COVER PAGE and CAMPUS MAP to be inserted (campus map on last page)

Welcome and Conference Overview

Welcome to the 2012 New Zealand Ecological Society Conference. The organising committee is excited by the wide range of symposia and papers submitted. When we volunteered Lincoln University to host this conference we wanted to show that science is still alive and well in Canterbury and the great response we have had from all of you indicates that our somewhat shaken heart is still beating!

Given the high numbers of papers submitted we have had to organise four concurrent sessions for the first two days of the conference. What this means is that we are hosting over 130 oral presentations. This high level of demand was somewhat unexpected but we are pleased to report that we accepted nearly all of the oral papers that were submitted to the conference organisers. No mean feat!

I would especially like to thank the organising committee and all our student helpers. We have a small team of organisers and they have all worked extremely hard to bring this event together. Our postgraduate students have done an excellent job creating the "student-only day" and it was a delight to support this endeavour. We also thank the Lincoln University Conference & Event Management group for their professional management of this event. Well done team!

This conference would not have been possible without the generous support of all our sponsors. Given the current economic climate I did wonder if we may end up with the "2012 Austerity Conference"; however, I was pleasantly surprised with the level of support we have received and I particularly want to thank our main sponsors: the Faculty of Agriculture and Life Sciences here at Lincoln and the Department of Conservation. In particular I want to personally thank Bruce McKenzie and Carol West for coming through for us!

I trust that you enjoy the conference programme and the Lincoln University campus. In the conference breaks if you take the opportunity to have a look around you can still see the remnants of the earthquake damage with the new Lincoln University rising somewhat like a "phoenix from the ashes". Ecology was first officially taught here at Lincoln over 50 years ago. Let's hope for solid foundations for many more years to come!

James Ross,
Conference Convenor

President's welcome

On behalf of the New Zealand Ecological Society I would like to welcome you to the *'Is New Zealand ecology on solid foundations?'* conference in Lincoln. The theme of the conference reflects, perhaps, the instability of the world that we live and work in – from biological, economic, political and (of course!) geological perspectives. In such changing and uncertain environments, the understanding and application of ecological concepts continues to grow in importance, and our conference plays an essential role in sharing and disseminating this knowledge.

We are delighted to be gathering again in Canterbury, and thank the local organizing committee for assembling symposia, contributed talks, workshops, field trips and social events that make up our annual conference. We trust that your participation in this conference will provide you with the opportunity to explore new horizons, debate research outcomes, and share best practices through updates of ecological research methods. A special welcome is extended to the recipients of the Society's Travel Grants and Kauri Seed Scholarships, 'emerging' ecologists who represent the future of ecology in New Zealand, and hope that your experience will be rewarding.

Our annual gathering always facilitates the strengthening of existing networks, and building of new collaborative links. It is this networking that will ensure that ecology within New Zealand is indeed on sound foundations to meet future challenges.

Mel Galbraith,
President NZES

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Important Information

Registration Information Desk
The Registration Desk will be open in the Stewart Foyer as follows:
Sunday 25th November - 3:00-5:00pm
Monday 26th - 7:30-9:00am, and at break times
Tuesday 27th - 8.00am-9:00am, and at break times
Wednesday 28th - 9:00am-9:30am, and at break times

Catering
For those in accommodation, catering is in the Recreation Hall (35 on campus map). Catering hours are as follows:

Breakfast	0730-0830 hours
Dinner	1800-1930 hours

Oral Presentations
Oral presentations need to be loaded onto the system a half a day in advance. To do this, speakers should report to the lecture hall in which they will be speaking with their talk on a USB or CD in Power Point Windows format (preferably a .pptx or .ppsx file). An assistant (in green t-shirt) will help you to load your talk onto the system. Please note the day and time of your talk in the Conference Programme. Speakers are asked to identify themselves to the session chairs 10 minutes before the start of their session.

Once you have loaded your talk, please check that it is functioning properly in that lecture hall. Check this as early as possible before your talk so as you have time to sort out any problems.

Poster Presentations with Wine and Cheese
Each poster has been allocated a number and a place on the poster boards. Please get your poster number from the Registration Desk and locate the corresponding space in the foyer. Posters must be put up no later than 1:15pm on Monday. Velcro dots will be available for mounting your poster. Assistants (in green t-shirts) will be there to help you as needed.

Please be next to your poster during the "Wine and Cheese" poster session on Monday at 5.30–6.30pm. All posters must be removed by 4:00pm on Wednesday.

Refreshment Break - Food
All teas and lunches will be catered during the conference programme. Some delegates in accommodation have requested and paid for evening meals on campus. Alternatively, there are several restaurants, cafes and takeaway outlets in the Lincoln Village, a short 900m walk from the University, as well as a supermarket en route.

Conference Dinner
This function is for people who have pre-paid on the registration form. A dinner ticket will be in the conference registration envelope. If you are not sure whether you have, please check with the Registration Desk. The Conference Dinner will be held in the Recreation Hall starting at 7:30pm on Tuesday night.

As we will be going late into the night people with accommodation off campus need to inform the Registration Desk on Monday if they need a ride into Christchurch after the dinner finishes at 11:30pm. Depending on numbers we will either arrange a bus or shuttles to ferry people to hotels.

Field Trips
It is very important that you go on the same field trip that you selected with your registration form. If you are unsure please check with the Registration Desk. Please assemble at least ten minutes before

departure at the bus stop near Gate 1 (see Campus map). Buses for both field trips will depart at 8:00am and will go ahead whatever the weather (provided the boat can run), so please wear appropriate clothing and footwear.

Quail Island excursion (Led by Mike Bowie and Stephane Boyer)
We will drive to Lyttelton where we will catch a ferry into the picturesque Lyttelton Harbour and head for Quail Island/Otamahua. This is a 10-min boat trip on very still waters. Upon arrival, we will walk to the Information Centre to read about the history of the island. Quail Island has a rich history and remains or reconstitutions of historical buildings are scattered throughout the island. While walking around the island you will see the extensive replanting of native vegetation, which has been carried on for about 30 years by the Quail Island Ecological Restoration Trust. Sharp eyes will spot the natural regrowth and spilling of native vegetation in non-actively restored areas. You will also hear about the predator control programme, the re-introduction of endemic invertebrates and the various research studies on-going on the island. There will be an opportunity to see some of the re-introduced invertebrates, including carabid beetles, leaf-vein slugs and weta that thrive under wooden discs or in weta motels.

While waiting for the ferry in early afternoon, you will be able to enjoy the beach and the most courageous of you will even have the opportunity to go for a swim.

Departs at 8:00am and returns to Lincoln University at 2:00pm – packed lunch provided.

Tour of Christchurch Natural Areas (led by Colin Meurk and James Ross)
This full-day tour includes visiting natural and restoration sites from the sand dunes into the city.

During the day we will more or less follow this itinerary:
8:00am Depart Lincoln University
9:00am Travis Wetland (toilets)–view Avon eco-sanctuary
10:00am Depart
10:15am New Brighton sand dunes
10:45am Depart
11:00am Avon-Heathcote Estuary via Bexley Red Zone and Oxidation Ponds
11:40am Depart
12:00pm Lunch at Aynsley Tce –King George Reserve (toilets)

1:15pm Depart
1:30pm Ernle Reserve
2:00pm CCC Installation of Ellerslie Exhibit at Lichfield St – Bus Exchange
2:30pm Depart
3:00pm Riccarton Bush
4:00pm Depart
4:30pm Southern Motorway and grassland reserve
5:00pm Depart
5:10pm Prebbleton Quarry
5:45pm Depart
6:00pm Arrive back at Lincoln University

Christchurch is a biodiversity hotspot and Canterbury often wins the annual OSNZ 24 hour birdathon because of the diversity of accessible habitats – e.g. the 115 ha Travis Wetland has at least 55 bird species (31 of those being native); the Estuary is one of the major NZ feeding grounds for the migratory bar-tailed godwit; and the Christchurch could claim to be bellbird city. Restoration challenges are being taken up in partnerships between the community, DOC and Local Govt; e.g. the recent release of 90 Canterbury mudfish into Travis Wetland with the intention of establishing a self-sustaining population and many other initiatives that we will see.

Departs at 08:00 and returns to Lincoln at 18:00 – packed lunch provided.

Medical
Lincoln Pharmacy
8 Gerald Street, Lincoln, Selwyn
Telephone (03) 325 2666

Lincoln Medical Limited
Market Square
Gerald Street
Lincoln
Tel: (03) 325 2411

In an emergency dial 111

Earthquake
-Identify nearest exit points
-If you feel an earthquake- DROP, COVER, HOLD
-Evacuate normally to the muster area

Taxis
Blue Star Taxis – 03 379 9820
Gold Band Taxis – 0800 963 963
Lincoln Shuttles – 027 231 0397
Selwyn Shuttles – 0800 735 996
The taxi fare from Christchurch airport to Lincoln University is approximately $75.

Internet Access
There is Wifi access on campus in hotspot locations including:

- Commerce building
- Library
- Central lawn
- Recreation centre
- Landscape Architecture building

Cell Phones
Cell phones must be turned off at all times during sessions.

Valuables
Please keep all valuables safe. The conference organisers cannot be held responsible for any loss or damage of personal items while attending the Ecological Society Conference. Any found property should be taken to the Registration Desk located in the entrance foyer of the Stewart building.

Conference Programme: Is New Zealand Ecology on solid foundations?

MONDAY MORNING

07:30	**Stewart Foyer: REGISTRATION DESK OPEN**

Stewart 1 (S1): Conference Opening			
08:30	Welcome		
Keynote Address			
08:50	Richard Hobbs	University of Western Australia	What restoration can and can't do: opportunities and constraints in a rapidly changing world *Sponsored by Faculty of Agriculture and Life Sciences, Lincoln University*
Plenary Speaker			
09:40	Trevor Worthy	University of Adelaide	A palaeontological perspective on the assembly of the terrestrial vertebrate biota of New Zealand and implications in understanding the ecology of the extant biota *Sponsored by Faculty of Agriculture and Life Sciences, Lincoln University*

10:20 – 10:50	**Stewart Foyer : MORNING TEA**

Stewart 1 (S1): Symposium: Restoration Ecology - Session Chair: Nick Dickinson			
10:50	Jill Rapson	Massey University	Is restoration succeeding? Testing against the criteria of the SER primer
11:10	Mike Bowie	Lincoln University	Indicators of restoration success in a sand plain forest
11:30	Olivia Burge*	University of Canterbury	Restoring a RAMSAR wetland – by reforesting it?
11:50	Robert Schadewinkel*	University of Otago	Does age matter? Dispersal and settlement patterns of a forest passerine reintroduced to a mainland fenced sanctuary
12:10	Tessa Roberts*	Massey University	Comparison of nurse plant species' effectiveness in the grasslands of Molesworth Station, Marlborough, New Zealand

Stewart 2 (S2): Contributed Papers - Session Chair: Laura Young			
10:50	Dave Kelly	University of Canterbury	Seed trapping, plant synchrony, and dispersal service in New Zealand forests
11:10	Laura Young*	University of Canterbury	Evaluating seed disperser effects on establishment of montane and subalpine fleshy-fruited plants
11:30	K.C. Burns	Victoria University of Wellington	What causes size coupling in fruit-frugivore interaction webs?
11:50	Debra Wotton	Landcare Research	Seed dispersal of fleshy-fruited environmental weeds in NZ: a review
12:10	Tarryn Wyman*	University of Canterbury	Possums and seed dispersal: a lazy, inefficient Australian at work

Commerce 1 (C1): Contributed Papers - Session Chair: Sam Brown			
10:50	Amie Parker*	Massey University	Exotic and Native Detritivores in Forests in the Manawatu-Whanganui Region
11:10	John Marris	Lincoln University	Islands in the snow: Ecology, systematics and biogeography of the New Zealand beetle genus *Protodendrophagus* (Coleoptera: Silvanidae: Brontini)
11:30	Jamie Stavert*	University of Auckland	Making the best of a crappy situation: food preference, selection and feeding behaviour in native New Zealand dung beetles
11:50	Dan Barrett*	University of Otago	Multiple-scale resource selection of an urban peripatus (Onychophora: Peripatopsidae)
12:10	Nathan Camp*	University of Auckland	Food and Sex: Strategic signal hierarchies in *D. melanogaster* and *D. simulans*

Commerce 2 (C2): Symposium: Wildlife Management and Conservation - Session Chair: Rob Cruickshank			
10:50	Nicolas Dussex*	University of Otago	Unexpected genetic population structure in the kea (*Nestor notabilis*)
11:10	Diana Prada	Landcare Research	Kiwi, Dogs, and DNA: The pathway to prosecution
11:30	Kerry Weston*	University of Otago	Rock wren (*Xenicus gilviventris*): Population structure in an alpine archipelago
11:50	C.M. King	University of Waikato	Multiple paternity and differential male breeding success in ship rats
12:10	Cheeho Wong	Massey University	Does Island size affect genetic diversity of native lizards?

12:30 – 13:15	**Stewart Foyer: LUNCH**

* Indicates student presentation

MONDAY AFTERNOON

Stewart 1 (S1): Plenary Speaker			
13:15	Kerry-Jayne Wilson		Is New Zealand's understanding of seabird ecology on solid foundations? *Sponsored by Faculty of Agriculture and Life Sciences, Lincoln University*

Stewart 1 (S1): Symposium: Restoration Ecology - Session Chair: Stephane Boyer			
14:00	Stephen Hartley	Victoria University of Wellington	Managing competition, disturbance and stress to achieve optimal tree survival – a cost-benefit analysis of management techniques for recreating a swamp forest
14:20	N. McArthur	Greater Wellington Regional Council	Turning rats into riflemen: biological alchemy in the Wainuiomata Mainland Island
14:40	Yanbin Deng	Waikato Regional Council	A refined methodology for prioritising Significant Natural Areas in the Waikato region
15:00 – 15:30	**Stewart Foyer: AFTERNOON TEA**		
15:30	Philippa Crisp	Greater Wellington Regional Council	Wairarapa Moana – Challenges and opportunities
15:50	B. Osborne	Auckland Council	Understanding Auckland's Ecosystems
16:10	Annette Evans*	University of Auckland	Scale insects as keystone species: the importance of honeydew to endemic gecko populations in a recovering island ecosystem
16:30	Simon Moore	Department of Conservation	Project Janszoon Ecological Restoration of Abel Tasman National Park

Stewart 2 (S2): Contributed Papers - Session Chair: Michael Rostas			
14:00	Georgia Cummings*	University of Auckland	The role of Short-tailed bats (*Mystacina tuberculata*) in the Pollination of *Dactylanthus taylorii* in Pureora Forest
14:20	Michael Rostas	Lincoln University	Sequestered plant volatiles protect gall aphids against large herbivores – Support for the Enemy Hypothesis
14:40	Mads Thomsen	University of Canterbury	'A friend of my friend is my friend' – the importance of facilitation cascades in maintaining biodiversity
15:00 – 15:30	**Stewart Foyer: AFTERNOON TEA**		
Contributed Papers - Session Chair: Michael Rostas			
15:30	Carol Frost*	University of Canterbury	Reverse spillover of predators from managed to natural habitats
15:50	Guadalupe Peralta*	University of Canterbury	Food web structure and community composition across a habitat edge between natural and production forest
16:10	Simon Litchwark*	University of Canterbury	Impact of Honeybee Declines on Pollinator Community Structure and Network Interactions
16:30	Francis Burdon*	University of Canterbury	Sediment pollution reduces niche space in agricultural stream food webs through altered carbon resource availability

Commerce 1 (C1): Contributed Papers - Session Chair: Jon Sullivan			
14:00	Benjamin Myles*	Alan Wilson Centre	Community assembly and phylogenetic structure of age stratified tree communities on Hauturu (Little Barrier Island)
14:20	Fiona Thomson	Landcare Research	Extending a quantitative classification to include New Zealand's non-woody plant communities
14:40	Robert Holdaway	Landcare Research	Quantifying uncertainty in forest inventory plot data
15:00 – 15:30	**Stewart Foyer: AFTERNOON TEA**		
Contributed Papers - Session Chair: Hannah Buckley			
15:30	Hannah Buckley	Lincoln University	Invertebrate communities of New Zealand sand dunes
15:50	Dhobasheni Newman*	University of Auckland	Ecology of New Zealand Seaweed flies
16:10	Adrian Paterson	Lincoln University	LDD – OTT, LOL or BFF? Long distance dispersal and the New Zealand biota
16:30	Esther Dale*	University of Auckland	The influence of seabirds on Cooks scurvy grass (*Lepidium oleraceum* s.s.), a threatened coastal cress

Commerce 2 (C2): Symposium: Wildlife Management and Conservation - Session Chair: Des Smith			
14:00	Adrian Monks	Landcare Research	Auditing Noah's Ark: properties of a PD-based threatened species prioritisation scheme
14:20	Alan Mark	University of Otago	Exotic conifers in the South Island high country: asset, liability or chaotic?
14:40	Christine Sheppard*	University of Auckland	Predicting weeds in a changing climate: are bioclimatic models validated by field trials?
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
15:30	Joanne Hoare	Department of Conservation	Advances in tools for reptile population monitoring in New Zealand
15:50	Kosuke Takaya*	Hokkaido University	High rate of incidental capture of native mammals and birds in introduced raccoon traps in Hokkaido, Japan
16:10	Jenny Laycock*	Massey University	Amphibian Pet Trade in New Zealand
16:30	Isabel Castro	Massey University	Fate over time of two populations of the endangered *Powelliphanta traversari tararuaensis* at two remaining strongholds

17:30 WINE AND CHEESE POSTER SESSION (**Stewart Foyer**)

TUESDAY MORNING

08:00	**Stewart Foyer : REGISTRATION DESK OPEN**

Stewart 1 (S1)			
08:55	Welcome and notices		
Plenary Speaker			
09:00	Bastow Wilson	University of Otago	Does ecology have any theories, and if so do they work? *Sponsored by The Royal Society of New Zealand*
Plenary Speaker			
09:40	Hamish Campbell	GNS Science	Geological perspectives for permanent land during the Zealandia-New Zealand transition *Sponsored by Selwyn District Council*

10:20 – 10:50	**Stewart Foyer : MORNING TEA**

Stewart 1 (S1): Symposium: Drylands Research - Session Chair: Deb Wilson			
10:50	S. Walker	Landcare Research	Effects of secondary succession from grassland to shrubland on flora and fauna in a New Zealand dryland landscape
11:10	D.J. Wilson	Landcare Research	Species richness and population density of native and exotic birds on successional dryland gradients from grassland to shrubland
11:30	Adrian Monks	Landcare Research	Lessons for low intensity woody restoration in drylands: limitations to seedling establishment
11:50	E. Cieraad	Landcare Research	Effects of soil moisture and N on the distribution of N-fixing species in drylands
12:10	Larry Burrows	Landcare Research	Can native trees and shrubs establish in dryland scotch broom stands?

Stewart 2 (S2): Symposium: Next Generation Sequencing - Session Chair: Adrian Paterson			
10:50	Mike Taylor	University of Auckland	Little friends: exploring the microbial ecology of New Zealand's endemic fauna
11:10	Laura Martinez-Garcia	Landcare Research	Arbuscular mycorrhizal-plant interactions across Franz Josef chronosequence
11:30	Mahajabeen Padamsee	Landcare Research	A metagenomic study of fungi in kauri forests and the impact of kauri dieback
11:50	Stephane Boyer	Lincoln University	From waste material to biodiversity capsules, how recent advances in molecular ecology raises the profile of generalist predators' faeces
12:10	Emily Fountain*	Lincoln University	The trials and tribulations of next-generation sequencing with non-model organisms

Commerce 1 (C1): Contributed Papers - Session Chair: Laura Molles			
10:50	Kevin Parker	Massey University	The effects of translocation-induced isolation and fragmentation on the cultural evolution of bird song
11:10	Brent Barrett	Lincoln University	Addressing the problem to kea posed by brushtail possums
11:30	A.L. Wilson*		Survival and Habitat use of brown kiwi chicks (*Apteryx mantelli*) in a high density, reduced predator population
11:50	Andrew Gormley	Landcare Research	Recent application of multi-species analysis of bird communities: (1) Assessing kiwifruit orchard management and (2) biodiversity monitoring on public conservation land
12:10	Sarah Wells*	Massey University	Love thy neighbour: mating systems and cuckoldry in the tui (*Prosthemadera novaeseelandiae*)

Commerce 2 (C2): Contributed Papers - Session Chair: Melinda Rixon			
10:50	Melinda Rixon	Auckland Council	Protecting significant ecological areas in Auckland
11:10	A. Zakharova	Landcare Research	Soil carbon dynamics: Quantifying labile soil carbon pools
11:30	Geoff Walls		Riding the rapids: an eco-ethical journey down the Mokihinui
11:50	Jonathan Boow	Auckland Council	Auckland Council's Biodiversity Strategy – Initial implementation
12:10	John Sawyer	New Zealand Plant Conservation Network	A network approach to implementing the Global Strategy for Plant Conservation

12:30 – 13:15	**Stewart Foyer : LUNCH**

TUESDAY AFTERNOON

Stewart 1 (S1): Plenary Speaker			
13:15	Grant Norbury	Landcare Research	Dryland habitat modification and succession: implications for pest ecology, impacts and damage mitigation *Sponsored by Landcare Research*

Stewart 1 (S1): Symposium: Drylands Research - Session Chair: Deb Wilson			
14:00	Emily Weeks	Landcare Research	The value of validated estimates of vulnerability for effective conservation planning under dynamic threats
14:20	Philip Seddon	University of Otago	Matrix matters: Differences of grand skink metapopulation dynamics in native tussock grasslands and exotic pasture grasslands
14:40	C. Rouco	Landcare Research	Annual hunting event reveals rabbit recovery 14 years after introduction of rabbit haemorrhagic disease in southern New Zealand
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
15:30	Ella Hayman	Landcare Research	Does foliage of *Thymus vulgaris* (Lamiaceae) inhibit the germination of native shrubs and grasses?
15:50	Richard Maloney	Department of Conservation	Differential responses to large-scale predator control and river flows by four braided river bird species
16:10	Christopher Jones	Landcare Research	Impacts of introduced European hedgehogs on endemic skinks and wēta in tussock grassland
16:30	C. Rouco	Landcare Research	One introduced species helping another: dispersal of a rose seed infesting wasp by possums in a dryland ecosystem

Stewart 2 (S2): Symposium: Community-led Projects - Session Chair: Jo Whitehead			
14:00	Jackie Van Hal	Department of Conservation	Working with others to grow conservation – changes at DOC
14:20	John Sawyer	Auckland Council	"Nature everything" – the future of community driven conservation
14:40	Jo Whitehead	Restoration SolutioNZ for Nature	Kids Restore the Kepler – an inspiring example of community collaboration for conservation in Fiordland
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
15:30	Will Allen	Lincoln University	Focusing on outcomes: How to support shared understanding and better integration across multiple science disciplines and stakeholder perspectives?
15:50	Chris Ferkins	Auckland Council	North-West Wildlink – engaging through community led development to deliver biodiversity enhancement
16:10	Shaun Ogilvie	Lincoln University	Applied Ecology and Matauranga Maori: naturally coupled in the natural world?
16:30	G. Norbury	Central Otago Ecological Trust	Outcomes of an Otago skink translocation: should the sanctuary movement fret about mice?

Commerce 1 (C1): Contributed Papers - Session Chair: Laura Molles			
14:00	M. Highway	Waikato Regional Council	Hamilton Halo
14:20	Chris Bycroft	Wildland Consultants Ltd	Bird monitoring before, during, and after the construction of a diversion wall structure at Ohau Channel, Lake Rotoiti, Rotorua
14:40	Josie Galbraith*	University of Auckland	Bird feeding in urban environments: quantifying the effects of a common human activity
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
15:30	Zoë Stone*	University of Auckland	Plant Phenology of Hauturu: resource availability and kakapo reproduction
15:50	Sandra Anderson	University of Auckland	Bird pollination and dispersal services to plants: interactions, losses, and trophic cascades
16:10	Des Smith	Lincoln University	A novel data-logger egg for the adaptive management of avian conservation breeding programmes
16:30	Jessica Hiscox*	Massey University	Are microbes contributing to the decline of our national icon, the kiwi?

Commerce 2 (C2): Contributed Papers - Session Chair: Helen Blackie			
14:00	J.W.B. MacKay	University of Auckland	The Possum Spitfire – a long-life tool for possum control
14:20	Cheri van Schrevendijk-Goodman*	Lincoln University	Distribution and concentration of the phytotoxin tutin in tutu (*Coriaria arborea*) – implications for use as a vertebrate pesticide
14:40	Karolina Petrovic*	Charles Sturt University	A world on a plate: What do possums eat when they are overseas?
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
Contributed Papers - Session Chair: James Ross			
15:30	Jack Lee*	Lincoln University	Both species sorting and neutral processes drive assembly of bacterial communities in aquatic microcosms
15:50	G.N. Bramley	Mitchell Partnerships	The costs and benefits of trapping to reduce the number of introduced mammals in Puketi Forest, Northland
16:10	Shona Sam	Lincoln University	Non-target interference of possum control devices affecting the success of possum maintenance control
16:30	Colin Meurk	Landcare Research	Landscape Theory to Applied Landscape Design in a New Zealand context

19:30 **Recreation Hall, Lincoln University: CONFERENCE DINNER**

WEDNESDAY MORNING

08:00	**Stewart Foyer : REGISTRATION DESK OPEN**

Stewart 1 (S1)			
09:35	Welcome and notices		
Plenary Speaker			
09:40	John Leathwick	Department of Conservation	Integrated prioritisation of the management of New Zealand's ecosystems and threatened species *Sponsored by the Department of Conservation*

10:20 – 10:50	**Stewart Foyer : MORNING TEA**

Stewart 1 (S1): Symposium: Wildlife Management and Conservation - Session Chair: James Ross			
10:50	Des Smith	Lincoln University	Modelling spatial data to optimize control of invasive vertebrates
11:10	Mandy Barron	Landcare Research	Pest control across borders
11:30	Helen Blackie	Lincoln University	Who, where and when: A new era in species recognition and animal monitoring tools
11:50	Cheryl Krull*	University of Auckland	Feral pigs in a temperate rainforest ecosystem: ecological impacts and management
12:10	Andrew Gormley	University of Otago	First evidence that marine protected areas can work for marine mammals: Hector's dolphins and the Banks Peninsula Marine Mammal Sanctuary

Commerce 1 (C1): Symposium: Microbial Ecology - Session Chair: Gavin Lear			
10:50	Gavin Lear	Lincoln University	The biogeography of stream bacteria
11:10	Paulina Giraldo-Perez*	University of Auckland	The impact of a selfish gene on the ecology of yeast
11:30	Tony Lough	New Zealand Genomics	NZGL: Genomics working in New Zealand
11:50	Claudia Buser	University of Auckland	DIY ecosystems: Can ecosystem engineering drive the evolution of mutualisms?
12:10	Julia Bellamy*	Lincoln University	Spatial variation in bacterial community composition, diversity and function in shallow alpine tarns

Commerce 2 (C2): Symposium: Plant Functional Traits - Session Chair: Tim Curran			
10:50	C.H. Lusk	University of Waikato	The whole-plant compensation point as a measure of tree species shade tolerance
11:10	George Perry	University of Auckland	Exploring the coexistence of tree species with different gap-making and gap-requiring strategies: a spatial simulation approach
11:30	Matt McGlone	Landcare Research	Ghosts in the Grasslands: evolution of leaf abscission in New Zealand grasses
11:50	Megan Van Etten	Massey University	Is phenotypic plasticity a blessing or a curse? How global warming may affect a North American alpine plant
12:10	Tim Curran	Lincoln University	Trait shifts across rainfall contrasts in tropical and subtropical rainforests indicate plant adaptations to drought

12:30 – 13:15	**Stewart Foyer : LUNCH**

WEDNESDAY AFTERNOON

Stewart 1 (S1): Plenary Speaker			
13:15	John Parkes	Landcare Research	Pushing the boundaries of pest eradication *Sponsored by Landcare Research*

Stewart 1 (S1): Symposium: Wildlife Management and Conservation - Session Chair: James Ross			
14:00	Idan Shapira*	Massey University	Conspecific attractiveness in invasive Norway rats can facilitate pest control
14:20	Belinda Whyte*	Lincoln University	Changes in possum spatial ecology following density reduction: implications for conservation and bovine tuberculosis management
14:40	Georgina Pickerell*	University of Otago	How to catch a cat: a comparison of methods for detecting mammalian predator presence on New Zealand braided rivers
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
15:30	Colin O'Donnell	Department of Conservation	Long-term persistence of bat-colony social structure: implications for conservation of threatened species
15:50	Dean Anderson	Landcare Research	On theory and applied ecological research: stoat (*Mustela erminea*) eradication from Resolution Island, Fiordland, New Zealand
16:10	Janine Duckworth	Landcare Research	Kapiti Island Stoat Incursion: A case study applying new technologies to understand the biology of the invasion and to improve trapping and surveillance outcomes
16:30	Isabel Castro	Massey University	Use of adhesives to attach devices to invertebrates: implications for depredation by ship rats (*Rattus rattus*)

Commerce 1 (C1): Symposium: Microbial Ecology - Session Chair: Gavin Lear			
14:00	Nina Koele	Landcare Research	Mycorrhizal fungi show no preference for different mineral phosphorus substrates incubated in NZ soils
14:20	Suzanne Orchard*	University of Western Australia	Small scale spatial variation in soil properties determines colonisation by arbuscular mycorrhizal fungi
14:40	Karen Adair	Lincoln University	Assessing the impact of land management practices on bacterial community structure in New Zealand soils
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
Symposium: Bio-Data Archiving and Bio-Monitoring - Session Chair: Jon Sullivan			
15:30	Jon Sullivan	Lincoln University	Extending New Zealand's natural history foundations with NatureWatch NZ (http://naturewatch.org.nz)
15:50	Hamish Maule	Landcare Research	Archiving vegetation plot data: the NVS experience
16:10	Stephen Reay	Auckland University of Technology	Exploring Art + Design as a means to engage urban people with ecology
16:30	David Scott		Utilization of archived vegetation and environmental monitoring data

Commerce 2 (C2): Contributed Papers - Session Chair: Tim Curran			
14:00	Angelina Smith*	Massey University	Vehicle damage to endemic plants on the Rangipo Desert, Tongariro National Park, New Zealand
14:20	Chloe MacLaren*	Lincoln University	The role of remnant forest vegetation in the conservation of biodiversity and ecosystem services in highland pastures of Ecuador
14:40	Gretchen Brownstein	University of Otago	Turf wars: drivers and dynamics controlling a two-phase coastal ecosystem
15:00 – 15:30	**Stewart Foyer : AFTERNOON TEA**		
Contributed Papers - Session Chair: Bruce Burns			
15:30	Bruce Burns	University of Auckland	Auckland's green volcanic heart: vegetation of the Auckland volcanic cone reserve network
15:50	P. Wehi	Massey University	Co-existence in two species of tree weta
16:10	Kate McAlpine	Department of Conservation	Managing ground cover weeds for biodiversity gain in New Zealand lowland forests
16:30	Andrew Barrell		Forest Canopy – The Final Frontier?

