s when he began his PhD on Argentine stem weevil (ASW). On completion of his PhD at Lincoln in 1979 he joined a research programme into the newly discovered lucerne pest Sitona discoideus. This programme developed chemical control techniques based on the pests' life cycle, before identifying and introducing a successful biological control agent. In 1988 he initiated research into the biological control of ASW. This programme has resulted in the introduction and commercial release of the biological control agent Microctonus hyperodae which has greatly reduced the impact of the weevil.

Dr Goldson is currently a member of the Biosecurity Ministerial Advisory Group. Most recently Dr Goldson has been working on the adaptation of military sensor-based technologies to improve container biosecurity.

Dr Goldson was elected a Fellow of the New Zealand Institute of Agricultural Science in 1998 and the Royal Entomological Society of London in 2000. He has been a member of several national science policy advisory groups and in 1996-97 worked as the science adviser to the Minister of Science, Research and Technology, the Rt. Hon. Simon Upton. In 1999 he was appointed by Cabinet to the Independent Biotechnology Advisory Council (IBAC). He is the author of >140 refereed publications on pest management in New Zealand.

Some Māori land managers perspectives and attitudes to weed management and control

Tim Barnard[1], Marijke Warmenhoven[2], and Toni Withers[1]
[1] Ensis, PB 3020, Rotorua; [2] 8 College Rd, Ruatoria

Effective implementation of weed management regimes may be influenced the perception of the extent of the problem, and the human, physical and economic resources available. This research using *kanohi ki te kanohi* (face to face) interviews with twenty-two Māori land managers sought to uncover some of the issues and challenges faced by land managers from Ruatoria on the East Coast to Opotiki in the eastern Bay of Plenty in managing weeds on their land. It was not an attempt to define a uniquely Māori view but to highlight some issues for further research.

Thistles, gorse and ragwort were considered to present major challenges to effective and efficient land use. Not all perceived 'weeds' were exotics – manuka regeneration being cited by some participants as problematic. In general, many managers found weed control an on-going and costly proposition; sometimes problematic infestations occurred from poorly developed neighbouring land.

Chemical herbicides were seen as effective but costly tools. Some land managers were cautious about their value as a long-term solution due to potential environmental impacts particularly on soils, site productivity and local water quality. Traditional approaches such as digging out, cutting or using grazing regimes were still practised by some smallholders. Most of the participants had heard of biological control, with some having had direct experience in release programmes to control ragwort. Others, including kaumatua, remained cautious about potential negative impacts of biocontrol on the environment.

We conclude by considering organisational constraints relating to land management in the areas concerned and issues relating to human, social and economic capital and their importance in achieving the sustainable and effective solutions to weed management in rural areas.

Toni Withers *is a research scientist at Ensis in Rotorua, previously known as Forest Research. A New Zealander who obtained a Ph.D. at Massey University, Toni has been undertaking applied entomology research, with particular emphasis on the behaviour and biology of weed biological control agents and pest insects for 10 years.*

Pest Control on the Chatham Islands

Adrian Couchman: West Coast Regional Council

The Chatham Islands are a very special part of New Zealand in that they contain some the of rarest and unique species to be seen, including twenty species of bird and 42 species and subspecies of plants that occur nowhere else in the world. It is this unique endism that makes the Chatham Islands a very special place.

The Department of Conservation is the largest government representation on the Chatham Islands. The Department conducts a number of annual animal pest control programs for possums, feral pigs and cats. This work is primarily for the preservation of the island's ecosystem. In addition, the Department also works closely with the community in conducting control of a number of plant pest species that are yet to gain a dominant roothold in the islands.

Humans have only inhabited the Chatham Islands for a few hundred years and as yet many of the pests of mainland New Zealand such as wasps, mustelids and Chilean needle grass have not yet arrived. It is also its isolation and distinctiveness that would make the Chathams vulnerable to any further invasion by any other pest species. Biosecurity for the islanders is not only important for the preservation of the islands biodiversity but there would be severe economic repercussions if certain unwanted species were to make it to the islands.

