NETS2015 the learning never stops

NETS2015

26-28 August, Dunedin

New Zealand Biosecurity Institute

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Welcome...

It is my pleasure to extend a very warm welcome to everyone who has joined us for the 65th annual National Education and Training Seminar (NETS) in Dunedin at the Otago University. This year's NETS theme is 'The Learning Never Stops', a poignant title for such a nationally and internationally successful learning institution.

I encourage you to use this time and venue wisely, learning, networking and sharing your successes while contemplating our future in biosecurity with the changes and challenges we are all facing. With a fantastic line up of papers, GEMs, posters and field trips you have really been spoilt for choice this year. A special thank you to all of our speakers for giving their time to present at this seminar, a fifteen minute time slot does not seem that long however the time and effort put into preparing these fantastic presentations can be extensive.

As many of you will know behind every successful annual NETS there is the hard working committee who pull it all together for us to enjoy. I would like to thank this year's committee for their contribution and tireless efforts to bring us all this learning opportunity. Your organising committee this year has been Richard Lord, Lynne Huggins, Randall Milne, Richard Bowman, Brent Rohloff, Derek Richards, Jeff Donaldson, Maurice Kennedy, and conference organiser Carolyn Lewis.

NETS could simply not be achieved without the generous support of our sponsors: a huge thank you to Ministry for Primary Industries, Otago Regional Council, Environment Southland, Landcare, NIWA , Key Industries and Ospri.

The NZBI mission statement is: "Working together to ensure New Zealand is protected from the adverse impacts of invasive species." Retain this thought as we launch into three fully packed days of learning, developing and sharing.

- Rebecca Kemp, NZ Biosecurity Institute President

A warm welcome is extended to all attendees at NETS2015 in Dunedin.

This is the fourth time that the NPCA has partnered with the NZ Biosecurity Institute to bring you the National Education and Training Seminar. This combined approach has proven over this time to provide the biosecurity / pest management profession with a successful forum to showcase both projects and research that provides valuable updates to our members and partners.

This year's programme offers attendees an opportunity to learn more about the current challenges facing biosecurity in New Zealand and in particular some of the issues facing biosecurity in Otago. There is a great line up of presentations covering the areas of weeds, vertebrates, and aquatic, marine, pathways and responses, by some of those people taking on the biosecurity challenges. Technology transfer and best practice hold more relevance than ever, getting it right first time is critical, and the wide range of presentations on offer will provide us with information to help us do what we do better.

NETS is a great opportunity to meet and exchange ideas with others from a cross section of our profession, both the formal and informal discussions held during previous events have proven invaluable to me and many other attendees when something new comes up in your own areas. The contacts made during this event will undoubtedly prove invaluable to you in the future.

I would like to thank, in advance, all the speakers and participants for sharing their experiences, and acknowledge the organising committee and the conference organiser for doing a fantastic job and dedicating their time and energy to bring us NETS2015.

On behalf of the NPCA I would like to sincerely thank our sponsors, Ministry for Primary Industries, Otago Regional Council, Environment Southland, Landcare, NIWA , Key Industries and Ospri, without whom we would not be able bring you such a wonderful event.

So, make the most of what NETS has on offer and enjoy the great Otago hospitality.

- Steve Ellis, National Pest Control Agencies Chair

Day 1 Wednesday 26 August 2015

9.00 CONFERENCE OPENING - mihi whakatau, official welcomes, and opening speakers

10.00 *Morning tea*

10.30 Invasions in New Zealand: Lessons for the 21st Century - *Bill Lee, Landcare Research*

11.00 GEMS - a variety of short updates and poster presentations - *Various*

11.30 Bridging the Biosecurity Gap Between Knowing and Doing - *Philip Hulme, Lincoln University*

12.00 *Lunch*

	DATA	POLICY	PATHWAYS
1.00	Modelling spatial data to optimise control of invasive vertebrates *D.Smith, Wildland Consultants*	New methods for cost-benefit analyses for Regional Pest Management Plans: towards implementation of the National Policy Direction *M.Hutchison, Wildland Consultants & J. Sullivan, Lincoln University*	Keeping insect and weed pests out of the Chathams: understanding the problem helps *M.McNeill, AgResearch*
1.20	Towards a New Zealand Biodata Infrastructure *J.Schmidt, NIWA*	What is the Bio-Managers Group? *R.Bowman, Environment Southland*	What's bedevilling island biosecurity today? *E.Kennedy, Dept of Conservation*
1.40	Horizons' experiences from implementing biological data standards *J.Lambie, Horizons Regional Council*	Navigating the regulatory landscape for better biosecurity outcomes *A.McKenzie, Latitude Planning*	Pest animals invading islands- are we learning? *K.Broome, Dept of Conservation*
2.00	Implementing data standards - Auckland's experiences *M.McMurtry, Auckland Council*	Making Good Things Great: a collaborative approach to align regional pest management plans *R.Maw, Consultant*	Stopping the spread: keeping good freshwater biosecurity behaviour sexy *R.Bird, Min for Primary Industries*
2.20	Weed invasion trajectories: how they inform cost-benefit analyses *G.Bourdot, AgResearch*	New Zealand Wilding Conifer Strategy *S.Smith, Min for Primary Industries*	Marine pest interim measures: Mediterranean fanworm as a case study. *I.Middleton, Northland Regional Council*

2.40 *Afternoon tea*

	COMMUNITY	TECH	AQUATICS	INSECTS
3.10	TBA	Combining Detection And Eradication Probabilities To Confirm Tb Freedom In The Hokonui Hills. *G. Nugent, Landcare Research*	Population ecology and genetic diversity of *Undaria pinnatifida* in the Hauraki Gulf *K.James, Auckland University*	Assessing *Pneumolaelaps* sp mite as a biocontrol agent of Vespula wasps: prevalence surveys *B. Brown, Landcare Research*
3.30	Pest Detective: what can we learn from the clues? *S.McCahon, NPCA & A. van Meeuwen-Dijkgraaf, Wildland Consultants*	The Trojan Female Technique: A novel approach for pest population control *D.Tompkins, Landcare Research*	Best practice framework (BPF) to support decision-making and management of aquatic weeds by regional councils *Paul Champion, NIWA*	Update: Brown Marmoreted Stink Bug And Learnings From Queensland Fruit Fly *R.MacLellan, Min for Primary Industries*
3.50	Southland Community Conservation *S. Cunningham, Environment Southland*	Design evolution to success with Goodnature Automatic Traps *S. Barr, Goodnature*	Aquatic weed research - the learning never stops *R.Wells & P.Champion, NIWA*	A Sting in the Tale *H.Pearson, Min for Primary Industries*
4.10	Environment Southland's Possum Control Areas (PCA) Programme *A.Paz, Environment Southland*	Technology advances for vertebrate pest eradication *C. Eason, Lincoln University & S. Ogilvie, Cawthron*	Searching haystacks for a needle: the challenges of lake weed surveillance *M.De Winton, NIWA*	Great White Butterfly Eradication: is success on the horizon? *C. Green, Dept of Conservation*

4.30 *New Zealand Biosecurity Institute Annual General Meeting*

6.00 *Mix 'n' Mingle, St David's Complex, University of Otago*

Day 2 Thursday 27 August 2015

'Breakfast with the Birds' at Orokonui Sanctuary

Set your alarms and put on your happy morning faces for the dawn chorus at Orokonui Sanctuary, the most protected forest in the South Island. Just a 30-minute bus ride from Dunedin, Orokonui is home to kaka, takahe, tui, bellbirds, silvereye, brown creeper, fernbird, tomtit, fantail, kereru, grey warbler, rifleman, Otago skink, jewelled gecko and tuatara! If you're lucky you may also see kiwi, saddleback and robin. Come and celebrate the biodiversity we are all working to protect. You'll get a packed breakfast for your wander through Orokonui, and we'll have you back at the NETS2015 venue in time for a hot drink before the morning speaker sessions start at 9am.
Numbers are limited for this excursion and a charge applies.

Plenary Session

9.00 Integration of biosecurity management into whole farm sustainability assessments: a sustainability dashboard tool for linking stakeholders in production landscapes
Henrick Moller (University of Otago) and Catriona MacLeod (Landcare Research)

9.30 Our Big Blue Backyard: How six hours of television inspired half a million Kiwis to fall in love with their coastline all over again.
Judith Curran (Natural History New Zealand Ltd)

10.00 Guest Speaker - Minister of Conservation, Hon. Maggie Barry.

10.20 *Morning tea*

Fieldtrip talks

Local speakers Kelvin Lloyd (Wildland Consultants Ltd) and Lala Fraser will set the scene for the afternoon field trips.

11.50 *LUNCH*

FIELDTRIPS

SINCLAIR WETLANDS
Just 30 minutes south west of Dunedin is the 315 ha privately-owned and internationally renowned Sinclair Wetlands which is protected under a QEII open space covenant. Sinclair Wetlands are part of a larger 2000 ha wetland area which includes lakes Waipori and Waihola. It consists of ponds, channels, swampland, scrub covered islands, walking tracks and is home to over 60 species of birdlife.

HUIAWA PENINSULA
Huriawa Peninsula is situated within the takiwā [tribal boundary] of Kāti Huirapa ki Puketeraki at the mouth of the Waikouaiti River. The field trip will introduce participants to the ancestral landscape of the historic Pā a Te Wera. Learn about the marine and terrestrial restoration of this wāhi tapu [special place].

EAST OTAGO GOLD TOUR
See some real Otago scenery along the northern coastline before heading inland to view NZ's largest goldmine. Continue through the rocky tor landscape of the Strath Taieri, following the Rock and Pillar Range down through Middlemarch before returning to Dunedin. Along the way you will be given a running commentary on the spartina programme, wilding pines, DOC's predator-free skink reserve near Macraes Flat, the history of both rabbit and possum control through the East Otago area, the Gorse and Broom Free Area, nodding thistle and biological control agents in the valley, and the Otago Rail Trail.

MONARCH WILDLIFE CRUISE
Cruise the length of the beautiful Otago Harbour, leaving Dunedin, passing the historic fishing village of Careys Bay and the working port of Port Chalmers. Friendly local experts will guide you on our classic boat MV Monarch, so you see the best of the Otago Peninsula and its wildlife: albatross, penguins, marine mammals, and ocean birds. In addition to this wonderful wildlife we'll share the fascinating history and geology of the Dunedin area with you. *Limited to 40 and a charge applies.*

OTAGO PENINSULA
Otago Peninsula is one of New Zealand's biodiversity hot spots and has a worldwide reputation for ecotourism. On this field trip we will meet various people who involved in improving habitats and protecting wildlife. The main aim of the Otago Peninsula Biodiversity Group is the eradication of pests and they have made a great start with their possum programme. We'll have a look at STOP's (Save The Otago Peninsula) site at Smiths Creek where they are tackling catchment issues, weeds and re-vegetating wetlands. From there we'll go on to Okia where we'll meet with the Yellow Eyed Penguin Trust and have a look at their work. There will be plenty of walking on this one, so pack your boots and a warm jacket.

BUSTING CLAYS
The annual competition for the claybird shooting trophy takes place again at a local gun club. If you would rather kill than cuddle, and busting clays is your thing, here's a chance to get your name on the trophy.
Limited to 20 people and a charge applies.

6.00 *Happy Hour*

7.00 *Conference Dinner*

Day 3 Friday 28 August 2015

	VERTEBRATES	PLANTS
8.30	Secretary Island Stoat Programme *P.McMurtrie, Dept of Conservation*	----------
8.50	Is one night enough? Improving the detection of pest animal species in upland beech forest and alpine habitats *J.Christie, Dept of Conservation*	Questions, answers more questions - Flupropanate herbicide *J. Underwood, Marlborough District Council*
9.10	Wide-scale predator control & fauna recovery: Lessons from Hawke's Bay *A.Glen, Landcare Research*	Contrasting Approaches to Pest Plant Compliance in the Deep South *A.Brown, Environment Southland*
9.30	Modified Victor Easy Set Rat Traps For Trapping Stoats And Ship Rats In New Zealand: Field Trial Results *G.Morris, Landcare Research*	Enforcement- why it works *D.Embling, Waikato Regional Council*
9.50	A review of chamois (*Rupicapra rupicapra*) management in Fiordland National Park 1998 to 2013: evaluating success and future options. *R. Ewans, Eco-South*	How to Identify Recently Released Weed Biocontrol Agents *L.Hayes, Landcare Research*
10.10	Development of a solid extruded bait containing diphacinone and cholecalciferol for possum and rodent control *L.Shapiro, Connovation*	Veteranisation - a new use for weed trees *I.Keenan, Wellington City Council*
10.30	Mega-masts and the costs of pest control: past, present and future *R.Pech, Landcare Research*	Combining remote sensing tools to map gorse *P.Peterson, Landcare Research*

10.50 *Morning tea*

11.20 **Closing Session**

Closing speaker
Awards presentations and NETS2016, Auckland
Closing address, President of the NZ Biosecurity Institute

12.20 *Lunch*

Wednesday 26 August 2015

Invasions in New Zealand – lessons for the 21st Century

Bill Lee, Landcare Research

Bill is a conservation ecologist with Landcare Research in Dunedin and the Centre for Biodiversity and Biosecurity, University of Auckland. His research investigates the history, spread, impacts and management of invasive plant species. Originally from a Waikato dairy farm, he has spent most of his research career in southern New Zealand working on a range of biodiversity issues.