Stewart 1 (S1): Conference Closing	
17:00	Prize giving and farewell

THURSDAY MORNING

Lincoln University Gate 1: Field trips	
08:00	Field trip departure (packed lunch provided)

Conference Organisers

Convenor
Dr James Ross (Lincoln University)

Organising Committee
Dr Stephane Boyer (Lincoln University)
Dr Hannah Buckley (Lincoln University)
Dr Tim Curran (Lincoln University)
Dr Adrian Paterson (Lincoln University)

Student Day Organisers
Belinda Whyte (Lincoln University)
Kevin McGinn (Lincoln University)
Tasha Shelby (Lincoln University)
Caroline Weser (Lincoln University)

Field trip organisation
Quail Island – Mike Bowie (Lincoln University) and Stephane Boyer
Christchurch Natural Areas – Dr Colin Meurk (Landcare Research) and James Ross

Student Volunteers
Elise Arnst (Lincoln University)
Ross Carter-Brown (Lincoln University)
Jenny Dent (Lincoln University)
Hannah Franklin (Lincoln University)
Ian Geary (Lincoln University)
Phil Holland (Lincoln University)
Hannah Lewis (Lincoln University)
Chloe MacLaren (Lincoln University)
Marie McDonald (Lincoln University)
Cathy Mountier (Lincoln University)
Andrew Pugh (Lincoln University)
Tim Sjoberg (Lincoln University)
Manu Sommerville (Lincoln University)
Ben Wiseman (Lincoln University)
Monique Wright (Lincoln University)

Conference Logo
Dr Shona Sam (Lincoln University)

Abstracts

Abstracts for both talks and posters follow in alphabetical order by the presenter's last name.

Assessing the impact of land management practices on bacterial community structure in New Zealand soils

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Efficient agriculture relies on healthy soils and understanding the long-term impacts of land management on soils, including soil microorganisms. Using ARISA, a molecular fingerprinting technique, we compared soil bacterial community structure after 17 years of mowing and nitrogen fertilizer treatments. Treatments were combinations of (i) three levels of mowing, never mown, mown regularly, or mown irregularly; (ii) clippings left or removed from the irregularly mown plots, (iii) and no fertilization or 50 kg urea-N ha^{-1} yr^{-1}. Each of the eight treatment combinations was applied to four replicate plots in a randomized block design. Multivariate analysis revealed nearly twice as much variation in bacterial community structure was attributed to clipping removal as mowing frequency, while long-term application of nitrogen did not significantly impact soil bacterial communities. The amount of within treatment variability in bacterial communities differed, with the least variability observed for plots in which no mowing occurred. There was more variability in bacterial community data from plots to which nitrogen had been applied compared to unfertilized plots. Soil chemistry parameters described 33% of the variation in the bacterial community structure. Olsen P alone explained 10% of the observed heterogeneity, which is likely the result of persistent biomass removal resulting in P limitation as Olsen P levels were significantly lower in plots with clippings removed. Our results suggest that in this system removal of plant biomass has a greater long-term impact on soil bacterial community structure than application of nitrogen fertilizers.

Focusing on outcomes: How to support shared understanding and better integration across multiple science disciplines and stakeholder perspectives?

ALLEN, Will[1], Ogilvie, Shaun[1], Blackie, Helen[1], Smith, Des[1], Sam, Shona[1], Barrett, Brent[1], Ataria, James[1], Jacobson, Chris[2], Eason, Charles[1,3]

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[3] *Cawthron Institute, 98 Halifax St, Nelson*

Abstract: Wildlife management and conservation initiatives are under increasing pressure to produce results. There is general recognition of the importance of developing a focus on outcomes for effective and responsive management. An outcomes-based approach requires a strategic focus on what matters to the different stakeholder perspectives involved. It supports integration across a range of social, institutional and operational activities. Yet implementing an outcome oriented approach has proved deceptively difficult to achieve in practice because many initiatives fail to address the underlying social process aspects required for successful engagement across the different groups involved. We introduce a New Zealand pest control research and development programme to illustrate how the engagement of multiple stakeholders can be supported through the use of frameworks and conceptual models that can develop shared understanding. These frameworks and models use graphics to provide a formal way of thinking about a topic area and help us build coherent work plans that integrate the required activities for any particular system. Within a research context this approach supports effective integration and can help teams move towards inter- and trans-disciplinary approaches. Lastly, we highlight how working in this way builds capacity for collaboration, social learning and innovation in communities and research groups.

On theory and applied ecological research: stoat (*Mustela erminea*) eradication from Resolution Island, Fiordland, New Zealand

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Theoretical models are attractive to environmental managers because they are steeped in rigorous science and generalizable across systems. However, their predictive value is often poor because of spatiotemporal idiosyncrasies of local conditions. To increase the application of sound ecological research into management decisions, researchers must address specific management questions and incorporate local complexity. Ecological theory contributes by providing guidance on biological processes that may influence the local system. We used the New Zealand Department of Conservation's programme to eradicate stoats (*Mustela erminea*) from Resolution Island (Fiordland) to illustrate an applied ecological model driven by biological processes. The following questions were addressed: (1) what was the stoat population size over time?; (2) what is the probability of successful eradication with the current trapping regime?; (3) what trapping effort is required to obtain a 0.95 probability of successful eradication?; and (4) for a range of spatiotemporal trapping strategies, what are the resulting population sizes of stoats over time? We developed a Bayesian hierarchical model in which the following process models were incorporated: (1) population dynamics incorporating abiotic factors and temporally varying growth rates; (2) immigration; (3) stoat spatial distribution as influenced by topography and vegetation cover; and (4) spatiotemporal interactions with trapping regime. Results indicate a mean "annual peak" population size of 20 stoats, and 0.23 probability of successful eradication with the current regime. Trapping in difficult access areas was required to obtain a 0.95 probability of successful eradication. The applied ecological model provides a useful tool to inform management strategies and justify expenditures.

Bird pollination and dispersal services to plants: interactions, losses, and trophic cascades.

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Worldwide declines in bird numbers have renewed interest in how well bird–plant mutualisms such as pollination and seed dispersal are functioning. Here we consider the effects of bird declines on two plants native to New Zealand, where birds service a relatively high proportion of the flora as both pollinators and seed dispersers and recent bird losses have been extensive. Unusually, *Dysoxylum spectabile* and *Pittosporum crassifolium* have both bird-visited flowers and fruit. Pollination studies highlight that bird visits are essential for successful seed production in both species, and that away from nature reserves pollen limitation is high, and seed number per fruit in *P. crassifolium* is reduced. Dispersal studies in the same plants show that outside reserves, seed dispersal is also lower and in *P. crassifolium* both lack of pulp removal and increased exposure to predation of un-dispersed seed reduce germination success. We stress two remarkable aspects of these results; (1) For some plant species the same bird species effect both pollination and dispersal (2) Dispersal interacts with seed predation (by native invertebrates and/or by introduced mammals) so that lower dispersal also increases losses to seed predators. In our system neither the range of plant species with both bird-visited flowers and fruit, nor the likely impact of mutualism failure despite acknowledged bird losses, were obvious prior to detailed study. This suggests that compounding interactions within plant-bird mutualisms may be more widespread, and need to be considered when assessing mutualism vulnerability.

Forest Canopy – The Final Frontier?

BARRELL, ANDREW

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The forest canopy represents what could arguably be considered as the final frontier for biological research. Many methods of accessing the forest canopy have been employed by the scientific community over the years with results ranging from success to fatal failure. People literally die from a lack of understanding of the physical, mental and practical requirements of climbing into the forest canopy.
Andrew Barrell has spent many years analysing the subject and has concluded that rope access systems represent the most versatile, cost-effective and low impact method of accessing the forest canopy. He identified failings in existing rope access methods and set about developing a system that addressed both the technical and safety deficiencies that were evident.
The result of many years of field-testing in both tropical and temperate forests around the world is a system that provided the foundation for a massive worldwide canopy access training program and is currently being utilised by volunteers in the Waitakere Ranges. This system has a number of attributes which make it suitable for any individual or institution undertaking canopy access work insomuch as it accommodates relevant industry best practice whilst still being relatively efficient.
The forest canopy presents a host of unique challenges and rewards to anyone inclined to explore it. The key to success in any such endeavour is firstly the right mindset to accommodate such rigours and secondly, possession of appropriate skills and knowledge.
Once these boxes have been ticked, the sky is literally the limit.

Addressing the problem to Kea posed by Brushtail Possums

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Possums (*Trichosurus vulpecula*) represent a huge ecological threat to endemic birds due to their omnivorous nature in the New Zealand landscape. While they are well-known to be a nest predator and have been recorded killing adult Kaka (*Nestor meridionalis*) their impact on wild Kea (*Nestor Notabilis*) were not well understood. Historically all Kea research was conducted in the Alpine region which has typically low possum numbers compared to the lush lowland forests. An investigation was conducted in order assess the risks to Lowland Kea populations from predation inside and outside areas with 1080 control operations. Following the deployment of trail cameras and burrow cameras to monitor known nests various predation events were recorded. While video footage of stoats killing kea chicks were significant these images also highlighted the risk that possums pose to wild kea populations. In order to provide predator control solutions that aid *in situ* Kea conservation these camera devices were used in pen trials and eventually field based trial applications of advanced trap or bait delivery technology which specifically targeted possums. The adaptability of these camera devices has aided in our "total-picture" response to a critical risk to biodiversity.

Multiple-scale resource selection of an urban peripatus (Onychophora: Peripatopsidae)

BARRETT, DAN

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Ecological studies of peripatus (Phylum: Onychophora) are deficient internationally, and nonexistent in New Zealand. Central to examining the ecology of species is an understanding of the resources it consumes, and the habitats it occupies. A vital tool used to quantify ecology is resource selection functions (RSF), which characterise food or habitat selection by plants and animals. The objective of this study was to model resource selection of an undescribed peripatus endemic to Southeast Otago, New Zealand. The "Dunedin peripatus", as they are commonly known, are often observed in urban reserves and private gardens, making them unique in the scientific literature. I employed logistic regression and multimodel inference to model peripatus resource selection. Because habitat selection occurs in a hierarchy of scales, I modelled habitat use at the scale of individual cover objects, as well as the greater surrounding habitat. At the micro-scale (1m radius) peripatus presence was primarily effected by the presence of tree fuchsia, the presence of small arachnids, and the dimensions, water content, and rot of cover objects. At the macro-scale (10m radius) peripatus presence was primarily effected by canopy cover, air humidity, and the number of candidate cover objects in a plot. The results of the habitat selection study can be used to manage peripatus species in Dunedin parks and in private gardens. The results also illustrate the need to model selectionon multiple scales, even for a sedentary invertebrate like the peripatus.

Pest control across borders

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Control of vertebrate pests is usually conducted within a defined area but do the benefits of pest control extend outside the boundaries of that area (in a "halo") or are they concentrated in the middle of the area (in a "core")? To answer these questions Landcare Research has taken advantage of the large-scale pest control conducted by the Department of Conservation in the Tararua ranges for the Project Kaka ecological restoration project and has set up biodiversity monitoring complementary to that being done by DOC. We have established two monitoring lines perpendicular to the Project Kaka pest control boundary extending 2.5 kilometres into and out of the Project Kaka control zone to investigate the spatial extent and benefits of pest control. Devices to measure the relative abundance of pest species (rodents, mustelids, and possums) have been set up along the monitoring line. We aim to assess whether the abundance of different pest species changes in relation to distance from the control zone and the abundance of other pests. We are also monitoring resource availability (seedfall), the relative abundance of native fauna (invertebrates) and tree canopy health along the monitoring lines to see if the benefits of pest control change with increasing distance into and out from the control zone. We are also interested in how long pest control benefits last, and will do repeated monitoring over the next 3-6 years to assess how quickly pest populations re-invade or recover to pre-pest control levels. We present some preliminary results, gathered over the one and a half years after the initial pest control.

Spatial variation in bacterial community composition, diversity and function in shallow alpine tarns

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Small scale spatial variation in microbial community composition, diversity and function in freshwater ecosystems is poorly understood. I investigated the spatial variation of microbial communities within tarns located at Tekapo Scientific Reserve using Automated Ribosomal Intergenic Spacer Analysis, or ARISA. I examined the variability in bacterial community composition both within and between tarn locations and explored if microbial communities adhere to the same biogeographical patterns commonly reported for communities of larger organisms (namely the taxon-area and distance-decay relationships). I also attempted to identify specific physicochemical variables that were significant drivers of the observed community heterogeneity. To achieve these aims, I collected multiple samples (100+, in total) and measured a range of physicochemical variables (pH, temperature, depth and anion concentrations) for each of three tarns. The ARISA data revealed significant variability in bacterial community composition between tarns and some variation within the tarns which appear to be driven by correlated spatial variability in a range of physicochemical variables (e.g., pH, total C, conductivity). Distance-decay and taxon-area relationships in bacterial community similarity were also detected. I identified a significant correlation between the composition and functional attributes of the microbial communities (e.g. carbon substrate utilization patterns) and distance-decay relationships in microbial community function were observed.This research provides valuable information regarding how freshwater microbial biodiversity is generated and maintained. These results are being used to provide better guidelines for the appropriate sampling of bacterial communities in lentic aquatic systems, and may also be used to aid the conservation and improvement of freshwater ecosystem health.

Who, where and when: A new era in species recognition and animal monitoring tools

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The ability to accurately monitor animal populations is a vital aspect of wildlife management and conservation practices, providing an important source of information on the population status of species of concern. Many current animal monitoring techniques are sub-optimal and leave much room for improvement. Research within our multi-disciplinary team has focused on developing new field tools for automatically distinguishing between different animal species interacting with a long-life device. These systems use electronic technology to analyse animal footprints, gaits, stride-lengths and other physical characteristics to accurately identify each species of interest. Complex, specifically developed mathematical algorithms have been developed to increase the functionality and accuracy of the device. Current work has been based on mammalian pest species, with trials showing that these tools can accurately identify 95% of stoats, ferrets, possums, feral cats, rats and mice. The technology has been designed to cope with environmental conditions encountered in the field and is a non-invasive monitoring device which will offer a cost-effective long-life alternative compared with current labour intensive methods for monitoring animal populations.

Auckland Council's Biodiversity Strategy – Initial implementation

BOOW, JONATHAN

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Auckland Council, formed from the amalgamation of one regional and seven district authorities in November 2010, is now the largest landowner in the region. The Council manages 26 regional parks and 4,000 local parks collectively covering 100,000 hectares of open space. While the Auckland region covers just 2% of New Zealand's landmass it is home to one in three New Zealanders and represents one of the country's biodiversity hotspots.
Since formation, the council has prepared its 30 year spatial planning document (the Auckland Plan), is preparing the "Unitary Plan" to replace all existing district and regional plans and has recently launched a Biodiversity Strategy. The Biodiversity Strategy's vision is that Auckland's biodiversity is "flourishing and treasured" and it sets out eight objectives aimed at achieving this. These objectives relate to: 1) ecosystem protection 2) species protection, 3) ecosystem services, 4) Maori wellbeing, 5) community engagement, 6) knowledge and understanding, 7) integration and 8) statutory tools.
The strategy is now in the early stages of implementation. This talk will describe how the implementation plan is being developed by cross-council working groups, including progress to date, and key challenges. Current projects include prioritising and implementing ecosystem and species conservation work, investigating the integration of ecosystem services into Council decision-making, rolling out a community engagement framework, articulating our research needs and consolidating our survey and monitoring work.

Indicators of restoration success in a sand plain forest

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One outstanding issue in restoration ecology is the need to set measurable goals. Restoration practitioners seek few simple indicators of restoration success by quantifying species, population or ecosystem gains. Current research undertaken by Lincoln University at the Punakaiki Coastal Restoration Project (PCRP) focuses on identifying the best early indicators of restoration success. The PCRP is a collaboration between Rio Tinto, Conservation Volunteers New Zealand and the Department of Conservation, that aims at restoring the sand plain forest habitat on the Barrytown flats 4 km south of Punakaiki Township. On this site, most of the native vegetation has been cleared for agriculture and was subject to extensive grazing in the past few years. A comprehensive set of potential indicators are being monitored and compared between unplanted exotic grassland, replanted areas (4 year old) and mature reference sites from the directly adjacent Nikau Reserve. These indicators include recolonisation by invertebrates (monitored using pitfall traps, wooden discs, soil and leaf litter sampling, weta motels and light trapping) and vertebrates (bird, lizard and mammalian pests) as well as native vegetation cover and abiotic parameters (soil analysis, water quality). Early results indicated that some species were able to re-colonise quickly after restoration, these included carabid beetles for which the number of species increased significantly in replanted areas after just 4 years, but also earthworms and birds for which the proportion of endemic species increased in replanted areas when compared to unplanted sites. Such species could therefore be considered as good early indicators of restoration success.

Investigating the diet of an endangered carnivorous landsnail using next generation sequencing (Poster)

BOYER, STEPHANE, Wratten, Steve D., Holyoake, Andrew, Cruickshank, Rob H. and Abdelkrim, Jawad

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The study of food webs is of major importance in ecology; however, feeding is sometimes difficult to observe or quantify for species that are rare, very small, aquatic or nocturnal. The assessment of such species' diet often relies on the study of prey remains (e.g., arthropod cuticle) in predator gut contents or faeces. However, this method often lacks precision at the species level, and is not applicable for soft-bodied prey such as snails, slugs, earthworms, etc. The development of molecular techniques targeting prey DNA remaining in the guts and faeces predators appears to be a good alternative. As it is based on DNA barcoding, this approach is both very precise in terms of species identification and applicable to soft-bodied prey. We used next-generation sequencing (454-pyrosequencing) to analyse the diet of *Powelliphanta augusta*, an endangered carnivorous landsnail endemic to New Zealand that was suspected to feed mainly on earthworms. This technique is capable of sequencing many thousands of DNA fragments simultaneously from mixed samples, which allows molecular identification of all prey species in a single faecal sample. Although earthworm tissue was not detectable in snail faeces, earthworm DNA was still present in sufficient quantity for molecular tools to detect and analyse it. Based on faecal samples collected from 40 landsnails, our results provide a complete map of the earthworm-based diet of *P. augusta*. These results are helping to ensure that snails translocated to new areas have access to an appropriate range of prey species, enhancing their likelihood of survival.

From waste material to biodiversity capsules, how recent advances in molecular ecology raises the profile of generalist predators' faeces

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Recently developed molecular techniques allow the detection and identification of DNA from all prey species present in the faeces of predators. In the case of generalist predators, these molecular tools could be used to inventory prey species that are difficult to sample with traditional methods because they are very small, rare and/or live in remote or inaccessible habitats. Such species include invertebrates inhabiting the soil, deep sea species, and small, rare flying insects. In this respect predator faeces can be regarded as 'biodiversity capsules' containing a representative sample of all potential prey species occurring in the predator's foraging area. Molecular analyses of these 'capsules' can give an accurate estimate of prey occurrence, distribution and even abundance.

The costs and benefits of trapping to reduce the number of introduced mammals in Puketi Forest, Northland

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Puketi Forest, near Okaihau, is public conservation land administered by the Department of Conservation. Between 2004 and 2010 a volunteer community group, the Puketi Forest Trust, began controlling introduced stoats and feral cats within 5,500 ha and rats and brush-tailed possums within approximately 650 ha inside the larger management area. The goal of this mammal control is restoration of the forest flora and fauna. Initially pest numbers were reduced by trapping or supplying cholecalciferol in bait stations, but low pest numbers have been maintained using trapping alone. Rat and possum traps are serviced by contracted trappers at four weekly intervals between March and August and fortnightly between September and February. Stoat and cat traps are cleared fortnightly from the end of November until the end of February and every 4 – 6 weeks during the rest of the year. Between January 2005 and April 2012 the number of birds recorded in five minute counts increased nearly three-fold from 2.5 to 7.2. The number of North Island Brown kiwi calls recorded doubled from 1.6 calls per hour in 2004 to 3.3 calls per hour in 2012. Low pest numbers have also allowed reintroduction of North Island robins and North Island kokako to the forest. The cost of establishing and maintaining traplines and servicing traps ranged from $65,593 to $110,577. Trapping has proved an effective management tool at Puketi, but trap effectiveness has been limited at times by interference by feral pigs. The costs and challenges of operating a trapping network will be discussed.

Spider: an R package for DNA barcoding (Poster).

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We present the R package "spider" (SPecies IDentity and Evolution in R) that provides customisable, user-friendly functions for calculating a diverse range of summary statistics essential for DNA barcoding, taxonomy, and analysis of species-level evolution. Until now, analyses of DNA barcode data have been carried out on multiple platforms, and often using piecemeal software applications and exploration of large datasets is limited by the availability of pre-programmed functions. The statistical programming language R, is a powerful, flexible and free environment for the analysis of a wide range of data, including nucleotide sequences. The package includes a novel sliding-window method for objectively evaluating discriminatory power across mini-barcode regions, an approach recommended for designing primers in degraded-DNA studies. In addition, spider also provides a suite of the more standard statistics for use in DNA barcoding, including: identification success rates using nearest neighbour, distance threshold, or neighbour-joining criteria; calculation of intraspecific and nearest non-conspecific neighbour distances; descriptive statistics (e.g. haplotype frequency); cumulative (false positive/negative) error analysis; inter-group permutation tests; character-based population aggregation analyses. We also include functions for producing publication-quality graphics of frequently used analyses, such as saturation plots and illustrations of the barcoding gap. Spider is available as a stable version from the Comprehensive R Archive Network (CRAN; http://cran.r-project.org) and as a development version from R-Forge (http://spider.r-forge.r-project.org). It is intended that further developments of the package will include additional methods for the analysis of DNA, morphological and spatial data.

Turf wars: drivers and dynamics controlling a two-phase coastal ecosystem.

BROWNSTEIN, GRETCHEN [1], Lee, William G. [2,3], Pritchard, Daniel W. [4] and Wilson, J. Bastow [1]

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Alternative stable states have long been thought to exist in natural communities but direct evidence for their presence and the environmental switches involved has been scarce. Combining laboratory and field experiments, we investigate the environmental variables and drivers associated with two distinctive herbaceous communities in coastal ecosystems in New Zealand. In a mosaic unrelated to micro-topography, a community dominated largely by native turf species (*Leptinella dioica, Selliera radicans, Samolus repens*) forms alongside vegetation of introduced pasture species (*Trifolium repens, Agrostis stolonifera, Lolium perenne, Holcus lanatus*).
The resilience of the native turf community is dependent on external drivers, particularly periodic salt spray, and also the maintenance of low nitrogen levels which develop over time. The switch to pasture dominance is driven by enhanced soil nitrogen levels created by an invasive exotic legume. Managing coastal herbaceous communities therefore requires an understanding of the environmental and species characteristics that maintain different stable states.

The effects of translocation-induced isolation and fragmentation on the cultural evolution of bird song

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Understanding the divergence of behavioural signals in isolated populations is critical to knowing how certain barriers to gene flow can develop as these changes can have both evolutionary and conservation effects. For many bird species, songs are essential for conspecific recognition and mate choice. Measuring the rate of song divergence in natural populations is difficult, but translocations of endangered birds to isolated islands for conservation purposes can yield insights, as the age and source of founder populations are completely known. We found significant and rapid evolution in the structure and diversity of bird song in North Island (NI) saddlebacks, *Philesturnus rufusater*, in New Zealand, with two distinct song lineages evolving in < 50 years. The strong environmental filters of serial translocations resulted in cultural bottlenecks that generated drift and reduced song variability within islands in a similar manner to genetic evolution. Critically, NI saddlebacks in isolated island populations show a preference for familiar over unfamiliar songs. Therefore, this rapid divergence coupled with loss of song diversity has important implications for the behavioural evolution of this species, demonstrating previously unrecognised biological consequences of conservation management.

Invertebrate communities of New Zealand sand dunes

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Once a common feature of coastal areas, New Zealand's sand dune ecosystems have been significantly reduced in area over the past 100 years. The majority of remaining sand dunes are dominated by exotic plant species. In the last 30 years increasing restoration efforts involving clearing, planting and weeding have resulted in many dunes around New Zealand supporting a mixture of both native and exotic plants. Little is known about how these widespread restoration efforts affect higher trophic levels. Here we report preliminary results from nationwide pitfall trapping surveys of foredune invertebrate communities in natural remnant dune vegetation, restored vegetation, and unrestored sand dune sites.

Sediment pollution reduces niche space in agricultural stream food webs through altered carbon resource availability

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Inorganic fine sediment pollution is one of the main pathways in which agricultural land uses exert pressure on stream ecosystems. Although sediment impacts on stream biota are well recognised, little is known of the effects of this stressor on stream food webs. Theory suggests that resource availability is a strong contributor to community dynamics, and perturbations that affect basal resources can propagate throughout a food web. The removal and homogenization of habitat by sediment may lead to a narrowing of niche breadth, thus contributing to changes in community composition through reduced resource availability and competitive exclusion. We investigated these ideas by surveying the invertebrate communities of twelve streams along a deposited sediment gradient. Using traditional community indices indicated that composition was strongly affected by deposited sediment, with a linear decrease (R^2 = 0.911, F = 113, P < 0.001) in the relative abundance of sediment-sensitive taxa (%EPT). Structural patterns in stream invertebrate food webs investigated using stable isotope metrics showed that trophic area was negatively associated with deposited sediment (R^2 = 0.537, F = 13.7, P < 0.01), thus indicating a 'compression' of niche space. This appeared to be a consequence of the carbon range narrowing, suggesting that a reduction in basal resource niche breadth affected invertebrate consumers. These results go past traditional indices, and complement previous research by demonstrating the widespread consequences of sedimentation through the reduction of critical resources (habitat and associated carbon sources), thus affecting stream invertebrates with implications for biodiversity, food web dynamics, and ecosystem function.

Restoring a RAMSAR wetland – by reforesting it?

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The Awarua-Waituna wetland is located on the south coast of New Zealand. It is a Ramsar-recognised area of some 19,500 ha, and is included by the Department of Conservation in its Awarai Kakariki programme as one of the most significant wetlands remaining in the country. Prior to anthropogenic disturbance, the wetland is thought to have been a diverse mosaic of tall podocarp forest on elevated sites, interspersed by bogs, fens and swamps in the lower lying regions. Due to a history of fire and land clearance, it currently has very little forest and is dominated by lower-diversity *Leptospermum scoparium* (manuka) and *Empodisma minus* (wire rush) in drier, elevated areas and *Carex* and *Phormium tenax* in wetter areas. The Department of Conservation considers that facilitating the restoration of some forest areas would increase the biodiversity value of the site, but natural regeneration is rarely seen. The research investigates to what extent seed dispersal, seed predation and the existing vegetation affect regeneration in the wetland, which is currently limited. The Department's initial supposition was that there was a lack of seed dispersal, related to a lack of proximate seed sources. The results support this, but have also shown an unexpected, significant effect of cryptic predation. This has implications for future restoration options of the wetland. The use of bird perches established as a potential tool to encourage seed dispersal by non-resident birds will also be discussed.