Adrian Couchman *has been involved in pest control for more than twenty years. He began his career in one of the last intakes of the old APDC trainee schemes in 1982. He went on to work for Pest Destruction Boards throughout New Zealand including Rotoura/Taupo, Alexander, and Wanganui. He became Supervisor of the Selwyn/Plains Pest Destruction Board in Canterbury in 1990 before the board was assimilated into the Canterbury Regional Council.*

Adrian continued to conduct pest management for the Canterbury Regional Council for the next seven years before taking up a position with the Department of Conservation (DOC) in the Wellington Conservancy, overseeing all wild animal

control operations there. It was during this time with DOC that he became involved in developing Island predator programs for the islands of Kapiti, Mana, and Matui/Soames.

It with this background that Adrian secured the position of Program Manager Threats on the Chatham Islands with the Department of Conservation. On completion of three years on the Chatham Islands, he was promoted to the position of Chatham Islands Area manager overseeing all DOC operations for a further three years.

On his return to New Zealand in 2004, Adrian took up the position of Vector Control Manager with the West Coast Regional Council responsible for possum control there.

Practical ways of engaging the community to prevent aquatic pest spread

Anne Brow, Department of Conservation

Aquatic pests pose serious environmental, social and economic threats to our waterways. To effectively manage the spread of aquatic pest populations the solutions are as much social as technical. This presentation will look at the work of the current regional and national programmes on aquatic pest awareness and the value of the newly created national aquatic pest awareness group. In the presentation I will share some of the important lessons learnt about engaging the community. These lessons are transferable to other biosecurity awareness work.

Anne Brow *was educated and trained in South Australia and holds a BSc in Ecology and a MA in Environmental Studies. While in Adelaide she worked for the Wilderness Society and the Investigator Science Centre (equivalent to Science Alive). Since returning to New Zealand, she has worked for DOC in Nelson/Marlborough on aquatic pest issues at local, regional and national levels including surveillance, control programmes, collating national survey data and coordinating regional and national awareness programmes. Anne is convinced of the importance of people in environmental solutions and is passionate about advocating for the environment. To prevent trans-Tasman confusion, she promises to refer to pest fish as "Pissed Fush" rather than "Peaaest Fiiiish".*

Chilean Needlegrass (Nassella neesiana) - The Threat that this Invasive Weed Poses to the Rest of the Country

Ben Minehan, Marlborough District Council

Chilean Needlegrass (Needlegrass) is an erect tufted perennial grass which can grow up to one metre high in the absence of grazing. It originates from South

America. Needlegrass excludes preferred pasture species and forms dense infestations which are unpalatable to stock during the flowing period.

Needlegrass produces sharp tipped seeds which can bore into the eyes and pelts of grazing animals, particularly sheep.

Needlegrass seed is easily spread through stock, hay, water, vehicle or soil movements. Needlegrass was first recorded in New Zealand in the 1930's, but at present there are only two extensive populations in the country - Marlborough and Hawkes Bay.

Needlegrass can be a difficult plant to identify when growing amongst other pasture species. Infestations are often not found until a dense patch has formed, which has already produced large amounts of aerial seed. Various herbicides are being used to control needlegrass with varying results.

When pasture is short due to drought conditions or overgrazing during Needlegrass flowering time, this weed is very difficult to identify, even for those with an experienced eye.

In Marlborough, new infestations of Needlegrass are being found each season. Land use changes on a number of properties with infestations of Needlegrass are making the containment of this invasive weed very difficult. Soil movements on heavy machinery pose a significant risk if machines are not cleaned down. Livestock movements out of the district due to the closure of Blenheim's PPCS plant also pose a significant risk.

Are we doing enough to minimise the spread of this invasive weed??

Ben Minehan *is a Biosecurity Officer (Team Leader) for the Marlborough District Council. His role is in the administration and implementation of the Regional Pest Management Strategy for Marlborough. Ben works with the Regional Pest management team to carry out surveillance and compliance inspections and enforcement where required to manage plant and animal species classified as pests in the Strategy.*

Rabbit Haemorrhaghic Disease Mackenzie Basin Results

Brent Glentworth, Biosecurity Team Leader, Environment Canterbury

Rabbit Haemorrhagic Disease (RHD) was illegally imported and later released into the Mackenzie Basin in August 1997.

With rabbit levels increasing and many runholders finding control costs unsustainable they were quick to co-ordinate and take advantage of the virus arrival. By mid September 1997 in excess of 150,000 hectares had been aerially seeded with home blended homogenised diseased rabbit organs sprayed on to carrot and oat bait as a biocide.

