New Zealand Ecological Society Conference 2007

# Feathers to Fur

## the ecological transformation of Aotearoa

University of Canterbury, 18–22 November

Landcare Research
Manaaki Whenua

Environment Canterbury
Your regional council

Department of Conservation
*Te Papa Atawhai*

UC
UNIVERSITY OF CANTERBURY
Te Whare Wananga o Waitaha
CHRISTCHURCH NEW ZEALAND

Lincoln University
Bio-Protection and Ecology Division

CONNOVATION
CONSERVATION BY INNOVATION

http://www.newzealandecology.org/

# Welcome and Conference overview

This year, the NZES conference returns to update the theme of its 1986 conference, "Moas, mammals, and climate in the ecological history of New Zealand", by reviewing and synthesizing current understanding about past changes to New Zealand's fauna and flora. The first day is an all-day symposium: "Feathers to Fur: the ecological transformation of Aotearoa". New Zealand's biota has changed substantially over the past several million years. The recent human-caused upheavals are just the last of many revolutions that have occurred on what Matt McGlone recently dubbed the "flypaper of the Pacific". As in the 1986 conference, we will compare and contrast the abiotic (climate, earthquakes, etc.) and biotic (extinction of moa, lost mutualists, invasions, etc.) causes and consequences of biotic change. Note that the alliterative title "Feathers to Fur" is not meant to imply a focus on introduced mammals to the exclusion of fire, climate, geology, fragmentation, etc. We hope by the end of this conference you will have state-of-the-art historical context necessary to understand what New Zealand ecology will look like in the near future.

The 1989 "Moas" volume of the New Zealand Journal of Ecology which published papers from the 1986 conference was a concise summary of our ecological understanding of New Zealand in the mid 1980s, and it has been highly cited as a result. Four of the ten most cited papers in the history of New Zealand Journal of Ecology come from the 1989 special issue. This is impressive given that there have been 48 issues of the journal so far since it was renamed in 1978. Overall, the special issue has attracted more citations per paper per year than any other issue of similar vintage. Thanks to sponsorship from Landcare Research and the Department of Conservation, Feathers to Fur will be published in 2008 as another special issue of the *New Zealand Journal of Ecology*. We hope that it proves to be as useful in the next two decades as the 1989 volume has been over the last two decades.

We also have four other symposia which cover other topics that are, judging by the response to this conference, of great interest to NZ ecologists and managers. The session on impacts of toxins seems to be considering almost a uniquely NZ problem, and one that clearly exercises the minds of members of the public a lot, going by the evidence of letters to the Press newspaper.

Finally of course there are also a series of sessions with contributed papers. In many ways these are the engine room of any conference, as they offer the range of topics that scientists in NZ are excited about right now. We hope you find a number of contributions here that are novel and relevant to your own interests.

Every conference draws on a huge input of time from a large number of volunteers, plus generous support from sponsors. I would like to record here my appreciation for the great efforts put in by the organising committee below, and many other people who have contributed in various other ways. I also record our appreciation for the major sponsors: the Department of Conservation, Landcare Research and Environment Canterbury. Without their support, neither the conference nor the forthcoming Journal issue would be possible in their present form, for which we should all be thankful. Thanks also to the Conference Office at the University of Canterbury who have done such a professional job on the organising.

So welcome to the 2007 NZES conference, and have a good and informative time!

*Dave Kelly*

## Sponsors

Principal sponsors for the conference this year are Landcare Research, Department of Conservation and Environment Canterbury. Other sponsors include Connovation Ltd, University of Canterbury and the Bio-Protection and Ecology Division at Lincoln University. We thank them all.

## The organising team for Feathers to Fur 2007:

| | |
|---|---|
| Dave Kelly (chair-entity) | University of Canterbury |
| Jenny Ladley (venue) | University of Canterbury |
| Jon Sullivan (scientific programme) | Lincoln University |
| Ruth Guthrie (student events) | Lincoln University |
| Jason Tylianakis (social events) | University of Canterbury |
| Philip Grove (sponsorship and LENZ) | Environment Canterbury |
| Shaun Ogilvie (toxins symposium) | Lincoln University |
| Lara Nicholson (accounts) | Landcare Research Ltd |
| Matt McGlone | Landcare Research Ltd |
| Amy Whitehead | University of Canterbury |
| Adrian Paterson | Lincoln University |
| Richard Duncan | Lincoln University |
| Matthew Turnbull | University of Canterbury |

Thanks also to the team of student volunteers headed by Amy Whitehead. These people have special red conference t-shirts and should be able to help if you have questions during the conference.