Invasions are a major component of management activities and ecological research in New Zealand, reflecting the pervasive impacts of introduced carnivorous mammals and the numerous introduced plant species. Internationally, however, some are now arguing for the acceptance of novel ecosystems with species from many countries, based on excessive cost, tractability of control, and accusation of biotic xenophobia. While I believe this perspective is misguided in the New Zealand context, we do need to rethink some of our strategies and approaches to weed (as lists get longer) and pest (get smaller) control to provide enduring and cost-effective benefits for biodiversity. Increasingly, an understanding of the ecological reality of invasive impacts, the endgame outcomes for biodiversity and the effects of control on ecosystem characteristics all need to be incorporated in developing relevant strategies.

Bridging the biosecurity knowing–doing gap: from information transfer to knowledge exchange

Philip Hulme, Lincoln University
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Philip holds the inaugural Chair in Plant Biosecurity at Lincoln University. A leading invasion biologist, has long argued for better communication between scientists and practitioners and helped identify key disparities between the needs of managers and research priorities. More recently, while as an editor of the Journal of Applied Ecology, he launched Practitioners' Perspectives a new feature to give voice to stakeholders in mainstream ecology journals.

A widely recognized challenge in biosecurity is the gap between the knowledge generated by scientists and uptake by practitioners. Bridging this gap requires reciprocal and iterative flows of information from both scientists and practitioners prior to research initiation and beyond its completion. Yet current approaches to knowledge exchange ignore the complexity of translating different types of knowledge and the constraints that might limit effective knowledge exchange. Knowing who might use a particular piece of research is the first step when developing projects that might be of value to practitioners, but different types of research often can have quite different audiences. Identifying the precise target for research outputs, whether practitioners, stakeholders or end-users, is essential for successful knowledge exchange, and outputs must be tailored to the knowledge needs of the intended recipients. The scope of many leading biosecurity related journals targets use-inspired basic research that aims to develop a theoretical or fundamental basis to support interventions, technologies and policies that lead to improved outcomes. This more conceptual approach, while essential to the development of future management applications, is probably not what most practitioners require. In contrast to the explicit knowledge generated by scientists, many practitioners apply their own tacit knowledge when making decisions regarding their conservation goals and interventions. Such knowledge is intuitive, largely experience based and hard to define. As a result is often context dependent and personal in nature. The failure of scientists to translate and consider tacit knowledge may be behind the lack of implementation of their research. Additional challenges to implementation include the continuing interest and relevance of use-inspired basic research, lack of consensus among researchers regarding management options and the need for scientists to remain independent brokers of intervention options rather than conservation advocates. Publishing research in peer-reviewed journals will only ever be a small part of closing the knowing–doing gap. Using examples from existing biosecurity research and measures of uptake a routemap for best practice will be presented.

Data

Modelling Spatial Data To Optimise Control Of Invasive Vertebrates

Des Smith, Richard Clayton, Dean Anderson, Bruce Warburton
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Des has 19 years' experience in wildlife management, starting out as a ranger with the endangered takahe. Des completed an MSc and PhD on the ecology and management of stoats, and took part in the eradication of stoats from offshore islands, and in the establishment of large-scale stoat control in the Takahe Special Area. Des worked as a scientist for the Department of Conservation, investigating the effectiveness of poison bait stations at controlling rat outbreaks in beech forest, and participated in writing the pest animal monitoring tool box. Des was also a threatened species biologist in Canada, working with whooping cranes, northern leopard frogs, and burrowing owls. More recently Des has been at Lincoln University with the MBIE funded programme Pest Control for the 21st Century, which is developing new tools for managing vertebrate pests. Des has been a Senior Fauna Ecologist with Wildland Consultants Ltd for two years.

In New Zealand, the severe impacts of mustelids, possums, rodents, and feral cats on indigenous flora and fauna are well studied. Despite this, there are very few tools available for guiding the planning and implementation of programmes aimed at controlling invasive vertebrates. We outline a simple simulation that allows managers to determine the proportion of animals within a target population whose home range will be intercepted by a pair of parallel control device lines. The simulation allows managers to explore the relative efficacy of different spacing between control lines, while considering the irregular shape of home ranges and that they are randomly orientated in the landscape. We provide an example by simulating spatial data collected on stoats (*Mustela erminea*). Results show that if a manager wants to ensure that 100% of female stoat home ranges are to be intercepted by a control device line, then the lines will need to be within ≤700m of each other. An important consideration is the type of home range estimate used, and this will be discussed in detail. This technique has potential for use as an important first step for planning the control of many invasive vertebrates. It lends itself to an adaptive management framework, where updates and improvements to the simulation can be made through the application of data from further monitoring.

Towards a New Zealand Biodata Infrastructure

Jochen Schmidt
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Jochen, NIWA's Chief Scientist for Environmental Information, is on a mission to reduce wasted effort by making information easy for anyone to get to. Schmidt, who is responsible for overseeing the management, storage and distribution of NIWA's science data, still vividly remembers a science job that took him the first six months just to find out what other scientists had done on the project beforehand. "Six months of time just wasted in catching up. All of those data should have been sitting there waiting for me to analyse. I am working towards a future in which that never happens to anyone else. We want to make it easier for scientists to get existing data and to work on them. But that's only possible when information is well managed, understandable and accessible," Schmidt says.

Many organisations in New Zealand are collecting and holding biodata. Data exchange and data access happens, and is generally based on ad-hoc person-to-person data exchange using much communication and negotiation to agree on formats, semantics, vocabularies etc. and including conversion and adoption steps. Generally, the amount of people resource required in data finding, understanding, and formatting is estimated to exceed the resource required to analyse and use that data, often of an order of magnitude. This is a waste of resources for the data provider and for the data user. We argue that establishing and maintaining a New Zealand Biodata Infrastructure supporting machine-to-machine data exchange is greatly desirable and the cost of maintaining it will by far exceed the cost of currently manual data transactions. In most general terms a New Zealand Biodata Infrastructure is based on national standards and systems that are adopted by all agencies within their internal management systems. Hence, the cost of maintaining a BDI is made up of the cost of maintaining national standards and national systems and the cost of agencies to change their internal data management systems to comply with the national systems.

The Biodata Services Stack (BSS) project has worked over the last year to work towards the goal of a New Zealand Biodata Infrastructure.

Horizons' experiences from implementing biological data standards

James Lambie, Manas Chakraborty, Sean Hodges, Adrienne Bonnington, Craig Davey
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James Lambie is the Science Coordinator at Horizons (Manawatu-Wanganui) Regional Council. The science team is involved in the collection, processing, analysis, and reporting of biological information in freshwater and terrestrial domains. James' work includes involvement in aspects of biodiversity and biosecurity information analysis to inform policy development, assess policy effectivenss, and report on the state of the environment.

Horizons is one of the partner councils in the Biodata Services Stack (TFBIS funded) project to develop standards for biological data exchange. Through the implementation of the first draft standard, we learned valuable lessons about our biological data management processes that potentially change our workflows. We also learned that some of the data we collect, while highly relevant to organisational needs, do not conform to proposed standards. These lessons have been helpful in advancing our internal data management processes that put us further ahead on the path of seamless biological data exchange with other agencies.

Implementing data standards - Auckland's experiences

Mike McMurtry
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Mike is a Principal Specialist with the Auckland Council's Environmental Monitoring and Reporting team (RIMU). The team undertakes a wide range of ecological and/or physical monitoring in many domains (terrestrial, freshwater, marine, and air) for the purposes of policy, planning, and SoE reporting. Mike is on the BSS project team, and EMaR Biodiversity/Biosecurity workstream. Mike's focus is on data systems for the collection, ingestion, management, and mobilisation of biodata and water quality data.

Auckland Council holds a plethora of biodata, yet the majority requires considerable work to conform to biodata standards required for data exchange and data federation. Auckland Council, as a partner in the Biodata Services Stack (BSS) project, will soon federate one primary dataset through BSS. The increased awareness of data standards will guide future data management system design, with a view to increasing data sharing.

A weed mapping application for strategic regional weed management

Graeme Bourdot, Dr Jon Sullivan, Paul Smale
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In New Zealand, over 400 weed taxa are the subject of weed management programmes in Regional Pest Management Plans and additional threatening species are continually being proposed. Their current and potential distributions are vital pieces of information for conducting the cost benefit analyses required for proposed management programmes under the Biosecurity Act. The current distribution of a species of interest, both within a region and in adjacent regions, will be a primary driver for determining which of the five types of intermediate outcome specified in the National Policy Direction (Exclusion, Eradication, Progressive Containment, Sustained Control, Protecting Values in Places) would be appropriate. The potential distribution of the species, on the other hand, provides the basis for quantifying the potential losses to the economy or the environment should the weed spread to fully realise its potential distribution. Many disparate weed occurrence databases exist in New Zealand with the collective potential to define current distributions. Furthermore, climate niche models for hundreds of weed species exist in the international science literature and institutional reports that can provide estimates of the potential distributions of these species in New Zealand. However, these data have not been readily available to weed management policy- and decision-makers. To redress this, we have developed a web-based data-sharing "weed mapping" application. For a species of interest, it combines the occurrence data from the disparate sources and displays this information on a map of New Zealand at a scale appropriate for strategic categorisation (rather than for infestation management). The application

enables this current distribution to be overlaid with the relevant climate niche model enabling a visual comparison of the current and potential distributions. Additional overlays of data such as land-use or vegetation type, e.g. LCDB2 information, enable the climate niche model projections of potential distributions to be constrained to the land-uses or vegetation types susceptible to the weed. This process provides quantitative estimates of the land area that could be invaded and hence also of the losses in productivity or biodiversity that would be sustained should the weed spread to fully occupy its potential range. The application has the potential to automatically harvest weed occurrence data from disparate sources including the planned Biodata Services Stack and to have climate niche models added as they become available thus providing an "always-up-to-date" source of weed distribution data for regional (and national) weed management policy- and decision-makers.

Policy

New methods for cost-benefit analyses for Regional Pest Management Plans: towards implementation of the National Policy Direction

Melissa Hutchison, Jon Sullivan
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Melissa has a PhD in Ecology (2009) from the University of Canterbury, and an MSc (2001) in Ecology from Massey University. Her doctoral research investigated the interactions between plant invasions and landscape structure in native forest remnants on the West Coast of the South Island. Her MSc research was on the ecology of native ground beetles. Melissa has worked for the Department of Conservation, Landcare Research, Banks Peninsula Conservation Trust, Massey University, and the University of Canterbury. Melissa has a broad range of ecological skills, with particular strengths in vegetation surveying, significance assessment, ecological restoration, and monitoring and management of invasive weeds.

Jon has a PhD in Biology (2000) from the University of Pennsylvania (USA) funded in part by a Fulbright Graduate Award, and a BSc (first class honours, 1994) in botany from the University of Canterbury. He worked as a weed ecologist for Landcare Research in Auckland in 2000-2002 before joining Lincoln University in 2003. Jon's research focuses on weeds, insect herbivores, and biodiversity monitoring. Jon has an extensive knowledge of New Zealand natural history and assorted technical skills in ecological analysis and database development.

The Biosecurity Act requires that Regional Councils carry out reviews of their Regional Pest Management Plans, which include an assessment of whether the benefits of each pest management programme outweigh the costs (i.e. cost-benefit analyses). In 2009, we developed a modified version of the Harris model for carrying out cost-benefit analyses for a review of the proposed Bay of Plenty Regional Pest Management Strategy. We have not changed the underlying economic assumptions of the model (we are ecologists, not economists); instead we have added additional features to the model which build on the standard equation, and provide greater flexibility to the model. Some of the major changes include quantification of pest impacts on non-productive land uses, more realistic prediction of pest spread rates, and incorporation of a range of values around many of the parameters (to allow for uncertainty in the data). Here we briefly present our methods, and explain some of the advantages of this new approach for carrying out Regional Pest Management Plan reviews.

What is the Bio-Managers Group?

Richard Bowman, John Simmons
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Richard is the Biosecurity Manager for Environment Southland. He has been in this and similar roles since 1994. He is a member of the BioManagers and Biosecurity Working Groups.

The Bio-Managers Group was formed in March 2012 to focus on key strategic issues related to biodiversity and biosecurity and provide integrated solutions that enable collective action from regional councils. It comprises Tier 2 and 3 level representatives from all Regional Councils/Unitary Authorities and reports the Regional Chief Executives Group.