The initial widespread disease epidemics that resulted were extremely successful with the average rabbit reduction being 83% ± 7%.

Over the following seven years the virus has consistently suppressed rabbit numbers to below three rabbits per nightcount kilometre on a district level. Nationally the best result is on land classified as extremely and highly rabbit prone. Although vegetative cover has increased on some soils not all species returning are desirable.

In 2005 the data collected from the RHD monitor transects (128 k/ms) still show low rabbit numbers. On the wider district transects (491 k/ms), while the mean is still low the variation around this is the widest since the virus arrived, this and collectively a higher level of virus inhibition rates in serological samples could indicate that the effect of RHD maybe declining.

Changing Paradigms

Chrys Horn, Landcare Research New Zealand

When I began to learn about pest control, I wondered where all the dead possums were. I thought that good pest control was about killing more pests more efficiently. I have since learned that for successful pest control in a world of finite resources, it is important to think much more strategically than simply more dead weeds and pests. Instead we need to clarify our goals and think about whether we could achieve them with the resources that we have. It may be more cost effective to live with a weed and control plants that are not yet classed as a weed. It may be better to think in terms of site led control rather than weed led control. Likewise in possum control we are not thinking more about eradicating TB or keeping our bush in good nick.

In this paper I want to outline what sorts of questions might be important if we are to think strategically about the “human dimension” of pest control. I will talk about what sorts of information social scientists already have that might be useful in doing this work more effectively. Some useful questions might include: Who do we want to educate? Why do we want to educate them? What do we exactly mean by education? Is this approach ethical? Will it work and how do we know that? Exactly what sort of results do we want and will education do it or are other measures called for?

Chrys Horn *works as part of the Collaborative Learning Group in Landcare Research based at Lincoln. She is interested in how people find and use new information to help them in their work in pests and weed management (among other things). Chrys works with community groups, regional council staff and scientists who are interested in working more collaboratively and getting their information used better by those who might have a use for it.*

Feral Deer Control in Taranaki

Dean Stronge, Department of Conservation

A Landcare report (Fraser *et al* 1996) on new populations of large introduced mammals identified three regions in NZ where new populations of deer posed a serious threat to the environment and could enhance the spread of bovine TB - one of these regions was Taranaki. In response to this the Department of Conservation developed a control plan aimed at halting the dispersal of red and fallow deer herds, reducing the risk of deer escaping from farms and eradicating sika from North Taranaki. The programme has been very successful with many populations being eradicated from the North Taranaki area. The programme has recently been expanded to take in populations in South Taranaki.

Dean Stronge *started working for DOC 10 years ago working in Taranaki primarily on animal pest projects relating to goats and possums. For the last nine years he has been based in the Wanganui Conservancy Office. In his current role as Technical Support Supervisor (Wild Animal Management) Dean provides technical support and advice to staff and managers on involved with animal control programmes within the conservancy.*

Perimeter control for possums using kill traps

Geoff Woodhouse

Recent development and improvements in kill trap designs have allowed pest managers to evaluate these types of trap for possum control operations.
The Department of Conservation in South Westland is operating two control areas which assess the effectiveness of using kill traps around the perimeter of a control area.
The first area covering 1,035 hectares has been set up for the protection of Mistletoe with a target of maintaining possum's densities below 2% residual trap catch (RTC). The second area, covering 7,000 hectares, has been set up to detect possum presence, the rate they are moving into the area and from which direction they are coming from.

Geoff Woodhouse *has been working for the Department of Conservation for 10 year in the pest control field. He has worked in the Wellington Conservancy ground hunting goats, Northland Conservancy supervising possum and goat control operations, the Galapagos Islands setting up a goat dog training program for Project Isabella, and then the West Coast Conservancy of the South Island at South Westland where he manages the biodiversity threats program which covers large scale aerial operations for possums, Tahr and weed control programs.*

Biodiversity – An ECan Perspective

Graham Sullivan, Environment Canterbury

The adoption of the biodiversity chapter of Environment Canterbury's Regional Pest Management Strategy (RPMS) in 2002 signalled a new approach to managing pests in Canterbury.