## Rock Art

The Maori rock art image used as our conference symbol is from the Te Manunui site in Pareora, South Canterbury. The name 'Te Manunui' is a reference to the many 'birdman' figures depicted in the rock drawings at this site, but the shelter also contains drawings of moa, marine mammals, and abstract designs. Although no dating has been carried out on the rock art in New Zealand, depictions of extinct birds such as Pouakai (the giant Haast's eagle) and Moa suggest that the practice of rock drawing has been carried out for centuries — a cultural traditional brought to New Zealand by its first human inhabitants.

Te Manunui is one of several Maori rock art sites in South Canterbury that are accessible to the public, providing a rare opportunity to experience this most fragile aspect of Maori culture first hand. During a recent upgrade of the pathway at the site the bones of two species of moa (*Pachyornis elephantopus* and *Euryapteryx gravis*) were found in blue clay at the foot of the shelter mouth. Although it could not be determined whether the bones were deposited at the site in cultural or natural circumstances, their presence provides valuable information on the past landscape in the wider area.

The image was supplied by the Ngai Tahu Maori Rock Art Trust, with the permission of Te Runanga o Arowhenua and Te Runanga o Waihao, who share the role of Kaitiaki (or guardian) for the Te Manunui site.

As an acknowledgement of the Ngai Tahu Maori Rock Art Trust letting us use the image $2 from every T-shirt sale will be donated to the Trust. There is a flyer giving more information about the trust on the T-shirt sale desk.

# Conference Information

### Venue

The conference will be held in the University of Canterbury's Central Lecture. Refer to the conference programme for individual session rooms.

### Emergencies

In case the building needs to be evacuated (earthquake, etc) the assembly area is the paved area outside the North Arts Lecture theatres.

### Registration Desk

The conference registration desk is located in the foyer of the Central Lecture block. It will be open at the following times:
Monday 19th 8:00-9:30 am
Tuesday 20th 7:45-10:45am and 12:15-1:15pm
Weds 21st 7:45-8:45 am
Thurs 22nd 7:45-8:45am
For enquiries at other times find a student helper (look for the red conference T-shirts).

### Catering

All morning and afternoon teas, lunches and the Poster session will be held in the Central Lecture block foyer. Please note that food and drink may not be taken into lecture theatres. The Tuesday evening BBQ meal is at the Staff Club (see Campus map at back of this book) and the Conference Dinner is in central Christchurch (see below).

### Cell Phones

You are kindly requested to please have your cell phone turned off while in conference sessions.

### Email, web access etc

There is a public terminal for brief web searching, webmail etc near the registration desk. Please be brief on this machine as others will probably be waiting.

For full access to the web, email etc you can purchase a temporary $5 usercode for use during the conference. These are available from the Conference Registration desk and should last for the week unless you get into serious downloading. Should you reach the credit limit of your usercode, you may purchase another one from the same place. This usercode lets you use the several other computer terminals in the lecture hall foyer, the full suite of computers in the basement of the Commerce building, and your laptop via either the ethernet ports in the lecture block foyer and/or the bluetooth network covering all the venue. For full instructions on connecting your laptop to ethernet or bluetooth, see the Conference Registration desk for instruction sheets.

Note that if you have a temporary usercode, you can use the computer suite under Commerce to view the PPT files for talks you have missed. These will be arranged in folders by session. If all goes to plan, you may find MP3 files for the audio of the Feathers to Fur talks from Tuesday in the same folder by later in the week.

### Messages

All messages for delegates will be posted on a notice board near the registration desk. Please check the stand regularly. Information regarding the conference will also be displayed on the notice board.

## Name Badges

Admission of delegates to all sessions, morning and afternoon teas, lunches and functions, is by conference name badge only. Delegates are requested to wear the name badge at all times.

Delegates are asked to return their badges at the end of the conference so that the plastic badges can be reused. There will be a collection box for the badges near the registration desk and at the front of the lecture rooms.