Its origins go back to the early 1990s through a series of predecessors known variously as the BWOG, BTAG, BMG and BGGGS. Over the last two decades these groups have played a significant role in the development of pest management and biodiversity policy and operational delivery. Their first major initiative was to produce guidelines for the preparation of the first round of Regional Pest Management Strategies under the Biosecurity Act 1993. This led to involvement in a wide range of activities aimed at improving pest and biodiversity management on a national basis. The Groups played a major role in the national Biosecurity Strategy (2003) and later with the Future of Pest Management which included significant amendments to the Biosecurity Act.

The Bio-Managers Group has brought together a wide range of players from within regional councils and from Government agencies particularly MAF/MPI, DOC and LINZ. Its membership is a veritable 'who's who' and has included many well-known personalities, such as Jack Craw, John Simmons, Bill Bayfield, Rob Phillips, Andrew Wilke, Chris Spurdle, Cambell Leckie and Ray Maw, to name a few.

The work of the Bio-Managers continues with the National Policy Direction, the role of regional councils in biodiversity, the wilding conifers national strategy, marine biosecurity, and so on.

Navigating the regulatory landscape for better biosecurity outcomes

Angus McKenzie, Hannah Palmer
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Angus McKenzie and Hannah Palmer of Latitude Planning Services are accomplished resource management practitioners with significant experience in the development and implementation of biosecurity programmes and projects. Their diverse skill set has seen them involved in a range of collaborative biosecurity projects to navigate legislative frameworks to improve the efficiency, including a national business case for simplifying the regulation of aerial 1080, a national permit for aquatic pest plant control and comprehensive consents for biosecurity programmes.

The regulatory system for biosecurity and biodiversity programmes and operations can be complex with managers often having to navigate a minefield of legislation to achieve beneficial outcomes. Significant potential exists to simplify the regulatory system and improve how we work within it. These opportunities can reduce programme costs, improve service delivery and ultimately improve biosecurity/biodiversity outcomes. In this presentation we will share our experiences with a range of regulatory tools that have resulted in programme level benefits for stakeholders. The presentation will draw on examples of successful regional and national projects, and potential improvements to the national regulatory system for aerial 1080.

Making Good Things Greater

Ray Maw, Consultant
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Ray has a Master s in Resource & Environmental Planning (1st Class Hons.), Bachelor Agricultural Science, and is a member of the Environment Institute Australia and New Zealand, New Zealand Association of Resource Management and New Zealand Biosecurity Institute. His expertise includes forty years of engagement with land managers, public agencies and the wider public associated with achieving sustainable management of soil and water resources, with particular capability associated with biosecurity and biodiversity policy development and analysis at the regional level along with a broad understanding of land based systems and enterprises.

Things can always be improved. The structure and contents of regional pest management plans now reflect more than 20 years of collective endeavours by regional council plan writers. What makes those plans good? This paper reviews the influence exerted by collaborative initiatives in bringing about the current level of consistency between regional plans while still providing for individual council uniqueness. How can plans be better? Biosecurity legislation continues to evolve, providing challenges and opportunities for improvement in plan alignments. The paper also explores areas where the current platform can be expanded under a cooperative umbrella. Barriers and risks associated with expansion exist and commentary is provided on addressing those impediments.

New Zealand Wilding Conifer Strategy

Sherman Smith
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Sherman is a senior advisor in the Long-term Incursion Management Team at the Ministry for Primary Industries. This team provides national leadership and coordination for a range of significant pest management issues. Sherman has previously worked in a number of biosecurity related roles across central and regional government.

The New Zealand Wilding Conifer Strategy has been released. Its development was a collaborative process led by the Ministry for Primary Industries, involving significant input from a range of organisations engaged in various aspects of wilding conifer management. The strategy provides a clear view of the changes that are required across the system for wilding conifer management to be effective. This presentation will discuss the key aspects of the strategy, the roles of various organisations in implementing the strategy and what this means for biosecurity practitioners and others.

Pathways

Keeping insect and weed pests out of the Chathams: understanding the problem helps

Mark McNeill, Trevor James, Paul Bradbury, Steve Palmer
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Mark's career has involved research both on the impacts of exotic pastoral pests and their biological control, along with research to improve our understanding of plant biosecurity issues. This has included pathways for insect pest movement within New Zealand, risks from imported soil and arthropod trapping systems at borders. The soils research has revealed the biological hazards associated with soil attached to both contaminated footwear and sea freight (including arthropods), identified a range of disinfectant suitable for treating footwear, and examined the role of environmental factors on survival of soil organisms over time.

The importance of biosecurity to protect New Zealand's primary industry and native estate from invasive alien species is generally accepted by the public as being critical to the country's economic wellbeing and biodiversity. However, internal biosecurity has only until recently seen as also important in either preventing or slowing the spread of unwanted organisms. For the Chatham Islands, this has significance as the islands possess several endemic vertebrate, invertebrate and plant species and is free of many pests found in New Zealand. And while there is an understanding that there are weeds and pests already established on the Chatham Islands, the islands are still free of many unwanted vertebrate pests and weeds that would impact on the native environment. In addition, there is recognition that there are unwanted weed and insect pests only found in New Zealand, and if accidently introduced could threaten the agriculture sector.

As part of the overall existing biosecurity programme for the Chatham Islands, a project investigated what arthropod pests and weeds were potentially being transported to the island in soil and used machinery as well as what insect pests were established on Chatham Island. The results showed that soil recovered from machinery could carry both viable weeds and live insects, but the nature of the contamination did influence the loading of plants and insects. Sampling of Chatham Island pasture, found that while some weevil species such as *Sitona obsoletus* and *Atriconotus taineatilis* were absent, others such as porina, Argentine stem weevil and a native weevil *Irenimus aequalis* were established. Surprisingly, the ASW parasitoid *Microctonus hyperodae* was also present, indicating at least two invasions of the weevil to the Island. Knowing what can be carried in soil or on contaminated used machinery combined with an understanding of what is on the island is valuable information to developing a programme focussed on pathways to keep unwanted pests out. One important component to all this research, is information sharing so that commercial operators supplying the islands and the general public are made aware of the risks and potential economic costs of unwanted weeds and insect pests reaching the Islands.

What's bedevilling island biosecurity today?

Euan Kennedy, Keith Broome and Verity Forbes
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Euan, Keith and Verity work as Threats Advisors in DOC's Science and Capability team (in Christchurch, Hamilton and Nelson respectively). All have worked extensively in specialist conservation fields. Euan's experience relates mainly to threatened species of all taxa, but especially insular endemic birds such as the Chatham Island black robin. He is currently co-ordinating DOC's programme to improve its biosecurity practices nationally. Keith instigated the project in his role as a founding member of DOC's Island Eradication Advisory Group (IEAG). He is widely regarded internationally as a pioneer and leader in the exacting field of island eradications. Verity came from a thoroughly practical grounding in ecological pest control to a national biosecurity role in 2001. She now manages plant, animal and pathogen pest threats of conservation significance on New Zealand's main landmasses.

DOC has embarked on a concerted programme to improve its island biosecurity performance nationwide. The original emphasis on strengthening internal culture, methods and tools has now extended to the fraught issues of managing public behaviour on and around pest-free islands. Our broadening horizons have confronted us with challenges and dilemmas, some unexpected. We discuss a small selection.

First, DOC pursues contradictory policies in pest-free island management wherein promotion as destinations outstrips capacity to protect them as sanctuaries for rare biota. Second, uncontrolled public access to open sanctuaries questions the sense in strenuous quarantine for our own visits. Third, the visiting public do not believe they may be carrying a mouse in their bag when we ask them to check. Fourth, fashionable notions of quarantine efficiency argue for focusing on high risk probabilities alone, despite pest organisms making no such elegant distinctions. Fifth, burgeoning concerns about the welfare of pests are sometimes blind to the welfare rights of the species they prey on. Finally, leaks at national and regional borders are ramping up pressures on our island surveillance systems and response tools. Resolving these matters is proving to be instructive and ultimately instrumental in reshaping our biosecurity arrangements.

Pest animals invading islands - are we learning?

Keith Broome, Euan Kennedy
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Keith and Euan are part of a small team of technical advisors dealing with plant and animal pest issues across NZ's conservation land. This is a national role with a primary focus on developing and maintaining quality management systems for DOC staff to use when planning and running animal pest management projects. Keith has been involved in pest management in NZ for 30-mumble years.

We Kiwis excel at eliminating pests from islands. Our pests seem to excel at getting back there. Recurrent incursions have a number of explanations. We are now eradicating pests from islands with high rates of visitation or within easier reach of mainland sources of infestation. These vulnerabilities are compounded by inadequate quarantine for visitors. Pests are also swimming further than we have anticipated, and some novel pathways have materialised in recent times. To sustain eradication pay-offs, we must be alert to all likely invasion pathways for new and familiar organisms. We need to improve our conventional tactics of prevention, detection and rapid response. New tools are tantalisingly close but won't be realised without concerted institutional support. Current initiatives in biose curity awareness and collective knowledge are striving for better public outreach. In these ways, defence of our vulnerable islands is teaching us how to normalise biosecurity consciousness at home on the mainland and sustain pest-free sites there too.

Stopping the spread - Keeping good freshwater biosecurity behaviour sexy

Rose Bird
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Rose is an adviser in the Long-Term Incursion Management Team for the Ministry for Primary Industries, with responsibility for the coordination of the Freshwater Pest Partnership Programme, National Pest Plant Accord and Domestic Marine Pathway Management Project.

Say No to Didymo!' has been the national call to action for the last few years, with advocates on river banks, bumper stickers everywhere, banners, events, and wash down stations. *Didymosphenia geminata* (didymo) has been one of New Zealand's highest profile freshwater biosecurity incursions. The lack of control tools available at the time meant new and innovative methods were required and so was born the *Check, Clean, Dry* social marketing campaign – encouraging freshwater users to take personal responsibility for reducing the risk of spread.

When it was launched, the *Check, Clean, Dry* campaign was ahead of its time. Over the last 10 years, there have been many lessons learned and there are many challenges ahead. This presentation looks at the different iterations of a long running behaviour change programme and discusses the new frontiers of behaviour change tools that are now available.

Marine pest interim measures: Mediterranean fanworm as a case study.

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Irene has been working at Northland Regional Council since 2012 specialising in aquatic biosecurity. Previously she worked at NIWA in aquaculture and marine biosecurity

Since the discovery of Mediterranean fanworm in Whangarei Harbour in 2012 Northland Regional Council has been initiating innovative tools and approaches to slow the spread of this pest into and around our region. The Northland Regional Pest Management Strategy currently includes rules for marine pests, including fanworm. The Council has been applying these rules to effectively assist in the fanworm programme. Most regional councils do not have marine pests in their pest management strategies, and thus have limited legal power and resources to deal with marine pest incursions. Northland Regional Council has been involved in the development of a set of Interim measures to be made available to regional councils that outline easy, sustainable and effective tools that regional authorities could implement immediately. I will discuss the interim measures available, how we have implemented a number of these, and their effectiveness. I will also discuss the effectiveness and relative costs of the other tools we have used during the fanworm programme.

Community

Pest Detective: what can we learn from the clues?

Shona McCahon, Maurice Kennedy
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Shona was project manager of the Pest Detective project for the National Pest Control Agencies (NPCA). She is a self-employed writer, editor and oral historian whose work often relates to conservation and resource management. She has a background in landscape architecture. Shona has assisted NPCA with its publications and special projects for a number of years. She also assisted the New Zealand Biosecurity Institute in setting up its archive project and, in 2013-2014, carried out the Institute's oral history project.

Essential to pest animal management is the ability to recognise the presence of pest animals in the environment and identify the species present. While some information on pest sign recognition in New Zealand has been available for some years, it has been scattered and not comprehensive.

In November 2014, the National Pest Control Agencies (NPCA) launched www.pest.detective to fill the perceived gap. Described as 'a new online tool designed to help people in New Zealand identify the presence of pest animals', Pest Detective was planned to be an illustrated field guide. It was aimed at a broad audience of pest control practitioners, landowners, community conservation volunteers, students and members of the public. Nine months on, how successful has the Pest Detective website been in meeting its objectives? What lessons have been learned and what further development is planned?

This presentation will cover the origins of the project and why it developed the way it did; the challenges encountered in its pre-launch development; judgements made about the amount and quality of information; and what the post-launch usage statistics and feedback reveal. Who are the main users and do they correspond to the target audiences? Have there been technical issues? To what extent have users responded to invitations to engage and contribute to the project?

Pest Detective exemplifies the NETS2015 theme, 'The Learning Never Stops'. It is a freely available learning and reference tool designed to be kept up-to-date as new information comes available. The interactive online format has also been a new direction for NPCA that holds further potential.

Southland Community Conservation

Shaun Cunningham, Richard Bowman
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Shaun is a Biosecurity Officer at Environment Southland involved specifically with pest animal and marine invasive species programmes.

Community groups play an important role in the conservation of New Zealand's indigenous biodiversity. Throughout Southland there are a number of community action groups that are vital and assist Environment Southland and the Department of Conservation to conserve native biodiversity in the region into the foreseeable future. Environment Southland offers a number of services to these community groups such as regular and ongoing site-based monitoring as well as technical assistance with pest control programmes. A number of these groups have seen positive changes to their natural environment.