Traditionally pest management has focused on 'production pests' such as the rabbit, the approach being 'pest led', underpinned by rules and funded, either in part or in full, by separate rates.

The biodiversity chapter of the RPMS allows ECan to manage a suite of plant or animal pests that pose a threat to endemic biodiversity in targeted high value ecological areas, in partnership with the community and agencies. The strength of these programmes lies with the partnerships, with common goals, where resources are pooled and expertise is shared. In the 2005/06 ECan will spend $1.26 million on Biodiversity programmes.

Graham Sullivan *is the Biosecurity Manager for Environment Canterbury and has worked for ECan since local government reform 15 years ago. The principle role of his team of 19 staff is to implement the Regional Pest Management Strategy.*

Release strategies for successful establishment of weed biocontrol agents

Helen M. Harman, Simon V. Fowler
Landcare Research, Private Bag 92170 Auckland,
Landcare Research, PO Box 69, Lincoln, Canterbury

Classical biological control of weeds is the introduction of exotic natural enemies, such as insects or pathogens, to permanently suppress exotic weeds. A number of factors are believed to influence successful establishment of biocontrol agents in a new environment. These include climate matching, genetic variability, numbers of individuals collected from source populations, number of individuals released, and release effort. We review records of past releases and experimental work to see what trends can be detected and applied to future releases to

maximise success using finite resources. For example, both serendipitous observations and experimental work increasingly point to the number of individuals required for successful establishment to be much lower than the numbers often released by biocontrol practitioners. However, the critical number to ensure a good chance of establishment is likely to vary for different species. Climate matching has been crucial to the establishment of gorse mite, with importations from two different climates from its European native range required to ensure establishment of the mite throughout the range of gorse in New Zealand. Climate is also important in the successful establishment of heather beetle in New Zealand, but the exact role of climate factors is more complicated than first thought. Despite our best efforts at controlling factors that may influence establishment success, some are beyond our control, such as bouts of unfavourable weather immediately after release of agents. In these cases, increasing the number of releases through both time and space is the only effective strategy.

Helen Harman *is a scientist at Landcare Research, Tamaki, Auckland. She works primarily in biocontrol of weeds, on the genetics of introduced organisms including weeds, and their insect and pathogen biocontrol agents. Before moving to Auckland three years ago she was based at Landcare's Lincoln site in Canterbury.*

Tawharanui Open Sanctuary - Animal Pest Eradication or Exasperation?

Jo Ritchie
Natural Logic Environmental Management Limited
21 Dormer Road R D 2 Helensville jor@clear.net.nz

Tawharanui Open Sanctuary is a 530ha mainland island contained within a 2.5km Xcluder pest proof fence at Tawharanui Regional Park 90km north of Auckland. A programme to eradicate 10 species of animal pests was initiated in 2004 including two aerial bait drops and a ground based follow-up to remove remaining pests. The fence has open ends to the sea and a buffer control programme has been established to reduce pest movements at the fence ends. A comprehensive monitoring programme has been running for five years to provide before and after eradication information. The Sanctuary aims to integrate conservation, farming and recreation. Managing people and livestock within a pest eradication programme has created some unique challenges as has the need to be cost effective and work within budget limitations. Can livestock play a role in keeping food and habitat requirements for rodents down? Can mice be eradicated? If not, how do you manage numbers in the absence of predators? Should it be linked to biodiversity outcomes? How large should a buffer control area be? How long should ground based follow up continue after aerial drops? How do you monitor pests when they are at low numbers? Does it matter? What would we do differently next time?

There is no one recipe for success and no standard set of ingredients. Success is reliant on teamwork, lateral thinking, good record keeping, adaptability and using a range of techniques. Getting out there and doing it and all the time building knowledge of the place and the species that inhabit it are key requirements.

Jo Ritchie *works in the general area of environmental management. She worked for the Department of Conservation in Auckland as a recreation planner and field officer for 10 years where she specialized in track construction, marine mammal, shorebird and reserve management. Jo left DoC in 1999 and since then has been working for herself and specializing in restoration ecology. She has written project plans for Limestone Island (Whangarei), Tawharanui, has managed the Tawharanui Open Sanctuary for 5 years and has also worked with a lot of community conservation groups including deer exclusion plans, pest fencing, pest eradication and revegetation.*

Update on Recent Deer Issues

Keith Briden, Department of Conservation, Pest Section

Current national deer issues will also become local deer issues in your neighbourhood. Three current national deer issues include:

- The downturn in the feral deer recovery industry means an increasing feral deer population.
- Updating feral deer ranges and proposals for a new deer farm gazette notice.
- Deer repellent in 1080 possum baits. General update. A recently announced policy for its use on Department of Conservation administered lands.