## Awards

Student Oral presentation. This year the student talks will be judged in a "people's choice: format. You have been provided with a voting slip with your name badge.

Student talks are marked on the mini-timetable at the back of your name tag and in the abstract book. Please rank your two favourite talks by ranking them first and second place. Place your votes into the boxes provided at the registration desk and in the session rooms. Any voting papers with the same talk in first and second place will be considered invalid.

Please submit your vote by afternoon tea on Thursday (2.50pm). The votes will be tallied and winners announced at the closing session on Thursday afternoon. Please only vote if you have seen at least 4 student talks

## Instructions for Oral Paper Presenters

Please read the following carefully for smooth paper presentation.

1. Note the date, time and room for your session from the final programme.
2. Please see the chair of your session **at least 10 minutes** before your session begins.
3. We encourage you to present your talk using PowerPoint. If you intend to use other visuals (DVD, VHS, slides etc) please see your session chair or a conference organiser well in advance (preferably the previous day).
4. The computers and data projectors used for presentations will be provided by the conference and no other computers (including laptops) will be permitted to be connected to the projectors. The computers provided will be running the latest versions of Windows XP and PowerPoint. There are also facilities to show DVD and VHS in the lecture rooms.
5. Please bring your presentation on a CD or USB/flash drive. Take it to the room you are presenting in **WELL IN ADVANCE** of your session, where it will be loaded onto the computer for you. Please flick right through the talk in the room beforehand to make sure it all shows correctly.
6. We ask that your PowerPoint file name begin with your session number followed by your surname (presenters surname), e.g. 4Robertson.ppt
7. Speakers in the Feathers to Fur symposium will have either 25 or 20 minutes for their presentation, followed by 5 minutes in each case for questions (30 or 25 minutes total). Speakers on Wednesday and Thursday will have 15 minutes for presentation followed by 5 minutes for questions (20 minutes total).

## Instructions for Poster Paper Presenters

1. The poster panels are located upstairs in the C lecture block.
2. You have been allocated a board, bearing a number and your surname (presenter's surname).
3. The poster can be fixed with Velcro dots to the panel. The Velcro is available from the registration desk. Please put your poster up as soon as possible and no later than afternoon tea on Wednesday.
4. The poster session is being held on Wednesday afternoon 4:20 - 6:00 pm in the upstairs area of the C lecture block. Please attend your poster at this time.
5. To encourage conference delegates to discuss your poster with you, all delegates will have a single voucher for a free drink. However, before they can cash it in, they need a stamp from a poster presenter. You will be given a rubber stamp for stamping the drinks tickets when people ask but they have been told they have to ask you a sensible question first! It's up to you how strictly you run this. At the start of the session you can stamp your own voucher and get your own drink handy.
6. Posters can remain on display for the full duration of the conference. Please remove them by Thursday 4 pm.

## Instructions for Session Chairs

1. Note the date, time and room for the session you are going to chair, from the final programme.

2. Please be present in your session room at the start and end of the break prior to your session, including the last 10 minutes prior to the commencement of your session. The Lecture Venue Assistant (in red t-shirt) will acquaint you and your speakers with the audiovisual and light controls, the microphone system and general room setup.
3. Please ensure that all PowerPoint presentations for the session are visible on the computer desktop and ready to go before the session begins.
4. Please start sessions on time, even if people are still arriving.
5. Please announce student talks at the beginning of each talk for the benefit of those voting for the student prize.
6. Session chairs on Wednesday and Thursday: It is essential that sessions run precisely to the schedule indicated, given that there are parallel sessions. Please keep speakers to time. Give them a warning at 12 and 14 minutes, AND STOP THEM AT 15 MINUTES.
7. Ensure that question time does not extend beyond the allocated five minutes, even if there are questions still requiring responses.
8. If a speaker finishes early, or if a talk is cancelled, do not advance the programme beyond the schedule. Have a pause or a break.
9. If you need any assistance please ask the assistant assigned to your session room, or any member of the conference organising committee.
10. Please announce any housekeeping notices at the beginning and end of your session.

Thank you for your role as session chair.

### Smoking

Smoking is not permitted inside any University of Canterbury building.