Success stories include Bluff Hill, Aparima Pestbusters in Riverton, the Otatara Landcare Group in conjunction with the Otatara Pestbusters, and more recently, the Omaui Landcare Group (OLG).

As a case study, OLG with assistance from the Department of Conservation, Invercargill City Council and Environment Southland has adopted a three stage plan to minimise the impact of invasive vertebrate pests to attempt to enable native flora and fauna to flourish along the Omaui coastline. Stage One began mid 2013 and involved trapping and tracking possums, rats and mustelids within the 14 hectare Omaui ICC reserve. The group witnessed significant changes to the birdlife and bush, and learned important pest control skills along the way. They are now at a point where they are ready to undertake 'Stage Two' which will have the group poison and trap the 220 hectare DOC Omaui Scenic Reserve. This is an interesting project in which the group has decided to undertake a one-off bait station distribution of sodium fluoroacetate (1080) throughout the centre of the DOC reserve to knock back pest populations. Reinvasion will be attempted to be controlled by extensive perimeter trapping in conjunction with monitoring programmes focussing on possums, mustelids and rats. Stage three will further expand control efforts, however, 'stage two' is currently of the upmost importance for OLG to achieve their conservation goals. Such programmes are very beneficial; not only are there positive changes to the local environment, actively involved community members learn important skills surrounding conservation management and pest control.

Environment Southlands Possum Control Areas (PCA) Programme

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Alfredo has been a Biosecurity Officer with Environment Southland since 20ll and has been involved with the Council's Possum Control Areas programme since that time.

The principal goal of the PCA Programme is the achievement of the Southlands Regional Pest Management Strategy objectives for possums in Southland, that is, landowners are responsible for maintaining possum densities at or below 5% residual trap catch (RTC) in the TB Vector Management Area (VMA) and at or below 10% RTC outside the TB VMA.

Possums have been significantly reduced and maintained (at less than 2% RTC) for a number of years on over approximately 1 million hectares as a result of the TB Free National Bovine Tb programme. As the Southland Tb programme meets its objectives and begins to wind down, large areas of land that have received annual possum control maintenance for several years or more are been dropped from the Tb programme. This allows possum densities to increase to a point where they would cause economic and environmental damage. This would be a huge step backwards after committing over $50m into this work in Southland during the past two decades.

Environment Southland (ES) implemented the PCA programme to assist landowners to meet their obligations under the strategy. Where the majority of farmers in a proposed area support in writing the long term control of possums, ES instigates initial control at its cost to ensure possums are reduced to a low level whereby farmers then take responsibility for maintaining this at <5 %RTC annually. ES will coordinate the annual control and either supply agreed materials at a reduced cost or access to a contractor. The use of possum bait stations throughout each PCA is the primary form of control. Currently Biosecurity staff have managed to successfully implement 210,000 hectares actively involving 32 PCAs and approximately 1000 farmers. There is strong support from land owners and the community at large to maintain low possum densities.

Tech

Combining Detection And Eradication Probabilities To Confirm Tb Freedom In The Hokonui Hills.

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Graham is a senior researcher at Landcare Research focused broadly on the management and control of mammal pest, with a major emphasis on the control and eradication of bovine tuberculosis (TB) from possums and other wildlife.

We developed and field tested a new surveillance concept for quantitatively assessing the probability that preceding possum control has successfully eradicated bovine tuberculosis (TB) from the possum population in a specified area. Currently, TB-infected possum populations are, in most areas, subjected to intensive possum control, to reduce local possum density to well below the level at which the disease can cycle within the possum population. Control is maintained for 10-15 years, and then surveillance (necropsy surveys of possums to determine whether or not they are infected) is often conducted to assess whether eradication has been achieved. Achieving a high level of confidence that an area is free of TB requires survey of a substantial proportion (more than half) of the possum population, which is expensive. The new approach involves earlier initiation of surveillance, at the same time as the last planned major control. By surveying a small proportion of the possum population (<15%) ahead of (for example) an aerial 1080 poisoning operation that achieves a >95% kill, the more-or-less simultaneous conduct of surveillance and control enables calculation of the joint probability that (for any specified number of TB-infected possums) any possum might have survived undetected, which is the converse of the probability of TB freedom. The practical feasibility of the approach was tested in the Hokonui Hills in Southland in winter 2014, and provided high confidence that that area (which has a possum-TB history dating back to the 1970s) was now free of infected possums.

The Trojan Female Technique: A new approach to pest control

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Dan is Portfolio Leader for the Managing Invasive Weeds, Pests and Disease area of work at Landcare Research. His own research focus is disease ecology and pest management. Key past research includes conducting the first field demonstration that orally-delivered live microbial vaccines can protect wildlife against natural disease challenge (working with bovine tuberculosis in possums), and demonstrating how interactions between parasites and herbicides cause developmental malformations in native New Zealand fish ('wonky' fish). Key current research includes developing novel control solutions for pests (such as the 'Trojan Female Technique'), developing metagenomic 'pathogen discovery' technologies (used, for example, for discovering an alpha-coronavirus in native New Zealand bat species), and conducting predictive modelling for the future risk of emergence of vector-borne diseases (such as Ross River virus) in New Zealand.

Each year animal pests cause an estimated $885 million of output losses in New Zealand's primary sector and devastate our valued indigenous species. Conventional approaches to pest control usually involve lethal control techniques that are limited by costs and effectiveness at low population density - and often have ethical as well as environmental issues. The Trojan Female Technique (TFT), potentially applicable to both invertebrate and vertebrate pests, aims to harness naturally occurring mutations that reduce male fertility to cause effective long-lasting suppression of pest populations. Here I outline the concepts behind the TFT, its potential applications and benefits, and the current stage of development

Design evolution to success with Goodnature Automatic Traps

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Stu is one of the founders of New Zealand conservation technology company Goodnature.

Multi-kill devices are considered an important component in the toolkit required to achieve and maintain New Zealand's long-term conservation aims. Two years of continued trap technology and lure development during long-term, large-scale field trials with the Department of Conservation have resulted in multiple successful pest control projects over large landscape scales using Goodnature Automatic Multi-Kill Traps.

This presentation will cover the Goodnature trap developments which lead to successful project use, lessons learned during the large scale trials and the planned future large scale application and the further enhancement of the system towards long-term conservation aims.

Technology advances for vertebrate pest eradication

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Charles gained a PhD from the University of Surrey, UK, after which, and from within the private sector, he played a major role in the development of a number of new drugs for the treatment of cardiovascular diseases. In New Zealand he worked for Landcare Research in different roles including MBIE (FRST) Programme Leader, Science Manager and Regional Manager for Hamilton and Auckland. He has played a major part in the development of a number of animal pest control tools currently employed within New Zealand, including Feratox®, Feracol® and Predastop®. Appointed a Lincoln University Professor in 2008 he established the Centre for Wildlife Management and Conservation where he led a number of research programmes, and where he still retains links. Charles specializes in leading research groups to achieve significant and tangible outcomes. His private sector experience is a major influence in his current leadership of Cawthron Institute whose researchers excel in freshwater, coastal and marine ecology, algal ecology and technologies, natural compound chemistry and food safety. He has published over 200 papers and achieved an A grade in the 2013 PBRF evaluation round.

Internationally, over the last 20 years the number of tools available for the control of small mammals has declined. Through the efforts of research we have bucked this trend in NZ and retained and developed new tools. Three new toxins have been extensively researched and registered with NZ EPA and MPI for field use, namely para-aminopropiophenone (PAPP) in 2011 for stoats and feral cats, zinc phosphide for possums in 2012 and encapsulated sodium nitrite (ESN) in 2013 for possums and feral pigs. The development of PAPP and ESN, coined red blood cell toxins, developed for humaneness, represent the first new vertebrate pesticides registered for field control of mammalian pests anywhere in the world for > 25 years. Research on rodenticides including norbormide continues, and more effective killing systems are being researched, and the first successful field trials of resetting toxin delivery devices for possum and stoat control were completed in 2013 and 2014. Improved deployment strategies, integration of humane and selective toxins, lures of greater potency and improved killing devices aided by species' recognition will transform ground control for endangered species protection. Aerial application of PAPP will greatly extend the range of stoat control. Our goals are shifting to enable reduction in density of rat, stoat and possum populations to zero over large scales (i.e. elimination at landscape scale), and to hold these at zero through detection and response including the use of new technologies for perimeter control as part of barrier systems for conservation.

Aquatics

Population ecology and genetic diversity of the invasive kelp *Undaria pinnatifida* in the Hauraki Gulf

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Kate has a BSc in Biology and Pharmacolgy and a post graduate diploma in Environmental Science. She has a strong work background in biosecurity and conservation and is currently in the last year of her PhD in Marine Science at the University of Auckland. Her PhD topic is 'The ecology and impact of the invasive kelp Undaria pinnatifida in the Hauraki Gulf'.

Understanding the ability of *Undaria pinnatifida* (Harvey) Suringar to impact upon native benthic communities and anthropogenic structures and activities in the Hauraki Gulf is vital to informing conservation and management plans in the Hauraki Gulf Marine Park. This requires an understanding of which genetic strains of *U. pinnatifida* are present and how population ecology manifests in this introduced environment. Population ecology was examined through two and a half years of monitoring at three sites; Westhaven marina in the Waitemata Harbour and a mussel farm and adjacent natural reef site in the Coromandel Harbour. Genetic analysis was carried out, following Uwai et al. (2006), on samples from around Westhaven marina (n=15) as well as a number of sites within the Wilson Bay Marine Farming Zone (WBMFZ) in the eastern Hauraki Gulf (n=15). Monitoring at Westhaven marina confirmed an annual population cycle with maximal growth rates of almost 3cm day-1 and peak abundances of more than 120 plants m-2 occurring between late winter and early summer. Populations in the Coromandel Harbour had lower mean maximum abundances than those found at the marina and the coastal reef population had a smaller average plant size than the populations on artificial structures. *Undaria pinnatifida* on the mussel farms and the marina had a longer annual presence and an extended annual reproductive capacity compared to the coastal population. Artificial structures such as marinas and mussel farms provide optimal conditions for *U. pinnatifida* growth and proliferation as well as aiding in anthropogenic spread. Genetic analysis confirmed all samples to be haplotype 10, a strain which originates from China and Korea and has been recorded in Argentina, Melbourne and from ports, marinas and aquaculture areas throughout New Zealand. Of the ten haplotypes identified in New Zealand, haplotype 10 is currently the only haplotype recorded north of Kaikoura. Distribution records indicate the suitability of haplotype 10 for a range of environmental conditions and substrata and the likely spread of this strain of *U. pinnatifida* amongst domestic ports and marine farming sites via local shipping and aquaculture transfers

Best practice framework (BPF) to support decision-making and management of aquatic weeds by regional councils

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Paul holds an MSc in biological sciences from the University of Waikato and has been a part of the aquatic plant management research team at NIWA since 1988, with over 25 years experience in the field of plant ecology. He specialises in freshwater biosecurity, especially risk assessment and pest management. He previously worked with MAF, co-ordinating eradication programmes for nationally important noxious aquatic weeds. He also has experience in wetland ecology and management of nationally endangered wetland plants. He provides management advice to various government departments and regional authorities, and is a member of several Technical Advisory Groups with MAFBNZ.

Many of the 70 aquatic plant species naturalised in New Zealand have become problem weeds. Most of our lakes, rivers and streams are affected by at least one of these species. The threats and impacts of invasive aquatic weeds require management within a complex range of environments with utilisation of a variety of control methods. Management of aquatic pest plants is a core biosecurity function for regional councils and their key biosecurity partners. Additionally these pests require management by other regional council groups to ensure efficient land drainage to protect agricultural and urban areas, and also to protect and enhance aquatic biodiversity. This tools development project fits strategically within both biosecurity and freshwater priority areas of the Regional Council RS&D strategy. Aquatic weeds are a stressor to water resources additional to water quality and quantity issues addressed in this strategy, and these weeds severely impact water uses such as drainage, irrigation and power generation, or are likely to do so in the future.

This talk will explore the proposed development of an aquatic weed best practice framework that will comprise three main components: strategic analysis tool, incursion detection tool, and the aquatic weed control toolbox. The tools are informed by long-term research programmes undertaken by NIWA (currently the MBIE core-funded programme “Freshwater Biosecurity” within NIWA’s Freshwaters and Estuaries Centre). This research, in conjunction with collaborative projects with regional councils and central government agencies, has provided the science supporting the development of all components to be brought together in this project. These guidelines will lead to better informed decision-making including preventative and reactive management of aquatic weeds, ensure legal compliance; the breach of which could prejudice future aquatic weed management with loss of some tools within an already limited control toobox. A key component of this project is the provision of feedback from regional council practitioners and managers as well as researchers into the framework to ensure its currency and maintenance of the framework after completion of this project is also essential to enable continued improvement and effectiveness of aquatic weed management.