Auckland's green volcanic heart: vegetation of the Auckland volcanic cone reserve network

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The volcanic cones of Auckland are distinctive landmarks of that city, reserved as a sequence of low green hills scattered through the urban matrix. As well as being important geological, biological and recreational reserves, most of the cones have been modified as hillforts through former occupation by Māori, and so have cultural and archaeological significance. Here, we review the vegetation of the Auckland volcanic reserves by survey, and use this to suggest future options. Forty-eight reserves currently occur on remnant features of the Auckland volcanic field. Excluding two islands (2372 ha), the other 46 reserves total 1241 ha of land within metropolitan Auckland. Most of the volcanic reserves support grassland with relatively rare patches of trees. The terrain diversity of the volcanic cone reserves covers a full range of aspects and slope classes, although with relatively high proportions of steep and flatter sites, reflecting hillslope modification by Māori earthworks. Based on 70 vegetation and 65 associated soil descriptions, we recognised eight vegetation units. These generally followed a topographic sequence from flatter, fertile sites dominated by ryegrass and clover, to steep sites dominated by patiti. Kikuyu was also a major component of groundcover vegetation, but its abundance was related to soil N levels regardless of slope. Soil analyses of volcanic cone reserves indicated that soils were generally nutrient-rich with high P and organic content. Future management should seek to restore forest on appropriate sites, and introduce more native species into other groundcover vegetation. Decreasing soil nutrient levels may assist this process.

What causes size coupling in fruit-frugivore interaction webs?

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The simplest and arguably the most ubiquitous pattern in seed dispersal mutualisms is 'size coupling' - large frugivores tend to consume larger fruits and small frugivores tend to consume smaller fruits. Despite the simplicity of this pattern, the potential mechanisms responsible for fruit-frugivore size coupling are mechanistically divergent and poorly resolved. Size coupling could arise deterministically, if large frugivores actively seek-out larger fruits to maximise their foraging efficiency. Alternatively, size coupling could also arise passively, if frugivores forage randomly, but are able to consume only those fruit species that are smaller than their gape width. I observed birds forage for fruits in a New Zealand forest reserve at approximately 5-day intervals for 6 years to test for fruit-frugivore size coupling. I then derived a suite of network analyses to establish whether fruit-frugivore size coupling was best explained by active or passive foraging by frugivores. Results showed a strikingly strong pattern in size coupling; the average size of fruits consumed by each frugivore species increased with their maximum gape width (R^2 = 0.98). Simulation analyses revealed that over 70% of variation in interaction frequencies in the observed fruit-frugivore web could be explained by a size-constrained, passive foraging model. Foraging models in which birds foraged actively for different-sized fruits to improve their foraging efficiency performed more poorly. Results were therefore consistent with the hypothesis that apparently non-random patterns in seed dispersal mutualisms can sometimes arise from simple stochastic processes.

Can native trees and shrubs establish in dryland scotch broom stands?

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Restoration of woody communities in drylands requires an understanding of the effects of 'nurse crops' such as scotch broom on establishment and growth of native trees and shrubs. We know that native trees and shrubs will readily establish into stands of broom and/or gorse in mesic conditions and will eventually overtop and suppress them and dominate the site, but we don't know if the same process is possible in dryland zones, nor the effect of various treatments of the broom. The total cost of direct broom control using herbicide in New Zealand exceeds $50m per year with more than $0.5m spent on Department of Conservation lands. The efficacy of herbicide control is often questionable due to the huge long-lived seed bank under broom stands where viable seeds can remain for periods of several decades. We treated broom stands in a number of ways and planted seedlings and sowed seeds of 6 species of trees/shrubs. We show all types of broom treatment resulted in minimal establishment, whereas intact broom stands facilitated establishment and growth of planted seedlings despite extremely dry conditions. Germination of seeds in all broom treatments was poor, although indications are that longer lived seeds (e.g. *Sophora, Plagianthus*) may be starting to result in new seedlings after three years. We suggest that initial establishment of exotic N-fixers such as broom in drylands confers an advantage to succeeding woody species by increased soil N and decreased evapotranspiration.

DIY ecosystems: Can ecosystem engineering drive the evolution of mutualisms?

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Organisms don't just adapt to environments, they may also manipulate them. For example, yeasts are classic ecosystem engineers that invade fruits by fermenting to produce a toxic cocktail of alcohol, heat, and carbon dioxide that sabotages microbial competitors. Yeasts also produce volatile compounds as they ferment (these also impart flavour to wine), but the biological function of these compounds is unknown. We are investigating whether ecosystem engineering is a new and previously unstudied mechanism for the evolution of mutually beneficial relationships between species: Yeasts benefit from volatile production because attracting vectors allows them to 'hitch a ride' with flies and escape ephemeral fruits, and flies benefit from following yeast volatiles because they reproduce better in fermenting fruits. This study investigates the population variance for attractiveness of *Saccharomyces cerevisiae* and their volatiles to attract *Drosophila simulans*. Furthermore, we test whether attractive yeasts are more successfully dispersed than unattractive yeasts. Our results could be a first support of our hypothesis that ecosystem engineering could drive mutualistic interspecies interactions.

New Zealand's Historically Rare Ecosystems: Online Factsheets (Poster)

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Naturally rare ecosystems make a disproportionately high contribution to national biodiversity and were poorly recognised and managed until Williams et al. (2007) provided a framework for identifying and distinguishing 72 different systems, These ecosystems typically arise due to unusual environmental conditions, are mostly small (<1– 1000 ha) and non-forested. As such, they often support unique biodiversity, but owing to their rarity are poorly understood, often threatened, and not distinguished in national-scale land cover classifications. Our typology has been adopted by the Ministry for the Environment and the Department of Conservation as part of their national priorities for biodiversity protection. In an effort to raise awareness of their character and extent, the rare ecosystems research team at Landcare Research has developed online factsheets for each ecosystem (http://www.landcareresearch.co.nz/publications/factsheets/rare-ecosystems).
The factsheets provide a detailed definition of the ecosystem to facilitate its identification, photographs, summaries of notable flora and fauna and current threats, and hyperlinks to major references and useful information resources. The goal is to provide conservation managers and policy makers with a resource to facilitate their efforts to reverse the decline and degradation of these important elements of New Zealand's natural heritage.

Bird monitoring before, during, and after the construction of a diversion wall structure at Ohau Channel, Lake Rotoiti, Rotorua.

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Bay of Plenty Regional Council has constructed a diversion wall structure in Lake Rotoiti. The objective of the structure (*c.*1,200 m long) is to divert water flowing from Lake Rotorua into Lake Rotoiti (via the Ohau Channel), by directing the bulk of the Ohau Channel outflow toward the Kaituna River, the main outlet of Lake Rotoiti. The purpose of the wall is to improve water quality in Lake Rotoiti. Construction of the wall commenced in June 2007 and the structure and associated works was completed by September 2008 (approximately 16 months). One of the consent conditions is to undertake avifauna monitoring and reporting on these results. Lake Rotoiti is considered to be outstanding wildlife habitat, including holding the largest population of New Zealand dabchick in the region. Monthly bird monitoring commenced in May 2005, over two years prior to wall construction, and continued during wall construction, and is ongoing. A total of 46 bird species (including 29 indigenous species) have been recorded during bird monitoring. Nine of these species are classified as 'Threatened' or 'At Risk'. The top of the diversion wall has become locally important roosting site for three gull species and three shag species. Results will be presented on ten important bird species of open water and lake margin habitats prior to, during and post wall construction.

Food and Sex: Strategic signal hierarchies in *D. melanogaster* and *D. simulans*

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Drosophila life history revolves around fruit. It is utilised for food, an area to court mates and as a brood site. *Drosophila* possess very precise olfactory sensory systems, that have secondarily evolved to locate fruit through perception of fruity volatiles. The attraction to fruit is enhanced by yeasts (e.g. *Saccharomyces cerevisiae*) which produce other volatiles such as esters, even though esters are not obligate by-products of fermentation. Yeasts may produce these volatiles to attract *Drosophila* that can act as a vector for transporting yeast to new fruits.
We tested whether *Drosophila* species and genders varied in their attraction towards fermenting and non-fermenting yeasts in fruit juice. Four yeast strains were selected based on whether they produced these volatile attractants and whether or not they fermented. Choice tests were used to observe the olfactory behaviour of *Drosophila* and construct an Attractability Index that indicates the attractiveness of each yeast strain ferment against grape juice. To investigate preference hierarchies in males, additional trials were performed, testing preferences for paired combinations of sterile juice, yeast, water, females and controls.
This research furthers our understanding of the strategic prioritisation of sensory inputs in *Drosophila* and further developing the investigation into the possible coevolutionary mutualism between yeasts and *Drosophila*, two key model organisms.

Geological perspectives for permanent land during the Zealandia-New Zealand transition

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In 2008, a small research team of geologists and ecologists published the 'drowning hypothesis'. These authors suggested that there may not have been any land in the New Zealand region c.23 million years ago. In the absence of sufficient geological evidence and the presence of considerable geological uncertainty, the paper stopped short of saying that there was no land at all. Considerable positive debate followed. Since then, there has been further independent research focused on the New Zealand Oligocene-Miocene 'geological record of terrestrial conditions' between 20 and 30 million years ago. This work largely confirms the 2008 geological interpretation and the definite presence of islands during the critical time interval but this in itself does not establish permanent land. Tantalisingly, the new geological results do not confirm that there was continuous land but there could have been.

Use of adhesives to attach devices to invertebrates: implications for depredation by ship rats (*Rattus rattus*).

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A method of marking wildlife for markrecapture studies should be long lasting, dependable and discreet. The use of radio frequency identification in studies of hard-shelled gastropods is a promising technique for recognition of individuals. Passive integrated transponders (PIT tags) can be attached to snails with easy-to-use adhesives (glues). However, anecdotal evidence suggests that the use of adhesives may attract predatory rats to tagged snails. In this study, we presented ship rats with empty Powelliphanta traversi tararuaensis land snails with PIT tags attached using three different adhesives. We measured the number and duration of any behavioural interactions associated with foraging directed towards different adhesives. We found that rats interacted more with shells that had Loctite† adhesive, and recommend that this glue should be used with caution in a field setting, as it may predispose marked snails to depredation by rats. Selleys Liquid Nails† appears to be the best adhesive choice for field-based studies.

Fate over time of two populations of the endangered *Powelliphanta traversari tararuaensis* at two remaining strongholds.

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We measured the abundance and size distribution of live and dead *Powelliphanta traversi tararuaensis* snails in two occasions at two remnant sites. Ohau was surveyed in 2004 and 2008, and Shannon in 2007 and 2009. In addition we had access to data collected at Ohau in 1996. We also collected information for snails of the genus *Wainuia* and *Rhytida*. Average abundance of live *P. t. tararuaensis* in Shannon decreased between surveys and was below the recovery goal set by the *Powelliphanta* Recovery Plan. The average size of snails found to be increasing between the surveys suggesting a decline in recruitment. Surprisingly mortality through predation appears to have dropped, suggesting that other factors such as habitat quality are affecting the snails at this site. The Ohau snail populations appear to have increased over the survey period, with all sites boasting significantly higher numbers of live *P. t. tararuaensis* in the later surveys. This increase is most likely the result of predator control operations in this area. *Wainuia* numbers remained low for both live and dead snails at both sites; although a large increase in dead snail abundance for some sites was notable. *Rhytida* remained at very low numbers in all areas surveyed. We suggest that monitoring of these other species of giant snails should also take place. Finally we discuss the sampling technique and suggest that it may be negatively affecting the snails and thus may not be representative of densities as a whole.

Effects of soil moisture and N on the distribution of N-fixing species in drylands

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The distribution of nitrogen-fixing species throughout the New Zealand drylands is not uniform. Symbiotic associations between vascular plants and nitrogen-fixing bacteria are expected to be costly except when nitrogen (N) availability is low. We tested the prediction that in low-N soils in dry climates, plants with nitrogen-fixing symbioses (N-fixing species) have higher growth rates, and occur relatively more frequently, than non-fixing species.

In a pot experiment, we measured the growth and survival of 6 N-fixing (native and exotic broom, gorse, kowhai, matagouri, and tree lupin) and 8 non-fixing species across nitrogen and moisture gradients. Using plot survey data, we then modelled the distribution of N-fixing species across the South Island, New Zealand, using derived measures of temperature, soil N and moisture.

In the glasshouse experiment, non-fixing species had higher relative growth rates than N-fixing species except when both soil N and moisture levels are low; under these conditions N-fixing species tended to outperform non-fixing species. The results were consistent with the field distribution data: survey data showed that a higher proportion of N-fixing species were present at cool, dry sites with low levels of soil N.

In temperate climates, with geologically young landscapes, the influences of soil N and water on N availability are key factors determining the relative success of N-fixing and non-fixing species. This result is relevant to the choice of species for active woody restoration, and expectations of the outcomes of 'passive' restoration.

Hamilton Halo

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The Hamilton Halo project was initiated in 2007 by Environment Waikato now Waikato Regional Council in conjunction with Landcare Research to help bring tui back into Hamilton City. Their decline is attributed to habitat loss and predation by introduced mammals. Research showed predation by rats was the largest single threat to the survival of tui eggs and chicks. The "Halo" describes a 20km radius around Hamilton city which encompasses several natural areas. These areas are within the winter feeding range of tui. The Hamilton Halo project involves control of rats and possums in these areas during tui breeding, leading to higher fledging success promoting increased bird dispersal to Hamilton City. Pest control is implemented in 7 forested areas (up to 1000ha) around the city. Individual sites receive pest control 3 consecutive years out of 5 during the start of the breeding season (August/ September). Each pest control operation requires a minimum RTI of 5% or less. Results indicate an increase in tui visiting the city. Within green spaces in Hamilton city, 5 minute bird counts in 2007 and 2010 show an increase in tui from 6% to 23% respectively. Bird sightings by the public have increased dramatically since Halo's inception. In 2007 and 2008 only 39 tui sightings were recorded. In the years since, tui sightings have been high, reaching the highest reported numbers in 2009 of 490 sightings. While this restoration contributes to tui returning to Hamilton city, other ecological benefits most certainly occur in the natural areas surrounding the city.

Wairarapa Moana – Challenges and opportunities

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How do you find out how to restore an ecosystem that has been so altered by human impacts that it becomes hard to predict the results of your restoration efforts? That has been the challenge for the Wairarapa Moana project, the focus of a collaborative effort by Iwi, the Department of Conservation, Greater Wellington Regional Council and South Wairarapa District Council. Wairarapa Moana encompasses over 10,000ha and comprises Lake Wairarapa, Lake Onoke and the surrounding freshwater wetlands. Major hydrological changes to this wetland system began in the 1960's, culminating in the implementation of the Lower Wairarapa Valley Development Scheme in 1984. The wetland complex maintains high ecological values despite these impacts and meets eight out of the nine Ramsar nomination criteria.
In recent years, research on the ecology of the lake and the surrounding wetlands has shown that the native fish community has been affected by the presence of pest fish, low-stature indigenous vegetation has been invaded by exotic grasses, alder and willow, but in contrast, improvements have been seen in the diversity and abundance of lake shore birds since 1984. Rare plant species, such as *Isolepis basilaris* have reappeared in constructed wetlands, but newly fenced ephemeral wetlands are rapidly invaded by exotic grasses.These challenges are part of the ongoing work program at the wetlands. The project has recently received funding from FreshStart for Freshwater Cleanup Fund administered by the Ministry for the Environment, which while being focussed on improving water quality has provided an opportunity to learn more about how to restore the edge wetlands within this complex system.

The role of Short-tailed bats (*Mystacina tuberculata*) in the Pollination of *Dactylanthus taylorii* in Pureora Forest

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Recent studies have found that lesser short-tailed bats (*Mystacina tuberculata*) are more important contributors to the pollination of a variety of native plants than was previously thought. Thus, it is imperative that the extent of the pollination services the species provides is further explored, and a more comprehensive understanding of its contribution to the ecology of New Zealand forests achieved. The aim of this study was to determine the variety of plant-species visited by *M. tuberculata* in Pureora Forest and to further explore the bat's pollination relationship with the native wood rose (*Dactylanthus taylorii*). Phenology surveys were carried out in conjunction with weekly sampling of pollen from fur. Infra-red video cameras were used to observe *M. tuberculata*'s feeding interactions with *D. taylorii* while a fluorescent pollen analogue was used to determine *M. tuberculata*'s potential for providing long-distance pollination. Finally we investigated the movement ecology of *M. tuberculata* and their association with areas containing high densities of *D. taylorii*. The results of the telemetry study show the bats moving into the *D. taylorii* patches as it comes into flower. While the preliminary results of the pollen analogue study indicate high levels of short distance pollen transfer but also long-range movement between isolated *D. taylorii* patches. Video footage shows a definite preference for male *D. taylorii* inflorescences over female. This study's findings will build on the limited knowledge we currently have on the foraging behaviour and movement ecology of *M. tuberculata* and their interactions with *D. taylorii*.

Trait shifts across rainfall contrasts in tropical and subtropical rainforests indicate plant adaptations to drought

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Severe droughts are increasingly frequent in many parts of the world; a trend expected to continue due to global climate change. Consequently, it is important to understand plant adaptations to drought to understand how vegetation might be affected and how best to conduct restoration. One way to identify putative adaptations is to compare likely drought resistance traits within pairs of closely related taxa across habitats with contrasting rainfall patterns. The rainforests of eastern Australia are ideal for this as many such pairs can be found in the mesic coastal habitats and nearby inland dry regions. We measured drought traits (leaf size (length, width, area), specific leaf area (SLA), leaf angle, water use efficiency (WUE), wood density (WD), wood water storage capacity (WC) in 11 pairs from the subtropics and nine pairs from the tropics. The most common trait shift was in leaf size; dry rainforest taxa mostly had smaller leaves. Recent work elsewhere has suggested that smaller leaves have higher vein density and thus lower hydraulic vulnerability and greater drought tolerance. As expected, many dry rainforest taxa also had higher WD, lower SLA, more vertically held leaves and higher WUE, though different taxa had different suites of these traits. Preliminary analyses suggest wood traits were generally uncorrelated with leaf traits, suggesting alternative axes in drought resistance traits relating either to plant stems or leaf structure and function. These results help identify key drought traits that can be used to parameterize dynamic global vegetation models to predict consequences of climate change.

The influence of seabirds on Cooks scurvy grass (*Lepidium oleraceum* s.s.), a threatened coastal cress

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New Zealand has a diverse seabird fauna, and prior to human arrival seabirds were a dominant influence throughout the country. Seabird colonies provide a nutrient-rich, disturbance-prone environment which favours a particular complement of plants. With the decline of seabirds many seabird-associated plants have also declined. For example, the threatened ornithocoprophilous endemic Cook's scurvy grass *Lepidium oleraceum* s.s. (part of a larger species complex), which occurs in the northern South, North and Kermadec Islands – with one record from the Chatham Islands. Early records suggest it was once widespread and abundant around New Zealand's coastline, now it is largely restricted to offshore islands. This paper presents research on the influence of seabird guano on *L. oleraceum* s.s. distribution and growth.

We carried out *Lepidium* germination and growth experiments using applications of gannet guano and fertiliser at different concentrations to investigate the reliance of this species on seabird presence. Elevated soil fertility from fertiliser or gannet guano resulted in larger leaves, higher relative growth rates and greener leaf colouration. Germination of *Lepidium* seed was greatest at low and intermediate concentrations of fertiliser solutions and poor with seeds given only water (control) or high fertiliser concentrations. Experiments examining soil characteristics, natural nutrient levels in wild *Lepidium* populations, salinity tolerance and competition effects from associated weed plants are still in progress. This research will increase understanding of the role seabirds play in terrestrial ecosystems and enable improved management of this threatened species.

Winter seed dispersal by birds and foxes in a hilly forest of Argentina (Poster)

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In southern temperate forests fruit and seed dispersal by animals can be as high as in tropics. The forest and scrub, in the hills of Córdoba province – Argentina, are characterized by great flora diversity, large number of bird species and an important fox (*Pseudalopex* sp) population. The aim of this study was to know the winter seeds dispersion by birds and foxes in a hills forest of Córdoba - Argentina. During winter 2012 were randomly collected 20 samples of bird feces (sample represents a point in a space with a variable number of individual excrement) and 11 feces of fox over 1.5 km^2. The results show that 83.3% of bird samples contained seeds, where, 72.4% were of *Ligustrum lucidum*, 19.7% of *Pyracantha* sp, 6.8% of Poaceae, 0.53% of Solanaceae and 0.53% of Cactaceae. In fox feces, 82% contained seeds and arthropods, and 73% contained mammals remain. 46.0% of seed present in fox feces corresponded to Solanaceae, 46.6% to Poaceae, 3.78% to *Olea europaeae* and we found presence of *Rosa eglanteria*, *Prosopis nigra, Celtis ehrenbergiana* and *Ligustrum lucidum* (less than 1% each one). *Ligustrum lucidum, Pyracantha* sp, *Olea europaeae*, *Rosa eglanteria* and *Prosopis nigra* are exotic and invasive species of hills forest. Our results reveal that birds and foxes disperse a large numbers of seeds through feces. Plant invasive species, which have a high fruit production, seems to constitute an important food source for bird and foxes during the winter.

A refined methodology for prioritising Significant Natural Areas in the Waikato region

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Waikato Regional Council is conducting ecosystem ranking to establish site-level biodiversity priorities for Significant Natural Areas (SNA) of terrestrial and wetland ecosystems. Key components of the prioritisation process include: (1) an inventory and assessment of SNA; (2) determining the ecological significance of each SNA against eleven "significance criteria" in the Waikato Regional Council Policy Statement; and (3) an ecosystem ranking framework using criteria covering ecological values, vulnerability and potential management outcomes. This procedure is primarily aligned with ecological principles such as rarity, diversity representativeness, size, buffering and long term viability. Through application of the ecosystem ranking framework, the methodology has been refined as follows: (1) excluding a threatened species score from the overall ranking for each SNA; (2) applying consistent value functions for criteria ranked by quantitative data; (3) including ecological integrity criteria which reflect intact and healthy ecosystem processes; and (4) modifying the existing irreplaceability criterion to better define regionally restricted populations of species and their vulnerability to extinction. Formulae were developed in Microsoft Excel to reduce errors from manual data entry and to help automate the ranking process. All criteria weights were expressed as percentages. In addition, spatial patterns of high priority sites were overlaid with a biodiversity linkages model to address habitat connectivity across the landscape. The refined methodology will be used for developing incentives to encourage landowners to protect high biodiversity values on their land, and will contribute to strategic planning for enhancement of Significant Natural Areas.

Kapiti Island Stoat Incursion: A case study applying new technologies to understand the biology of the invasion and to improve trapping and surveillance outcomes

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Kapiti Island is a predator-free wildlife sanctuary and home to rare New Zealand birds including the Little Spotted Kiwi (*Apteryx owenii*). A sighting of a stoat (*Mustela erminea*) in November 2010 was unexpected because stoats had never previously reached Kapiti and 5km of ocean between the island and mainland was considered a substantial natural barrier. The incursion response by the Department of Conservation included intensive trapping, tracking tunnels and stoat detection dogs. In a collaborative effort, researchers from DOC, University of Auckland, Ecogene, and Landcare Research used tested and novel technologies to identify the likely timeline and biology of the stoat incursion and to support trapping and surveillance efforts. The presence of stoats was confirmed by faecal DNA analysis and a mature male was captured in a trap lured with female stoat bedding in February 2011. Two pregnant female stoats were caught in mid-2011. Genotyping indicated a high degree of relatedness for the three trapped stoats compared to mainland individuals. Morphological and genetic information suggests the incursion arose following the arrival of a pregnant female that gave birth to at least one male and one female late in 2009. No further individuals have been located despite intensive surveillance efforts including trapping, detection dogs and molecular analysis of suspicious scats and predated bird remains. This case study exemplifies how a collaborative approach across disciplines has been successful in guiding the incursion response from DOC. Stoat detection dogs in conjunction with modern molecular and biological techniques were key components of the successful pest surveillance and conservation efforts on Kapiti Island.

Unexpected genetic population structure in the Kea (*Nestor notabilis*)

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The Kea (*Nestor notabilis*) is an endemic alpine parrot of the South Island of New Zealand. After 150 years of persecution, it was fully protected in 1986, but the species is still declining over its whole range. Here I present data from 17 microsatellite and one mitochondrial markers for Kea sampled at nine different locations along the length of the South Island. Kea are known to have considerable dispersal capabilities and are sometimes sighted far from their alpine habitat. It is therefore expected that such a potential for gene flow would make distant populations less genetically differentiated. However, we found a significant isolation by distance (IBD) pattern. Moreover three distinct genetic clusters were identified using microsatellite data while mitochondrial data identified two main groups of haplotypes. Our data suggest that kea population might have been reduced to at least one refugium during the last glaciations and subsequently recolonized their range. We discuss possible causes for this unexpected population structure, including social behaviour and call differences as a barrier to dispersal, the "beech-gap" hypothesis and potential implications for species management.

Scale insects as keystone species: the importance of honeydew to endemic gecko populations in a recovering island ecosystem

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Restoration projects often assume that ecosystems can be restored by removing key mammalian pests or replanting vegetation. However, insects also play pivotal roles in the recovery of ecosystems and yet are often overlooked during restoration projects. Scale insects are known to have keystone roles within New Zealand honeydew forest ecosystems. Most previous research in these ecosystems has been conducted in modified areas where herpetofauna are heavily suppressed by introduced predators, therefore little is known of potential trophic interactions between honeydew and native lizards. Korapuki Island, east of Coromandel Peninsula is one of New Zealand's few remaining locations where the endemic scale insect *Coelostomidia zealandica* (Coelostomidiidae) and honeydew exploiters survive in densities likely to be representative of pre-human conditions. We examined the relative importance of the sugar resources on Korapuki to the established populations of Duvaucel's geckos (*Hoplodactylus duvaucelii*) and common geckos (*Woodworthia maculatus*). We recorded the abundance and diversity of visitors to sugar-producing plant species three times daily along a fixed transect. Large numbers of Duvaucel's and common geckos were recorded nocturnally feeding on honeydew; often co-occurring on infested hosts. Common geckos were also abundant on flax and seasonally exploited pohutukawa, whereas Duvaucel's geckos relied more heavily on honeydew throughout the year. This research measures the strength of scale insect-gecko interactions, which will assist in the development and evaluation of future restoration and management plans for these ecologically important keystone species.

North-West Wildlink – engaging through community led development to deliver biodiversity enhancement

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The North-West Wildlink (NWW) concept is to provide a corridor of ecosystems linking across the Auckland isthmus between regional biodiversity hotspots on the East and West coasts. Initiated by Forest and Bird in 2005, the legacy councils, Department of Conservation and Forest and Bird signed an accord to cooperate. NWW is based on a 'restoration approach' with the focus on enhancing natural capital across existing natural areas, open space, production space, stream banks, esplanade reserves, and backyards to provide healthy and safe habitats, refuges and routes for native fauna and flora. A number of community-based projects adopted the concept, many of which were actively brokered and facilitated by accord partners. Most projects continued but local authority support faltered after the November 2010 amalgamation. Auckland Council is now re-initiating a project to support and develop the Wildlink, which includes better defining the corridor, best practice management of assets and supporting community projects. Significant public land is included but the corridor is mostly private land, both rural and urban. Achieving the NWW vision is envisaged to be via a mass of mostly small projects undertaken by individual landowners and residents, families and hapu, communities, and community groups. Some of the landowners will be businesses and agency based asset managers including Council. There are a number of key challenges, in particular:

- how to effectively support the community as they engage with each other to enhance natural capital?
- how to manage the biodiversity challenges across an area of such varied ecological health, uses and ownership?

The paper will discuss these challenges and some of the tools (for example Community Led Development (CLD) and the natural capital approach) to be adopted as part of the project.

The trials and tribulations of next-generation sequencing with non-model organisms

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Next generation sequencing (NGS) has brought substantial progress to the field of genomics and has been recognized for making profound advances in ecological and evolutionary studies. However, the sequencing revolution has mainly consisted of re-sequencing genomes that have already been obtained via traditional methods or major genome sequencing projects that often involve large amounts of time, money, and resources to achieve. Recently, studies involving NGS have begun to focus on non-model organisms and, in particular, on single nucleotide polymorphism (SNP) discovery for population genetics. In this study, we investigate the use of reduced representation libraries for SNP discovery in two non-model organisms, *Hadramphus tuberculatus* (Pascoe 1877) and *H. spinipennis* Broun 1911, in which no closely related reference genome is available. One sequence library was obtained from the GS Junior run, which was split into two according to the MID tags. *De novo* assembly resulted in 1121 *H. tuberculatus* contigs with high coverage for each contig and for *H. spinipennis de novo* assembly resulted in 1265 contigs. 450 SNPs were tagged for *H. tuberculatus* and 320 SNPs were tagged for *H. spinipennis*. Validation of 15 SNPs was conducted via standard PCR and high resolution melting (HRM). Working with non-model organisms is still not a straightforward process. Without a reference genome, assembling contigs and choosing SNPs becomes increasingly difficult, and without validating hundreds of SNPs one must rely heavily on the assumption that the previously published literature on stringent conditions for choosing SNPs really does eliminate a great deal of false positives.

The role of New Zealand native plants in nutrient retention in the riparian zone (Poster)

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This project investigates the potential benefits of native riparian planting in terms of mitigating nutrient transport to receiving waters through an improved understanding of interactions in the rhizosphere. The enrichment of ground and surface waters (with N and P) has coincided with the loss of native biodiversity in agricultural landscapes in New Zealand. Native plants have the potential to reduce contaminant mobility and increase landscape biodiversity, however little is known about the suitability of various species for this role. Plant roots and their associated micro- and macrofauna significantly alter soil chemistry and structure. Little is known about processes that occur in the rhizosphere of New Zealand natives. This research focuses on understanding the mobility of nutrients in the rhizosphere of lowland/riparian trees, shrubs and sedges. Various native plants and exotic control species are being studied in a combination of field and greenhouse trails. Methodology includes a non-disruptive technique (vacuum rhizon samplers) to obtain soil pore water, destructive soil sampling for extractable nutrients, soil leachate collection and plant uptake measurements. Comparisons of the soil-water nutrient profile in rhizosphere of different species and changes during effluent application will be used to assess the potential reduction in nutrient transport through the riparian zone. Early results suggest species and nutrient specific differences exist which may depend on rooting structure. Knowledge of the ameliorative capabilities of native species could be used, in combination with the known ecosystem services provided to streams, to develop tailored planting strategies to deal with different on farm situations.