# General Information

**See also the campus map at end of this book**

### Banking and Currency

ATM machines are located inside the ground floor entrance of the Commerce Building, in the foyer of the Central Library, outside the entrance to the Registry Building and at the car park entrance to the Students' Association UCSA building. The nearest branches of major banks are as follows:
**Bank of New Zealand (BNZ)**, Upper Riccarton branch, cnr Riccarton and Waimairi Roads
**National Bank**, Upper Riccarton branch, 322 Riccarton Road
**Westpac**, Upper Riccarton branch, 3 Waimairi Road

### Central Library

During the summer the Central Library hours are 8.30am to 9.00pm Monday to Thursday, 8.30am to 5.00pm Friday and 1.00pm to 5.00pm on Saturday and Sunday.

### Dining Out

The following list is not exhaustive, but offers a few suggestions for dining a reasonable distance from the University.

**Food outlets on campus:**

- Café 101 is situated on the ground floor of the Commerce Building.
- Spice Traders is situated next to the University Bookshop and serves Indian and Chinese food.
- Student's Association UCSA building also has several food outlets.

**Restaurants within walking distance of the University:**

- Bush Inn Cobb and Co (fully licensed, family style dining) cnr Waimairi & Riccarton Rds
- Foo San Restaurant (BYO, Chinese) 6 Rountree Street, off Ilam Road
- Robbies Bar and Bistro (licensed bistro dining) Church Corner, 8 Yaldhurst Road
- Tandoori Palace (fully licensed, Indian) 71 Ilam Road.

**Suburban Cafés:**

- Misceo Café and Bar (fully licensed café style, gourmet pizzas, bar snacks) Cnr Ilam and Clyde Rds
- Merrin Street Cafe (fully licensed Pacific Rim cuisine) Avonhead Shopping Centre, cnr of Withells and Merrin Sts

**Fine Dining:**

- Rotherhams of Riccarton (fully licensed NZ European cuisine) 42 Rotherham St Riccarton

**Fast Food:**

- Campus Corner, corner Rountree Street and Ilam Road (5 minutes' walk) – fish and chips, Chinese.
- Clyde and Riccarton Roads corner (15 minutes' walk) - ethnic, Chinese, fish and chips

## Emergency Medical Services

Riccarton Clinic, 6 Yaldhurst Road, Church Corner. Phone 343 3661. Open 8.00am to 10.00pm Monday to Friday, 8.00am to 8.00pm Saturday, Sunday and public holidays.
After Hours Surgery, corner Bealey Avenue and Colombo St. Phone 365 7777. Open 24 hours, seven days a week.

## Pharmacies

Students' Association Building, ground floor. Open Monday to Friday 8.30am to 5.30pm. Phone 364 2215.
Church Corner Amcal Chemist, 376 Riccarton Road. Phone 348 6397, open Monday to Friday 8.30am to 8.30pm; Saturday 9am to 8.30pm; Sunday 9.30am to 8.30pm.

## Parking

All carparks on campus may be used except those reserved for departments, disabled, University vehicles or individual position-holders. Note that if you park in the Pay and Display areas, you need to pay ($2 per day); tickets are available from Café 101 in the Commerce building (next to the C lecture block). Please refer to the parking areas shown on the map at the back of this book.

## Photocopying and Fax Facilities

Photocopying and fax facilities are available at the Copy Centre, situated at the rear of the ground floor of the Central Library. Copy Centre hours are 8.30am to 5.00pm weekdays.

## Post Office

Postal services are available from the Convenience Store in the Student's Association UCSA building.

## Public Transport

Buses depart for the city on weekdays approximately every 30 minutes (near the hour and half hour) from the bus stop opposite the School of Engineering on Creyke Road and approximately every 15 minutes from the bus stop outside the Student Association Building on Ilam Road. Please check the timetables at the bus stops or on the conference noticeboard for exact times. Alternatively, you may phone BusInfo on 366 8855.

## Shopping

The closest shopping malls are Fendalton Mall, Memorial Avenue (15 minutes walk); Bush Inn Centre, Riccarton Road (15 minutes walk); Riccarton Mall, Riccarton Road (25 minutes walk). The nearest dairy (corner store) apart from those on campus, is on the corner of Ilam Road and Rountree St.