Aquatic weed research - the learning never stops.

Rohan Wells, Paul Champion
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Rohan is a freshwater ecologist with 35 years in aquatic plant ecology and weed control research with MAF and now NIWA. He has worked in virtually all significant accessible water ways throughout the country; supervised the Rotorua lakes weed control programme from 1998 through the early 2000’s for DOC and included pre- and post- SCUBA and sonar assessments of results for fine tuning the programme; tested new US aquatic herbicides fluridone and endothall for use in New Zealand and was involved with the aquatic registration of Aquathol K through ERMA (now NZ EPA); and was also involved with grass carp use and evaluation in lakes and drains, as well as evaluating bottom lining, mechanical harvesters and draglining for weed control. Rohan researched control options for water net and was part of the didymo response team for the North Island and part of the TAG for the eradication of hornwort from the South Island and supervised the eradication of hornwort from Centennial Lake Timaru, the last known site in the South Island.

This paper traces the history of aquatic weed research and application to weed management with an update of new techniques arising from NIWA research. It follows a range of historical management actions with numerous examples of weed problems arriving, assessing their threat, detecting them early and, in some cases, eradicating them. The message is, there is no single best option for weed control; none of them are without potential environmental impacts. For each situation and in each location it is up to managers and the community to weigh up the option(s) and decide on an approach that best

suits their desired outcomes within economic, political, cultural and environmental constraints for that situation, guided by good science. Finally, new research directions such as remote assessment of submerged weed infestations and region-wide aquatic ecological condition monitoring and their possible adoption into aquatic weed management programmes are discussed. As history has shown, "the learning never stops" and this is also the way forward; adapting and refining existing management tools, testing new ones and if effective, adopting them.

Searching haystacks for a needle: the challenges of lake weed surveillance

Mary de Winton, Tracey Burton, John Clayton
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Mary is a scientist and freshwater ecologist at NIWA, Hamilton, with over 25 years' research experience on submerged vegetation management. During this time Mary has worked on (and in) over 155 New Zealand lakes. Research interests include the biosecurity management of invasive water weeds, the enhancement and restoration of native submerged plants, resource survey, management of aquatic plant data and its application to research questions, and the taxonomy of New Zealand charophytes (freshwater algae akin to seaweeds).

Surveillance and incursion delimitation practices for the early detection of new submerged aquatic weeds are challenging. Amongst these challenges are the large areas of potential underwater habitat for weeds, varying water depth and restrictive water clarity. Recently NIWA undertook a review of potential methodologies and their effectiveness for Bay of Plenty Regional Council (BOPRC). Results confirmed that the most effective methods are those using in-water observation by divers with various propulsion devices. We tested the best in-water diver methods in the field, under depth and clarity conditions typical of many lakes (Lake Ōkāreka). Surrogates for aquatic weeds (totara branches) were used to test diver detection accuracy at different depths, levels of background vegetation development and for different heights of surrogates. Surrogates were placed within a 2 m wide, 100 m long transect for divers' observations. Techniques tested included snorkel diving, scuba diving, underwater scooters and boat tows (snorkel or manta board tow). Also tested for comparison were sonar side-scan and underwater video.

The trials identified significant differences in the detection accuracy for surrogates between the techniques, depending on water depth. The greatest detection accuracy in shallow water was by snorkel (89%), whilst in deeper water, scuba/scooter techniques were most accurate (74-77%). Nevertheless, the speed of different methods also needs to be considered in formulating strategies (e.g., more frequent coverage with less effective detection vs detailed coverage less often). We concluded that prioritised and systematic underwater searches of at-risk areas provides the best chance of intercepting new submerged weed incursions.

Insects

Assessing *Pneumolaelaps* sp mite as a biocontrol agent of *Vespula* wasps – prevalence surveys

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Over the past ten years Bob has worked on a wide range of projects. These have ranged from developing new techniques to propagate endangered freshwater mussels in my home state of Missouri, to insect pests of tree fruit in Washington State, to invasive wasps here in New Zealand. For the past six years Bob's work has been almost entirely focused on wasp behaviour and ecology. His work at Landcare Research is be mainly centred on determining the value of a new species of mite as biological control agent of wasps.

New Zealand has suffered from the introduction of two of the most invasive wasp species known, the German and common wasps. Recently a new species of mite was discovered in wasp nests that appeared to be smaller in size and less aggressive

in disposition. The mite is a new species to science and hardly anything is known about it. In winter 2014 we started a study to explore the possibility of using the mite as a biocontrol agent against wasps. Our first objective was to find out how prevalent the mite is in New Zealand. Winter surveys for the wasp mite in the Tasman, Marlborough and Nelson Lakes areas were carried out in 2014. The results from the winter survey demonstrated that the mites can be present on over-wintering queens of common wasps (~25%) as well as the German wasps (~30%). Methods have been developed to rear the mites in captivity so that can be used in future bioassays. Another survey will be performed to determine the prevalence of mites in Marlborough, Tasman and Canterbury and correlated with nest size.

Update: Brown Marmoreted Stink Bug And How Learnings From Queensland Fruit Fly, Can Be Applied.

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Rory joined MPI in Dec of 2010 where he manages the gypsy moth and fruit fly surveillance programs, originally from the east coast of Canada were he worked in biosecurity with the Canadian Food Inspection Agency (CFIA) in various commodities for nine years including potatoes, fertilizer and forestry. Roles have included managing national forestry pest programs such as gypsy moth, Dutch elm disease and Christmas tree exports.

The Brown Marmorated Stink Bug (BMSB) is a temperate/subtropical species of stink bug native to China, Japan, Korea and Taiwan and has recently become a serious horticultural pest causing significant economic harm in the USA. (Pfeiffer, 2011). All BMSB life stages except eggs can be damaging to plants. The host range of this bug is wide, including many fruit trees, field crops and forest trees. It infests both cultivated and wild hosts, feeding damage to fruit can result in premature fruit drop and unmarketable fruit resulting in economic loss. Additionally BMSB is a significant public nuisance in its aggregation phase. It overwinters indoors as an adult throughout most of its range in large numbers in homes and commercial buildings which increases the likelihood of transportation on inanimate objects. Since 2010, warm early spring and summer seasons have resulted in an increase in the number of generations and subsequently a higher than normal BMSB population in the United States. With no natural control mechanisms to keep populations in check, significant impacts to horticultural crops have occurred. Initial attempts to successfully control the population are proving unsuccessful. The pest's impact on integrated pest management systems is significant, as growers were forced to apply increasing amounts of insecticides.

The likelihood of entry into New Zealand is pathway-dependent and the pathways that pose the highest likelihood of entry are containers (and items within), and vehicles and machinery especially during the northern hemisphere fall/autumn (Sept-Jan) when aggregation takes place. Passengers visiting or returning to New Zealand are also seen as a pathway as BMSB could potentially hitchhike in traveller's luggage or personal belongings sent via mail. BMSB is a highly mobile pest persisting for most of the growing season, adults commonly migrate changing hosts to find the most desirable food sources. BMSB has been recorded from more than 300 different plant species belonging to 49 different families. Therefore, once BMSB has entered New Zealand it is likely that it will find a suitable host plant.

BMSB continues to be intercepted both at the border and post border in New Zealand with numbers increasing each year. An overall whole of MPI systems approach has been integral in ensuring that BMSB does not get established in New Zealand but the pressure is on. An overview of the current BMSB situation, the actions that MPI has taken and the science being investigated in New Zealand to mitigate the risk of introduction to New Zealand will be discussed.

The Queensland fruit fly (QFF) (*Bactrocera tryoni*) an exotic pest of economic significance continues to be detected post border in New Zealand in 3 of the last 4 years after 16 years of no detections. The pressure from this pest on New Zealand continues to increase. For the first time in February 2015 a breeding population was detected in Auckland New Zealand. The actions by MPI, Asure Quality, Auckland Regional Council and other members of the National Biosecurity Capability Network (NBCN) were instrumental in controlling this incursion swiftly. How this network worked together as a cohesive team and the actions that were taken will be discussed and how these may apply to a likely post border detection of BMSB in New Zealand's future.

A Sting in the Tale

Heather Pearson
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Heather has been an Incursion Investigator in the Plants and Environment team with the Ministry for Primary Industries in New Zealand for over nine years. An Incursion Investigator's work involves preventing harmful organisms that have crossed New Zealand's borders from establishing and managing the risks and impacts of pests and diseases that have already established in New Zealand.

Scorpions have been detected on numerous occasions in New Zealand directly associated with imported commodities and international travellers. This highlights the need to be vigilant about introductions on these pathways. Scorpion interceptions at the border from the last 10 years will be presented. Investigations relating to detections of scorpions beyond the border will be discussed. The deliberate introduction of scorpions, hitchhiking of scorpions in goods and belongings, and the use of scorpions in novelty food and drink items are some of the methods by which scorpions gain access to New Zealand. This paper will review how MPI deals with these incidents.

The Great White Butterfly Eradication, Nelson: Is success on the horizon?

Chris Green
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Chris works in the Science and Capability Group of DOC as a Technical Advisor on Threats (pests) based in Auckland and has a specialist background in entomology. Much of his work involves biosecurity and he has provided advice to MPI during a range of successful eradications. Chris has also worked on threatened insects and island restoration programmes.

The first record of great white butterfly (*Pieris brassicae*) (GWB) in Nelson was found on 14 May 2010 as caterpillars feeding on nasturtium. The property was 1.5km from the Port of Nelson where it was presumed to have entered the country. The GWB lays eggs in clusters of 30 to over 100 on host plants and caterpillars feed gregariously with the possibility of complete defoliation before moving en masse to neighbouring host plants. Overseas records show that GWB caterpillars feed on a broad range of species but mostly within the cosmopolitan family Brassicaceae (cresses). As well as brassica species grown commercially as crops, including forage crops, there are 79 species of native cresses in New Zealand, 92% of which are endemic and 71% are classified as 'Threatened' or 'At Risk' with 18 species being "Nationally Critical". Many of our endemics are known hosts for the small white butterfly (*Pieris rapae*) and overseas records show an overlap in the host range between the two butterfly species. The arrival of the GWB represented a significant additional threat to many endemic cresses.

In November 2012 the Department of Conservation (DOC) took over the response initiated by the Ministry for Primary Industries (MPI). The 2012-2013 season saw GWB spread out to a maximum of 12 km, both north and south, from the Port. However, by late autumn 2013 the distribution had been reduced to about 7 km from the Port and this was maintained through to mid-2014. As well as containment the emphasis during the 2013-2015 seasons has been on suppression of the infestation. This involved reduction of the higher numbers in the core of the infestation nearer the Port as well as preventing expansion of the distribution beyond the 7 km boundary. During 2014-15 there have been up to 30 field staff in teams which have gone door to door through Nelson suburbs with repeated sweeps in many prioritized areas during each GWB generation.

A computer generated GWB phenology model shows that there appear to have been 3 to 4 generations per year in Nelson. The model allows the opportunity to target particular life stages at certain times of the year. This targeted approach has maximised the efficiency of the available resources leading to a massive decline in GWB counts over the spring – summer period of 2014-2015. December 2014 saw just a one single record found and zero finds for January 2015. Thus the programme has achieved "knock-down" and has entered the "mop-up" phase. But how close are we to eradication? The presentation will explore this and describe the highlights of the huge effort over last season.

Thursday 27 August 2015

Integration of biosecurity management into whole farm sustainability assessments: a sustainability dashboard tool for linking stakeholders in production landscapes

Henrick Moller (University of Otago) and Catriona MacLeod (Landcare Research)

Henrik is an ecologist and wildlife manager who applies a mix of ecology, social and economic research methods for supporting bottom-up and community-led approaches to sustainability. He is a Professor Emeritus at the University of Otago's Centre for Sustainability and director of Ecosystems Consultants (www.ecosystemsconsultants.co.nz/). He is the science leader of the NZ Sustainability Dashboard project. Henrik has researched strategies and methods of controlling rabbits, wasps, rats, stoats, cats and ferrets for conservation, disease control and sustainable farming. Dr Catriona MacLeod, an ecologist based at Landcare Research (Dunedin), came to New Zealand shortly after completing her training in Scotland. Understanding the impact of land management practices on farmland bird populations was a primary focus of her early work. More recently, she has played an active role in designing, trialing, implementing and reporting on national environmental monitoring systems in both production and conservation landscapes in New Zealand. Catriona is developing the New Zealand Sustainability Dashboard project's environmental assessment framework.

The New Zealand Sustainability Dashboard (www.nzdashboard.org.nz/) is a voluntary and producer-driven sustainability reporting framework and online tool for benchmarking farm performance, learning, and future-proofing New Zealand's agricultural export market access. This talk will outline the challenges and opportunities in designing a framework and monitoring approach that first and foremost makes sense to producers, helps their decision making and demonstrates their environmental, social and economic contributions to all New Zealanders and consumers. It will also provide indicators that can be upscaled to landscape, regional and national levels to assist policy makers, local and central government, scientists, NGOs. Two main lessons emerge from the project for delegates at this NETS2015 conference: firstly, all the "layers and players" have valuable knowledge and linked roles to play for enhanced biosecurity; secondly, managing biosecurity as a single threat rather than part of a whole social-ecological-economic-governance systems approach will undermine our best efforts for mitigating and counteracting the effects of invasive species.