Olfaction and behavioural ecology of a New Zealand seabird, the Grey-faced petrel (*Pterodroma macroptera gouldi)* (Poster)

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New Zealand's birds are internationally important in chemical ecology as the lack of mammalian predators has facilitated the evolution of bird species with complex chemical communication, e.g. Kiwi (*Apteryx mantelli*) and Kakapo (*Strigops habroptilus*). On-going resarch in the field of seabird sensory ecology demonstrates the importance of olfaction and odors in many species, particularly Procellariiformes (tube-nosed seabirds). This avian order is characterized by extreme pelagic foraging bouts, returning to large colonies only at night, and many species nest in inconspicuous burrows. These behaviours, which may limit other sensory modalities, make their use of chemical sensing particularly important. While siginficant research has demonstrated the use of odors in foraging, individual or nest recognition, and ectoparasite avoidance in some seabird species, the use of chemical sensing in New Zealand seabirds remains unexamined. The Grey-faced petrel (*Pterodroma macroptera gouldi*) is a New Zealand endemic subspecies of the Great-winged petrel (*Pterodroma macroptera)* and an ideal model organism for this proposed study examining the behavioral evidence of chemical communication in courtship and mate choice, distinct odor profiles of feathers and nest materials, examination of decades of pedigree data in comparison to individual odors, and behavioural assays testing recognition and response to important petrel volatile organic compounds. The information gained from this proposed study will inform conservation organizations in New Zealand regarding important habitat for breeding Procellariiformes and the potential behavioural interference of volatile organic compound pollution.

Reverse spillover of predators from managed to natural habitats

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The declining productivity gradient between managed habitats, such as agricultural areas or planted forests, and adjacent natural areas, suggests that there will generally be spillover of consumers across edges between managed and natural habitats. While movement of consumers in the natural-to-managed direction has received a great deal of attention, there has been almost no investigation of movement in the other direction, from managed to natural habitats. We investigated spillover from plantation pine forest to native New Zealand forest at a community scale, looking at movement of consumers, as well as at the effects of spillover on trophic interactions in the native forest. We conducted a large-scale experimental reduction of the herbivore populations in eight pine plantations adjacent to native forest, and monitored predator movement across the edge and parasitism rates in the native forest, both before and after herbivore reduction, at treatment and control sites. We found that there was a net movement of consumers from plantation to native forest at control sites, and that reducing herbivore abundances in the pine forest changed movement patterns of predators across the edge. These results support the hypothesis that there may generally be spillover of consumers from managed habitats to adjacent, less productive, natural habitats. Moreover, our results suggest that anthropogenic herbivore abundance manipulations that are confined to managed habitats may impact adjacent natural ecosystems by altering abundances of higher trophic level consumers that spill over the edge.

Bird feeding in urban environments: quantifying the effects of a common human activity

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Birds are a dominant feature of urban ecosystems with many species surviving in urban centres throughout the world. However, few studies have focussed on the avifaunal assemblages in urban environments, particularly in the Southern Hemisphere. One factor that may contribute to the observed structure of bird communities in these areas is the provisioning of supplementary food by people. The practice of bird feeding is becoming increasingly common, and, given the lack of attention by the scientific community, appears to be perceived as a harmless human activity. However, there are a number of serious potential implications of both supplying a copious food source for wild birds and encouraging congregation of these birds at a focal point to feed, including enhancing populations of introduced birds and increasing the spread of avian disease. A study of bird feeding in New Zealand is currently underway, focussing on both describing the practice of bird feeding here by way of a nationwide survey, and investigating the effects of feeding at a series of experimental feeding stations in urban Auckland. Survey responses indicate that the practice of feeding birds is common place in New Zealand, with the majority of people providing food that will not benefit native species. At experimental feeding stations changes in bird community structure have been observed within a few months of feeding commencing, with the abundance of some species increasing dramatically.

Matrix matters: Differences of grand skink metapopulation dynamics in native tussock grasslands and exotic pasture grasslands

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The threatened grand skink (*Oligosoma grande*) is one of New Zealand largest lizard species, inhabiting schist-rock tors surrounded by grasslands in central South Island. The conversion of indigenous tussock grasslands into exotic pasture grasslands, and introduced mammalian predators have been identified major threats. Spatially explicit metapopulation models are useful tools to investigate the effects of land-use change and conservation management strategies on population dynamics, but require species-specific data. In this study grand skink movements and rock-outcrop occupancy data was integrated in a spatially explicit simulation model. Home range size and movements of grand skinks revealed that grand skinks spent the majority of their time on rock-outcrops, and use the surrounding grassland matrix only for rare movements between outcrops. However, movements on and between rock-outcrops were reduced in pasture grasslands. Occupancy data was used to estimate outcrop-specific colonisation and extinction probabilities and showed that rock-outcrops in pasture had lower colonisation probabilities and higher population extinction probabilities compared to outcrops in tussock landscapes. Using the estimated probabilities in a spatially explicit population model resulted in low overall occupancy rates in pasture landscapes, whereas predicted occupancy rates for tussock landscapes were constant or increasing over time. Although grand skinks did not use the grasslands matrix during their daily life, changing the matrix had large implications for population dynamics. The simulation model also identified an optimal translocation site in an unoccupied tussock landscape, highlighting that a high density of outcrops was the best predictor of rapid metapopulation growth.

The impact of a selfish gene on the ecology of yeast

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Most genes that spread through a population do so because they increase the fitness of the organisms that carry them. However, some genes have 'selfishly' managed to survive without such cooperation, but this survival has come to depend on interesting and dynamic organismal and ecological relationships. For example, selfish genetic elements (SGEs) residing in inbred populations in which horizontal transmission does not occur are doomed to extinction, and many depend on their hosts' sexual reproduction to at least replicate within one genome. Some SGEs may infect a new population but their invasion becomes hindered by novel genes or by environmental factors that increase their detrimental load and thus impede the success of their own hosts. Throughout this past year we investigated the interplay between SGEs and the ecology and population biology of the host species, specifically *Saccharomyces cerevisiae*. In this process, we examined the fitness effects of VDE, one of *S. cerevisiae*'s selfish elements. VDE has a demonstrable competitive advantage at the genic level because of its ability to overrepresent itself relative to most other genes. Previous studies had failed to demonstrate that VDE affected phenotypic fitness and therefore, selection was thought to act only at the genic level; until now. The results from this study indicate that VDE has a measurable detrimental load and that it has managed to adopt an additional mechanism that increases its chances to spread in a highly inbred species. Selection, then, where VDE is concerned, is acting at both, genic and organismal, levels.

Recent application of multi-species analysis of bird communities: (1) Assessing kiwifruit orchard management and (2) biodiversity monitoring on public conservation land

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Avian studies assessing effects of land management often focus on measuring changes in abundance of common and widespread species, using single-species modelling techniques and discarding potentially important information about rare or elusive species. Multiple-species analysis techniques offer more powerful, efficient and cost-effective approaches for processing bird count data. We present multi-species models that enable changes in bird species occupancy and species richness to be assessed whilst accounting for imperfect detection. Two case studies illustrate recent application of the methodology. In the first case study, we assessed changes in bird occupancy in New Zealand's kiwifruit orchards in relation to species traits (origin, taxonomy or feeding guild), orchard management system (integrated or organic) and stage of the production cycle. Overall, native bird species are more sensitive to land management practices on kiwifruit orchards than introduced ones, but the biodiversity benefits of organic farming extend to non-passerine species, a result that was missed using single-species models. Although the multi-species modelling approach allowed us to measure changes in occupancy among a wide range of species, stronger inferences would have been drawn with a larger sample of orchards. The second case study reports on the effectiveness of the Department of Conservation's recent Biodiversity Monitoring and Reporting System where bird monitoring was carried out at 70 forest sampling locations. New Zealand's forests were found to support at least twice as many native bird species as introduced ones, irrespective of the forest class or land status. These measures represent New Zealand's first assessment of forest bird community composition at the national scale, thus providing important baseline information for monitoring future changes. Further insights will be gained as a result of future monitoring planned at a greater number of sampling locations including non-forest habitats.

First evidence of that marine protected areas can work for marine mammals: Hector's dolphins and the Banks Peninsula Marine Mammal Sanctuary

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Marine Protected Areas (MPAs) have been widely advocated for the protection of threatened marine mammals, but previously there was no empirical evidence that they are effective. In 1988, the Banks Peninsula Marine Mammal Sanctuary was established to reduce gillnet mortalities of Hector's dolphin (*Cephalorhynchus hectori*), an endangered dolphin species endemic to New Zealand. Over 21 years photo-identification surveys of Hector's dolphins were carried out along standardised transects from small outboard-powered boats, resulting in photographic "capture" of 462 reliably marked individuals. Mean annual survival during the pre-sanctuary and post-sanctuary periods was estimated by applying a Bayesian random effects capture-recapture model to the data. Population growth was estimated from population simulations using a stage-structured matrix model. We estimate a 90% probability that survival has improved between the pre-sanctuary and post-sanctuary periods, with estimates of mean survival probability increasing by 5.4%, (from 0.863 to 0.917). This improvement in survival corresponds to a 6% increase in mean annual population growth (from 0.939 to 0.995). The improved estimate, however, remains <1, suggesting that protection is insufficient to ensure population recovery. Our results provide evidence that area-based protection measures can be effective for marine mammals. We note that estimating demographic parameters in marine mammals requires many years of data to achieve sufficient precision to detect biologically meaningful change. Marine Protected Areas should be established with a commitment to long-term monitoring.

Managing competition, disturbance and stress to achieve optimal tree survival – a cost-benefit analysis of management techniques for recreating a swamp forest.

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Philip Grime's C-S-R triangle model of plant life history strategies classifies plants according to their level of adaptation to three external forces: disturbance, competition and stress. Restoration ecology often seeks to direct plant community dynamics by manipulating the environment to favour particular trajectories of change. At Wairo wetlands, near Lake Wairarapa, we conducted a field-scale multi-factorial experiment of the most common management techniques used to manipulate a plant's experience of competition, disturbance and stress. In practical terms, the use/non-use of mechanical clearance, weed-mats or herbicides applied along a gradient of increasing soil moisture and flooding. The growth and survival of c.2000 planted trees (including kahikatea, cabbage tree, totora and bush daisy) were monitored for one year. Relatively dry (non-stressful) conditions resulted in the best survival for all species, including kahikatea which was the most tolerant of prolonged inundation. Scraping of topsoil (to reduce competition from grasses) was beneficial in dry sites, but had a negative or neutral effect in wetter sites as it lowered the local ground-level and encouraged pooling of water. Facilitation by nurse species was a fourth experimental factor, whose influence is predicted to gain in prominence as succession proceeds. In summary, when recreating a swamp forest, the more stressful the environment (i.e., the more water-logged the soil) the less need there is to reduce competition through mechanical or chemical means. Determining the optimum level and mode of intervention required under different environmental conditions has the potential to substantially reduce the labour costs of many restoration schemes.

Closing the circle: how ecologists can increase their confidence in stable isotope data using their own soil-based quality control material (Poster)

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Stable isotope analysis (SIA) is widely used in ecology but SIA is usually performed by dedicated laboratories rather than by ecologists. Consequently, the reliability of SIA data is completely dependent on the quality systems put in place by the laboratory unless ecologists take steps themselves. Although widely recommended, practical advice on how to do this is lacking. Here, we outline preparation of 150 vials of an in-house quality control material of known isotopic enrichment, and describe methods for data analysis. Any reference sample must be homogenous, and stable. As a readily available, stable and ecologically relevant biogenic material, we propose air-dried soil. Homogeneity testing involves 10 vials analysed in duplicate, a Cochran test to identify outliers, and 1-way ANOVA. Given that many ecologists find SIA expensive, we propose that the ecologist pre-test for homogeneity using a simple, robust colorimetric analysis of a soil quantity (bicarbonate-extractable phosphorus) sensitive to inhomogeneity. Once pre-test homogeneity has been established, homogeneity under SIA can be tested. We obtained a 1-way ANOVA *P* value of 0.824 in our laboratory pre-test, then 0.943 ($\delta^{13}C$) and 0.331 ($\delta^{15}N$). The target enrichment value for each isotope came from the mean and standard deviation of the homogeneity test results. Submission of each batch of samples for SIA should be accompanied by two vials of reference material, labelled as normal samples. Control charting of the results using established protocols then allows both detection of within-batch issues and assessment of long term analytical control.

Factors affecting soil microbial carbon distribution in a colony of burrow nesting seabirds, and implications for soil carbon cycling (Poster)

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Seabirds deposit large quantities of marine detritus on land, but little is known of the processing of this material. Burrow-nesting seabirds concentrate their activities in their burrows, so we tested the hypothesis that microbial C within burrows is higher than on the adjacent forest floor. Samples collected from a Westland petrel colony in July (while the birds were incubating) did not support this hypothesis. Instead, concentrations were highest on the forest floor and showed no difference between occupied and unoccupied burrows. Although microbial C showed strong positive correlations with total soil N concentration (r^2=0.69) and soil moisture (r^2=0.52) and negative correlations with soil $\delta^{13}C$ (r^2=0.54) and soil $\delta^{15}N$ (r^2=0.59), covariance between these variables meant that the most parsimonious predictive model involved soil C only (r^2 = 0.74). Along with stable isotope measurements on fresh guano, the results are consistent with rapid immobilisation of guano (C:N 1.2) into soil organic matter (C:N 19.8) and loss or plant uptake of excess N, then a decrease in soil microbial C as soil organic matter is repeatedly reprocessed and remineralised (coincident with increasing $\delta^{13}C$ and $\delta^{15}N$). We intend repeating the measurements at other times of the petrel breeding cycle, and using fatty acid markers to measure the relative proportion of bacteria and fungi.

Does foliage of Thymus vulgaris (Lamiaceae) inhibit the germination of native shrubs and grasses?

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Competition with exotic species is seen as a key factor limiting the establishment of native woody species in New Zealand drylands. We tested whether foliage from the exotic shrub *Thymus vulgaris* L. grown at low and high fertility inhibited the germination of seven drylands species. *T. vulgaris* dominates many areas in Central Otago on dry, shallow soils with very little organic matter. *Thymus* foliage contains monoterpenes that inhibit growth and germination of other species in its native environment. Plots containing *T. vulgaris* were fertilised for 2 growing seasons with nitrogen. Toward the end of the second growing season, the foliage and litter were harvested and compared with that from unfertilised plants and distilled water controls for inhibitory effects on germination in Petri dish trials. There was no significant inhibition of germination in fertilised or unfertilised litter treatments compared with controls. Unfertilised foliage significantly inhibited germination compared with water controls by between 75 and 100 % in six out of seven species. Fertilised foliage had a similar effect but significantly reduced germination in all species by between 90 and 100%. These results show that *T. vulgaris* negatively affects the germination of a range of native species and suggests that the strength of the allelopathic effect cannot be mitigated through fertilisation. Continued dominance of *T. vulgaris* in many areas represents a significant barrier to low intensity restoration using seed.

Are microbes contributing to the decline of our national icon, the kiwi?

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The some birds initiate incubation with the first laid egg; however most wait until part or the entire clutch is completed. This means some eggs are exposed within the nest for several days before incubation. In a wild passerine, microbial infection during this period reduced hatching success by 20 %. Sixty per cent of wild kiwi eggs fail to hatch with microbial infection suggested as a possible cause for mortality. Kiwi eggs are particularly vulnerable to microbial infection because they are thin shelled, porous, laid in humid, soiled nests, and first laid eggs can be exposed for ≥13 days before incubation. My research aims to explore the relationship between microbes and kiwi eggs. To achieve this I have identified a sample of microorganisms from the shells of wild kiwi eggs; and researched the potential for these species to impact on the health of the embryo. I will also investigate: 1. the penetration through the shell by potential pathogens; 2. the effect of the microbial community on penetration; and 3. identify a suitable model species for future research.

Advances in tools for reptile population monitoring in New Zealand

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Robust monitoring is essential to evaluating the effectiveness of conservation management. For many cryptic taxa, including herpetofauna, reliable, standardised techniques do not exist. Recent developments of novel techniques for New Zealand reptiles, particularly the use of various artificial retreats, funnel traps and footprint tracking tunnels, show considerable promise. However, to gain confidence in novel techniques, research is required to: (1) develop optimal protocols that minimise variability and (2) assess whether indices of abundance from novel techniques reflect population size estimates obtained through an independent method. We have synthesised progress in developing techniques for reptiles in New Zealand and examined the use of artificial retreats as a monitoring technique using common skinks, *Oligosoma polychroma*, in Fiordland National Park as a case study. At the Fiordland site, skink sightings beneath retreats were most consistent at intermediate temperatures of 12-18°C and in dry conditions. Permanent placement of artificial retreats influenced demographic composition and frequency of skinks using retreats, but not their body condition, relative to temporarily placed retreats. Skink counts from artificial retreats provided a reasonably accurate and highly precise index of population size (obtained from capture-mark-recapture pitfall trapping), when sampling was conducted under optimal weather conditions. We suggest that artificial retreats represent a reliable, cost-effective monitoring technique for terrestrial lizards and recommend similar testing of other novel survey methods to investigate their potential as monitoring techniques.

What restoration can and can't do: opportunities and constraints in a rapidly changing world

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In September 2011, the 'Global Partnership of Forest and Landscape Restoration' (GPFLR), IUCN issued what is now referred to as the Bonn Challenge, an appeal to the world to restore 150 million hectares of disturbed and degraded land by 2020. At the United Nations conference on Sustainable Development Dialogues (Rio+20), achieving this goal was voted as the second highest priority in 'The Future We Want'. It has been estimated that an initiative of this scale will require US$18 billion per year, however would provide an estimated US$84 billion to the global economy. The need for, and scope of, restoration in the coming decades is immense, as are expectations that restoration science and practice can deliver outcomes at such a huge scale. At this juncture it is essential that we take stock of the opportunities but also the constraints for restoration. The field in its modern form is only a few decades old and the science and practice is evolving rapidly. Significant successes can be found in most parts of the world. However, syncrhronous with the development of the field of restoration are increasingly rapid and pervasive environmental changes, including land use and climate change, spread of non-native species and a range of other factors. Ecosystems and human societies are changing in response, and restoration hence sits within a complex, fluid and unpredictable socio-ecological context. It is thus essential that restoration ecology develops as a science and practice that keeps up with the changing realities in which it is practiced. What are effective goals for restoration and how can these be best achieved? What is possible where, and how can we best prioritize actions to achieve effective ecological and social outcomes? I will consider these questions in the context of recent discussions of the success of restoration activities, rapidly changing and novel ecosystems, and how restoration fits within a broader umbrella of ecosystem interventions.

Quantifying uncertainty in forest inventory plot data

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National monitoring and reporting procedures for both biodiversity and carbon are heavily reliant on metrics derived from standard forest inventory plot data. For example, field measurements of stem diameter, species identification and tree height from 0.04 ha plots are commonly used in conjunction with allometric models to derive estimates of carbon stock. However, our understanding of the true uncertainty associated with such highly derived metrics is poor. Current estimates typically include only the uncertainty associated with among-plot variation and do not include other potential sources of uncertainty such as measurement error or model uncertainty. To address this issue, we quantified measurement error associated with standard forest inventory methodologies by undertaking three complete independent repeat measurements of seven natural forest carbon monitoring plots. All measurements were conducted by experienced field teams within a one month period allowing us to directly quantify measurement error under typical field conditions. We used this data to identify which field measurements exert a disproportionate influence on derived metrics such as carbon stock. We also quantified model uncertainties associated with wood density estimates, and height-diameter and volume-biomass allometric equations. Both measurement error and model uncertainty had significant effects on both the accuracy and the precision of carbon stock estimates. This analysis provides a more complete representation of the uncertainty associated with plot-based measurements of carbon stock, and highlights the need to consider all the potential sources of uncertainty associated with highly derived ecological metrics.

Impacts of introduced European hedgehogs on endemic skinks and wēta in tussock grassland

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Relationships between pest abundance and impact are rarely defined, yet they are critical for knowing when pest control is sufficient to achieve biodiversity outcomes. We investigated relationships between densities of introduced European hedgehogs (*Erinaceus europaeus*) and: (i) two sympatric species of small endemic skink (*Oligosoma* spp.), and; (ii) large endemic orthopteran ground wēta (*Hemiandrus* spp.), using an enclosure-based experimental manipulation of hedgehog density in tussock grasslands in North Otago. Hedgehogs are the most abundant and widespread introduced mammalian predator in New Zealand. Faecal analysis confirmed that hedgehogs consumed skinks and invertebrates frequently in the enclosures. We used capture-mark-recapture methods to estimate changes in densities of skinks before and after exposure to a range of hedgehog densities over a 3-month period and also compared changes in abundance indices of skink demographic groups and ground wēta. Both the proportional increase in juvenile McCann's skinks and the numbers of ground wēta in pitfall traps declined significantly with increasing hedgehog density. There was also an apparent (but non-significant) negative trend in change in density for both skink species with increasing hedgehog density. Our results confirm that hedgehogs are important predators of small native fauna, but suggest that highly abundant prey populations may be buffered against significant impacts. Less abundant prey and some demographic groups, however, may be at significant risk from hedgehog predation.

Seed trapping, plant synchrony, and dispersal service in New Zealand forests

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Seedfall varies greatly among years (mast seeding), which can have widespread community effects from pulsed inputs of resources. In New Zealand, seedfall monitoring began in the 1950s but has been patchy in both geographic and taxonomic spread. A recent intiative has since 2004 created a systematic network of seedfall monitoring sites covering seven sites and 24 tree species, many of them not previously studied for seedfall variability. Here we present some early results. The longest-established site, Pelorus Bridge, now has 12 years of data on six fleshy-fruited species, all important food for native frugivorous birds. These data confirm early reports that, in the Podocarpaceae small-seeded species (*Dacrydium cupressinum*, *Dacrycarpus dacrydioides*) had high variability among years, but the larger-seeded *Prumnopitys ferruginea* had low variability, while *Beilschmiedia tawa* (Lauraceae) was intermediate. Despite previous work showing significant wide-scale synchrony among masting species in New Zealand, seed crops for different species in Pelorus Bridge were largely uncorrelated across years, increasing the reliability of fruit resources as a whole. Seeds fall into traps either with flesh intact if they have not been dispersed, or clean if they have passed through a frugivore. The percentage of clean seeds gives a measure of dispersal service to plants by birds throughout New Zealand. Data from 163 species-site-year combinations showed very high % clean seeds for *Hedycarya arborea* (Monimiaceae), *D. dacrydioides*, and *Podocarpus totara*, but low % clean for *Elaeocarpus dentatus* (Elaeocarpaceae). There was no strong relationship between fruit size and percent clean.

Managing an invasive predator pre-adapted to a pulsed resource: A model of stoat (*Mustela erminea*) irruptions in New Zealand beech forests (Poster)

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The stoat (*Mustela erminea*) is a specialist predator that evolved to exploit the unstable populations of northern voles and lemmings. In New Zealand, it is pre-adapted to respond with a population irruption to the resource pulses that follow a heavy seedfall of southern beech (*Nothofagus* spp.). Culling stoats during an irruption is necessary to reduce damaging predation on nesting endemic birds, but cannot reduce the stoat population long term if the known high natural mortality in peak years exceeds culling mortality. During other phases of the beech-mast cycle, culling might have a greater effect on a smaller stoat population, whether or not damage prevention is critical. We developed a 4-matrix model to predict the effects of culling on λ, the annual rate of change in the size of the stoat population, through the four annual phases of an average masting cycle, explicitly distinguishing between apparent and real culling. In the Post-seedfall phase of the cycle, large numbers of stoats are killed, but little of this extra mortality is additive; in other phases, culling removes larger proportions of smaller total numbers of stoats that would otherwise have lived. Culling throughout all phases is most effective at reducing stoat populations, but is also the most expensive option. Culling in Post-seedfall plus Seed or Crash years is somewhat less effective but better than culling in one phase only. Culling has different short-term effects on stoat age distribution depending on the phase of the cycle when culling begins.

Multiple paternity and differential male breeding success in ship rats

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We genotyped the embryos carried by 17 pregnant female ship rats collected from eight forest fragments trapped to extinction in rural Waikato, North Island, New Zealand. Best results were obtained from a Northern subgroup of five forest fragments, all located within 5 km of each other, where we had data for 57 candidate fathers, and 71 embryos in 15 litters. We matched 12 fathers with 31 embryos confidently, so identifying paternity for 44% of offspring. Multiple paternity was the norm: only one complete litter could be attributed to a single father. Eight of the 12 Northern group fathers had contributed to only one litter each, whereas three were represented in three litters each and one in two litters. Another 45 males were present, and sexually mature, but they were not definitely linked to any of the 71 embryos sampled even though the genotypes of both groups were known. These data support the expectation that some males would be more successful than others. Three additional genetically plausible matches were ruled out from supplementary data on trapping history. The distributions of 74 rats marked with Rhodamine B dye suggest that old breeding females are relatively sedentary, while old males actively search for mates on an extensive geographic scale.

Mycorrhizal fungi show no preference for different mineral phosphorus substrates incubated in NZ soils

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Ectomycorrhizal fungi are thought to be able to directly weather mineral grains to increase the inorganic phosphorus (P) uptake of plants. Of particular importance is the mineral apatite, which is the primary source of mineral P in ecosystems. The mineral weathering trait is thought to be absent in arbuscular mycorrhizal fungi, however this has never been directly tested in the field. We incubated substrate bags containing either pure quartz (control), pure quartz mixed with 1% igneous apatite or pure quartz mixed with 1% sedimentary apatite in the topsoil of 12 ectomycorrhizal and 12 arbuscular mycorrhizal forest sites for 1 year. The meshbags were designed to exclude roots but include fungal hyphae. After harvesting we separated fungal hyphae for DNA analysis and calculation of hyphal lengths. Roots attached to the bags were washed and freeze-dried and analysed for rare earth elements (REE's) by ICP-MS after microwave acid digestion. Fungal hyphal length was higher in ectomycorrhizal ecosystems than arbuscular mycorrhizal ecosystems, but no differences among P substrates were observed. REE patterns of igneous apatite contrasted from that of the surrounding soil and showed that roots had taken up elements from the substrate in the meshbags, but this did not differ between mycorrhizal types. This means that fungal hyphae in both ecosystems were able to take up P from the substrate, but did not colonize P rich substrates preferentially. A likely explanation is that fungal hyphae in the topsoil are predominantly harvesting organic phosphorus instead of mineral phosphorus in these ecosystems.

Feral pigs in a temperate rainforest ecosystem: ecological impacts and management.

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Feral pigs (*Sus scrofa*) are increasingly perceived as a problem in New Zealand. However, there is a lack of scientific evidence for the impacts of pigs, and no evidence-based management strategies to mitigate these impacts. This research determines the impacts of feral pigs in a temperate rainforest, describes the relationship between disturbance and pig density, and explores disturbance thresholds. The negative impacts of pigs on ecosystem processes were investigated using exclosures during a 21-month study in the Waitakere Ranges, Auckland. Plant disease transmission was also assessed, by testing soil collected from feral pigs for *Phytophthora* Taxon *Agathis* (PTA). The relationship between ground disturbance and pig density was explored using data from ground disturbance monitoring transects and pig culls, which were then used in a model to simulate management scenarios and explore impact mitigation through the use of disturbance thresholds. Feral pigs were found to increase soil nitrate, and change plant species richness and composition. Feral pigs also vectored a large number of plant pathogens. No PTA was found in the soil associated with pigs, although this is likely due to detectability issues. Model simulations demonstrated the use of disturbance thresholds in maintaining disturbance at an acceptable level. To conclude, feral pigs should be managed as an invasive species in New Zealand as repeated disturbance by pigs could increase plant disease spread and have long-term impacts on seedling recruitment and composition. This research demonstrates the capability to reduce pig ground disturbance without large reductions in pig populations and provides management recommendations advocating disturbance thresholds.

Amphibian Pet Trade in New Zealand.

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Since the introduction of the Biosecurity act in 1993, the international trade of amphibians in and out of New Zealand has become highly restricted and extremely limited. Conversely, the national trade in amphibians is now highly active and completely unregulated. Large numbers of live amphibians are regularly posted via the mail service or couriered throughout the country. The trade primarily involves the introduced *Litoria* species, axolotl and newts. Yet it is likely that disease transmission through this trade poses a high risk to New Zealand's wild populations of aquatic species. *Litoria* are a species that are able to survive and reproduce in the New Zealand environment so releases (whether intentional or accidental) pose a disease risk to native wildlife. The transportation of *Litoria spp*. throughout New Zealand via the pet trade is most commonly done at the tadpole stage but adult frogs are also bought and sold as pets. The extent of this trade or movement of live animals was previously unknown. In this study we monitored *Trade Me* sales of *Litoria spp.* and recorded over five thousand individuals being sold during an 18 month period (2011-2012). The majority of sales were of tadpoles. Husbandry advice was rarely given by pet traders. Further, wild release of frogs and tadpoles was frequently advised. Confusion over species identification was also common with species incorrectly identified as introduced or endemic and *Litoria ewingii* often being confused with *Lieopelma archeyii* .