### Taxis and Shuttles

| | | | |
|---|---|---|---|
| First Direct | Ph: 377-5555 | Blue Star | Ph: 379-9799 |
| Gold Band | Ph: 379-5795 | Corporate Cabs | Ph: 379-5888 |
| Supershuttle | Ph: 0800-748-885 | | |

### Telephones

There are two telephones located in the Central Lecture block. These are available for local calls only. Card/coin phones are situated on level one of the Central Library (see Central Library hours below) and in the concourse of the Registry building, open weekdays from 8.30am to 5.00pm.

### University Bookshop

Weekday opening hours are 8.30am-5.30pm.

# Social Programme

### Monday evening

*Monday 19 November, 5.30 – 7.00pm, Staff Club*
This is an opportunity to gather for an informal mixer after the field trips, at the Staff Club with a cash bar. (See site map at end of book for location of Staff Club).

### BBQ

*Tuesday 20 November, 7.00 – 11.00pm, Staff Club*
The barbeque dinner is on Tuesday evening at the Staff Club, meal (with vegetarian options) provided, cash bar available.

### Poster Session

*Wednesday 21 November, 4:20 – 6.00pm, Upstairs in Central Lecture Block*
Delegates are invited to attend the Poster session. To encourage spirited discussion of the posters and make the poster session more sociable, all delegates will have a single voucher for a free drink and nibbles will be provided. However, before you can cash your voucher in and get your drink, you need to get your voucher stamped by a poster presenter. They have been told you have to ask them a sensible question first! There will also be a cash bar if you want more drinks, or to get a first one before you talk to any presenters.

### Conference Dinner

*Wednesday 21 November, 7.30pm dinner*
The conference dinner will be held from 7:30pm on Wednesday 21 November at the Hotel Grand Chancellor, one of Christchurch's premiere venues, located in the city centre, 5 minutes walk from Cathedral Square. The exact location is the corner of High St and Cashel Mall, near Manchester St. The Venue will be open from 7.00pm.

The dinner will be a buffet with hot and cold dishes (including vegetarian options) and desserts. We will also provide the equivalent of half a bottle of wine per person, and additional drinks can be purchased from the cash bar. A jazz band (The Oval Office) will provide music until late. For those with stamina, the hotel is very close to the bar & nightclub area of Christchurch so you can easily move on to other revelry after midnight.

Some transport from the University to the dinner will be provided (2 buses). The buses will leave from C Lecture block outside Café 101 at 6.35pm.

If you have not bought a conference dinner ticket and would like to buy one now, you can do so at the Conference Registration desk up until 4 pm on Tuesday.

# Field Trips - Monday 19 November

Two full day trips and one part day trip have been offered:

**Banks Peninsula forests & dolphins**. Full day trip. A trip by bus to Akaroa, including a 2 hour boat trip on Canterbury Cat to see Hectors dolphins, and visits to several peninsula forest remnants. Includes lunch. Boat trip is weather dependent but refundable if cancelled. Maximum of 43 places, minimum of 28. Departs from University of Canterbury, outside C Lecture block, near Café 101, at 8:30am then via domestic terminal at airport at 8:40am, return to university 5:30pm.

**Quail Island**. A day on the island restoration project in Lyttelton Harbour, by bus from the university and ferry from Lyttelton. Lunch provided. You will be shown progress with revegetation and pest control and also be able to see historic sites, including those used by Robert Falcon Scott before his Antarctic expedition. Depart from outside C lecture block, near Café 101, University of Canterbury at 9:30am, return 5pm.

**Canterbury Museum:** One-hour exploration with Richard Holdaway of the moa bones stored in the Canterbury Museum, including moa pelvis bones with *Harpagornis* puncture wounds. Before or after your tour you can explore the rest of the Museum and its café, or visit other sites or cafes in the Arts Centre, Art Gallery and Botanic Gardens which are all adjacent. Transport to the Museum is not provided. Three start times (1:30. 2:30 or 3:30pm). At the start time, meet at the Museum information desk inside the front entrance.

# Announcing the 2009 INTERCOL Conference Brisbane 16-21 August 2009

The tenth INTECOL meeting has a theme of Ecology in a Changing Climate, Two Hemispheres, One Globe. The conference is being jointly hosted by the Ecological Society of Australia and New Zealand Ecological Society in Brisbane August 16 - 21 in 2009. In 2009 INTECOL will substitute for the annual NZES conference.