The feral deer recovery industry has been in slow decline for many years. Current low returns and new NZ Food Safety Authority requirements has meant there has been no significant level of recovery for the last three years. The industry is likely to remain depressed for some time. Feral deer populations are now increasing. Where there is little hunting pressure deer populations have the capacity to double in three years. DOC is seeking new funding for deer control. As deer populations increase, we may see more Regional Council RPMS's including deer as a pest. In most cases deer control will be a responsibility of landowners.

Feral ranges for deer species have recently been updated. There are current proposals to update the deer farm gazette notice. This affects where deer can be farmed and held on safari parks outside feral ranges. A consultation process is in progress with submissions closing on September 23.

Deer repellent used in possum 1080 baits is increasing in its use. The Minister of Conservation recently announced a policy that allows for the use of deer repellent in Recreational Hunting Areas, subject to several conditions.

Keith Briden *works for Department of Conservation on invasive weeds and animal pests, including some deer issues. He also shoots the occasional deer outside work hours while recreational hunting.*

Kezia Barker, University College, London

Kezia will use this presentation to briefly introduce herself and outline her research interests, and to highlight why plant biosecurity is interesting for a cultural geographer.

Kezia Barker *is a geography PhD student from University College London. She is at the start of five months of empirical research in New Zealand, in which she hopes to learn more about the value interface between plant biosecurity and weed control, and gardening practices. Kezia is both a keen gardener and has had experience working as a park ranger, and so is curious about the ways in which these alternative environmental practices are required to negotiate their differences.*

Progress on the development of a new method for possum monitoring

Malcolm Thomas, Pest Control Research Ltd
info@pcr.co.nz

Reducing possum numbers and maintaining them at low levels is essential in order to reduce bovine tuberculosis and prevent damage to native ecosystems. To undertake possum control effectively managers need to be able to accurately measure possum population densities. Currently this is measured as the proportion of leg-hold traps that capture possums. This methodology is described in a national protocol written by the National Possum Control Agencies (NPCA). However leg-hold traps have disadvantages, for example, they threaten ground birds such as kiwi and weka and they are labour-intensive which reduces sample size and the precision of density estimates.

For over 10 years now research has been conducted to investigate a new method of possum monitoring using possum bite-marks left in wax. This method is less labour-intensive than leg-hold trapping and does not threaten ground birds. Pest Control Research (PCR) has developed a device specifically for this purpose called the Waxtag. Recent research using the Waxtag showed that it could identify possum presence on up to 50% more lines than leg-hold trap lines. Also a good

correlation was obtained between Waxtag derived density estimates (TSI and PAI) and leg-hold trap derived density estimates (RTCI). There are currently many agencies now using Waxtags such as the Department of Conservation, Regional Councils and the Animal Health Board. This has led to the publication of a national protocol by the NPCA for their use.

Malcolm Thomas *is the Managing Director of Pest Control Research Ltd a private research company that undertakes contract research for clients such as the Department of Conservation and Animal Health Board. He has been involved in research on vertebrate pests for over 30 years and specialises in the development of new tools that will improve vertebrate pest monitoring and control.*

The spread of clover root weevil in New Zealand and research to reduce its impacts

Mark McNeill and Craig Phillips, AgResearch
Agriculture and Science Centre, PO Box 60,
Lincoln, Canterbury, New Zealand

New Zealand's low-input, pastoral agricultural system is dependent on the nitrogen-fixing capability of white clover (*Trifolium repens* L.), which is worth in excess of NZ$1.5 billion/year. Unfortunately, this system has been jeopardised by the recent colonisation by *Sitona lepidus* Gyllenhal (Coleoptera: Curculionidae). The larvae feed on the rhizobial nodules and roots of white clover, while adults feed on the foliage. This weevil, which occurs throughout Europe and North America, was first identified in 1996. Two areas of establishment were found, one north of Auckland and the other in the Waikato/coastal Bay of Plenty region. By the middle of 2005, *S. lepidus* had spread throughout the North Island but does not appear to have reached the South Island.