The Biogeography of Stream Bacteria

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The extent to which bacterial communities exhibit biogeographic patterns in their distribution remains unclear. We examined the relative influence of factors including geographic distance, latitude, altitude and catchment land use on the distribution and taxon richness of stream bacterial communities across New Zealand. Bacterial communities were collected from biofilm growing on submerged rocks in 244 streams. Sample sites spanned a north-south gradient of over 970km, an altitudinal gradient of ~750m and were collected from a variety of catchment types in both the North and South Islands of New Zealand. We used ARISA, a DNA fingerprinting technique, to characterise the structure and taxon richness of each bacterial community. Key attributes relating to sample location, upstream catchment land use and a suite of additional environmental parameters were collected for every site using GIS procedures. We observed distance decay patterns in bacterial community similarity related to geographic distance and latitudinal distance, but not to altitudinal distance. Bacterial taxon richness was related to the geographic location of the sample site, being significantly greater at latitudes closer to the equator. However, variance portioning revealed that bacterial community structure was more closely related to variability in catchment land use, than to climatic variability or geographic location. Our study confirms that bacterial communities have biogeography at regional and national scales. Our results supports the widely held view in microbial ecology that 'everything is everywhere, but the environment selects'.

Integrated prioritisation of the management of New Zealand's ecosystems and threatened species

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The Department of Conservation is currently implementing a systematic approach to the integrated prioritisation of its ecosystem and threatened species management. A set of candidate 'ecosystem management units' have been identified to represent a full range of New Zealand's ecosystems, with their selection also informed by the distributions of threatened species. A smaller number of species management units are currently being identified at which to manage threatened species not occurring within ecosystem management units. Management prescriptions are used to identify for each unit those actions required to protect its ecosystem and/or threatened species values. Spatial prioritisation software is then used to prioritise sites for management implementation, taking account of the distributions of both ecosystems and species, current ecological integrity, management contributions from external agencies, and management costs. The prioritisation process is run in a step wise fashion, initially to prioritise the implementation of ecosystem-level management actions, and then to prioritise sites at which additional species-focussed actions will be implemented. Developing such an approach involves a range of technical, social and institutional challenges, requiring ongoing flexibility and adaption.

Both species sorting and neutral processes drive assembly of bacterial communities in aquatic microcosms

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The importance of 'neutral processes' (random immigration, births, deaths and speciation) in structuring bacterial communities is controversial. We investigated the effects of neutral processes (immigration) and species sorting (environmental selection) in structuring aquatic bacterial communities within microcosms containing water from three chemically distinct ponds (A, B and C). Microcosms either contained pre-sterilised (PS) water or non-sterilised (NS) water containing pre-existing bacterial communities. The effects of different immigration times were investigated by opening microcosms for 12, 24, 48, 96 or 167 hours to allow airborne bacterial immigration. Changes in bacterial communities were investigated using a DNA fingerprinting technique (ARISA) revealing significant differences in community similarity between the PS and NS microcosms, indicating that the PS microcosms were colonised by distinct immigrant taxa. Significant differences in community similarity relating to water source was observed for all microcosms indicating species sorting occurred during the experiment. However, there were no significant differences in community evenness relating to water source for the PS microcosms, providing evidence for neutral processes. To support this further, a significant number of dominant OTU's were present in both rain water and the PS communities, which was not the case for the NS microcosms. We tested the neutral model of Etienne, and investigated the effects of different immigration periods on the neutral parameters. We provide evidence for both processes being important during the colonisation of aquatic environments.

Impact of Honeybee Declines on Pollinator Community Structure and Network Interactions

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Worldwide there is great concern about the "Global Pollination Crisis"- a reduction in pollinator populations, particularly honey bees. In NZ, honey bee (*Apis melifera*) numbers are currently declining nationwide due to the spread of the invasive bee mite *Varroa destructor.* Combined with the effects of changing land use and agricultural intensification, this will likely have a large impact on pollination systems and could change the ways in which plants and their insect pollinators interact. As social bees are introduced to New Zealand, their decline could result in differential impacts on various plant groups, potentially benefiting native species and their pollinators, while restricting the pollination success of many bee pollinated invasive weeds. This was tested using a manipulative field experiment, based in the Mackenzie basin, in which eighteen sites were selected at a range of distances from commercial hives to construct a gradient of honey bee density. Flower observations were conducted on a range of plant species over a three month period during summer, and all pollinators visiting these were collected, identified, and their pollen load carried was quantified. The pollinator community changed as honeybee densities declined, and was also affected by surrounding land use. Pollinator species differed in the amount of pollen they carried and its viability, such that pollination of experimentally exposed plants (yarrow) increased as honey bee densities declined.

NZGL: Genomics Working in New Zealand

LOUGH, TONY

New Zealand Genomics Limited Chief Executive

New Zealand Genomics Limited – NZGL – is now providing New Zealand scientists with access to a genomic infrastructure to promote research throughout the country. Access to equipment and bioinformatic expertise for both small and large-scale genomics projects is provided via its collaborating partners at Massey, Otago and Auckland universities. Sequencing services on a HiSeq2000 have been operating since September 2011 at the Otago Sequencing Facility, MiSeq sequencing at Massey became operational in March 2012, and NZGL's alliance with Auckland's Centre for Genomics and Proteomics Sequencing now includes provision of further MiSeq capability, Ion Torrent and 454 GS Junior sequencing and a Microarray service. NZGL now has a distributed team of Bioinformaticians operating at each of the collaborators and providing services to clients. The final component of providing a fully integrated service package involves our delivery of Bio-IT and IT services, anticipated to be available from late 2012. NZGL's role is to provide genomics technology and bioinformatics services to New Zealand scientists – thereby underpinning research in a broad range of areas, including medicine, agriculture and the environment. NZGL's Chief Executive will describe NZGL's provision in its first year of service delivery, with examples of projects delivered to clients in New Zealand; and outline the future scope and possibilities for what the NZGL infrastructure can achieve.

The whole-plant compensation point as a measure of tree species shade tolerance

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Although "shade tolerance" has featured prominently in the vocabulary of ecologists and foresters for a century, we have yet to agree on a standardized method for quantifying this elusive property. The "whole-plant compensation point" has been proposed as a simple, robust parameter potentially enabling shade tolerance comparisons across, as well as within, forest assemblages. However, others have argued that shade tolerance is primarily a function of differential ability to survive periods of slow growth ("suppression"), implying that measurements of survival are vital. We measured growth of juveniles (500-1000 mm tall) of five tree species (*Nothofagus solandri* var. *cliffortioides, Weinmannia racemosa, Podocarpus hallii, Dacrydium cupressinum, Prumnopitys ferruginea*) across a wide range of light environments in a cool temperate rainforest in New Zealand, to determine whether whole-plant compensation points predicted species differences in occupancy of understorey light environments, which were quantified using hemispherical photography. Compensation points of most species fell within the first quartile of the distribution of light environments occupied by juveniles. Compensation points were strongly correlated with understorey mortality rates of juveniles, estimated from permanent plot data archived in the National Vegetation Survey databank. Compensation points were also positively correlated with height growth rates in high light, confirming the presence of the growth vs shade tolerance trade-off detected in many other forest tree assemblages. Results support the proposal that the whole-plant compensation point distinguishes reliably between species of differing shade tolerance. Excepting situations involving parameterization of demographic models, shade tolerance can therefore be assessed without survival measurements

The Possum Spitfire – a long-life tool for possum control

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Possums are one of the worst mammalian pests in New Zealand. They cause significant negative impacts both to native biodiversity and to the dairy industry through the spread of bovine Tb. Current control methods are able to substantially reduce possum numbers in the short term but immigration and in situ breeding mean populations recover quickly and control must be repeated every few years to maintain the low population densities required for conservation gains and to limit the spread of bovine Tb. The next step in possum control is therefore the development of devices that are able to attract and kill possums over long periods of time with minimal input. The Possum Spitfire has been designed in collaboration with Connovation Ltd. to revolutionise long-term possum control. It is species-specific, lightweight, robust, and has the capacity to dispense a measured dose of toxin to over 100 possums before it requires any servicing. The device will last at least one year and incorporates a long-life aerosol lure dispenser. During this presentation we will describe the development process and report on the results of field trials testing long-life lure formulations and the effectiveness of prototype versions of the Possum Spitfire.

The role of remnant forest vegetation in the conservation of biodiversity and ecosystem services in highland pastures of Ecuador

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In the Ecuadorian highlands it is common practice to leave remnant forest vegetation scattered throughout pastoral landscapes. This remnant vegetation can have benefits for the conservation of both biodiversity and ecosystem services. This study investigated the variation in vegetation communities between pasture and forest environments. The relationships of different communities with environmental variation, biodiversity, and ecosystem services were explored. The aim is to provide recommendations to the local farmers on the best approaches to maintain biodiversity and ecosystem services on their land, and to minimise any trade-offs between conservation and farm productivity. The results of the study indicate that although protected natural areas will remain fundamental to effective biodiversity conservation, some diversity can also be maintained within farms alongside reasonable levels of productivity. Conserving natural vegetation in farms can also improve the quality of the farmland through the provision of ecosystem services.

Differential responses to large-scale predator control and river flows by four braided river bird species

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Braided rivers of the central eastern South Island flow through large areas of rabbit infested grasslands. These grasslands support very high predator densities, and consequently bird species that inhabit these braided rivers are at high risk of predation. Since 2005 we have continuously trapped mammalian predators over an entire braided river valley, Tasman River valley (~23000 ha), in an attempt to benefit these river birds. However, different bird species (or life-stages) may respond differently to the same predator control regime. To test this, we measured the interacting effects of two extrinsic factors, predator abundance and river flow, on survival of four bird species (banded dotterel (*Charadrius bicinctus*), wrybill (*Anarhynchus frontalis*), black-fronted tern (*Chlidonias albostriatus*) and kakī/black stilt (*Himantopus novaezelandiae*) at different life-stages. We determined survival of chicks and/or hatching success for banded dotterels, wrybills and black-fronted terns, and adult survival for kakī in the core of the trapping area. Responses were different. High river flows increased the risk of nest loss by flooding for dotterels and terns. Predation rates decreased with predator control, but were also influenced by colony-specific factors for tern nests, and by increased river flows for dotterel nests and wrybill chicks. Predator control improved hatching success of terns and adult survival of kakī. Our results highlight the importance of considering the effects of multiple factors on multiple species and life-stages when evaluating the effects of management on threatened species.

Exotic conifers in the South Island high country: asset, liability or chaotic?

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Continuing debate on the place of exotic conifers in South Island high country is reviewed. In particular, conflict between current government policies; two promoting through the Emissions Trading Scheme (ETS) and the Permanent Forest Sink Initiative (PFS), and one discouraging or denying through an informal national policy for wilding conifer management. Wilding conifer control from historical plantings is currently under way, at considerable cost in funds and effort, in several regions: Mid Dome, Wakatipu Basin, Craigieburn, Marlborough Sounds, central North Island, etc. Government is partially offsetting the costs in C credit removals and deforestation liability associated with pre-1990 planted *Pinus contorta* stands, as at Mid Dome (estimated by MPI as $3 million for ~250 ha), which is additional to the estimated >$12 million for the eradication exercise. Meanwhile a Government SOE (Landcorp) and some high country farmers are planting mostly Douglas fir (suited to high altitude sites but now known to have high spreading potential), into high country tussocklands, some adjacent to prime conservation tussocklands, despite their forestry consultant's warning that "The risk of wilding spread is high." Some Regional and District Plans restrict exotic afforestation on high country lands but many are ineffective in dealing with the issue and should be appropriately revised. Meanwhile, concern is being expressed among forest enthusiasts at the uncertain C market for such plantings, and also that there is, as yet, no successor to the Kyoto Protocol, scheduled to expire this year. The situation is generally chaotic and needs urgent attention by central Government.

Islands in the snow: Ecology, systematics and biogeography of the New Zealand beetle genus *Protodendrophagus* (Coleoptera: Silvanidae: Brontini)

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Tectonic activity, the emergence of the Southern Alps, and subsequent periods of glaciation have had a major impact on the evolution of New Zealand's biota. The New Zealand endemic beetle genus *Protodendrophagus* (Coleoptera: Silvanidae: Brontini) is restricted to high altitude (>1400 m) habitats – a trait that is otherwise unknown within the family Silvanidae worldwide. Once thought to be rare and restricted to the northern part of the South Island, recent field studies have revealed the specific microhabitat of *Protodendrophagus* and found it to be widely distributed across the South Island. The combination of high altitude habitat and flightlessness means that *Protodendrophagus* populations are effectively isolated to 'islands in the snow', making the genus an ideal subject to investigate how geological forces have influenced its evolution. We report on preliminary findings from morphological and molecular investigations and discuss the ecology, systematics and biogeography of the genus.

Arbuscular mycorrhizal-plant interactions across Franz Josef chronosequence

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Chronosequences provide strong gradients of soil nutrients, providing an ideal system for understanding how nutrient status influences the interaction of mycorrhizal and plants communities. In this study we characterized the arbuscular mycorrhizal fungi (AMF) community across the Franz Josef chronosequence in New Zealand. We collected 50 roots at 10 different sites, sampling all the different successional stages; from the glacial forefront through primary, climax and retrogressive forest. The AMF community was characterized using T-RFLP and 454 sequencing. A sequence database of the plant community was made with DNA extracted from leaves. Root sequences were matched with this database to identify the plant species. We expected significant changes in the AMF community driven by plant succession and soil chemistry. However, preliminary results show lower diversity than expected and no marked differences in the AMF community among sites. The community was dominated by a few species, notably from the genera *Glomus* and *Acualospora*. Other genera such as *Diversispora*, *Scutellospora* and *Archaeospora* were present, but in lower frequencies. These are the first data on AMF succession across a long-term chronosequence that includes retrogressive stages and provide a first glimpse of AMF diversity in NZ soils.

Death by rats or poison? The impact of a rat reinvasion and eradication using brodifacoum on Stewart Island robins (Poster)

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Many endemic bird species are vulnerable to predation by introduced rats (*Rattus* spp.), and non-target poisoning during the control or eradication of rats. To determine the effect of the presence of rats and non-target poisoning, we monitored a population of Stewart Island robins (*Petroica australis rakiura*) before and after a reinvasion and eradication of Norway rats (*R. norvegicus*) on Ulva Island in 2011. The robin population declined by nearly one-third (31.5%; 432 to 296 adults) in the breeding season following the rat reinvasion and eradication. The survival rate of robins in the presence of rats just prior to the poison operation was only slightly lower than expected, which suggests Norway rats may have had a relatively minor negative effect on robin survival. In contrast, the majority of the decline occurred immediately following the poison operation, which suggests the robins were susceptible to non-target poisoning from the brodifacoum poison bait. We observed robins pecking at the bait pellets and detected brodifacoum residues in 12 of 13 dead nestlings 3-4 months after the poison operation, which suggests the robin population suffered from both primary and secondary poisoning. Our results highlight the potential role of invertebrates as vectors of anticoagulant rodenticides in the environment and suggest that mitigation against the risk of secondary poisoning of insectivorous species and their offspring may be necessary when planning brodifacoum operations.

Archiving vegetation plot data: the NVS experience

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To successfully archive compatible and useful vegetation data records requires data-model design and development that is based on national and international standards for plant names, geographic position and ecological metadata, as well as compliance with the emerging international standard for vegetation plot data (Veg-X). Resolving and maintaining these standards presents a challenge for data deposited into any databank framework and for on-going electronic capture. New Zealand's National Vegetation Survey (NVS) Databank is the national repository for quantitative vegetation plot data gathered over many years by a wide range of agencies and individuals using many disparate methods. The principal goals of the NVS databank are to provide a secure archive for data depositors and to ensure quality data are readily available to end-users. The databank comprises both a physical archive of plot-sheets, photos and maps and an electronic database containing records from approximately 77,000 vegetation survey plots covering forest, grassland, scrub, wetland, etc. This paper outlines some of the challenges faced and overcome by the NVS databank team in this task, and lessons learned along the way.

Managing ground cover weeds for biodiversity gain in New Zealand lowland forests

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Shade tolerant ground cover weeds are common invaders of lowland forest remnants in New Zealand. Control efforts usually focus on elimination of the weed, with little consideration given to likely outcomes for native biodiversity. Overly aggressive control methods can cause significant non-target damage to native plants, and may lead to re-invasion by the same or different weed species. In many cases there is no net gain, and possibly even a loss, for native biodiversity. Here we introduce a new long-term experiment which seeks to identify better ways of managing ground cover weeds in order to achieve biodiversity gain. Specifically, we aim to a) quantify the impacts of three species of ground cover weeds on native plant recruitment, b) investigate the effects of different weed control regimes on subsequent native plant recovery, and c) test whether native plant recruitment can be facilitated at invaded sites by sowing native seeds into the weed and/or excluding seed and seedling predators. Our observations and experiments are based on three ground cover weed species (*Tradescantia fluminensis*, *Plectranthus ciliatus*, *Asparagus scandens*) in six lowland forest remnants in the Bay of Plenty Region. We report preliminary data on the impacts these species have on native plant regeneration, and on the effects of different weed control regimes (manual control, herbicide at full-strength, herbicide at half-strength, no control) on subsequent native plant recruitment.

Turning rats into riflemen: biological alchemy in the Wainuiomata Mainland Island

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The Wainuiomata Mainland Island contains the largest remaining tract of original lowland podocarp forest in the lower North Island. Since 2005 this 1200-hectare site has received intensive multi-species pest control with the aim of returning the forest ecosystem to a healthy, functioning state. Pest animal monitoring has been carried out in the mainland island and an adjacent non-treatment area to determine whether or not pest control targets have been met. The results of this monitoring has given us the confidence to attempt our first species re-introduction; with 60 North Island robins having been transferred from Kapiti Island in July 2012. Ecological outcomes of the intensive pest control regime have also been monitored over time; for example five-minute bird counts have shown that significantly higher numbers of some native bird species are now being counted in the mainland island compared to the adjacent non-treatment area. Our experiences at this site illustrate the value of setting aside a non-treatment site against which apparent changes in our mainland island can be compared.

Ghosts in the Grasslands: evolution of leaf abscission in New Zealand grasses

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Most grasses do not abscise their leaves, but let them wither or retain them as dead tissue within their canopies. Retention of dead leaf tissue can protect against mammal grazing but decreases productivity. Bamboos excluded, the global abscission rate is ca. 4%. New Zealand is unusual in that two large genera in the Danthonioideae (*Chionochloa* and *Rytidosperma*) have very high rates of leaf abscission (ca. 55%). A recent paper (Antonelli *et al*. 2011: Proc.Roy. Soc. B: 278: 695-701) shows that overseas Danthonioideae lineages with leaf abscission have rarely diversified, whereas in New Zealand they have become species rich. This different fate is attributed to the absence of mammalian grazing in New Zealand. As mammal grazing is now intense in New Zealand, they term leaf abscission a 'ghost adaptation'. However, if this were so, leaf-retaining tussocks should have a current advantage against introduced mammal grazing. They do not. On the other hand, fire is an efficient remover of dead tissue, eliminating the need for abscission. Grasslands globally are associated with frequent fires and grass leaf-abscission is almost exclusively found in species of moist, cool regions where fire is less frequent. We propose that the low prehuman frequency of fire is a more likely explanation for the evolution of leaf-abscission in New Zealand.

Landscape Theory to Applied Landscape Design in a New Zealand context

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The foundations of landscape ecology are well established and comprise vertical structure within a location; horizontal or spatial structure in terms of patch/node, corridor and matrix configuration; functional dynamics involving animal movement, propagules, material cycles and energy flows; and social interactions with the natural world. In continental regions, with long-established accommodation between autotrophs, herbivores and predator guilds, there are generally easily applied rules around the relationship between habitat area and species diversity, and between wildlife strategies and the edge to core ratio of habitat. In New Zealand these relationships are blurred because of the overwhelming impact of introduced competitors and predators on long-isolated, naïve biota. New Zealand continues to experience significant species loss, particularly within intensively developed agricultural landscapes with limited and fragmented supporting habitat or biological sources. At the same time, there is an increasing interest in habitat restoration among public institutions, communities, iwi, private landowners, landscape architects and students who seek guidance in their restoration efforts. This demand is outstripping the careful, empirical testing of best practice, especially when it comes to spatial considerations; yet we can't really afford to wait for the definitive science given the urgency of the task. Here we accordingly describe a broad structural framework for restoring native biodiversity at the landscape level in New Zealand based upon collected publications and local ecological opinion to inform practitioners about basic principles of biodiversity restoration. These best practice rules will be refined and adapted as theory and practice converge.

Auditing Noah's Ark: properties of a PD-based threatened species prioritisation scheme

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Limited resources dictate that conservation managers must choose between competing priorities in threatened species management. In New Zealand, these decisions have traditionally been made using an *ad hoc* combination of local and national decision-making that has left the process open to accusations of bias and ineffective targeting of resources. Mathematical prioritisation schemes have been developed to counter this criticism with the proponents arguing that the mathematics make the assumptions more transparent and lead to better conservation outcomes. However, the data inputs into these schemes (e.g. management costs, probability of species persistence) are often estimated by panels of experts in the absence of hard data, with little acknowledgement of the uncertainty in those estimates in the prioritisation process. We report on work to measure the sensitivity of a species prioritisation scheme to uncertainty in the input data using a New Zealand threatened species dataset. Using the maximisation of phylogenetic diversity as our management goal, we present an example incorporating such diverse taxonomic groups as herpetofauna, birds, vascular plants, invertebrates and bats (91 threatened species, 442 species in total) and highlight the limitations of tree-building methodology given incomplete molecular data. We determine how robust the optimised species management priorities are to uncertainty in the costs of management actions and the probability of species persistence, and discuss the implications for operational use.

Lessons for low intensity woody restoration in drylands: limitations to seedling establishment

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Effective low-intensity restoration of woody communities in drylands requires that we understand the limitations to seed germination and establishment. Using experimental results from the New Zealand drylands we highlight some of the environmental challenges facing managers wishing to restore wood into the driest parts of this environment. Whilst dry environments are universally difficult places for seedlings to establish, land use changes and their accompanying environmental shifts such as increases in mammalian herbivores and competitive sward grasses exacerbate the difficulties for woody species. We show that while the exact natures of the limitations vary between sites, they are collectively linked to the rainfall gradient, with the driest sites facing the most severe constraints. The primary limits on initial survival appear to be adequate moisture and herbivory. Competition and water are the strongest determinants of relative growth rates. While management of herbivores may also allow managers to limit herbaceous competition, amelioration of low soil moisture remains a challenge. We suggest that at very dry sites, short-term high-intensity methods to create woody islands that facilitate local woody establishment could be coupled with low intensity methods over longer time periods to restore native wood to these landscapes.

Project Janszoon – Ecological Restoration of Abel Tasman National Park

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Project Janszoon is a 30-year collaboration between the Department of Conservation and the privately-funded Janszoon Trust to undertake ecological restoration in Abel Tasman National Park. Features of the park include: extensive uninterrupted forest sequences from coastline to mountain top; dunes, wetlands, frost flat, and karst communities; pest-free islands; and a high number of Nationally Threatened and At Risk species relative to its size. The high level objectives are focussed firstly on securing the current values through a multi-pronged approach to pest management. Once this is achieved and a maintenance programme is in place, it will be possible to undertake specific habitat recovery of smaller ecosystems (e.g. selected dunes and wetlands), as well as enhancing coastal and forest ecosystems through strategic reintroductions of flora and fauna. A monitoring regime will track trends in condition, composition and functioning, and performance measures will gauge success. There is a strong imperative to future-proof the project beyond 2042 by building links with the community, iwi and businesses.
The park presents challenges to restoration. As well as an array of animal pests and weeds a significant portion of the coastal and lowland zones were farmed in the early 1900's. Repeated burning of vegetation on infertile and highly erodible granite soils has meant slow recovery and vulnerability to continued weed infestation. The park attracts over 150,000 people per annum, largely near the coast. This presents an opportunity for advocacy and also a challenge when planning large-scale pest control.

Site selection for restoration initiatives of two endemic flora species of Central Chile using a prioritization model (Poster)

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The Mediterranean climate zone of Central Chile has been severely affected by degradation and fragmentation of natural habitats, and is considered as one of the 34 Biodiversity Hotspots. Today there is an increasingly public and private interest for conservation initiatives in these habitats; however the information needed for the priorization of potential conservation initiatives is still scarce. We aimed to assess the conservation status of two threatened endemic flora species of this Chilean hotspot, *Pouteria splendens* and *Beilschmiedia miersii*, as well as develop a site priorization model for restoration initiatives. We used the Worldclim database and Maxent software to generate a GIS bioclimatic based prediction of the potential distribution of these two species. The resulting layer was integrated with four actual land use layers (roads and cities, native forest inventory, national parks, conservation interest sites) in a linear non-pondered model to predict the best sites for restoration initiatives. Our results show that both species have predicted distributions that are highly overlapped with zones that have been severely transformed by human related activities, and support the urgent need to conserve and restore the remaining habitats. The results from the site priorization model showed the specific areas where conservation and restoration initiatives should be carried out. The model worked well with the chosen species, however it will be necessary validate it with more species in order make modifications and improvements.

Could autotoxicity be responsible of the lack of regeneration of *Beilschmiedia tawa* in some sites? (Poster)

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The lowland podocarp-tawa forest type in New Zealand is rich in biodiversity and endemic species. At present this forest type is fragmented, under exotic herbivore pressure, competing with exotic weeds and showing signs of limited seed dispersal and recruitment particularly *Beilschmiedia tawa* (tawa). We hypothesise that the low germination rates in disturbed sites are caused by autotoxicity. Previous studies have shown that *B. tawa* has leucoanthocyanins in the leaves that could inhibit germination and radicle growth. A more recent study showed that tawa leaf leachate at high concentrations had a significant negative effect on radicle elongation but a positive effect at low concentrations in *Lactuca sativa* seeds. To determine the potential autotoxicity effects of *B. tawa* leaf leachate on *B. tawa* seeds we collected 220 seeds from Pureroa Park (Waikato region) and applied three different concentrations of *B. tawa* leaf-leachate to seeds: 1:1 1:50 and filtered water as a control. We randomly selected 56 seeds distributed in 18 seed trays with eight individual cells (one seed/cell). Each tray represented a combination of two factors, seeds with/without mesocarp and one of the three concentrations of leaf-lachate. Seeds were watered on average once a week. Preliminary results show that there is an effect of *B. tawa* leachate on seed germination. We expect to have more conclusive results, such as data on radicle growth and hypocotyl length, after we carry out planned seed dissections in the coming weeks. Results may prove significant for long term restoration and conservation programs of *B. tawa*.

Community assembly and phylogenetic structure of age stratified tree communities on Hauturu (Little Barrier Island)

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Tree community assembly and canopy recruitment are notoriously complex and often studied topics. Species assemblages frequently represent a non-random sample of the regional species pool— but understanding the drivers behind this remains a challenge. Likewise, the mortality rates of seedlings and saplings on the road to "treedom" are known to be unevenly distributed across species, but difficult to model. Here, we test the hypothesis that such non-randomness in the New Zealand tree flora may be better understood by taking an evolutionary approach. To do this, the phylogenetic community structures of seedling, sapling and tree communities on Hauturu were calculated and compared using alpha and beta phylogenetic diversity (PD) metrics. Species diversity was quantified using Fisher's alpha (richness) and Simpson's beta (evenness) indices, and assessed for neutrality using the UNTB framework. To build the dataset twenty-three 20 × 20 m plots were botanically surveyed across an elevational gradient, following the standard Hurst & Allen (2007) protocol. This resulted in a matrix of 2144 individual seedlings, 4735 saplings, and 3223 trees, spread across 63 taxa. Each species was DNA barcoded using the chloroplastic *rbc*L and *rpo*C1 genes, and community phylogenies were constructed for the three age classes in each plot. The results show that neutral theory can only account for a subset of the observed community structure. Phylodiversity patterns showed little significant variation between the age classes, but higher altitude plots revealed clustering, and some of the lower altitude plots revealed over-dispersion. This suggests that environmental filtering is playing a more active role in driving community assembly at higher elevations on Hauturu, while competitive exclusion is more active in the lowlands.