Our Big Blue Backyard – How six hours of television inspired half a million Kiwis to fall in love with their coastline all over again.

Judith Curran, NHNZ Ltd

Judith is Executive Producer at Natural History New Zealand Ltd. Since joining NHNZ in 2001, Judith has been the driving force behind a diverse range of high profile documentary programs which have screened on multiple networks around the world. Judith's subject matter ranges from the exploits of young orang-utans in the Borneo jungle - to Vintage Fashion glamour in Los Angeles. Survivors of terrifying shark attacks rub shoulders with a high profile Chinese conservationist who investigates horrific rhino and elephant poaching in Africa. Judith also produced the recent ratings blockbuster on TV1 "Our Big Blue Backyard" which explored six marine locations around New Zealand. She is now currently in production on Season #2.

Natural History New Zealand's series 'Our Big Blue Backyard', funded by NZonAir's Platinum Fund, is a ratings blockbuster that hit our screens late 2014. This series with its intimate portrayal of the daily dramas of some of our marine animals struck a chord with its New Zealand audience which is still resonating. Kiwis were reminded of their connection with the marine environments which surround us - all 15,000 kilometres of coastline - and reminded of how fascinating the lives of our sea creatures, from the most charismatic to the most mundane, really are.

Vertebrates

Secretary Island Stoat Control Program

Peter McMurtrie
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Peter is a Biodiversity Ranger with the Department of Conservation's Fiordland District. Peter has been leading the Secretary Island and Resolution Island Restoration Program since its inception in 2005. His skills lie in leading large scale stoat control and species monitoring operations in remote back country areas that are often logistically and operationally difficult to work in. The Secretary Island stoat trapping program has been underway since 2005. Over the course of this period stoat numbers have been reduced to very low densities over the 8,140 ha island.

The current operation is effectively delivering sustained stoat control and maintaining very low stoat densities, with the offspring of un-trappable stoats and most, but not all, invaders being trapped. However, due to sporadic reinvasion and breeding among a few un-trappable female stoats, the original programme goal of full and sustained stoat eradication is not being achieved using the current conventional stoat trapping techniques. This regime appears to be sufficient to sustain species where populations have some tolerance to low-level stoat predation. It may not, however, be sufficient to enable a successful reintroduction of species that are highly vulnerable to stoat predation such as saddleback/ tieke and is not adequate for kakapo or snipe to persist. Maintaining a status-quo approach to management of these islands will result in a rising stoat population over time, as the numbers of stoats resistant to existing tools grow due to the inherent selection pressures. The stoat trapping program remains a highly cost effective programme with very low stoat levels being achieved at $10.70 per hectare. Nevertheless, if the goal of maintaining stoats at zero density for long periods of time is to be achieved we need to invest in new tools which enable trap shy and reinvading stoats to be caught prior to breeding events.

Looking forward, the program needs to invest in new stoat killing technologies if it is to achieve its objectives. This includes using new trapping devices and lures as well as trying new poisons such as PAPP. The program is also investigating the feasibility of increasing trapping on the mainland to intercept reinvading stoats. The program has proven best practice stoat control standards can knock down stoats to very low numbers on islands. However, developing techniques to remove reinvading stoats or small numbers of trap shy stoats is essential, not only for this project but for the wider success of island eradication attempts and the fulfilment of the wider communities Predator Free NZ aspirations. Secretary Island offers the ideal opportunity for investment in trialling these technologies using a project team that is committed to the success and innovation of island eradication attempts.

Is one night enough? Improving the detection of pest animal species in upland beech forest and alpine habitats

Jennifer Christie, Penelope Holland, Andrea Byrom, Roger Pech
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Jenny is an ecologist who works for the Department of Conservation. She has undertaken a variety of ecological research projects, including investigating the ecology of short-tailed bats in Fiordland; methods for improving pest animal detection and capture success; and the impacts of climate change on biodiversity in New Zealand. Her most recent research is in partnership with Landcare Research, and is investigating how invasive pests, such as ship rats, may respond to climate change.

The ability to monitor pest animal species when they are at low densities is vital for conservation management and pest control. Adequate long-term monitoring of these species is vital for detecting changes in distribution and the effects of ecological perturbations such as climate change. However, detecting animal species when they are at low density is difficult as species are sparsely distributed in time and space.

In New Zealand, footprint tracking tunnels are used extensively to estimate relative indices of abundance using a standardized one-night index for rodents. This method is good because tracking tunnels are able to detect multiple species, are simple to operate, and relatively cheap. However there is a trade-off, between robust detection and rapid detection with minimum cost. In some ecosystems, such as beech forest and alpine areas where pests are at low density, footprint tracking rates after one night are low or non-existent. Because there is no measure of probability of detection associated with this index, establishing whether zero tracking means no animals are present, or whether they were simply undetected, is not possible.

In this study multi-night footprint tracking tunnel data were used to estimate how many nights is enough to detect a particular pest species if they are present, but at low density. The probability a species was present, given they weren't detected after one night, was also estimated. The effects of site, season, altitudinal / habitat zone and operational treatment were also taken into account. We discuss the results of our models and make recommendations about how the existing one-night tracking tunnel index can be improved.

Wide-scale predator control and fauna recovery: Lessons from Hawke's Bay

Al Glen, Rod Dickson, Campbell Leckie
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Predator control is often targeted at sanctuaries and reserves with rare or endangered fauna; it is rarely conducted in pastoral landscapes. In Hawke's Bay the Department of Conservation conducts intensive predator control in Boundary Stream Reserve to protect endangered species such as kiwi, kaka and kōkako. However, predators still occur on neighbouring farms. They continuously reinvade the reserve and also prevent native species from expanding into nearby bush fragments. Since 2011, Hawke's Bay Regional Council has been controlling predators on two farms adjacent to Boundary Stream. The aims are to reduce reinvasion into the reserve and to promote native biodiversity in the broader landscape. Landcare Research monitors predators, native birds, lizards and invertebrates on these farms, and in an adjacent area with no predator control. Since trapping began, the abundance of cats, ferrets and stoats has declined compared to the non-treatment area. Tracking rates of native lizards have increased from zero to around 50% in the predator-removal area, while tracking tunnels in the non-treatment area have detected no lizards. Predator captures have also decreased within Boundary Stream, suggesting the wide-scale predator control provides an effective buffer for the reserve. From these results we have learned that predator control should not necessarily be limited to areas where vulnerable species occur. Strategic control in nearby areas can help to reduce reinvasion and/or allow native species to disperse through the broader landscape. This emphasises the importance of an integrated approach to pest control across public and private land to achieve landscape-scale benefits.

Modified Victor® Easy Set® Rat Traps For Trapping Stoats And Ship Rats In New Zealand: Field Trial Results

Grant Morriss, Bruce Warburton
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Grant has worked for Landcare Research for 23 years, developing and field-testing new methods for vertebrate pest control, improving target specificity of vertebrate pesticides, monitoring impacts of vertebrate pesticides, and welfare-testing of vertebrate pest traps.

In New Zealand, stoats (*Mustela erminea*) and ship rats (*Rattus rattus*) are trapped to reduce their predation on native wildlife. The Victor® Easy Set® rat trap, designed initially just for rats, has been modified to also capture stoats; the modified trap was tested and has passed New Zealand's National Animal Welfare Advisory Committee trap-testing guidelines for capturing and killing both stoats and ship rats. In collaboration Pest Control Research, commercial prototypes of the modified trigger and a shroud were manufactured and field-tested in Omahu Bush in Canterbury. The modified traps were placed in purpose-built corflute tunnels to minimise any risk to non-target species. A total of 288 traps were deployed, clustered in groups of three in a 50 × 100-m grid pattern covering 50 ha. Prior to trap deployment chewcards were used to assess rat densities in the area and in a nearby un-trapped area. Although the traps had been modified to also kill stoats, rats were the primary target in this field test. Traps were first set in October 2014 and cleared and re-baited at monthly intervals. In January and March 2015 rat densities were again assessed using chewcards and this result compared with the pre-trap chewcard index. In the first 4 months a total of 59 rats, 31 mice and one stoat were caught. We will report the full trapping results and analyses of data from this field trial.

A review of chamois (*Rupicapra rupicapra*) management in Fiordland National Park 1998 to 2013: evaluating success and future options.

Richard Ewans, Em Oyston
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Richard has a BSc (Hons) in Plant Ecology from Otago University and spent 10 years working for the Department of Conservation in Te Anau as a biodiversity monitoring specialist. He is now an independent consultant ecologist (Eco-South) focusing on animal pest and botanical work for a variety of clients.

Chamois (*Rupicapra rupicapra*) have been present in Fiordland National Park since the 1950's and are now distributed throughout, with the highest densities in the northern part of the park. Chamois densities were periodically reduced in localised areas by Wild Animal Control Operations (WARO) and limited control operations between the 1970's and early 2000's but have only been subject to a widespread control programme since 2003. Between 2003 and 2013 kills per unit effort (kills per kilometre flown in observable habitat) decreased substantially in the central and southern operational blocks within the Fiordland National Park chamois control operational boundary. Kills per unit effort also decreased overall in the northern block but with some periodic increases. The periodic increases in the northern block appear to be due to increased hunting effort in areas not previously hunted, or not hunted for a number of years, and therefore likely to be a function of lack of overall effort across the block rather than immigration into the block or recruitment within it. A small period of increased effort in this block should achieve a large enough reduction in chamois densities to ensure sustainable control of chamois at low densities across the large majority of Fiordland National Park. The chamois control programme alongside commercial deer recovery (WARO) appears to be providing a high level of protection to native flora in indigenous ecosystems above treeline across approximately 1.2 million hectares of Fiordland National Park.

Development of a solid extruded bait containing diphacinone and cholecalciferol for possum and rodent control

Lee Shapiro, Charles Eason, Elaine Murphy, Duncan MacMorran and Paul Aylett
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Lee manages the research and development portfolio at Connovation Ltd as well as co-leading the MBIE funded possum research program at Lincoln University. Most of his work involves the research, development and registration of new toxins and delivery systems like PAPP for stoat and feral cat control, sodium nitrite baits for possum and pig control and zinc phosphide in resetting systems to control possums.

A solid extruded multispecies bait for the control of possums and rodents containing diphacinone and cholecalciferol (D+C) has been developed by Connovation Ltd. The bait contains the same dose of diphacinone (0.005%) as current rodenticides and a very low dose of cholecalciferol (0.06%), less than one tenth the amount of our standard cholecalciferol baits. The aim is to provide a multispecies bait that does not require a controlled substance license like 1080 and zinc phosphide, is cheaper than standard strength cholecalciferol baits, only requires a single feed to be lethal to possums and rats and has the potential to be safer for non-target species. This combination appears to provide single dose potency equivalent to that delivered by brodifacoum without the residue concerns associated wi th second generation anticoagulants. The D+C bait will provide conservation gains alongside TB vector management as the bait has the potential to be both a rodenticide and a possum toxin. Cage and field trial results will be presented and registration is being pursued promptly, with both actives already approved for use in New Zealand this should not be a lengthy process.

‘Mega-masts’ and the costs of pest control: past, present and future

Roger Pech, Mandy Barron, Andrea Byrom, Jenny Christie
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Roger is a Principal Scientist at Landcare Research. His research interests are multi-species pest management, the impacts of invasive mammals on biodiversity, and the management of outbreaking species of small mammals. He has worked primarily in New Zealand, Australia and China. Currently he leads the ‘Invasive Mammal Impacts on Biodiversity’ programme at Landcare Research, a project on ‘Surveillance and forecasts for mouse outbreaks in Australian cropping systems’ at the Invasive Animals Cooperative Research Centre, and a collaborative project on ‘Early warning and sustainable management of rodent pests’ in eastern China.

Changes in New Zealand’s climate could have major consequences for the cost of controlling invasive pest mammals. Masts in native forest and grassland ecosystems can lead to outbreaks of rodents and their predators, with subsequent high predation pressure on native fauna. The management solution is pre-emptive control operations, usually with aerially-sown 1080 baits distributed over large areas. At the moment this is happening with DOC’s ‘Battle for our Birds’, which aims to increase the area of pest control to over 500,000 ha of native forest.

Analysis of long-term data sets, some spanning more than 30 years, suggests the likelihood of masts by several species, including beech and tussock grasses, is positively correlated with the difference between average summer temperatures in successive years (ΔT). Also ΔT can predict directly the probability of outbreaks of house mice after beech masts. Based on ΔT values for the last 4 decades, ‘mega-masts’ (defined as years with >50% of beech forest predicted to experience a mast) have occurred sporadically at a rolling average of 5.2 per 25 years. For example, the 2014 mega-mast was predicted to extend across 85% of beech forest in the South Island.