Sitona lepidus does not have any important natural enemies in New Zealand, and efforts to source biological control agents from the Northern Hemisphere began in 1998 through collaboration with CABI Bioscience in Switzerland and the University of California, Berkeley, in the USA. The area of exploration was further increased during 1999 – 2001 by collaboration with the USDA, ARS, European Biological Control Laboratory (EBCL) in France, the Institute of Grassland and Environment Research (IGER) in England, and with scientists from several European countries involved in a COST 814 research programme.

Most effort has been devoted to finding natural enemies of the adult stage of *S. lepidus*, and a combination of two search strategies has been used. One has involved collecting adult weevils in the Northern Hemisphere, sending preserved specimens to New Zealand, then dissecting them to ascertain the occurrence of immature parasitoids. The other has been to maintain live weevils in laboratories in

Europe to rear parasitoids from them. This latter approach has allowed parasitoids to be tested against New Zealand and European *S. lepidus*.

The strain of *Microctonus aethiopoides* (Hymenoptera: Braconidae) already present in New Zealand (introduced in 1982 for biological control of the lucerne pest *Sitona discoideus* Gyllenhal) seems unable to overcome the immune system of *S. lepidus*. Accordingly, an Irish strain that can parasitise *S. lepidus* has been tested in quarantine at AgResearch Lincoln, and an application has just been made to ERMA New Zealand for approval to release it from containment. Also, a European strain of the fungal disease *Beauveria bassiana* which is more virulent against *S. lepidus* than New Zealand strains, is being developed for use as a biopesticide.

A range of recommendations have been developed to help farmers deal with clover root weevil. In essence, these involve more careful grazing management to minimise stress to clover plants, and supplementary applications of nitrogen fertiliser.

***Mark McNeill** is a research entomologist at AgResearch Lincoln with19 years experience at AgResearch. He is involved in research on biological control and population dynamics of three pastoral weevil pests Sitona lepidus, Listronotus bonariensis and Sitona discoideus. Mark has extensive experience in quarantine-based host range assessments and development of novel techniques for assessing host range. His current research includes biosecurity focussed projects looking at novel approaches to detecting 'new to New Zealand' insect pests, and the potential for the pests to be transported within New Zealand via commercial carriage of nursery plants.*

Seek, find and destroy

Mike Urlich, Greater Wellington Regional Council

This talk looks at the highs and lows of trying to eradicate a pest plant in a region. Greater Wellington has 13 eradication plants that have the objective of being eradicated by 2022. We take a look at African feather grass, eelgrass and woolly nightshade.

I also highlight the need for public awareness. This has been undertaken in greater Wellington through billboards, poster, library displays, pamphlet, news paper articles and shows.

One of the main points is that public education should be undertaken before a plant is included into a regional strategy and not just afterwards.

Mike Urlich *is a Biosecurity Officer (Pest Plants) with Greater Wellington Regional Council.*

"Do quail spread broom seed in NZ?"

Nick Ledgard and Krysta Giles-Hansen

Californian quail (*Callipepla californica*) is an introduced graniverous bird with an extensive range. It is known to be able to consume large quantities of seed of broom (*Cytisus scoparius*) – one of New Zealand's most wide-spread and troublesome woody weeds. Knowing the role of quail in broom seed dissemination is valuable when developing appropriate management and control methods.

Captive quail were experimentally fed broom seed and the droppings collected and inspected for intact seed. An average of 2.5% of seed survived passage through the gut. Although passage advanced water imbibition time (compared to un-ingested control seed), germination was not enhanced. The proportion of intact seed surviving ingestion by the quail in this trial is likely to be an overestimation, as broom seed was a new food to the captive birds, which were not used to consuming the grit that wild birds use to aid the breakdown of hard foods.

The conclusion is that quail are a theoretically possible disperser of broom seed in New Zealand, but that in reality such a means of dispersal is unimportant. This supports similar conclusions from off-shore.