Ecology of New Zealand Seaweed flies

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Seaweed and Kelp forests are rich sources of primary productivity in the marine environment. This nutrient rich biomass may make its way into the terrestrial environment forming wrack piles on coastlines. Wrack is composed of washed up seaweed, kelp and other items of jetsam, providing a key primary productivity input to the beach environment. Due to the ephemeral and event-dependent nature of wrack pile presence and formation, wrack is rapidly colonised and utilised by a combination of marine and terrestrial invertebrates after deposition. Despite being a biomass rich environment where many species and individuals appear to inhabit the same niche, wrack ecology has been poorly studied. Diptera (true flies) have been found to comprise a large component of the wrack community using this habitat to complete their life cycles and they are particularly important for the mechanical breakdown of beach cast seaweed. The macroinvertebrate community of NZ wrack has been investigated at few locations; however there has been no investigation of how wrack communities differ with location and the type of habitat they provide. Here I will describe and compare the Diptera communities from wrack on several North Island beaches with differing wrack constituents

Dryland habitat modification and succession: implications for pest ecology, impacts and damage mitigation

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This plenary examines land use issues that affect a diverse assemblage of invasive species characterising New Zealand's dryland ecosystems. For the most part, these ecosystems are in poor ecological condition and/or ecologically unstable. Land tenure is mostly private, allowing substantial modification of landscapes at very large scales, primarily through agricultural development. A small proportion of land is reserved for conservation and at lower altitudes undergoes successional change to woody species with dense herbaceous understoreys, often dominated by highly productive agricultural plant species. Land development and successional processes have contrasting effects on animal pests. Pasture improvement favours rabbits and the suite of invasive predators that consume them. Removal of livestock boosts grass seed production, leading to ecological release of mice, particularly where pasture swards are overtopped by shrubs. There is emerging evidence of detrimental effects of mice on indigenous species in dryland ecosystems. Both removing invasive predators and retiring land from grazing can benefit indigenous species, but the ensuing vegetation changes and complex interactions among invasive species can temper recovery of indigenous fauna that are vulnerable to mice. Bottom-up ecological release of mice, and landscape-scale supplementation of top predators, are key processes in these highly invaded landscapes. The theme of this conference poses the question of whether New Zealand ecology is on solid foundations. For dryland ecosystems, the answer is arguably 'yes' for ecological research, but definitely 'no' for ecological management. The imbalance between protected and unprotected areas, and between invasive- and indigenous-dominated communities, is severe.

Outcomes of an Otago skink translocation: should the sanctuary movement fret about mice?

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The Central Otago Ecological Trust (COET) is a community group restoring indigenous lizard communities and dryland habitats in Central Otago. COET recently completed a pilot study to test re-establishment of locally-extinct Otago skinks in a small 0.3-ha fenced site protected from predators. Initially, 12 adult captive-bred skinks were translocated to the site in November 2009. All skinks are recognisable by their unique skin patterns. Two years of photo-resight data were analysed in program MARK to estimate an annual survival rate of 0.85 (0.60 – 0.95, 95% CI). This is similar to survival of wild Otago skinks protected at Macraes Flat. Four baby skinks were produced from this release. These preliminary findings encouraged COET to undertake a second release of 16 skinks in November 2011. Ten days later, mice had breached the fence and their density increased to about 65 mice per ha. Mice were seen attacking adult skinks on two occasions (both skinks escaped). The survival rate of the second release of skinks was only 0.38 (0.05 – 0.73). Notwithstanding the wide confidence interval, survival of the second release was markedly lower than the first. Interestingly, survival of the first-release was largely unaffected during the mouse incursion. One explanation is that the first-release skinks cornered the best territories, forcing the second-release skinks into less favourable microhabitats where they were less able to avoid mice. These results suggest that mice are predators of Otago skinks and, when at high densities, may seriously limit recovery of translocated populations.

Long-term persistence of bat-colony social structure: implications for conservation of threatened species

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How populations of threatened species are structured may influence fitness, resilience to stochastic events and potential to recover from population declines. Living in groups is one of the primary social systems displayed by mammals and confers a number of fitness benefits (e.g. thermal clustering, information transfer) to group members. A short-term study indicated that New Zealand long-tailed bats live in closed social groups. We investigated stability of social structuring using a 20 year mark-recapture dataset (332 capture sessions; 12953 captures of 2325 bats). We calculated association indices and used cluster analysis in programme SOCPROC (V. 2.4) to examine social structure. We found non-random associations of individuals, a low degree of mixing among colonies and strong fidelity to natal colonies. Few bats (8.6% of individuals, 1.8% of total captures) switched among four adjacent colonies and the majority (>70%) returned to their original colony. Juveniles switched less often than adults, females switched less than males and breeding females switched less frequently than non-breeding females. Females of known fate (97.6%) returned to their natal colonies to breed. The behavioural data support the hypothesis that long-tailed bats live in closed societies. Despite the potential advantages of strong social structuring, this strategy may be disadvantageous if it restricts either immigration of individuals into colonies reduced in size by predation or re-establishment of colonies in areas where bats have become extinct.

Applied Ecology and Matauranga Maori: naturally coupled in the natural world?

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We explore frontiers of knowledge by posing a new paradigm for the relationship between what are often considered to be two distinct bodies of knowledge: Applied ecology and matauranga Maori (Maori knowledge). There is perhaps a timely need for new ways of investigating environmental problems, their impacts on humanity, and on indigenous peoples in particular, and applied ecological solutions that are inherently linked with indigenous knowledge. We will introduce the key existing literature in this area, explore existing definitions within each body of knowledge, and then pose the new paradigm, that shows the natural connection between applied ecology and matauranga Maori of the natural world. We will then illustrate the paradigm, explain and populate ideas, with two applied ecological research case study examples: 1) new tools for vertebrate pest control, and 2) managing the poisoning risks of tetrodotoxin, a recently-discovered naturally-occurring toxin in NZ. We will conclude with a synthesis of how this new paradigm could contribute to future environmental management.

Small scale spatial variation in soil properties determines colonisation by arbuscular mycorrhizal fungi

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Understanding of the edaphic factors which determine colonisation levels and community composition of arbuscular mycorrhizal fungi (AMF) is limited. Factors measured in the field are rarely tested under controlled conditions. Field sampling was undertaken in a sloping pasture in southern Western Australia with three distinct zones (upper, middle, lower), distinguished by soil properties, vegetation and occurrence of waterlogging. Colonisation by AMF was examined across the landscape within the roots of *Lolium rigidum* and *Lotus subbiflorus*. A glasshouse experiment examined the factors identified as influencing colonisation by AMF within the pasture: plant species, waterlogging and soil properties (zone). Waterlogging was imposed after 42 days. Colonisation by AMF, community composition of AMF (DNA analysis) and plant growth were assessed. There was a three-way interaction among plant species, waterlogging and zone for colonisation by AMF. Colonisation decreased greatly with waterlogging, except for *L. subbiflorus* in the lower zone soil. The concentration of fungal DNA was always greatly reduced by waterlogging. Careful examination of colonisation morphology revealed a group of AMF not detected by the DNA analysis, fine endophyte, which were responsible for the high colonisation of *L. subbiflorus* under waterlogging. The community composition of AMF and their colonisation of plant roots can be strongly influenced by small-scale spatial variation in plant species, soil properties and, in particular, waterlogging. This study emphasises that it is essential to use microscopy to complement molecular methods if we are to increase our understanding of AMF and their environmental niche.

Understanding Auckland's Ecosystems

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An understanding of ecosystem diversity, distribution, structure and ecological function is critical to their protection and restoration. Auckland Council has developed detailed descriptions for 41 ecosystem types based on the Department of Conservation's national classification system (Singers & Rogers, in press). Existing ecological surveys and maps from a variety of sources were collated, analysed, and converted into the ecosystem classification system. A 2011-2012 gap analysis and ecological survey of more than 1,800 sites (which was completed as part of the preparation of the Significant Ecological Areas overlay for the proposed Auckland Unitary Plan) provided up-to-date additional information about the distribution and condition of Auckland's ecosystems on private land. The combination of existing and recent survey information, in conjunction with input from experts and other spatial datasets, was used to estimate the current and historic extent of each ecosystem type. The regional conservation status of each ecosystem type was then evaluated by applying the recently developed IUCN threatened ecosystem classification system. The data produced will provide vital insight into the changing state of Auckland's ecosystems and priorities for protection and management. This paper will discuss the methodology used to assign ecosystem types, assess current and historic extent, and evaluate conservation status. Challenges encountered with both the classification and mapping will also be discussed.

A metagenomic study of fungi in kauri forests and the impact of kauri dieback

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Kauri (*Agathis australis*, Araucariaceae) is restricted in distribution to the Northern tip of the North Island of New Zealand. Living to 2,500 years or more and having trunks up to 7 m diam., kauri is a keystone species. Kauri were extensively logged and now less than 1% remains of undisturbed old-growth forests. Since the 1970s these trees have also been under threat from the exotic invasive, *Phytophthora* taxon Agathis (PTA) that causes kauri dieback. The kauri duff (i.e., leaf litter) under disease-free trees was investigated to assess the baseline data of a "healthy" fungal community and compared with the litter fungi found under diseased trees. We used pyrosequencing to study fungal biodiversity and assess changes in fungal community composition after invasion by PTA. The sampling scheme was optimized and several methods of analysing the data were tested. A sequence database of known fungi was created with which to compare the metagenomic data.

Culturing versus pyrosequencing to measure fungal communities associated with different species of Nothofagus (Poster)

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Nothofagus forests are the most myco-diverse forest type in New Zealand, making them a key to the conservation of New Zealand's fungi. Although large areas of Nothofagus forest are protected in national parks and reserves, whether some of those forests are more valuable than others in terms of fungal diversity and conservation is not known. This study addressed a basic question – are different species of Nothofagus associated with distinct fungal communities. We addressed this using leaf endophytic fungi associated with living, healthy leaves as a surrogate for fungal diversity. Two methods were used, a culture-based method using surface sterilised leaf pieces, and amplicon pyrosequencing. The same set of leaves were sampled using both methods. The leaves were collected from 2 sites, at each site 75 leaves were taken from four different trees of each of three different Nothofagus spp. Despite the two methods having very different methodological biases, the results were similar. Nothofagus menziesii (Nothofagus subgenus Lophozonia) had a greater diversity of associated fungi than the other two species sampled, N. fusca and N. solandri (Nothofagus subgenus Fuscopora). The fungal communities associated with N. fusca and N. solandri were more similar to each other than they were to that associated with N. menziesii. Although the pyrosequencing method detected many more species than the culturing method, and between-species community differences were more clearly defined using this method, about half of the species detected by culturing were not detected by pyrosequencing. The advantages and disadvantages of the two methods will be discussed.

Exotic and Native Detritivores in Forests in the Manawatu-Whanganui Region

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There has been limited work conducted on native detritivores in New Zealand, and how flexible they are at adjusting to change in forest ecosystems due to human impact. The project focuses on invertebrate detritivores and assessing whether exotic invertebrate detritivores are (1) penetrating native ecosystems and (2) competing with native species. The project also investigates whether native species of detritivores live in exotic pine plantation forests. Slaters, amphipods, and millipedes are the detritivore groups that are being examined, as these groups allow exotics to be differentiated from natives. The research covers forests in Manawatu and Wanganui regions. Samples are being collected from a range of both native and exotic forests. The forests being sampled vary in size and distance from large human populations (including some urban forest remnant). Detritivores in each forest are collected from leaf litter samples and from fallen logs. Results show that native and exotic detritivores can co-exist in the same forests. A future goal for the project is to use stable isotope analysis to see if native and exotic detritivores have the same diet and therefore, are competing for the same niche.

Pushing the boundaries of pest eradication

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New Zealand has often led the way in eradicating invasive species (mostly mammals), setting precedents for success (e.g. aerial rodent eradications) and failure (e.g. the 'last rabbit' campaigns). Eradication attempts are increasingly being applied around the world and although practitioners often look to New Zealand for advice, they are also thinking for themselves and developing tools and processes from which we can learn.

Here I challenge New Zealand pest managers to think about some of these new approaches in pest eradication (and sustained control) and will discuss two. First, I will discuss two systems that allow the probability that absence of evidence equals absence of pests, and determine the amount of extra monitoring to increase this probability to some level commensurate with the risks of being wrong. One system applies to pests that are eradicated by a series of control events and where it is uncertain when to stop (e.g. ungulates, possums). The second system applies to aerial baiting for rodents and provides a method to detect survivors with known probability, but more importantly to locate any so localised action is an option – rather than wait and detect failure by weight of numbers. Second, I will look at the belief that 'over-engineering' in aerial baiting is necessary (i.e. use of the most toxic anticoagulant, excess baits, multiple sowings, widespread distributions) and the costs to do this.

I will then briefly look at the implications of what we would need to advance to progress multi-pest eradications on big, inhabited New Zealand islands – such Stewart or Chatham islands – currently being promoted in the pest-free NZ debate.

Biodiversity and Local Government (Poster)

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In the past it was government and or regional agencies that were responsible for the conservation of New Zealand's biodiversity. Local governments are now at the front line when it comes to managing our natural resources. Their day to day planning decisions have a direct impact on the environment with urban expansion inevitably putting major pressures on undeveloped areas. The Hurunui district is a biodiversity hotspot in Northern Canterbury that contains many endangered species and habitats. The threats faced by these diminishing natural areas are typical of other regions in New Zealand and throughout the world. As well as the clearing for development and resulting fragmentation of bush lands and wetlands, there are many other pressures; these include the invasion by weeds and feral animals, erosion, pollution and lack of information about the identification of important natural areas and what support they need. Coordinated planning at a local level is critical for conserving biodiversity especially in areas where there is a rapid change in urbanisation e.g. Christchurch

Local governments need to have 5 guidelines as part of their biodiversity strategy:

1. Identifying ways of protecting local natural areas,
2. Supporting conservation on private land
3. Conserving bush through development
4. Managing natural areas
5. Working with the district communities and other organisations

It shouldn't be underestimated the role that local governments in the future will play in the protecting a regions biodiversity that will require a coordinated planning approach

LDD – OTT, LOL or BFF? Long distance dispersal and the New Zealand biota

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Debate over the extent of the 'Oligocene Drowning' of New Zealand has often focussed on the implications for the New Zealand biota and is often characterised by bitter vicariance versus long distance dispersal arguments. Here we use data gathered in dune habitats around mainland New Zealand and the Chathams to examine species traits that may have played a role in successful colonisation over large water gaps.

Are there distinct phenological seasons in New Zealand plant communities? (Poster)

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New Zealand has a high percentage of evergreen flora with 12% of the entire flora being fleshy fruited and 4% bird-pollinated. The bird-pollinated or bird-dispersed plants have evolved to attract nectivores and frugivores which facilitate pollination and seed dispersal enhancing the reproductive success of plants while the mutualists benefit from rewards of nectar and fruit pulp. Timing of reproductive phenology in plants often coincides with the seasonal presence of pollinators and dispersers. In New Zealand, birds the main vertebrates facilitating pollinations and seed dispersals and they are largely non-migratory. Hence, this study hypothesized that the reproductive phenologies of New Zealand bird-pollinated and dispersed plants follow a uniform pattern. The hypothesis is tested for the eleven most common bird-pollinated and dispersed species in Zealandia, Wellington. Community-wide annual flowering and fruiting cycle is derived from a matrix (circular standard deviation) describing the intensity of flowering and fruiting species available throughout the year. The preliminary results show that flowering and fruiting phenology of study species differ significantly from the uniform distribution. Flowering peak was observed during the end of December while fruiting peak was observed at the end of February. The flowering and fruiting times of individual species will be further tested for even displacement of phenologies. We are anticipating direct conservation recommendations from our research outcomes such as choice of plants to achieve welfare of both plants and birds of conservation concern as well as enhancement of scientific knowledge on the mutualistic relationship of plants and their respective mutualist birds.

Food web structure and community composition across a habitat edge between natural and production forests

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Land-use intensification, habitat loss and fragmentation are the main drivers of community change, increasing the proportion of habitat edges compared with core habitats. Habitat edges have been described as hyper-dynamic, with more variable and dynamically less stable communities than interior habitats. However, the effects of edge on the architecture of interaction networks, the structure of the community as a whole, are still unknown. Community-scale interaction-web structure has been linked with the ability to resist perturbations and species loss, so determining how this responds to habitat edges will contribute to a broader understanding of ecological dynamics in fragmented systems.
Our research studied for the first time how the structure and composition of insect-feeding interaction networks (food webs comprised by Lepidoptera and their parasitoid enemies) change across a habitat edge between native beech forest and pine plantation forests. We compared the structure and interaction, herbivore, and parasitoid community composition of the networks across the different habitats and at edges.
We found that the structure (architecture) of food webs does not change across habitats or at the edge between them, but that the identity and frequency of particular interactions changed significantly, as did the herbivore and parasitoid community composition. This indicates a balance between those interactions that increased vs. decreased in frequency, such that overall architecture remained constant.
We consider that determining the impacts of anthropogenic changes on interaction networks and community composition will be critical to understanding and managing fragmented ecosystems, as the proportion of edges relative to core habitats continues to increase.

Exploring the coexistence of tree species with different gap-making and gap-requiring strategies: a spatial simulation approach

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Understanding how species with different life-history traits coexist, whether stably or unstably, in plant communities continues to challenge plant ecologists. One way to simplify this question is to pool species on the basis of their functional responses to the abiotic and biotic environment (e.g., into plant functional types, PFTS) and evaluate interactions between these PFTs. A simple two-dimensional functional classification of tree species is into: (i) species that create gaps on their death vs. species that do not create gaps, and (ii) species that require gaps to regenerate vs. those that do not require gaps. Examples of all four of these strategies co-occur in New Zealand forests. Although an obvious simplification, this classification is intriguing because it includes species who favour their offspring on death (make a gap – need a gap), species that do not (don't make a gap – need a gap) and species that favour others (make a gap – don't need a gap). On the face of it, therefore, some strategies should be considerably advantaged over others in the long-term. Using a spatial simulation model I explore the conditions under which these different PFTs can persist alongside each other by evaluating the types of stabilising trade-offs in the regeneration niche and in seed dispersal required for the four PFTs' to persist alongside each other. I also consider the roles of broad-scale disturbance and of space in facilitating the co-occurrence of PFTs following these strategies.

A world on a plate: What do possums eat when they are overseas?

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Resource heterogeneity expressed at multiple spatial scales has been recognized to explain adaptive responses of generalist herbivores to the distribution, abundance and nutritional quality of forage. This knowledge is relevant for understanding ecology of introduced herbivores with their adverse effects on native flora and the adoption of pest management practices. In this paper, resource selectivity of the common brushtail possum (*Trichosurus vulpecula*) was examined in the context of availability and nutritional quality of forage in heterogeneous Australian woodlands. Resource selection was measured at a broad landscape scale and within possum home-ranges using spotlighting, radio-tracking and faecal content analysis. Small-scale chemical heterogeneity was studied within and between tree species, and co-occurring parasitic plants. Possums exhibited resource selectivity at multiple scales of resource heterogeneity ranging across habitats, tree species, and individual trees, to discrete patches of mistletoes within tree canopies. The most dominant *Eucalyptus* species were consumed less than expected, while *Acacia dealbata* was eaten more than its availability in the habitat. Possums also selected mistletoe *Amyema pendula* over its tree hosts, as well as a root parasite *Exocarpos cupressiformis*. Despite inter- and intra-specific differences among trees and parasitic plants in the amounts of nitrogen, tannins, and fibre, possums showed no clear patterns for all measured attributes. In summary, the heterogeneity of tree assemblages, and availability of parasitic plants, appear to be more important for generalist herbivores than the chemical variability among plant species and individuals. This can be a key to life success of possums in New Zealand's species-rich ecosystems.

How to catch a cat: a comparison of methods for detecting mammalian predator presence on New Zealand braided rivers

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Efficient detection techniques successfully confirm the presence of a species at a site where the species exists and are essential for effective population monitoring and for assessing the outcome of management programmes. However, detection techniques vary in their ability to detect different species. A wide range of mammalian predator species, most introduced into New Zealand since the late 18th Century, have had a detrimental impact on the native flora and fauna. To date, there has been little research to compare the efficiency of detection techniques for these species, especially in non-forest habitats. We used nine commonly available techniques to survey for the presence of mammalian predators at 19 sites on the banks of the Rangitātā River, a large braided river in South Island, New Zealand. We compared the relative efficiency of the techniques using three metrics: raw data, Kaplan-Meier survival analysis, and Probability of Detection (POD). Methods varied in their ability to detect eight species of mammalian predator. The most successful detection methods included large tracking tunnels and hair tubes for cats, large tracking tunnels for hedgehogs, and WaxTags® for possums. We show also what length monitoring period is needed for a 90% POD. We discuss the implications of the results and provide some recommendations for future monitoring protocols and further research.

Kiwi, Dogs, and DNA: The pathway to prosecution

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Kiwis are New Zealand's most iconic bird, yet they are threatened with extinction on mainland unprotected habitats within 15 years, due entirely to predation. In Northland their life expectancy is on average just 14 years as opposed to the usual 40-65 years elsewhere. Dogs are one of the key factors driving extinction where a single individual can quickly wipe out whole populations. Despite kiwi aversion training being offered, the statistics for dog related kiwi deaths are not abating. To date, nobody has been made accountable for their dog causing kiwi deaths, yet legislation through the Wildlife Act and Dog Control Act is available. What has prevented these Acts being enforced is the lack of tools available to link an individual dog to a predated bird. Current molecular tools employed by EcoGene® have identified an individual dog from the saliva traces left on kiwi carcasses. In separate instances, this approach has both excluded and linked suspect dogs to dead kiwi. Additionally, molecular tools have the potential of detecting canine presence in kiwi areas through isolation of DNA from scats or hairs. In combination with circumstantial evidence, this method could finally make irresponsible dog owners accountable and contribute to the conservation of a national icon.

Is restoration succeeding? Testing against the criteria of the SER primer

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Restoration is commonly undertaken in New Zealand, but here is little direct evidence that it succeeds in its supposed objective of facilitating natural succession towards a stable climax community. We investigate three forest restoration projects, using the criteria from the Primer of the Society for Ecological Restoration, to evaluate their restoration success. For each project we use 2-3 restoration planting stands of different ages, and reference these against some (relatively) undisturbed forest. Results indicate that the three projects are quite different floristically, but all show sequences which resemble successional patterns between the different aged stands. However, planted stands still show very high exotic cover, presence of many monocots (especially exotic grasses), and presence of a strong shrub component, all a consequence of planting natives densely into grassland. More interestingly, such stands may also show high specie's diversity, presence of climbers, and a high diversity of species of seedlings. Compared with unplanted bush, though, such stands are lacking in forest fern diversity and cover, especially of epiphytes (ferns being rarely planted in restoration programmes, and so acting as indicator species), low native diversity, and seedling density, as well as all variates indicating abundance of woody canopy species. Conclusions are that restoration is still only at early stages of development, and there is at best only a possibility that the normal successional processes will be eventually achieved. Longer-term monitoring is required, probably along with further in-planting, as well as more sophisticated research associated with designed restoration projects.

Lower Meola Restoration Project (Poster)

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The Lower Meola Restoration Project (LMRP), initiated in late 2010, is a community led riparian restoration project within Meola Creek, Point Chevalier, Auckland. A primary objective of the LMRP is to create a functioning riparian environment that increases native biodiversity and provides green corridor linkages throughout the lower Meola Catchment. As well as ecological improvements, the project aims to empower communities through involvement and action. Priority for restoration was given to the lower section of Meola Creek following the development of the Meola Creek Watercourse Management Plan (WMP) written by Morphum Environmental Ltd. The WMP provides a tool to describe specific management actions and zones to improve watercourses through identification of Restoration Opportunities (ROs), which are then prioritised within the catchment. Community and volunteer groups who expressed an interest were assigned specific ROs to undertake weeding and planting. An Implementation Plan was drafted to outline timelines and provide guidance to groups. The LMRP is being completed according to this plan as funding allows, taking into account areas of restoration priority and the level of school and community groups' commitment. To date over 4000 native species have been planted by more than 150 volunteers. Currently, monitoring initiatives are limited to qualitative measures, however it is clear the groups are benefiting in various ways from their involvement in the project. The project is gaining recognition across the wider Auckland community, and was the recipient of the Auckland Council Consultation and Engagement Award in 2011, recognising the value of collaboration to achieving environmental outcomes.

Exploring Art + Design as a means to engage urban people with ecology.

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Urban development has resulted in a loss of connection with the larger and more complex ecologies that exists outside of a city. City dwellers need to first engage with the vast ecological narrative surrounding them before they can become connected to it, and ultimately care about what happens to it. The escalation in the loss of the planet's 'cultural biodiversity' has occurred as we continue to disengage with other life forms that exist and live alongside our own species. In an urban context these 'other' species are in essence invisible in our day-to-day existence. Are we simultaneously detached from ecology and regard it merely as a resource for our use and exploitation? If so what might be effective methods of initiating reconnection with ecological subjects? We describe several of our art and design projects. They range from practical, more applied design interventions that support biodiversity and communicate ecology to more abstract and conceptual art practices. These projects aim to confront how we have detached ourselves from the ecology, and regard it merely as a resource for our use and exploitation. We ask how then can we adjust our concept of value to include and celebrate in the scale (both temporal and physical) and complexity of ecology, as well as acknowledging the challenges for a method of inquiry, and a proposition for designing future sustainable living. Ultimately, we propose that disciplines can collaborate more effectively to reconnect urban people with ecosystems outside of capital value, and question whether art and design practices can engage unrelated communities more broadly in conversations of their ecology?

Protecting significant ecological areas in Auckland

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The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance in the Resource Management Act 1991. The formation of Auckland Council in 2010 (merging Auckland Regional Council with seven local authorities) has led to a new process to develop a single overarching planning document (the Unitary Plan) to replace all existing RMA statutory council plans and to give effect to the Auckland Plan (Council's 30 year strategy to create the world's most liveable city). An important part of that Unitary Plan development is the preparation of policies, objectives and rules for the protection of significant ecological areas and the identification of all sites of ecological significance in one schedule (including marine, freshwater and terrestrial areas together). To achieve this Auckland Council staff have: collated biological data from all previous ecological surveys; collated data from existing biological databases (including national herbaria, and species databases held by various organisations); written to 2,500 landowners seeking permission to undertake surveys, undertaken more than 1,800 field surveys; developed a new approach to assessing ecological significance (for the purposes of the RMA 1991); applied an ecosystem classification system to all vegetation and determined the threat status of each ecosystem type according to the new IUCN ecosystem. This paper will describe progress made with the development of a significant ecological area schedule for Auckland and highlight a number of challenges and opportunities for the future.

Comparison of nurse plant species' effectiveness in the grasslands of Molesworth Station, Marlborough, New Zealand

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Protective nurse species can facilitate establishment of native woody seedling populations, which can be used as a conservation management tool. The Molesworth Station, Marlborough, has a history of anthropogenic disturbance, vegetation clearance, fire and grazing, resulting in a degraded environment. Invasive woody species frequently establish, causing concern to both the agricultural and conservational values of the station. We tested the situation at Molesworth Station by measuring seedling recruitment under various woody nurses, especially *Discaria toumatou* (matagouri), *Cytisus scoparius* (broom), *Rosa rubiginosa* (sweet briar) and *Nothofagus solandri* (black beech). More seedlings are found under spiny nurses, but not under nitrogen-fixers. Exotic seedlings are more common under exotic nurses than native ones. Broom nurses no native seedlings. Native seedlings are more diverse under native nurses. There is a strong relation between nurse and seedling communities. The results show that native nurse crop species are more successful in supporting native seedling regeneration than exotic species, with beech being most supportive and broom being the least. Sweet briar is the most successful of the exotics. The limiting aspects preventing succession in the Molesworth Station appear to be dryness, mammalian grazing, lack of seed dispersal, erodible soil, and competition with invasive species. Management suggestions can be made.

Supporting the Enemy Hypothesis: Sequestered plant volatiles protect gall aphids against large herbivores

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According to the Enemy Hypothesis, galls have evolved to protect the inducing insect from natural enemies. While studies on gall morphological traits have supported this assumption, evidence for the adaptive value of gall chemicals is still lacking. Wild pistachio trees (*Pistacia atlantica*) in the Middle East often bear numerous galls of the monophagous aphid *Slavum wertheimae*. Each gall of the size of a tennisball may contain thousands of aphids that feed inside and eventually disperse in autumn. In this study we demonstrated that galls accumulate high concentrations of plant-derived tannins and volatile terpenes of which the latter are emitted into the environment. Damascus goats (*Capra hircus hircus*) that commonly browse the host plant's foliage avoided feeding on galls and were repelled by their odour. Food pellets spiked with the main gall terpenes reduced feeding and suggested that gall volatiles acted as repellent signals and feeding deterrents. This presents an altered function for plant volatiles that benefits the insect but not the plant and to our knowledge is the first evidence for a defensive role of sequestered secondary metabolites in galls.

One introduced species helping another: dispersal of a rose seed infesting wasp by possums in a dryland ecosystem

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There is little field evidence of fruit-infesting insect species surviving passage through the digestive tract of frugivorous mammal species. In this study, we collected brushtail possum faecal pellets from a Central Otago dryland ecosystem and demonstrated emergence of adult torymid wasps from Rosa seed without removing the seeds from the pellets. Nineteen percent of possum dung pellets were infested by adult wasps, and a large proportion (85%) of wasps survived. Survival rates were high considering that gut passage time in possums averages 50 hours. This period allows greater dispersal distances of wasps than would occur naturally by their own means. This is an example of an insect-plant-vertebrate triad where both brushtail possums and briar rose are invasive species that did not co-evolve. An exaptation process might have occurred since introduction of these species 150 to 180 years ago.