The latest projections from a regional climate model for New Zealand provide ΔT values to 2100 for four Representative Concentration Pathways (RCPs) corresponding to different scenarios for greenhouse gas emissions. RCP 2.6 is an optimistic scenario with peak CO2 concentrations around 2050 followed by a decline, RCP 4.5 is a lower mid-range scenario with CO2 increasing initially then stabilising over the 25–30 years prior to 2100, RCP 6.0 is an upper mid-range scenario with CO2 stabilisation after 2100, and RCP 8.5 is a pessimistic scenario with rapidly increasing greenhouse gas concentrations.

Compared to a reasonably likely future climate with mid-range greenhouse gas emissions represented by RCP 4.5, the number of mega-masts with subsequent high-cost pest control is estimated to decrease for all other RCPs over the 21st century.

Plants

Questions, answers more questions - Flupropanate herbicide

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In November 2011, a soluble herbicide containing the active ingredient flupropante (Taskforce) was registered in New Zealand to combat a number of invasive dryland pastoral weeds – most notably Chilean needle grass (*Nassella neesiana*). The chemistry is not new with flupropanate products having been available in Australia for over 40 years. The relatively small market in New Zealand has been a stumbling block for manufacturers until a tenacious former Biosecurity Officer from Marlborough District Council (MDC) took the bull by the horns. After initially being registered for ground application only, a further application was approved in July 2012 to expand the registration to include aerial use and include kangaroo grass (*Themeda triandra*).

Since 2011, landholders battling Chilean needle grass and Nassella tussock (*Nassella trichotoma*) have been using flupropanate – especially in Marlborough. MDC staff have also been tracking progress on a smaller scale through their own use. Not only has there been plenty of opportunity to watch, observe and learn more about the product but more research supporting a renewal of registration has also been occurring in the background. An overview of field observations and preliminary research results will demonstrate that when a new herbicide comes on the scene, the learning definitely never stops!

Contrasting Approaches to Pest Plant Compliance in the Deep South

Adam Brown
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Adam is a member of the biosecurity team at Environment Southland. Educated in Biological Science, he caught the biosecurity bug whilst employed in an aquatic pest advocacy position with the Bay of Plenty Regional Council. He is currently in a pest plant compliance role having once worked as a Police Officer in London.

Environment Southland employs two different methodologies in achieving compliance with RPMS rules for a select group of pest plants in the region. This presentation outlines the use of powers under the Biosecurity Act, particularly to give directions and act on default, as a tool for tackling gorse and broom infestations in 23 Southland townships. In comparison, advice and education through discussion with land owners/occupiers is the approach taken for ragwort and nodding thistle infestations in the rural environment.

Enforcement- why it works

Darion Embling
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Darion has worked as a pest plant officer at Waikato Regional Council for eight years. Based in Hamilton, his main roles of late are site led programmes with pest plants spartina and royal fern, biocontrol, Regional Pest Management Plan review, pest plant surveillance, the sea spurge eradication programme, restoration, conservation and pest plant inspection/enforcement.

Pest plant enforcement can be a difficult, costly and a time consuming activity to undertake. So, why bother and put people through this process? The Waikato Regional Council Biosecurity team has been using enforcement, at a number of different levels, as a key tool in managing pest plants since Regional Pest Management Plan's were established. So does this process work, how do we know it works and is it worth while? These questions were put to the Hamilton Pest Plant Officer and the results confirmed the justification of using enforcement in RPMP's. Most people who had gone through an enforcement process were still following the RPMP rules many years later. This talk will discuss enforcement as a pest management tool and outline Waikato Regional's Councils biosecurity enforcement process.

How to Identify Recently Released Weed Biocontrol Agents

Lynley Hayes
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Lynley is the leader of the Biodiversity & Conservation team at Landcare Research. Based at Lincoln, Lynley has been involved in weed biocontrol research for the past 25 years, and has helped to co-ordinate the National Biocontrol Collective for more than a decade.

The National Biocontrol Collective recently agreed to adopt a protocol for ensuring that all the weed biocontrol agents that they develop and release are followed up adequately. The success of this new initiative will require that council staff, and others, are able to competently recognise weed biocontrol agents in the field. This presentation will explain distinctive features of some of the newer agents for broom, Japanese honeysuckle, lantana, tradescantia and woolly nightshade.

Veteranisation - a new use for weed trees

Illona Keenan, David Spencer, Dan Jackson
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Illona is the Biosecurity Technical Advisory, Urban Ecology Team, Wellington City Council. Illona manages pest plant and animal control contracts in Wellington City Councils parks and reserves.

Veteranisation is an European arboriculture technique of damaging trees to encourage habitats that are more common ancient trees, which are often missing from forests. David Spencer (Arborlab Consultancy Services) thought this might work for Wellington's pest trees, and create habitats that are missing from Wellington's secondary forest, such as cavities for nesting birds. Arborist, Dan Jackson (Wilding Wood Management), drilled pest trees, then cut holes and slits to create habitat for native birds, lizards, insects and fungi. This has now been done both inside and outside Zealandia, with improvements in techniques and increasing success. Nest box examples from Zealandia were later used as templates for the cavities created, and anecdotal evidence has shown occupation of nests. Wellington City Council wish to share initial lessons from this technique of getting additional value from pest tree control.

Combining remote sensing tools to map gorse

Paul Peterson, James Shepherd and Harley Betts
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Paul has worked at Landcare Research as part of the biodiversity and conservation team for the last 20 years. Most of his research to date has related to the ecology and biocontrol of invasive weeds. More recently he has become interested in remote sensing using satellite imagery, aerial photography and LiDAR to map and monitor weeds.

Mapping on a landscape scale is an important step for regional authorities required to make management decisions based on widespread invasive weeds. Gorse (*Ulex europaeus*) has been identified by the Bay of Plenty Regional Council as a contributor to reduced water quality because it fixes, accumulates and releases significant amounts of nitrogen into Lake Rotorua. Identifying large gorse stands for conversion to low nitrogen land uses is now a priority for the Council. We have used a unique combination of up-to-date high resolution satellite imagery targeted to gorse spring flowering, orthophotography and a canopy height model derived from LiDAR to identify flowering gorse in the Lake Rotorua catchment, check vegetation texture and exclude non-target species that are taller than gorse. Ninety seven flowering gorse patches ≥ 1ha consisting of ≥ 75% cover over an area of 649ha were digitised in ARcGIS v10.2 from the total lake catchment area of 46 000ha. Sprayed areas that had previously been gorse, and may return to gorse, were also mapped where possible. This combination of remote sensing tools allows for targeted, rapid and accurate mapping to assist land managers.

GEMS and Posters (Weds & Thurs)

Risk pathways for the spread of Argentine ants by commercial businesses in the eastern Rodney district to the islands of the Hauraki Gulf Marine Park.

Hannah Dabb
Rachel Gibbons, Jeff Cook, Nick Waipara, Nigel Adams, Glenn Aguilar, Diane Fraser
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Hannah is currently studying in the third year of a Bachelor of Applied Science majoring in Biodiversity Management in the Department of Natural Sciences at Unitec, Auckland. Hannah was awarded a summer studentships by the Treasure Islands initiative of with Auckland Council Biosecurity (Dr Nick Waipara and Jeff Cook), which funded the project. In addition, the results of this study will be submitted as part-fulfillment of her required self-directed study research project for completion of her degree. Hannah is supervised at Unitec by Senior Lecturer Dr Diane Fraser and supported by Assoc. Prof. Nigel Adams and Senior Lecturer Dr Glenn Aguilar.

The Argentine ant (*Linepithema humile*) is a global invasive pest species which is spread via human mediated dispersal. The species first established in New Zealand in 1990. The islands of the Hauraki Gulf, New Zealand, contains pest-free islands that are particularly vulnerable to the negative impacts of this invasive ant species. A previous study surveyed businesses in the eastern Rodney district, New Zealand, that were deemed as high and very high risk pathways for the dispersal of Argentine ants to the islands of the Hauraki Gulf. Using the same methodology, this study expanded the classifications of businesses surveyed to include those of low and moderate risk with the aim of validating the effectiveness of the survey tool to determine the risk of businesses transporting *L. humile* to the Hauraki Gulf islands. The results of this study will support the Auckland Council Biosecurity division to prioritise their work effort towards reducing the risk of commercial pathways transporting Argentine ants to the Hauraki Gulf Islands.

Communicating the Treasure Islands biosecurity message to the public in the Hauraki Gulf Marine Park.

Terri Todd
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Terri is currently studying in her third year of the Bachelor of Applied Science majoring in Biodiversity Management in the Natural Sciences Department, Unitec. Terri has been awarded a summer studentships by the Treasure Islands initiative of Auckland Council Biosecurity (Nick Waipara and Jeff Cook), which funds the project. Terri is supervised at Unitec by Senior Lecturer Dr Diane Fraser and Mel Galbraith.

Islands of the Hauraki Gulf have a high conservation value with many having pest free status. The biosecurity of these islands is under threat due to increasing numbers of passengers and merchandise transported to the islands. Treasure Islands is a conservation initiative run by the Auckland Council Biosecurity division in collaboration with the Department of Conservation (DOC) which aims to inform the public of the biosecurity risk of invasive species to the unique islands of the Hauraki Gulf. The desired outcome is an increase in public awareness of the issues and shift in behaviours, such as checking for stowaways, that will assist with the protection of these islands from invasive species. A biosecurity advocacy project was undertaken to ascertain public awareness of biosecurity issues of the Hauraki Gulf islands, communication of the risks and impacts of invasive species such as Argentine ants and rainbow skinks and education of the actions that the public can adopt to reduce the biosecurity risk to the island group. This study will report on the perceptions gleaned from conversations with the public in relation to biosecurity awareness and provide recommendations that may improve the effectiveness of the communication of the Treasure Islands initiative.

A survey tool to assess the risk of transport of the invasive rainbow skink by businesses in the eastern Rodney district to the Hauraki Gulf islands.

Rachel Gibbons
Hannah Dabb, Jeff Cook, Nick Waipara, Nigel Adams, Glenn Aguilar, Diane Fraser
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Rachel is currently studying in her third year of the Bachelor of Applied Science majoring in Biodiversity Management in the Natural Sciences Department, Unitec. Rachel has been awarded a summer studentships by the Treasure Islands initiative of Auckland Council Biosecurity (Nick Waipara and Jeff Cook), which funds the project. In addition, the results of this study will be submitted as part-fulfillment of her required self-directed study research project for completion of her degree. Rachel is supervised at Unitec by Senior Lecturer Dr Diane Fraser and supported by other senior lecturers Assoc. Prof. Nigel Adams and Dr. Glenn Aguilar.

The Hauraki Gulf Islands are considered an area of National Significance under the Hauraki Gulf Marine Park Act 2000, due to their value as habitats for New Zealand native flora and fauna. Introduced pest species have significantly impacted native species and development and maintenance of the islands of the Hauraki Gulf plays a significant part in the conservation of these species. Rainbow (or plague) skinks (*L. delicata*), which first arrived in Auckland in the 1960s have spread rapidly from Northland to Waikato regions via human mediated dispersal. Pathways exist for *L. delicata* to extend their range to the Hauraki Gulf islands and reverse the hard work of restoring the islands and keeping them free of pests. A previous study identifying commercial businesses as high risk pathways for *L. delicata* to the Hauraki Gulf Islands was extended. We test whether a property risk score based on type of products, storage of products, site hygiene and the presence/absence or rainbow skinks can predicted the risk of businesses potentially transporting this invasive species to the islands of the Hauraki Gulf. Results of this study will be used by Auckland council towards their management goals of controlling the spread of *L. delicata* to the Hauraki Gulf Islands.

A novel technique for the detection of rainbow (plague) skinks on Great Barrier Island, New Zealand.

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Molly is currently studying in her third year of the Bachelor of Applied Science majoring in Biodiversity Management in the Natural Sciences Department, Unitec. Molly has been awarded a summer studentships by Auckland Council Biosecurity (Nick Waipara and Jeff Cook), who fund the project. In addition, the results of this study will be submitted as part-fulfillment of her required self-directed study research project for completion of her degree. Molly is supervised at Unitec by Assoc. Prof. Nigel Adams and supported by other senior lecturers Dr. Diane Fraser and Dr. Glenn Aguilar.

Great Barrier Island has a diverse lizard fauna with 13 known species. In common with other New Zealand native fauna this community is vulnerable to the impacts of invasive organisms. The rainbow (plague) skink (*Lampropholis delicata*) is an invasive species within New Zealand. Due to their high reproductive potential, *L. delicata* are considered to be a competitive threat to many of New Zealand's native skinks with which they share a similar local niche. There is currently only one known area of incursion by plague skinks onto Great Barrier Island, namely the wharf at Tryphena, which is currently being managed by the Auckland Council Biosecurity's Treasure Islands initiative. This locality is the major entry point of bulk goods and people on to the island. Before a method of control can be determined for this incursion, it must first be known whether or not *L. delicata* have established populations anywhere else on the island. We monitored 50 other high risk sites across the island where humans may have transported *L. delicata*, such as wharfs, airports, campgrounds and building sites. In contrast to previous passive monitoring efforts which primarily relied upon tracking tunnel data, invertebrate sticky traps were used to increase identification speed and accuracy. With no existing management protocols currently in place to manage their rapid dispersal throughout the North Island, the protection of off-shore islands such as Great Barrier from this pest species is all the more crucial.