Krysta Giles-Hansen *completed this Honours dissertation study in 2004, as part of a Batchelor of Forestry Science degree at the University of Canterbury's School of Forestry. Krysta is currently travelling overseas. The study was partly supervised by Nick Ledgard.*

Nick Ledgard *is a Scientist with Ensis, Scion (formerly Forest Research), based on the University of Canterbury campus at Ilam, Christchurch. His specialist research area is high country forestry, including the spread of wilding trees – on which he has written many papers and management reports. His interest in the natural regeneration of introduced woody plants extends to the spread of gorse and broom.*

ERMA application for boneseed leafroller – surviving the plunge.

R K Maw, Environment Canterbury

The story of a successful application to ERMA New Zealand to import for release a South African moth, the boneseed leafroller (*Tortrix s.l.* sp. "chrysanthemoides") for the purpose of biological control of boneseed (*Chrysanthemoides monilifera*

ssp. *monilifera*). An outline of the process will be provided, along with some lessons to be considered for future applications.

Ray Maw *is a Policy Planner with the Canterbury Regional Council (Environment Canterbury). Since the inception of the Biosecurity Act he has had responsibility for developing and reviewing regional pest management strategies along with the provision of other biosecurity policy advice to the Council.*

Banks Peninsula Conservation Trust

Rick Menzies* and Dr. Frances Schmechel**

Banks Peninsula, an island for most of its 15 million years of existence, is a unique part of Canterbury with a number of endemic species. Human settlement brought dramatic changes. Once almost completely covered in forest, native bush was reduced to less than 1% by the early 1900s. Numerous native species have been lost or threatened as a result of both this habitat loss and introductions of various animal and plant pest species.

The Banks Peninsula Conservation Trust (BPCT) is a community organisation formed in 2002 as the result of a contentious district plan process which attempted to conserve remaining areas of ecological significance primarily through rules. The BPCT aims to implement requirements of the RMA using voluntary measures, and to promote the ideas of conservation and sustainable land management on private land.

A noticeable achievement of the Trust has been to gain the authority under the Reserves Act (1977) to place covenants on private land. Since receiving this authority it has protected over 250 ha of land and is in negotiation with a number of other landowners for future covenants.

The BPCT has held several workshops and field days to promote biodiversity conservation; topics have included endemic and rare plants of Banks Peninsula, mustelid control, native insects, and habitat restoration among others. The BPCT facilitates a feral goat work group which is in its second year of a five-year eradication programme. It has been instrumental in bringing together key local agencies and organisations via the 'Banks Peninsula Conservation Forum'. In partnership with ECan funding from the Biodiversity Advice Fund has been sourced to develop a 'Banks Peninsula Pest Plan' to provide information to landowners and community groups on the best ways coordinate and implement animal and plant pest programmes. The Trust is also developing a plan with Ngai Tahu and DOC to restore tui back onto the peninsula.

The BPCT is an example of a successful community-led initiative to protect conservation values on Banks Peninsula.

Rick Menzies *is a 63 year old semi retired sheep and cattle farmer from Banks Peninsula. He has, in the past, been a district councillor and was a Federated Farmers representative on the Banks Peninsula Task Force which was set up to solve the problems of the contentious Banks Peninsula Proposed District Plan in 1998. He has chaired the Management Committee of the Trust since its inception in 2002.*

Dr. Frances Schmechel *is the Banks Peninsula Coordinator for the NZ Landcare Trust, and works closely with the Banks Peninsula Conservation Trust to maintain and enhance biodiversity on Banks Peninsula in her position hosted by the NZ Landcare Trust and funded by the Biodiversity Advice Fund. Previous to her current position she worked in the area of conservation biology in New Zealand for 11 years, and wildlife management and forestry in the USA for seven years. She did her undergraduate studies in biology at the University of Colorado, USA, and has a PhD in ecology and post-grad diploma in Natural Resource Management from Lincoln University, New Zealand.*

Application of plant population theory to weed management

Shona Lamoureaux, AgResearch Ltd.