Ecologists from around the world will explore how global climate change has impacted, and will further impact, ecosystems and their vital services to human communities. They will explore unique features of ecosystems in the southern and northern hemispheres but look for common elements in a search for solutions to this looming problem.

Symposia will represent all scales of ecology from individual organisms to landscapes, and report on a diversity of ecosystems from marine to freshwater aquatic systems and terrestrial ecosystems from arid to rainforest and from polar to tropical.

The meeting will bring expert ecological commentary on a range of vital processes including land and water use, sea level change, restoration of ecosystems, biotic invasions, changing water patterns, urban ecology and fire ecology. It will include discussions on long term monitoring of ecosystems, on incorporating ecological knowledge into policy, on integrating indigenous knowledge into conventional science, and on communicating ecological information to a broader community.

While the meeting will attract an international attendance the ecological research of the two host countries, New Zealand and Australia will be on display, and visiting delegates will have the opportunity to appreciate both the unique biotas of these two countries and the strong basic and applied research effort applied to regional ecological issues that could be translated to other regions

# New Zealand Ecological Society
## MEMBERSHIP APPLICATION

**PLEASE COMPLETE ALL SECTIONS AND EMAIL OR POST TO THE ADDRESS BELOW**

## A PERSONAL DETAILS

| | | |
|---|---|---|
| **Circle Title:** Prof Dr Mr Mrs Ms Miss | **Last Name:** | **First Name(s):** |
| **Mailing Address:** | | |
| **E-Mail:** | | |
| **Phone Bus:** | **Fax Bus:** | **Phone Private:** |

## B MEMBERSHIP DETAILS

| |
|---|
| **Occupation/Expertise:** |

## C TYPES OF MEMBERSHIP AND SUBSCRIPTION RATES (2005)

(please tick the class for which you qualify)

*Open to any person interested in ecology and includes botanists, zoologists, teachers, students, soil scientists, conservation managers, amateurs and professionals*

| | | | |
|---|---|---|---|
| | **Full** | Receive journal and newsletter | $80.00* p.a. |
| | **Unwaged Member** | Is available only on application to Council for full-time students, unwaged or retired persons. Unwaged members may receive the journal but must specifically request it. | $45.00* p.a. |
| | **Joint** | Joint members get one copy of the journal and newsletter to one address | $80.00* p.a. |
| | **Overseas Full** | Receive journal and newsletter | $105.00* p.a. |
| | **Overseas Unwaged** | Is available only on application to Council for full-time students, unwaged or retired persons. Unwaged members may receive the journal but must specifically request it. | $65.00* p.a. |
| | **School** | Educational institutions may receive the newsletter at the cost of production to stay in touch with Society activities by application to Council | $12.00 p.a. |

* There is a $10 rebate for members who renew before 15 February each year and for new members

**Make cheques payable to: NZ Ecological Society**
**Bank account details for direct payment: 060729 0465881 00** ***(make sure your name is included)***

☐ Tick if you wish to make a donation to the Kauri Fund (see NZ Ecological Society website for details)

☐ Tick if you don't have an email address to receive the newsletter which is sent out electronically

**Signature/Email Address of Applicant: _____ Date: _____**

**NZES National Secretariat, PO Box 25 178, Christchurch. Tel: (03) 318 1056 Fax (03) 318 1061**
**Email: nzecosoc@paradise.net.nz Website: www.nzes.org.nz/**

# THE KAURI FUND

**Kauri Fund**
**New Zealand Ecological Society**
**P.O. Box 25 178**
**Christchurch 8144**

**From seedling to giant**

- The name "Kauri Fund" refers to the iconic New Zealand native tree *Agathis australis* which is renowned for its ability to accumulate large quantities of biomass (capital), live a long time, and influence its surrounding community.
- The Fund is not intended to provide funds specifically for kauri, or research on kauri solely (though that could be a topic eventually considered).

## Germination of the NZES Kauri Fund

It is a tribute to New Zealand ecologists that they have accomplished so much on such limited funding. Money for the study and promotion of ecology in New Zealand has never been abundant. To help this situation and to leave an enduring legacy of resources for future ecologists, the Society 'germinated' a fund at the 2001 Jubilee Conference in Christchurch. The 'Kauri Fund' seeks to develop a capital base, with interest earned on this capital being available for specific initiatives to assist the development of ecology and ecologists in New Zealand. Donations from members and organisations (and anyone else who feels so inclined), and other fund raising activities will grow the fund.