Annual hunting event reveals rabbit recovery 14 years after introduction of rabbit haemorrhagic disease in southern New Zealand

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Rabbits are a major pest in New Zealand drylands. Rabbit haemorrhagic disease (RHD) was illegally introduced in Central Otago in 1997 and spread rapidly across the country. RHD initially reduced rabbit densities by 50-90+% but it has since become less effective and rabbit populations are increasing again. Using the results from an annual rabbit hunting competition (Alexandra Easter Bunny Shoot), we present evidence of rabbit population trends in Central Otago, 14 years after the first RHD outbreak. We derived an index of rabbit abundance on 80 pastoral properties by calculating the number of rabbits shot per shooter in the year before RHD was released, and thereafter. Since 1997, more than 177,000 rabbits have been shot by 402 teams during single 24 hour sessions every year. There was a significant reduction in hunting rates immediately after RHD. This declined further after 3 years, but thereafter there has been a steady increase in hunting rates, punctuated occasionally by minor declines. The rate of recovery is only one quarter of that detected by spotlight counts following conventional rabbit control operations before RHD arrived, indicating that RHD continues to kill rabbits. However it is only slowing the rate of recovery, not preventing it. Therefore, the efficacy of RHD as a biological control agent is waning. This community competition provides a valuable, cost-free source of scientific information that is helping us understand the epidemiology of a major wildlife disease.

Non-target interference of possum control devices affecting the success of possum maintenance control

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Possum numbers have been significantly reduced in many regions of New Zealand. However, recent research has indicated unexpected consequences of possum control. For example, evidence has shown rat numbers can double in two years after possum control compared with non-control sites. Anecdotal reports from possum contractors suggest that these high rat numbers make possum maintenance control difficult and expensive. This research aimed to quantify the issue of high rat numbers and their effect on possum maintenance control. Also discussed is the the interference of possum control devices from other non-target species that may cause issues with possum maintenance control.

A network approach to implementing the Global Strategy for Plant Conservation

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The NZ Plant Conservation Network is New Zealand's largest non-governmental organisation devoted solely to the protection of indigenous plants. Since 2003 the Network has developed a plant conservation programme around the 16 targets of the Global Strategy for Plant Conservation and this has matured over the last 9 years to include:
The national on-line flora information system (www.nzpcn.org.nz) – with information for 7,500 taxa; 23,000 plant images; digitised back issues of regional botanical society journals; and a flora mapping database with > 1.4 million plant occurrence records. The website receives > 500,000 visits annually and users can record observations and phenology events; download distribution datasets; make plant books; use a quiz to test their knowledge; and post queries on the on-line forum.
Plant conservation training – four plant conservation training modules covering plant identification, covenant management, plant propagation and streamside and wetland management.
David Given Threatened Plant Research Trust – delivering research grants for people studying threatened plants and ecosystems.
Establishment of the NZ Threatened Plant Seed Bank – providing a repository for threatened plants (in conjunction with the Millennium Seed Bank).
Advocacy programmes and collaboration – promoting plants through media activities, publications and conferences and working with central and local government, NGOs, botanic gardens, herbaria and CRIs.
Fund raising – raising money to undertake plant conservation projects and programmes.
This paper will describe the Network's achievements in implementing the Global Strategy. It will highlight how people can contribute to the Network's strategies and describe the challenges ahead for sustaining a national plant conservation programme.

“Nature everything” – the future of community driven conservation

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The resilience of communities involved in nature conservation is critical to natural heritage protection and restoration in New Zealand. Conservation depends on the strength and commitment of social and political actors and means solutions to the ever expanding list of problems must be framed for them in a meaningful way. Authoritarian nature protectionist measures are failing due to lack of engagement with New Zealanders over potential outcomes, the tools to deliver and monitor those outcomes and the implications for not achieving them. Meanwhile, DOC wants to increase community delivery of conservation and to frame future conservation debates around commodification of nature. Irrespective of the degree to which they are harmonious and ecologically friendly, communities are increasingly being relied upon to do environmental work. Three factors help communities in this regard: social networks aid organisation; resources are abundant (especially financial and information); and increasingly large cohorts of retirees are willing to get involved. NGO’s are now proliferating to tackle environmental issues leading to increased effort and capacity and, hopefully, achievement of outcomes. On the downside there are problems of sustainability in terms of maintaining momentum, competition and intergenerational interest. This paper will discuss issues relevant to community-led nature protection and restoration initiatives and will highlight priorities for supporting this growth industry including: understanding motivation; objective setting; landowner trust and support; resource allocation; access to accurate information and good training; leadership succession and mentoring; managing growth; calculating and demonstrating economic benefits; project connectivity; complementarity and community performance assessment.

Does age matter? Dispersal and settlement patterns of a forest passerine reintroduced to a mainland fenced sanctuary

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Since the early 1990s the intentional translocation of birds has been increasingly used as a conservation tool for the management of threatened species. The main goal for the translocation of any animal species is to establish a persistent and growing population at the introduction site. In contrast to the translocation of bird species to ‘predator-free’ true islands, the main threat for a new population in predator-free mainland sanctuaries is dispersal due to the open nature of the release areas. Here we investigate the demographic and environmental drivers for the successful establishment of a persistent founder population of South Island robin/toutouwai (*Petroica australis*) in a fenced mainland reserve, Orokonui Ecosanctuary. Birds from two different age classes, post-dispersal juveniles aged 4 months or more (n=25) and pre-dispersal fledglings aged 1-2 months (n=20) were translocated during the 09/10 and 10/11 breeding seasons, respectively. Results indicate that choosing fledglings drastically increases the likelihood to establish a persistent founder population. In addition, the fledglings released in 10/11 were fitted with radio transmitters and each bird’s movement was tracked for six weeks. Spatial analysis of movements, settlement patterns and environmental factors using ArcGIS are used to gain a better understanding of the population ecology of recently reintroduced SI robins.

Utilization of archived vegetation and environmental monitoring data

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There is current emphasis on monitoring as an aid to management of ecological systems, and the theme of this symposium on archiving and accessibility to such data. The paper considers how such data may be utilized and its implications for the archiving stage. A comparison was made between analysis methods of stored monitoring data for extrapolating quantitative values or trends from subsequent partial further measurements. These were done for prediction from both:

- 'species from environment and management' (e.g. inferred hieracium abundance from further soil fertility level and grazing pressure measurements),
- or 'environment and management from species' (e.g. inferred grazing pressure from further vegetation composition measurements).

The sample data used was from two 19 year annually monitored grazing trials in a tussock grassland environment under 90 different controlled treatment combinations, but treated as if from a random ecological survey. Quantitative estimation of trends from such a reference data set was best by a direct data search for closest matching observation, followed by response surface regression, simple multiple regression, multiple imputation, transformation regression, and least from principal component analysis. The implications were:

- Greater emphasis and measurement frequency on the more abundant species
- Archiving the data in its simplest form
- Need to reference each data set relative some more general classification of environments or ecological systems.

Trials and observations on short tussock grassland restoration (Poster)

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Several trials in the Lake Tekapo area have investigated drilled seeding or transplanting methods under differing inputs for native grass restoration and have been followed for up to two decades. Three drilled seeding trials compared 6 native and 6 pasture grasses under different starter fertiliser levels and sowing methods. Over two decades the most successful native species in order were *Poa colensoi, Elymus falcis*, *Festuca novae-zelandiae,* and *P. cita.* However, in two of the trials these were exceeded in performance by the five introduced grasses. Two trials investigated immediate re-planting of on-site, dug-up plants, and subdivided into few tiller ramets. These were largely unsuccessful unless into cultivated moderately fertile sites. The results are discussed in terms of material availability, propagation costs, inputs and seral versus climax species

Conspecific attractiveness in invasive Norway rats can facilitate pest control

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Invasive rodents pose major issues for conservation, human health and agriculture. Eradication of invasive rodents is feasible, but detection of individuals at low densities using traditional methods is difficult. We tested the hypothesis that in social species, conspecific attraction might often be a more appealing than food in the invasive Norway rat *Rattus norvegicus*. We compared trapping devices containing male and female laboratory rats (the domesticated form of *R. norvegicus*) with food baited devices to test the efficacy of live lures at four mainland sites, three zoological parks and in two incursion scenarios on a rat free island. We predicted that live conspecific would be more attractive to wild *R. norvegicus* and that males will be more attracted than females to the live lures. Live lures were significantly more attractive to wild *R. norvegicus* compared with food baits at all mainland sites. Slightly more (but not significantly) males were caught than females. Live lures were more efficient attractants in two out of the three zoos. In the two incursion scenarios where single male wild rats were released on a rodent free island, released invading animals were caught within one to five nights from trap activation only with female lures. Animal behaviour can be a strong tool in conservation practices. In the current study we show that laboratory rats are highly efficient as lures for their wild conspecifics in situations where food baits might fail. We suggest that live lures should be considered as additional method in future management plans for the control of invasive *R. norvegicus*.

Predicting weeds in a changing climate: are bioclimatic models validated by field trials?

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In the coming decades, climate change will lead to greater uncertainty for management decisions on invasive species. Climate change may provide opportunities for alien plants to expand into regions where they previously could not survive and reproduce, especially for species originating from warmer areas introduced into temperate areas. In this study, the potential distribution of three newly naturalised plants from warmer native ranges (*Archontophoenix cunninghamiana*, *Psidium guajava* and *Schefflera actinophylla*) was determined using bioclimatic models and a range of climate change scenarios. To validate the models we conducted field trials to test whether the alien plants perform as expected in suitable, potentially suitable and unsuitable habitats (as identified by the models): seedlings were grown in six sites across the country and their performance was measured. The results of the bioclimatic models showed that the three species are likely to expand their range by the end of the century: suitable habitat is predicted to increase by on average 101% (*A. cunninghamiana*), 70% (*P. guajava*) and 112% (*S. actinophylla*) compared to the currently suitable habitat. The field trials indicate high growth rates in some but not all of the potentially suitable sites. The combined results from both the models and field trials provide strong evidence of the potential invasiveness of these plants. By having higher confidence in the predicted spread of new weeds, management decisions can be made that lead to greater cost effectiveness: resources can be prioritised, to control alien plants at an early stage of their naturalisation.

Use of refuges in field margins by farmland invertebrates (Poster)

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This study sought to determine if different types of artificial refuges differed in the diversity and abundance of invertebrates associated with them. Four different types of artificial refuge; (wood discs, mortar bricks, weta motels, and bamboo canes) were positioned along various field margins on a mixed cropping farm near Lincoln. Invertebrate numbers on, in or under the refuges were assessed in the field every fortnight (between March and May 2006). After 8 weeks all insects present in the refuges were removed and identified to order and/or species level. Overall invertebrate abundance was significantly higher than expected if refuge type had no effect on invertebrate numbers (X^2_{27} = 1305.6; $p<0.001$). Discs and bricks attracted the greatest variety of invertebrate groups (14 orders), but bamboo canes had the highest overall number of invertebrates, with beetles being the most abundant order. Bricks had the highest numbers of spiders and harvestmen (X^2=299,104.8 respectively). Compared to the other refuges the weta motels had the least diverse range of invertebrates, with woodlice and mites as the dominant groups found in and around the motels. This study showed that the refuge types differed in the diversity and abundance of invertebrates the discs and bricks in particular showed significantly higher numbers of invertebrates associated with them. The next step would be to determine how this relates to species diversity and abundance in the field margins and surrounding crops and how practical it would be to use these in agro-ecosystems.

Vehicle damage to endemic plants on the Rangipo Desert, Tongariro National Park, New Zealand.

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The Rangipo desert, part of the Tongariro National Park is not a desert in the traditional sense. Due to adverse weather conditions and volcanic eruptions a unique environment has been formed with low-stature, sparsely spaced vegetation between developing desert crusts. The vegetation and desert crusts are vulnerable to unauthorised vehicle usage. Off-road drivers prefer to manoeuvre vehicles over low-stature vegetation, on bare sandy substrates, on flattish terrain having both direct and indirect effects on the flora. When vegetation is run over, plant limbs break and roots become exposed resulting in plant dieback. Indirectly the micro-topography can change, substrate breaks up or become compacted, and erosion increases. Also the surface crust can break either at the point of impact or to the side of the impact. Broken substrate has the potential to shear more easily in wind and rain, increasing erosion. Evidence suggests that plants don't show detrimental effects of vehicle damage immediately; it can take up to two years to see the impacts. Plants that have been driven over grow more slowly, compared with control plants. Further, different species are affected in different ways depending on their growth forms. It appears that vehicle usage in this area is hindering the growth and perhaps the succession of vegetation, increasing soil erosion and altering the topography, preventing further regenerative succession. Management practices should consist of preventing drivers from driving off legal roads.

Modelling spatial data to optimize control of invasive vertebrates

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Invasive species have been recognised as a serious threat to global biodiversity by the Convention on Biological Diversity. In the Pacific, invasive vertebrates are the single biggest threat to biodiversity on island ecosystems where levels of endemism are typically very high. In New Zealand, the impact of Mustelids, possums, rodents and feral cats on indigenous flora and fauna are particularly 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 on the landscape. We provide an example by simulating spatial data collected on stoats (*Mustela erminea*). The results show that if a manager wanted to insure 100% of female home ranges were intercepted by a control device line that the lines would need to be within 400m of each other. This technique has potential as an important first step for planning the control of many invasive vertebrates, and lends itself towards and adaptive management framework where updates and improvements to the simulation could be made through further monitoring.

A novel data-logger egg for the adaptive management of avian conservation breeding programmes

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Worldwide ~168 bird species are captive bred for reintroduction into the wild. Programs tend to be initiated for species with a high level of endangerment. Depressed hatching success can be a problem for such programs and has been linked to artificial incubation. The need for artificial incubation is driven by the practice of multi-clutching to increase egg production, or uncertainty over the incubation abilities of captive birds. There has been little attempt to determine how artificial incubation differs from bird contact-incubation. We describe a novel archive (data-logger) egg and use it to compare temperature, humidity, and egg turning in five whooping crane nests, four sandhill crane nests and three models of artificial incubator; each of which are used to incubate eggs in whooping crane captive breeding programs. Mean incubation temperature was 31.7°C for whooping cranes and 32.83°C for sandhill cranes. This is well below that of the artificial incubators (which were set based on a protocol of 37.6°C). Humidity in crane nests varied considerably, but median humidity in all three artificial incubators was substantially different than in the crane nests. Two artificial incubators failed to turn the eggs in a way that mimicked crane egg turning. Archive eggs are an effective tool for guiding the management of avian conservation breeding programs, and can be custom made for other species. They also have potential to be applied to research on wild populations.

Making the best of a crappy situation: food preference, selection and feeding behaviour in native New Zealand dung beetles

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Unique and diverse feeding habits have been documented in dung beetle taxa across an array of ecosystems and this is recurrently linked to a number of important ecological processes. In contrast, New Zealand's endemic dung beetle fauna is poorly understood, even though these beetles habitually fill entomologists' pitfall traps. The feeding ecology of New Zealand dung beetles is intriguing given the near absence of terrestrial mammals in New Zealand's evolutionary history and the importance of mammal dung for most dung beetles elsewhere. It has been hypothesised that New Zealand species use a range of non-mammalian dung resources, and default to saprophagy, although this remains unproven. My research is focused on the feeding ecology of three North Island dung beetle species and seeks to investigate their food preference, feeding behaviour and trophic position. To date I have found that these dung beetles have a strong preference for dung from animals of higher trophic levels, particularly that of omnivorous native birds. When coupled with GCMS odour analysis of potential food types this has revealed an array of compounds that are likely to be attractive to New Zealand dung beetles. Additionally, video analysis of feeding behaviour has confirmed that *Saphobius edwardsi* is a ball roller, while the newly described species *Boreobius lescheni* appears to be a tunneler – a rarity in the Canthonini. This research highlights the importance of dung beetles in indigenous New Zealand forest ecosystems and identifies potentially lost links between endemic coprophagous insects and vertebrate dung providers.

Merino sheep habitat use in tall tussock grasslands in the Canterbury high country (Poster)

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We wanted to know whether sheep grazing on high biodiversity tall tussock grassland is sustainable. Vegetation changes in the high country are occurring with and without sheep. When monitoring vegetation changes, we need to know how much is attributed to the presence of sheep. So, we need to know what habitats sheep use regularly and when, for the optimum placement of monitoring sites. Merino ewes on a high country summer grazing block in Canterbury were observed and monitored with GPS collars for one month. Sheep did not use habitat at random. Merino ewes showed a strong daily activity pattern, grazing in the morning and afternoon, resting around midday, and camping at night. Daily activites were the drivers of habitat use. Grazing habitat was predominantly in short tussock grassland on lower slopes or fans. Resting habitat was predominantly on or near the riverbed. Night camps occurred in several different locations but were all at higher altitude, higher slope and furthest from water than daytime sites in tall tussock grassland or in a native mix of grasses, herbs, sub-shrubs an shrubs. Daily movements and home ranges reflected pasture quality. Areas of intensive use were identified. Monitoring plots should be placed on lower slopes in short tussock grassland where exotic grass species are present to monitor for grazing effects. Plots should also be placed on higher altitude steeper slopes up side valleys in tall tussock grassland to asses the impacts of night camping.

Plant Phenology of Hauturu: resource availability and kakapo reproduction

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Plant phenology, the timing of vegetative and reproductive stages (phenophases) in a plant's life, is an important aspect of ecosystem functioning. Phenological patterns in terrestrial ecosystems provide the basic resource utilised by all higher organisms. Spatial and temporal variation in plant resources have significant implications for the distribution and reproductive success of the plants themselves and the animals that rely on them. Knowledge of the resources provided by plant phenophases is highly important for successful management of terrestrial ecosystems and their inhabitants, particularly in terms of some species management techniques such as restoration and reintroduction. Little Barrier Island, or Hauturu, is one of the few remaining 'intact' ecosystems in New Zealand. Its vegetation has had relatively little human disturbance, particularly at higher altitudes, and is home to a range of native species that have been lost from most mainland ecosystems. Because of its pest-free status it is also an important site for species management and conservation efforts. This research investigates the temporal and spatial variation in plant phenology on Hauturu. This was conducted by collecting phenological observations over the 2011-2012 summer periods, along with the analysis of a five-year phenological data set collected by Ron Moorhouse from 1991-1995. The plants studied are key components of the range of forest types found on the island, and are also key resources for the successful reintroduction of kakapo. This paper describes results to date of an assessment of variations in their phenology, and draws preliminary conclusions on their potential contribution to the reproductive success of kakapo.

Royal parenting: Foraging strategies and risks in Northern royal albatross (Poster)

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Despite continuous, intensive management of northern royal albatross at Taiaroa Head on the Otago Peninsula, there are still important gaps in our knowledge of the relationship between their foraging habitat use, fisheries interactions and chick provisioning. In this research, we examine foraging locations and behaviours of northern royal albatross breeding at Taiaroa Head in relation to provisioning patterns and fisheries distribution during the post-guard stage. Such information on how at-sea behaviour impacts chick survival can be incorporated into the colony-based monitoring programme to improve the conservation management of the species. We also investigate whether there is an age-related difference in at-sea habitat use between breeders and non-breeders and their relative relations to fisheries distribution. In order to collect the necessary data to achieve the objectives we have deployed GPS tags, radio transmitters, temperature loggers, as well as automated nest balances to record chick weights. This will be the first study to combine at-sea tracking and provisioning data of northern royal albatross in an attempt to elucidate the natural variability in meal size and frequency relative to foraging movements and trip duration. When fine-scale fishing vessel location data is compared to bird tracking and activity data, we are able to quantify overlap and identify changes in foraging behaviour patterns in response to commercial fishing activity. GPS tracking data to date shows use of a large spatial extent over the continental shelf to shelf break off the east coast of the South Island, New Zealand.

Extending New Zealand's natural history foundations with NatureWatch NZ (http://naturewatch.org.nz)

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The natural world is changing in response to human activities that alter New Zealand environments. Yet, we know worryingly little about most of these changes, particularly gradual changes. More generally, there is still much basic natural history to uncover about New Zealand species. And yet most New Zealanders are largely disconnected from the wild species and natural processes around them. For these reasons, we set up the NZ Bio-Recording Network back in 2005. NZBRN began by adapting the Swedish Artportalen nature-observation website to NZ requirements. Through it, we amassed about 400,000 observations of animals, plants, and fungi, including historical data, made by thousands of users from across the country. In August 2012, we launched NatureWatch NZ, a completely new nature observation web and mobile application that is replacing our legacy system. NatureWatch NZ makes several important advances which we hope will support a wider community, young and old, engaged in observing, recording and monitoring the natural environment. These new features include the ability to record any species anywhere, upload photos, comment on and identify other people's observations, flag observations as "ID Please", make and share Projects and Places, and use online and offline functional mobile apps (for iOS and, soon, Android). NatureWatch NZ provides a central service to crowd-source NZ natural history knowledge (of all species, indigenous and introduced, wild and cultivated) and has much to offer ecological research, community-based monitoring and agencies involved in managing New Zealand's natural environments.

Using next generation sequencing to overcome the challenges of studying major histocompatibility complex diversity in New Zealand birds.

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Major histocompatibility complex (MHC) molecules form an integral component of the vertebrate immune system, as they are responsible for the recognition of foreign proteins and for initiating subsequent immune responses. Understanding the variation at MHC genes is, therefore, an increasingly important component of population genetics, particularly when addressing questions regarding natural selection and host-pathogen interactions. However, the inherent complexity of MHC genes can hinder accurate, cost-effective genotyping. These challenges are especially problematic when studying passerine birds, which have evolved a more complex MHC compared to most other vertebrates. Next generation sequencing provides a method to overcome many of these challenges. Here, we present a case study characterising MHC diversity in New Zealand saddlebacks (*Philesturnus carunculatus*). We address the issues associated with co-amplifying several similar MHC loci, and we describe an efficient process for reliable genotyping at the individual level. We illustrate that the saddleback MHC has evolved in a similar fashion to other passerines, with strong evidence of gene conversion. High rates of non-synonymous to synonymous substitutions, particularly at peptide binding regions, assist with identification of putatively real loci from pseudogenes, and indicate historic selection.

High rate of incidental capture of native mammals and birds in introduced raccoon traps in Hokkaido, Japan

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Alien species is one of the most serious problems threatening biodiversity. To prevent their negative impacts, considerable efforts have been paid to remove alien species by various traps. However, most traps catch not only target species, but also non target species (i.e. “incidental capture”). In fisheries, a great number of researches have been performed to reduce incidental capture, especially for marine mammals, but there is little scientific information on incidental capture for alien species. Because incidental capture may affect native ecosystems, it is necessary to assess the potential impacts of incidental capture. In this study, we investigated incidental capture in introduced raccoon traps in the Nopporo Natural Forest Park, central Hokkaido, Japan. Raccoons are chosen as “100 of the Japan's Worst Invasive Alien Species”. Capturing was conducted in May and July, from 2009 to 2011. We obtained a total of 9,252 trap-nights, and captured 707 individuals. However, the target species (i.e. introduced raccoon) was captured only 45 individuals (6%): 77% were incidental capture for native mammals and birds (other 15% were introduced weasel and domestic cat). Raccoon dog (21%), Jungle or Carrion crow (29%) and brown eared bulbul (13%) were main species for the incidental capture. Capturing locations was significantly different between raccoon and raccoon dog. In addition, incidental capture of bulbul was much higher in May compared to July. Therefore, changing locations or seasons of trapping points may reduce incidental capture.

New techniques reveal higher than expected reproductive effort in little spotted kiwi (*Apteryx owenii*)

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Small, isolated populations with a history of bottlenecks are prone to inbreeding depression, which could affect their long term viability. Once widespread throughout New Zealand, the little spotted kiwi (*Apteryx owenii*) went through a severe population bottleneck of just five individuals in the early 1900s. The population is now thought to be in demographic recovery, having grown to ~1,700 individuals, but the lasting genetic effects of the bottleneck and subsequent small population size are unknown. We investigated reproductive success in *A.owenii* as part of a new study into inbreeding depression in this species. Specially designed radio tags loaded with a bespoke "chick timer" program were employed for the first time in *A.owenii*, in tandem with infra-red camera traps to uncover novel information on nesting behaviour and success in two populations. The chick timer tag is an effective and accurate tool for use in *A.owenii* and revealed an unexpectedly high reproductive effort in this kiwi species, with a higher incidence of two-egg nests and double clutching than the existing literature would predict. The use of motion sensor camera traps also uncovered novel behaviours around the nest. These findings will provide new estimates of population growth rates and inform decisions on future translocations of individual *A.owenii*. They will also provide insight into the effects of inbreeding in wild populations and its impact on species' recovery.

Little friends: exploring the microbial ecology of New Zealand's endemic fauna

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Animals provide a diverse array of habitats for microorganisms to colonise, and virtually all animals form symbiotic relationships with one or more microbial species. In many cases such interactions have profound implications for the animal host, such as conferring protection against pathogens or enabling survival on nutritionally unbalanced diets. Due to its environmental heterogeneity and extended period of geographic isolation, New Zealand has a unique variety of animal host organisms. Our group has been researching the microbial ecology of our unique (and unusual) fauna for the past few years, and I will be discussing our recent findings about bacterial symbionts of endemic scale insects (family Coelostomidiidae) and the gut microbiome of the critically endangered kakapo. 16S rRNA gene surveys utilising both cloning and 454 pyrosequencing approaches have revealed the presence of only two bacterial phyla, *Firmicutes* and *Proteobacteria*, in the kakapo gastrointestinal tract. As intensively managed birds, kakapo are subject to considerable human intervention including the application of antibiotics as well as translocation between offshore islands. We are currently investigating the influence of these interventions on the composition of the kakapo gut microbiota, and are beginning to expand this work to include other threatened New Zealand species.

Habitat associations of two species of *Pahoroides* (Araneae: Synotaxidae) in Pukenui Forest, Northland, New Zealand (Poster)

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Members of the synotaxid spider genus *Pahoroides* are common inhabitants of low vegetation and twiggy litter in northern North Island forests. A recent revision of the genus has shown that at least two species, *P. whangarei* and *P. confusa*, occur in Pukenui Forest, a large mixed lowland forest fragment close to the city of Whangarei. The aim of our study was to investigate the habitat associations of these two similar species in order to further understand the conditions under which they coexist. Spiders were sampled from twenty randomly selected points in the forest by beating low-lying (<50cm) live and dead vegetation in a standardised manner. Multiple environmental variables were recorded at each sample site along with the host plant species from which each *Pahoroides* individual was collected. A total of 67 adult *P. whangarei* and 33 adult *P.confusa* individuals were collected at 18 and 12 sites respectively. Both species were recorded at ten of the sites. Most *P. confusa* individuals (79%) were found in fallen, partially decomposed, nikau fronds while 97% of *P. whangarei* individuals were found on living plants, mostly crown fern (*Blechnum discolor*) and young kiekie (*Freycinetia banksii*). Even though *P. whangarei* and *P. confusa* are very similar and may be spatially very closely associated, our results show that they occupy quite different microhabitats. Differences in microhabitat variables such as moisture or vegetation structure are therefore likely important factors in enabling these two species to coexist.

'A friend of my friend is my friend' – the importance of facilitation cascades in maintaining biodiversity

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Evidence is emerging that chains of positive species interactions are common and ecologically important. For example, primary biogenic habitat-formers can facilitate secondary biogenic habitat-formers which indirectly facilitate many plant and animal end-users (= facilitation cascades). Such facilitation cascades have been identified in temperate and tropical forests, seagrass beds, rocky coasts, mudflats, coral reefs, lakes and salt marshes, and are particularly important where epiphytism is common (e.g., in many New Zealand forests). In this presentation we focus on how habitat cascades from NZ estuaries can modify local patterns of animal biodiversity. Specifically, we will show correlative and experimental data describing the relative contribution of three co-existing habitat formers (ephemeral seaweeds, long-lived seagrass, cockles) in controlling community structures and if and how they increase biodiversity. We compare our results to studies on facilitation cascades from similar ecosystems characterised by different biogeographies (estuaries from different continents) and to different ecosystems inhabited by fundamentally different habitat formers (forests and marshes).

Extending a quantitative classification to include New Zealand's non-woody plant communities.

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New Zealand is currently lacking a national-scale quantitative description of existing non-woody vegetation communities. Such a classification can provide a framework to underpin conservation planning and priority setting, as well as reporting. Recently a quantitative-based classification of New Zealand's woody vegetation types was produced; our goal now is to incorporate non-woody plant communities into this classification. The woody classification used an approach – Fuzzy Noise Clustering – that allows it to be modified or extended when new data are collected, while leaving the original classification intact. This contrasts with traditional clustering approaches. The woody classification used 13551 plot records from New Zealand's National Vegetation Survey (NVS) databank to define and characterise 29 woody alliances and 79 associations. We collated an additional 8001 non-woody vegetation plot records from NVS and published studies, including unique ecosystem surveys in volcanic and coastal regions. The majority of plots (~80%) were from the South Island, with montane and alpine grasslands well represented. To minimise sampling bias, we used a geographic and compositionally stratified subset of the data for the classification. Fourteen new alliances and 26 new associations were defined. *Poa colensoi* was a dominant species in 9 of the 14 alliances, while the most widespread alliance was dominated by the exotic species *Trifolium repens, Holcus lanatus* and *Hypochaeris radicata*. Our study illustrates how the fuzzy classification approach can result in a national scale classification that can be progressively improved as more comprehensive plot data is collected from poorly documented vegetation types.