Population models are one of the few predictive tools available to those interested in the management of weed species. To design robust control strategies that are both cost-beneficial in the long term and manageable, it is important to understand the regulating forces and temporal variation in a population's growth, spread, and persistence. Through the use of mathematical models, exploitable weakness in the population can be identified and different control strategies (including biological control) can be "tested" on model populations to determine optimal management strategies including timing for release of biological control agents and the intensity of other control measures. With this information, researchers and managers can focus their efforts on developing control methods, or finding control agents, that might be able to achieve these targets, and can also explore integrated control "packages." In the case of biological control, once suitable control agents are found, models can be used to predict the likely outcome and success of a specific introduction or combination of introductions. After a control agent is introduced into a field or region, models can be used to increase understanding of processes and reasons for success or failure. Although models, no matter how sophisticated, will never perfectly describe the dynamics of pest populations, they can help us understand the functioning of these populations, and help direct our efforts in selecting appropriate biological control agents and establishing integrated management strategies for weedy species.

Shona Lamoureaux *has a BA and MSc in mathematics, a PhD in plant ecology and currently work for AgResearch as a plant ecologist. The main focus of her research is on improving the management of weedy species using population ecology and ecological modelling. Of particular interest is the use of ecological models to improve the selection of potential biological control agents and the development of spatial population models that better describe the dispersal and spread of plant populations.*

Pacific Ant Prevention Programme

Simon O'Connor, Biosecurity New Zealand

When it comes to international movement of people and commodities, ants are one of the best hitchhiking invertebrates known. Viable ant nests frequently infest all manner of objects and can be transported over vast distances to new locations in short spaces of time. Red imported fire ants (RIFA) are also highly transient and have already spread to the USA, Taiwan, Hong Kong, Singapore, Australia and China. RIFA have extremely high multi sector impacts, with affecting health, environment and economy. The Pacific islands are flanked by RIFA infested countries and are frequently used as hubs for exported commodities from around the world. The Pacific islands are at high risk of receiving RIFA contaminated sea or air containers and are climatically very suitable for their establishment and spread. There is also direct link of ant infestations in the Pacific islands arriving in New Zealand and establishing nests. The Pacific Ant Prevention Programme is a collaborative effort at minimizing risk to the Pacific island from RIFA and other ant pests.

Simon O'Connor *currently works as senior adviser to Biosecurity New Zealand's National Invasive ant programme. His primary role is to coordinate and manage the invasive ant incursion response and surveillance programmes. He came to Biosecurity New Zealand from Kakadu National Park in the Northern Territory where he managed the feral animal and weed programme, and likewise held a similar position prior to that in DOC, at Wanganui.*

Pest-free mainland refuges using exclusion systems

Dr Tim Day, Xcluder™ Pest Proof Fencing Ltd

Pest exclusion systems have been used with varying degrees of success over many years. Recent research has led to significant advances in exclusion technology in New Zealand and several highly effective commercial exclusion fences are now available. Better fence designs, materials and components, coupled with eradication expertise and tools have created the opportunity for pest-

free mainland refuges. Smart monitoring systems and careful planning are essential for achieving eradication and maintaining the pest-free status of refuges post-eradication (including plans for malicious or accidental re-invasion).

Several mainland refuges have now had pest eradication attempts. A 16ha Xcluder fenced refuge in the Waikato has been free of all pests except mice since late 1999, and mice were eradicated by 2001. Karori Wildlife Sanctuary appeared to eradicate all pests from 230ha and have maintained a pest-free status for all species except mice and later weasels (re-invasion due to fence failure). An eradication attempt at Riccarton Bush failed to remove all pests. Current eradications at Tawharanui Peninsula (660ha) and Mt Maungatautari (30 and 70ha refuges) appear to have been highly successful for most species. At Maungatautari extensive monitoring suggests that functional eradication of all species may have been achieved and re-introductions of threatened wildlife are beginning. At Tawharanui, mice have not been eradicated, but eradication of other pests may have succeeded.

Pest eradication is achievable on mainland sites using exclusion systems. Significant questions remain about the long-term ecological, social and other costs and benefits associated with pest-free refuges, but early evidence indicates hugely positive outcomes are possible. Only time and ‘giving it a go’ will reveal the full extent of change that may result from successful pest-free refuges on mainland New Zealand.

Dr Tim Day *is the Research and Development Manager for the Xcluder Pest Proof Fencing Company. He trained as an animal behaviour scientist and has been involved in research related to pest animal management for 11 years. Tim currently leads an ongoing research and development programme designing effective pest exclusion systems for mainland sites in New Zealand and around the world.*