New DOC systems for animal pest management

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Michelle is Technical Advisor (Systems Development) for Threats in DOC's Science and Policy Group. Her work supports better management of risk when using vertebrate pesticides, through research, systems development, and working with regulatory agencies. Michelle chairs the DOC Pesticides Advisory Group and is part of the development team behind the DOC Animal Pests SOPs, Animal Pests Framework and associated training.

DOC reviewed its planning system for animal pest control (Animal Pests Framework) and standard operating procedures (SOPs) in late 2014, to respond to feedback and to prepare for new hazardous substances regulations in the Health and Safety at Work regime. New systems and documents have now been published, which affect all organisations that control animal pests on land managed by DOC.

We've reduced the number of SOPs that apply and made the processes easier to follow. For DOC operations, the Animal Pests Framework has been expanded to a single operational planning SOP. For independent organisations whose primary purpose is not conservation gain, the current suite of SOPs has been replaced with two slim documents:

- A guide for applying for DOC permission
- National performance standards for all use of pesticides and traps on land managed by DOC

Most animal pest control by individuals and independent groups working for conservation gain will work with DOC under the operational planning SOP, depending on their formal agreement with DOC. The new documents are on the DOC website. The new hazardous substances regulations are now expected in early 2015. The improved systems will be revised at that time and DOC staff will be trained on the legal changes.

Challenges and lessons learnt for management of large scale salvinia (*Salvinia molesta*) infestations in New Zealand

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Susanne works as adviser in the Plants and Environment Response Team at MPI and is the response manager for salvinia under the NIPR (national interest pest response) programme.

Salvinia (*Salvinia molesta*) is one of the world's worst aquatic weeds, capable of completely transforming native wetlands. Due to its ability to build dense floating mats, salvinia poses a significant threat not only to wetland ecosystems, but also recreational activities. It can increase the risk of drowning for people and livestock. This noxious weed has been managed in New Zealand for several decades. For the past 10 years, salvinia has been managed under the NIPR (national interest pest response) programme led by the Ministry for Primary Industries. The majority of salvinia sites consist of small to medium sized ornamental and farm ponds on private properties and fish tanks of various sizes. Management options include physical removal (manual and mechanical) and herbicide applications. Larger infestations (> 1000m²) provide more challenges for containment and management. We use the Te Henga salvinia response where the largest NIPR managed salvinia infestation up to date occurred, as a learning example: Salvinia was first found at Te Henga in 2011 and was managed with manual removal and herbicide application. In late 2014 after a period of no finds of salvinia, three large infestations within the wetlands (totalling 0.9 ha), were found at Te Henga. Within two months the infestations had spread and merged to cover 3.6 ha. To prevent salvinia from further spread, large scale custom-made booms were deployed. We discuss containment and management options with special focus on helicopter based treatments. Furthermore we will share our experiences working with a diverse community.

Woolly Nightshade Biocontrol Successes in the Bay

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Shane works as a "Land Management Officer – Biosecurity" for the Bay of Plenty Regional Council, focusing on pest plants in the Western Bay of Plenty. In the past he has worked in varied environmental fields including the Biological Control of Weeds team at Landcare Research, forestry industry and research in USA and NZ, contract work for the Environmental Protection Authority, and has managed a safari company in Botswana.

Woolly nightshade (*Solanum mauritianum*) is a significant weed in the Bay of Plenty and other regions of NZ. It forms dense stands crowding out and suppressing all other plants. Chemical control methods have proven too expensive and labour-intensive to sufficiently control woolly nightshade populations alone so a biological control program was undertaken which has resulted in the release of the woolly nightshade lacebug (*Gargaphia decoris*). However, the impact of this agent to date has been a mixed bag, with many areas reporting poor performance. This gem explains what we have seen in the Bay of Plenty region when we have released this agent in shaded sites, compared to non-shaded. This could potentially help others decide where best to release this agent in order to achieve the greatest impact on woolly nightshade infestations.

Variability in New Zealand Strains of Rabbit Haemorrhagic Disease Virus- Implications for Rabbit Biocontrol

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Janine is based at Landcare Research in Lincoln and specialises in the biological control of wildlife pests. Current research includes RHDV-based biocontrol of rabbits, fertility control of possums and rats, and the development of pheromone lures for the improved detection and control of stoats and possums.

Following its introduction to New Zealand in 1997, rabbit haemorrhagic disease (RHD) spread rapidly, causing high mortality (often >90%) and greatly reducing the use of toxins, the costs of pest control to farmers, and the degradation of land in rabbit-prone regions. However since then rabbit numbers have increased, possibly due to changes in the virus or due to a high proportion of rabbits having antibodies that make them immune to circulating strains of RHD virus. Rabbits can acquire protective antibodies following non-lethal exposure to RHD virus early in life or possibly from infection with a closely-related but benign form of rabbit calicivirus (RCV) that may have been present in rabbits when they were first released in New Zealand 150 years ago. Researchers are now trying to determine whether variations in the effectiveness of RHD throughout New Zealand are due to differences in the virulence of the RHD virus strains or differences in rabbit immunity levels and whethe r a benign RCV exists in New Zealand that may protect rabbits against RHD virus infection. It is clear that successful and affordable rabbit control is more likely to be achieved if the effectiveness of the existing biological control agent, rabbit haemorrhagic disease virus, can be regained and maintained.

Researchers have collected more than 20 field strains of RHD virus from rabbits throughout NZ that had recently died from RHD. RHD virus strains were screened by (1) PCR analysis and sequencing to identify genetic differences and (2) by infecting naïve captive-bred rabbits to study changes in pathogenicity of the virus. Nucleotide sequences suggest that NZ viral strains arose from a single introduction of virus from Australia. Over time the genetics of various strains of RHD virus have developed regional variations. To examine the effect of genetic changes on the pathogenicity of the RHD strains, domestic rabbits (n=8) were oral dosed with 1.5 x 107 copies of RHD virus and health and virus production were monitored. There were significant differences in the time to death and viral load (number of copies of virus detected per mg of liver) between strains. The potential impact of these differences on the efficacy of RHDV as a rabbit biocontrol agent will be discussed.

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Repeat defoliation does not kill Asiatic knotweed

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Trevor, co-auther of your most favourite books on weeds, has been studying the damn things for more than 40 years but still they won't go away! Claire does all the hard work these days while Trevor collects the kudos.

Asiatic knotweed (*Fallopia japonica*) is a nuisance weed listed on the RPMS of many councils. It grows in riparian areas and creeps into pasture and other useful land. The aim of this study was to determine if repeat defoliation would kill the plants. In spring 2011 eight short (50 mm) and eight long (150 mm) lengths of rhizome freshly collected from Asiatic knotweed were planted into 400 mm cube crates. The plants were trimmed back to ground level as soon as they reached a set height. Four of each rhizome length were trimmed as soon as they reached 150 mm height and the other four whenever they reached 300 mm height. The plants with the 150 mm threshold were cut off up to 15 times over a 4 year period while the 300 mm trimming threshold were cut off up to eight times over this period. On 27 F ebruary 2015, nine of the original sixteen plants were still growing. Of the plants grown from the short rhizome, two of the plants with the 150 mm threshold and one with the 300 mm threshold continue to survive. For the plants grown from the long rhizome, there were two and four, respectively, that continued to survive. This study shows that repeat defoliation by mowing is unlikely to be an effective control measure for this weed.

GBIF and NZ bio data standards

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Nick is a member of the Informatics team at Landcare Research, a partner in the Biodata Services Stack (BSS) project. Nick has participated in international biodiversity data exchange standards initiatives and works closely with Landcare's biodata collections and databases. Together with Alistair Ritchie, Aaron Wilton and Jerry Cooper (also from Landcare Research), Nick has been a member of the technical group developing the first iterations of the BSS standard and implementation of the companion technology stack it sits within.

The Global Biodiversity Information Facility (GBIF) has been in existence since 1999 and now hosts over 526 million species occurrence records from across the globe. How did it amass these records, what approaches, technology, and processes were used. Lessons learnt and applied to the Biodata Services Stack (BSS) project.

Tall wheatgrass Thinopyrum ponticum - a new threat to saltmarshes or ryegrass on steroids

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Rob holds qualifications in horticulture and began his career with an apprenticeship. From 1996-2009 he worked for the then MAF Quarantine Service at Aucklnad International Airport, while completing extramural studies with Massey University. In late 2009 Rob joined the Biosecurity team at the Marlborough District Council where he now manages regional pest management programmes as a Senior Biosecurity Officer.

A grass species native to Anatolia has been found in Marlborough and for the first time identified as a newly naturalised species in New Zealand. Tall wheatgrass (*Thinopyrum ponticum*) has been extensively hybridised and introduced to other countries for the purpose of pasture establishment and soil conservation in saline areas and has a documented history as a trial plant in New Zealand for the same reasons; trial plots long destroyed (or were they?) and the plant long forgotten about until now. What will our weed risk assessment reveal about this plant, Is It the ideal pasture species for saline soils or a potential threat to Marlborough's pastoral production and the iconic Vernon Lagoons?

D-Block Rodenticide Bait

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Lyn is Sales Manager for Connovation Ltd, Auckland and her work is focused on handling sales, disseminating information, and providing product best practice advice and customer service. Lyn's background in vertebrate and invertebrate pest control spans many years both in the field and in technical and sales and marketing roles.

A comparative trial between D-Block - a hard block bait containing 0.05 g/kg diphacinone, in a field trial on rodents versus Ditrac.

Updating the Vertebrate Pest DSS

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Dave is well-known to many in the audience. He has carried out research for over 40 years on control of possums by both aerial and ground-based methods. His work was recognised in 2013 by the NZ Association of Scientists as part of the team that received the Shorland Medal for "major and continued research that has added significantly to scientific understanding or resulted in significant benefits to society".

We have updated the decision support system (DSS) that we first developed in 2010. It aims to help New Zealanders, from novices to experts, select the most appropriate options for controlling vertebrate pests in a particular locality. Using your answers to a series of questions about the control operation you want to undertake, the DSS systematically evaluates the potential constraints that may be operating in the area, and provides you with 'best practice' advice and other information about the recommended options. Of particular value for professional pest managers is the summary sheet generated. This contains all key details of the proposed control operation and the advice given by the DSS, thus underpinning managers' decisions with transparency and objectivity. Presently the DSS cover s five common pests: possums rats, stoats, ferrets and feral cats.

A weed mapping application for strategic regional weed management

Graeme Bourdôt, Mike Dodd, Paul Smale

Paul trained in mathematics, statistics, operations research and software engineering. He is a Research Associate in the Soils, Land Use and Global Change team at Agresearch, where his specialist areas of activity include farm systems optimisation, image analysis, GIS, and database development.

In New Zealand, over 400 weed taxa are the subject of weed management programmes in Regional Pest Management Plans and additional threatening species are continually being proposed. Their current and potential distributions are vital pieces of information for conducting the cost benefit analyses required for proposed management programmes under the Biosecurity Act. The current distribution of a species of interest, both within a region and in adjacent regions, will be a primary driver for determining which of the five types of intermediate outcome specified in the National Policy Direction (Exclusion, Eradication, Progressive Containment, Sustained Control, Protecting Values in Places) would be appropriate. The potential distribution of the species, on the other hand, provides the basis for quantifying the potential losses to the economy or the environment should the weed spread to fully realise its potential distribution.

Many disparate weed occurrence databases exist in New Zealand with the collective potential to define current distributions. Furthermore, climate niche models for hundreds of weed species exist in the international science literature and institutional reports that can provide estimates of the potential distributions of these species in New Zealand. However, these data have not been readily available to weed management policy- and decision-makers.

To redress this, we have developed a web-based data-sharing “weed mapping” application. For a species of interest, it combines the occurrence data from the disparate sources and displays this information on a map of New Zealand at a scale appropriate for strategic categorisation (rather than for infestation management). The application enables this current distribution to be overlaid with the relevant climate niche model enabling a visual comparison of the current and potential distributions. Additional overlays of data such as land-use or vegetation type, e.g. LCDB2 information, enable the climate niche model projections of potential distributions to be constrained to the land-uses or vegetation types susceptible to the weed. This process provides quantitative estimates of the land area that could be invaded and hence also of the losses in productivity or biodiversity that would be sustained should the weed spread to fully occupy its potential range. The application has the potential to automatically harvest weed occurrence data from disparate sources including the planned Biodata Services Stack and to have climate niche models added as they become available thus providing an “always-up-to-date” source of weed distribution data for regional (and national) weed management policy- and decision-makers.