Long-term forest dynamics on Mt. Hauhungatahi, North Island, New Zealand: a forest-landscape simulation study (Poster)

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Palaeoecological records imply that catastrophic, landscape-level disturbances are major drivers controlling long-term dynamics of New Zealand's forests. However, the effects of multiple factors (e.g. climatic variation, disturbance, human influence) can confound the interpretation of these palaeoecological records. Using the forest landscape model LandClim, we aim to simulate the long-term forest dynamics under controlled environmental conditions and compare results to palaeoecological findings. For this purpose, the well-investigated western slope of Mt. Hauhungatahi in the central North Island was used as a case study for examining forest succession following large-scale stand-replacing disturbances, in this case the Taupo eruption of *c*. 1700 BP, and the subsequent emergence of altitudinal species zonation. Model results agreed closely with the key empirical patterns seen in pollen reconstructions and contemporary vegetation studies along the altitudinal transect. The modelled successional sequence displayed a major shift in forest composition between simulation years 400 to 1000 after the Taupo eruption, when the dense initial stands of conifers (dominated mainly by *Libocedrus bidwillii* – pāhautea or kaikawaka) were progressively replaced by the angiosperm *Weinmannia racemosa* (kamāhi) in the montane forest. From around year 1000 onwards, the current altitudinal species zonation was attained. Our simulation study suggests that LandClim provides a suitable framework for investigating the role of spatial processes, in particular disturbance, in New Zealand's forest landscapes.

Working with others to grow conservation – changes at DOC

VAN HAL, JACKIE

Department of Conservation

The Department of Conservation (DOC) has changed. We have a greater focus on growing conservation through working with others and have changed how we provide some of our support and service functions. This presentation outlines the vision and new structure of DOC at national and conservancy levels which commenced in July 2012. DOC is currently re-designing the structure of Area Offices to reflect this increased emphasis on achieving more conservation through working with others. This will be implemented in mid 2013. 'Conservation for prosperity' is intended to convey that conservation of our natural (and historic) resources is essential for the health, economy and cultural identity of our country. Our soils and waters, our wildlife and landscapes, and our marine ecosystems underpin our economy (primary industries, as well as New Zealand's tourism and brand image). They underpin aspects of our lifestyles, health and identity too. We will continue to focus on our core business in conservation with national goals and priorities guiding our work. It's clear however that to achieve the goals of the Biodiversity Strategy, conservation outcomes will need to more than double. Maintaining and restoring those ecosystems that support our lives and lifestyles is much bigger than DOC. This is a job that involves all New Zealand and all New Zealanders. A number of communities are already undertaking some fantastic work and achieving a variety of conservation gains. We want to build on this by using new ways of working with others to achieve more. The new structure will enable us to be better placed to work more with community groups, local authorities, iwi and business so that together we can grow the amount of conservation that gets done. Together, we have a responsibility under the korowai of kaitiakitanga to protect, enhance and maintain the natural and historic heritage of Aotearoa New Zealand.

Distribution and concentration of the phytotoxin tutin in tutu (*Coriaria arborea*) – implications for use as a vertebrate pesticide

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Efforts to develop new chemical tools for vertebrate pest control in Aotearoa/New Zealand now include tangata whenua in investigations of natural resources that are found in "*our backyard*". Ngāi Tūhoe and Ngāti Ruapani representatives are collaborating with a multi-disciplinary research team that has identified a native plant toxin, tutin, which shows promise for further investigation as a vertebrate pesticide. A decision-making framework has assisted in the selection of the 'new' tool and criteria around how that tool might be sourced and utilised as toxic bait. For our tangata whenua research partners, this means investigating natural extraction of the toxin from its source plant, tutu (*Coriaria arborea*), as opposed to synthetic production. Therefore, characterisation of tutin concentration distribution in different parts of the plant and across seasons is fundamental to how this might be used in pest control. Between March 2011 and April 2012, different parts of tutu were sampled from two populations in the Whirinaki Forest Park, Te Urewera, using historical medical reports of human poisoning events to guide the selection of plant parts. With the assistance of Tūhoe kaumatua, the following plant parts were identified and sampled: young shoots, mature leaves that were older than six months, mature leaves that were aged 12 months or older, immature fruit and ripe fruit. Preliminary results of LC-MS analyses indicate that immature fruit are the most toxic, followed closely by young leaves. This presentation discusses the data and the potential implications for development of tutin as a pest control tool.

Is phenotypic plasticity a blessing or a curse? How global warming may affect a North American alpine plant

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Global warming has the potential to greatly alter population distributions, interactions among species and population/species survival. Plants have the disadvantage of being sessile and having limited dispersal capabilities, however, they are also highly plastic, which can help them adjust to changes in the environment. We investigated how phenotypic plasticity in a variety of traits may interact with environmental changes due to global warming in an alpine perennial, *Aquilegia coerulea*. We found plasticity in every trait examined, from leaf size to floral morphology. However, these changes may not be beneficial for population persistence. In particular, changes in floral traits may change pollinator interactions and increase selfing rates. Plasticity in traits may also limit the effectiveness of selection, further impacting this species long-term response to climate change. Our results suggest that long-term responses to climate change may not be straightforward and even short term changes may be difficult to predict.

Effects of secondary succession from grassland to shrubland on flora and fauna in a New Zealand dryland landscape

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Secondary succession from fire-induced grassland to shrubland vegetation is a common trend in dry eastern areas of South Island, New Zealand, but little is known about how the change from herbaceous to woody vegetation alters the characteristics and composition of the biota. We describe results of a space-for-time study measuring the diversity and abundance of dryland plants, birds, and terrestrial lizards and invertebrates in 100-ha blocks representing grassland, mixed grassland-shrubland, and shrubland vegetation at three sites in central Otago. We found complementary indigenous plant, bird and invertebrate taxa in shrubland and grassland. Competitive exclusion of indigenous plant species by exotic grasses was evident only where indigenous shrub or tussock canopies had been depleted or lost, suggesting local loss of indigenous plant species is primarily linked to reduced structural dominance by indigenous species, and only secondarily to invasion by exotic grasses. Lizards were little affected by woodiness, but appeared sensitive to microsite characteristics and were more abundant in grasslands and shrublands dominated by indigenous species. We conclude that transitions from grassland to indigenous-dominated shrubland increased both indigenous structural dominance and the diversity of indigenous species at a range of scales, and offer a potential route to the rehabilitation of mixed indigenous-exotic grassland plant communities in dryland South Island.

Riding the rapids: an eco-ethical journey down the Mokihinui

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A personal view is presented of the hazards to ethical and scientific integrity when swept along in the legal currents associated with commercial development projects. Using the Mokihinui Hydro Proposal as an example, some of the methods used to distort the perception of ecological reality are examined. They include focus on species rather than ecosystems, simplistic biodiversity off-setting, fragmentation of view and reductionism. All are ethical traps for ecologists contracted as expert witnesses. Guidelines are offered to avoid entrapment.

The value of validated estimates of vulnerability for effective conservation planning under dynamic threats

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Data needed for informed conservation prioritisation are generally greater than the data available, and surrogates are often used. Although the need to anticipate dynamic threats is recognised, the effectiveness of surrogates for vulnerability to habitat conversion is seldom tested. Here we consider the importance of using validated vulnerability data in conservation planning tools that assist prioritisation of conservation land in New Zealand's indigenous grasslands. We compared properties of two different vulnerability surrogates that have been applied in our study area to a validated prediction of habitat conversion-vulnerability based on recent assessment of land-use change. We found that neither surrogate was a particularly effective predictor of validated vulnerability. Importantly, both surrogates performed poorly in places where grasslands were most imminently threatened with conversion. Our study suggests the integration of validated estimates of vulnerability into conservation planning tools may be an important requirement for effective conservation planning under dynamic threats and in rapidly changing landscapes. We also show that the majority of New Zealand's indigenous grasslands protected over the last two decades have low vulnerability to the most active threatening process in this biome. The contrary patterns of vulnerability and protection suggest that use of validated vulnerability would help clarify protection needs, which might lead to the improvement of conservation land allocation decisions. We apply our results to discuss the practical considerations and potential value of incorporating validated vulnerability into conservation planning tools both generally and in the context of New Zealand's indigenous grasslands.

Co-existence in two species of tree weta

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Classical ecological theory refutes the possibility that co-existing species have overlapping niches, and instead argues that either resource partitioning or competitive exclusion can solve the problem of interspecific competition. In sympatric species, interspecific competition for non-substitutable resources selects for character convergence. For herbivores and omnivores sources of carbohydrates and of protein are likely to be nonsubstitutable, or at least complementary, resources. We looked for evidence of resource partitioning in two sympatric herbivorous species, the Wellington (*H. crassidens*) and the Auckland (*H. thoracica*) tree weta. We identified nutrient targets for these species in the lab, before analysing the crop contents of wild caught weta to determine actual nutrient intake during the late summer breeding season. We compared the protein content of crops and hindguts to further investigate any species differences in post-ingestive processing. In addition, we examined longer term diet and intra and interspecific resource competition, using $^{12}C/^{13}C$ and $^{14}N/^{15}N$ stable isotopes. We found that tree weta diets appear to largely overlap, and we could not detect strong interspecific differences between the species. Our evidence on resource partitioning indicates similar ecological niches for these two species of tree weta, such that co-existence is likely to be short-term rather than long-term. In addition, reliable discrimination by the weta of heterospecifics and conspecifics, a critical assumption of long term co-existence, is not met in this case. Our research emphasises the importance of considering temporal scale in evolutionary ecology.

Population viability of highly inbred black robins (Poster)

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The Chatham Islands black robin, one of New Zealand's iconic bird species, has recovered from a single-pair bottleneck in 1979-1982 to around 230 adults today. The species currently exists in three small subpopulations on two geographically and genetically isolated islands. All individuals are highly inbred. Some inbreeding depression has been observed, raising concerns about the long-term viability of the species. We are using Vortex to assess population viability over the next 50 years. Preliminary results suggest that inbreeding depression has a relatively minor effect on population growth rates and extinction probability. However, the expected viability of the three subpopulations depends strongly on several assumptions in the model. We will discuss these findings in the context of implications for management of this critically endangered species, including the potential value of efforts to reduce inbreeding or increase habitat availability and quality.

Love thy neighbour: mating systems and cuckoldry in the Tui (*Prosthemadera novaeseelandiae*)

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Breeding and mating strategies are life history traits that have evolved in order to maximise fitness, and with the recent advent of molecular parentage analyses, many socially monogamous birds have now been proven to be promiscuous. Knowledge of a species' mating system can aid in conservation management by providing important information on populations, such as the effective population size. The extinction risk of a population or species can also depend on the type of mating system adopted. For example, monogamy has been found to correlate to a higher risk of extinction than polygamy (Legendre *et al.*, 1999) as it is more susceptible to the effects of demographic stochasticity. The tui (*Prosthemadera novaeseelandiae*) is an iconic endemic honeyeater. Despite its role as an important pollinator of New Zealand forests, it has been understudied and even its basic life history parameters remain unknown. This study combines behavioural observations and genetic data to produce the first investigation of tui mating systems. Tui form stable pair-bonds during a breeding season. However, microsatellite analysis has revealed high rates of extra pair paternity (EPP) with many EP males having neighbouring territories. Individual variations in EPP and factors that may influence EPP in tui will be discussed. The results of this study will contribute significantly to increasing knowledge of tui social behaviours and will have benefits for tui conservation.

Rock wren (*Xenicus gilviventris*): Population structure in an alpine archipelago

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Many species occur in naturally subdivided populations due to spatial heterogeneity of the landscape. Such a pattern is especially evident in alpine species, where naturally fragmented habitat forms an 'alpine archipelago'. High altitude habitat patches and the species they harbour can serve as both biological models for identifying past bio-geographical change and for predicting responses to the synergistic effects of anthropogenic habitat fragmentation and climate change. The rock wren (*Xenicus gilviventris*) is a threatened alpine passerine belonging to the endemic New Zealand wren family (Acanthisittidae). This largely flightless family was once represented by at least seven species, however due to the impacts of introduced mammalian predators, only two species remain. Conservation management of rock wren has only recently commenced via translocation of individuals to offshore islands, but genetic considerations are not currently a part of management practices. Here we investigate genetic population structure by sampling rock wren (n=216) from throughout their range. Using rock wren-specific microsatellite markers and mitochondrial DNA sequence, we describe significant differences in genetic variation and differentiation between rock wren populations across the South Island. A significant North – South divergence is identified, consistent with the 'biotic gap' hypothesis. These results provide early indication that separate management units need to be conserved to maintain the genetic diversity of rock wren.

Kids Restore the Kepler – an inspiring example of community collaboration for conservation in Fiordland

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Imagine a 3000 hectare prime piece of habitat made safe for NZ birds, insects, lizards and bats. Imagine a brilliant reserve that also happens to be one of Aotearoa's Great Walks. And now imagine that one of the driving forces behind this remarkable restoration project is *the next generation of New Zealanders!* In Fiordland at least, conservation is on solid foundations thanks to a major project with a difference. The *Kepler Backyard Birdsong Project* is not only restoring birdsong to the forest but also has a strong educational focus. It is helping Fiordland's young people develop knowledge, values and skills so they can be connected and actively involved in caring for their environment both now and in the future. Come along to this talk and hear about how a stoat trapping project run by the Fiordland community inspired the setup of a larger restoration project within the Kepler Mountains. Led by the Fiordland Conservation Trust in collaboration with the Department of Conservation**,** the *Kepler Backyard Birdsong Project* seeks to create a mainland island within the Kepler Track covering an area of 12,000 hectares. Stage One (3000 ha) of this three stage project is now underway with support from the Air New Zealand Environment Trust and is known as *Kids Restore the Kepler* (www.kidsrestorethekepler.co.nz). Come and hear about the numerous projects and success stories to date – including the discovery of long-tailed bats – and how you too can become involved in this inspirational project.

Changes in possum spatial ecology following density reduction: implications for conservation and bovine tuberculosis management

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Although a number of animals have been recorded changing their spatial distribution following density reduction, the mechanisms of this spatial perturbation are not always clear and may vary among species. Experimentally investigating how spatial perturbations affect space use increases our understanding of the spatial organisation of populations and allows the better management of pest species. For example, understanding changes in movement patterns may allow the determination of optimal control strategies, such as the timing and duration of control. The possum in New Zealand is a pest, affecting our native flora and fauna, and transmitting bovine tuberculosis to livestock. Possums exhibit a dominance hierarchy, with dominant individuals preventing subordinates accessing limited resources and likely regulating their space use. Therefore, we hypothesised that population reduction would result in survivors changing their space use, due to less aggression and competition. To test this, we monitored the spatial ecology of three possum populations; two subjected to density reduction and an experimental control site not subjected to density reduction. Possum movements were monitored using VHF and GPS collars to determine changes in den-site, home-range and pasture use. We identified changes in a number of movement parameters due to density reduction. For example, average home-range sizes increased at the two treatment sites by 106% and 93% following density reduction. This research further highlights the need for efficient control that reduces possum populations to very low densities, due to increases in possum space use and consequently potential increases in bovine tuberculosis transmission risk.

Survival and Habitat use of brown kiwi chicks (*Apteryx mantelli*) in a high density, reduced predator population.

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Currently the survival of wild kiwi chicks is about 5% with 60% of mortality ascribed to predation by introduced mammals. However, even with predator control, some populations are failing to increase. We need to understand what drives natural chick survival, aside from predation, to more effectively manage and conserve kiwi populations. Our brown kiwi study population has a high density estimated at 1 kiwi per hectare (Cunningham et al 2007) and has a reduced number of predators relative to other kiwi populations. We used radio telemetry to follow the movements of 27 brown kiwi chicks (2010/11 and 2011/12), and used these data to assess dispersal and habitat preference. Chicks were measured at intervals to assess growth rates. Additionally, we measured invertebrate abundance (via pitfall traps), soil penetrability and litter depth to assess the potential effects of these factors on growth rate and dispersal. We found that even in the presence of reduced predators chick mortality was 86.3%. Causes of mortality included predation by cats (31.8%), and disease and starvation (68.1%). Starvation was not related to the abundance of food but rather its availability; for example, competition for food and inaccessibility of prey due to hard soils. Our results indicate that conservation of kiwi should re-focus to not only control introduced predators but reduce other causes of mortality.

Species richness and population density of native and exotic birds on successional dryland gradients from grassland to shrubland

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Secondary succession generates novel woody communities in dry interior South Island, New Zealand, as shrubs colonise anthropogenic grasslands where fire and herbivory are controlled. We studied how succession to woodier habitats may affect species richness and abundance of native and exotic dryland birds. We recorded bird species along successional gradients, from grassland to mixed grassland–shrubland to shrubland, at three dryland sites in central Otago. We estimated population density of nine common native and exotic passerine species with distance sampling on line transects at these sites, and on point transects at a fourth site. The presence of some indigenous forest birds (fantail and tomtit) appeared to depend on large blocks of woody vegetation, and proportions of species that were indigenous were significantly higher in tall woody vegetation than in grassland. Exotic yellowhammer density declined as woody-species frequency increased, and exotic redpoll density was highest at intermediate woodiness. Densities of seven other species, including indigenous grey warbler and silvereye, did not vary consistently with woodiness. We conclude that development of secondary woody plant communities under low intensity land use is likely to enhance the diversity of the indigenous bird fauna in this dryland landscape. For most common passerines, succession to shrubbier habitats may have little effect on population densities, but for yellowhammer, succession may lead to local declines.

Does ecology have any theories, and if so do they work?

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Community ecology has a number of theories. The most well-known, and the only ones that are well-defined, are: (a) the Clements-Gleason theory, (b) MacArthur's theory and (c) Grime's CSR theory. The presentation will examine them, and attempt to apply them, using New Zealand situations where possible.

Is New Zealand's understanding of seabird ecology on solid foundations?

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New Zealand is the country with the greatest number of breeding and globally threatened species of seabirds with about 86 of the world's 350 seabird species breeding in the New Zealand region, including about 38 endemic species. Taxonomic research will probably describe further endemic species. Some of New Zealand's rarest and most abundant birds are seabirds, yet we know little of the status and ecology of most species. New Zealand seabirds have received less attention than their terrestrial counterparts for both research and conservation. New Zealand has one of the world's largest and most economically valuable EEZs. Fisheries threaten some seabird species. Marine oil and mineral exploitation would pose additional threats to seabirds. The New Zealand EEZ is dynamic and with climate change some marine species will decline while others may prosper. Birds are the most accurately monitored of the top marine predators, thus they present the best opportunities to monitor changes occurring at sea. But which species are likely to be impacted by fisheries, oil and mineral exploitation or climate change, and which species are most suited to monitoring changes occurring at sea? At a time when threats to seabirds are increasing in both intensity and number, the Department of Conservation has inadequate seabird expertise in house, and the number of other seabird researchers is too few to address all the current problems. In this talk I will discuss some taxonomic uncertainties, some research questions that need to be addressed and suggest some seabird species that may be suitable for monitoring changes in the marine environment.

Burning tussock grasslands: effects on Amphipoda (Poster)

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Fire was rare in the pre human history of New Zealand, increasing significantly with the arrival of humans and the establishment of agriculture. Burning indigenous tussock grassland has been used extensively as an agricultural management tool in New Zealand to stimulate young palatable regrowth and increase the success of oversown pasture species. There has been little research into the effects of burning in New Zealand tussock grasslands; less still on the effects of fire on invertebrates. Both farmers and conservation managers have recently sought to increase their understanding. This project focuses on the effects of burning in tussock grasslands in Otago on Amphipoda (Talitridae: Crustacea). Amphipods are detritivores existing in the litter layer, shredding decaying vegetation and are key recyclers of nutrients and carbon in the ecosystem. Terrestrial amphipods are highly susceptible to changes in humidity relying on behavioural mechanisms to control water loss. Burning removes the litter from the habitat on which amphipods rely for food and shelter, making these taxa a valuable bioindicator to the changes caused by fire. The long term data set reveals amphipod abundance has still not recovered to pre-burn levels in inter-tussock samples eleven years post burning. Evidence of significant yearly fluctuations in abundance is apparent in control plots. Sampling targeted at revealing differences at the microhabitat level was used to determine possible explanations for the lack of recovery of amphipods in burnt plots.

Does Island size affect genetic diversity of native lizards?

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Genetic diversity is known to be important for the fitness of animal populations. Reduced genetic diversity has been found to result in reduced immune responses and reproductive success. In New Zealand, habitat loss and predation by introduced mammals has resulted in extinctions of many native lizard species from the mainland habitats. Most native lizard species are now only found on offshore islands where mammalian predators have been removed. Some of these offshore island reserves are very small and subsequently may only support small populations. Small and isolated populations often face the risk of reduced genetic diversity due to higher levels of inbreeding. In this study we have used 10 microsatellite markers to compare the genetic diversity of common gecko (*Woodworthia maculates*) populations between mainland and 11 islands of different sizes ranging from 0.98ha (Aeroplane Island) to 1970ha (Kapiti Island). We discuss whether island size is consequential to the genetic diversity in common geckos and management implications for island populations. We also discuss the effects of past mammalian presence on the genetic diversity of common geckos.

A palaeontological perspective on the assembly of the terrestrial vertebrate biota of New Zealand and implications in understanding the ecology of the extant biota

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New Zealand has long been renowned for its unique biota. The vertebrate fauna exemplifies this well, being characterised by high endemism especially at generic and specific level of a most unusual taxon assemblage. Birds dominate the fauna, especially the 'original' Recent fauna, in terms of both taxonomic diversity and habitat exploitation. But while diverse at higher taxon levels, in an apparent anachronism there is insignificant diversity at the genus/family level with the largest radiation being the 7 species of acanthisittid wrens. The 9 moa are in 3 families and 6 genera. Mammals had an insignificant role with a complete absence of terrestrial mammals in the fauna, unlike any other faunal-bearing major landmass: their role was in part replaced by a suite of large browsing birds, a fact appreciated by the early nineteenth century European naturalists. Moreover the herpetofauna was depauperate at high taxonomic levels with squamates restricted to just skinks and geckos and a complete absence of turtles and crocodilians. This depauperate herpetofauna is augmented though by the presence of the endemic leiopelmatid frogs and the tuatara, both globally significant evolutionary relicts. In contrast to the lack of high-level taxon diversity, the skinks and geckos exhibit the most diverse radiations within a vertebrate family in New Zealand with some 44 *Oligosoma* skinks and 36 diplodactylid geckos. We have a good understanding of the composition of the 'original' prehumen fauna thanks to an outstanding Quaternary record, so we know what has been lost following human impacts, perhaps better than for any landmass on earth. The questions that palaeontological investigations can and are now addressing do include: 'Has it always had the characteristics of the Recent fauna? How and when was this biota assembled?' I will show in this presentation that the recent investigations of the Early Miocene St Bathans Fauna provide an unprecedented insight into such questions. Its diverse fauna includes: Teleosts – 6 families, 15 species, with Galaxiidae, Eleotridae, and Retropinnidae the principle fish inhabitants of palaeolake Manuherikia; Amphibia – 2 species *Leiopelma* & a neobatrachian frog; Reptilia – a crocodilian, a ?meiolaniid turtle, a sphenodontid, and 2 skinks & 2 geckos; Aves – minimally 39 species (dinornithiforms, kiwi, diving petrel, waterfowl, raptors, herons, *Aptornis*, rails, waders, pigeons, parrots, owlet-nightjars, swiftlets, and passerines); Mammalia – 5 bats (Mystacinidae, Vespertilionidae, a new family), and a terrestrial form (order & family indeterminate). This Early Miocene fauna had all the main characteristics of the Recent New Zealand fauna including high endemism. It differed importantly by greater diversity at higher taxon levels indicating that the most important trend in the evolution of the New Zealand terrestrial vertebrate fauna in the last 20 million years has been extinction. This has been mediated to a limited extent by colonisation following dispersal to New Zealand. The recent spate of successful colonisations allowed by human mediated biotic perturbations combined with the lack of any in the preceding 50,000 years suggests that most colonisation events were associated with ecological perturbations. The periods of major climatic change of the Middle Miocene Transition and the Plio-Pleistocene glacial-intergalacial cycles provide the obvious mechanism to explain both the dramatic extinctions and Neogene colonisations.

Seed dispersal of fleshy-fruited environmental weeds in NZ: a review

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Understanding frugivore-mediated seed dispersal is crucial to effectively managing established weeds, predicting the rate of spread for newly naturalised species, and assessing the feasibility of successful eradication. We reviewed the literature on seed dispersal of fleshy-fruited environmental weeds in New Zealand. Specifically, we investigated the following questions: (1) What proportion of the New Zealand environmental weed flora has fleshy fruits adapted to animal dispersal? (2) How do fruit traits influence dispersal? (3) Which animal species are the major dispersers of fleshy-fruited weeds? and (4) How do disperser attributes influence weed dispersal patterns? Of 295 non-native, terrestrial, environmental weed species in New Zealand, 32.5% have fleshy fruits dispersed by animal ingestion. With the exception of two species (both with a restricted distribution), all weeds have either fruits that are small enough to be swallowed whole or small-seeded fruits that can be eaten in pieces. Most weeds produce ripe fruits from midsummer to late autumn or early winter. However, several weed species have ripe fruits during winter, spring and early summer, when native fruits are scarce. Blackbirds, silvereyes and starlings are particularly important dispersers of environmental weed seeds. Introduced mammals, especially possums, probably play a significant role in the spread of weed seeds. Birds disperse most seeds within 100 m, although seeds may also be dispersed several kilometres either regularly (by starlings) or occasionally (by kereru, tui and myna). Possums and pigs probably disperse many seeds hundreds of metres and some seeds several kilometres.

Possums and seed dispersal: a lazy, inefficient Australian at work

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Animal seed dispersal in New Zealand is dominated by birds and is a key process in shaping plant communities. In the face of bird declines there is increasing concern about how this interaction is faring, and whether introduced mammals can replace absent birds. Possums are known to eat a range of introduced and native fruits, and therefore have the potential to be important seed dispersers in New Zealand. However, fruit in the diet of possums compared to that of birds in terms of seed dispersal quantity and quality is poorly known. Faecal samples were collected from birds and possums and examined for seeds. The most frequently caught frugivorous birds were bellbirds and silvereyes. Although possum faeces contained similar numbers of seeds as bird faeces, the number of defecations per day is much lower. Thus the number of seeds dispersed per day by possums is estimated to be less than one quarter of that dispersed by bellbirds. When number of animals per hectare is taken into account, this drops to one twentieth of that of bellbirds. As silvereyes move a similar number of seeds to bellbirds, the contribution of possums to total seed dispersal is probably trivial. Although possums are several orders of magnitude heavier than the two birds, all swallowed fruits up to the same maximum size (about 9mm diameter). In addition, possums destroyed large numbers of ingested seeds. Consequently, there is little benefit from possum seed dispersal to compensate for the damage they do to native flora and fauna.

Evaluating seed disperser effects on establishment of montane and subalpine fleshy-fruited plants

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Factors that determine the effectiveness of frugivorous animals as seed dispersers include: effects of gut passage on seed viability and germination, the microsite into which they deposit a seed and their impacts on seedling establishment through herbivory. New Zealand montane, subalpine and alpine ecosystems have many fleshy-fruited plant species but the frugivorous animal fauna is now relatively depauperate. Key questions therefore include: are these plants still being dispersed, if so where to, by what animals and is this important in relation to the final site for plant recruitment? We used a fully-factorial field experiment for eight plant species measuring the effect on germination, seedling growth and survival to 3.5 years of: (i) fruit pulp removal (yes/no), (ii) seed deposition microsite characteristics (shaded/open), (iii) competition (turf dug/not), and (iv) seedling herbivory (caged/uncaged) . Shade was the most important factor affecting seed germination, height growth and seedling survival with higher success in shaded versus light microsites for seven of the eight species. The magnitude of other effects was smaller, and varied depending on species and stage of recruitment. The microsite results were related to the effectiveness of frugivorous animals as seed dispersers using fixed-area faecal sampling transects over two fruiting seasons to record disperser type and seed deposition microsites. Possums (*Trichosurus vulpecula*) moved >75% of all mammal-dispersed seeds in the study, yet most possum faeces were deposited inside beech forest fragments, a largely unsuitable habitat for recruitment of these plants. Apparently-important dispersers are therefore instead transporting high numbers of non-forest plant species to their doom.

Soil Carbon Dynamics: Quantifying Labile Soil Carbon Pools

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Globally soils contain more than two thirds of the total carbon in terrestrial ecosystems. Soil organic matter (SOM) is complex and heterogenous and is considered to consist of different pools that turnover at very different rates. Labile carbon, with a fast turnover rate and least physical protection, is vulnerable to loss following soil disturbance, which triggers increased oxygen diffusion into soil aggregates and can also increase the physical availability of carbon to microbes. The stable isotopic signature of CO_2 respired from soil ($\delta^{13}C$) is being used to determine the size of their labile carbon pools. Within a few hours of disturbance the $\delta^{13}C$ signature of respiration from turnover of SOM becomes more depleted, as more labile carbon becomes available as respiratory substrates. A study has been carried out on different agricultural soils on the Canterbury plains. Significant differences in the change of the $\delta^{13}C$ signature of respiration have been observed for different treatments (fallow, ploughed and pasture) within the same soil type and between different soil types (Temuka and Wakanui soils). Traditional measurements (such as dissolved organic carbon and hot water extractable carbon) have been used as a way to quantify soluble carbon in soils. Weak correlations between isotopic measurements and chemical extractions for all soil types suggest that carbon vulnerable to loss following a disturbance isn't always just the soluble carbon. To test this hypothesis mineral substance (allophane) with a high absorption capacity for SOM will be added to soils, and isotopic and chemical measurements will be compared.

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Campus Map