The fund has now grown to about $34,000. Initial grants will soon be used to support postgraduate student research and attendance at conferences. As the Fund grows other types of grant support will be possible that support the development of ecology and ecologists in New Zealand (e.g., early career project grants, travel for visiting ecologists, funds to run special workshops or conferences), at the discretion of the Council.

The Kauri Fund is a registered charitable trust. Donations to the Fund can be made to the above address. For more information, please contact Bruce Burns (BurnsB@landcareresearch.co.nz).

New Zealand Biodiversity Recording Network

# NZBRN

www.nzbrn.org.nz

NZBRN is a web-based system to record and process your natural history observations of birds, plants, butterflies, mushrooms, reptiles, frogs and mammals.

NZBRN is intended to complement other systems such as BIOWEB, NHMS, NVS, NZPCN, NZERN and Landcare Research's, NIWA's and Te Papa's online voucher-based plant and animal databases. Ultimately all will be linked through the Global Biodiversity Information Facility (GBIF).

Bellbird observations in Christchurch City.

## live demonstration
## Wednesday + Thursday
## lecture room C2 during morning tea

The New Zealand Biodiversity Recording Network (NZBRN), is a new online, automated system for recording natural history observations and retrieving data in a variety of formats including zoomable distribution maps.

NZBRN was initiated with funding from the Terrestrial & Freshwater Biodiversity Information System Fund (TFBIS) 3 years ago; data entry has been active since December 2006 and already maps are filled with over 3 000 bird and 15 000 plant records.

The fungal, herpetofaunal and mammal portals are only just starting up and soon a partial invertebrate portal will be added.

The purpose of NZBRN is firstly to provide a secure, feature-rich repository for storage and graphical (or spreadsheet) retrieval of natural history data (from both past and present sources) that falls outside institutional plot-based records. Validation and privacy options are available.

NZBRN aims to engage the public in observing and recording nature in a systematic way with instant feedback through maps, graphs, and tables. NZBRN can facilitate neighbourhood or school nature watch projects.

NZBRN can also provide a mechanism for tracking movement of migratory or pest species across the country once a network of observers is established.

NZBRN is adapted for New Zealand from the highly successful, prize-winning Swedish Artportalen (species gateway) system (http://artportalen.se). Artportalen receives over 5000 bird records per day, and several hundred records of other organisms per day.

# Conference Overview

| Tuesday 20th<br>Venue C1 |
|---|
| **1 Feathers to Fur I** |
| Morning tea |
| **2 Feathers to Fur II** |
| Lunch |
| **3 Feathers to Fur III** |
| Afternoon tea |
| **4 Feathers to Fur IV** |
| **BBQ** (Staff Club) |

| Wednesday 21st<br>Venue C1 | Wednesday 21st<br>Venue C2 |
|---|---|
| **5 Toxins & Pest Control I** | **6 Conservation Management** |
| Morning tea | Morning tea |
| **7 Toxins & Pest Control II** | **8 Landscape Ecology** |
| Lunch | Lunch |
| **9 Biodiversity & Ecosystem Function** | **10 Plant Ecology** |
| Afternoon tea | Afternoon tea |
| **11 Interactions** | **12 Birds I** |
| **Poster session** (foyer) | **Poster session** (foyer) |
| **Conference Dinner** | **Conference Dinner** |

| Thursday 22nd<br>Venue C1 | Thursday 22nd<br>Venue C2 | Thursday 22nd<br>Venue C3 |
|---|---|---|
| **13 LENZ & Threatened Environments** | **14 Populations & Communities** | **15 Birds II** |
| Morning tea | Morning tea | Morning tea |
| **16 Vegetation Change** | **17 Invertebrate Ecology** | |
| Lunch | Lunch | |
| **18 Island Restoration** | **19 Urban Ecology** | |
| Afternoon tea | Afternoon tea | |
| **20 The Barlow Session** | | |
| **Feathers to Fur: overview** | | |
| **Awards and Closing** | | |

# Conference Programme

| Tuesday 20 November | |
|---|---|
| **Time** | **Venue: C1** |
| **8.40**am Conference opening | |
| **1. Symposium: Feathers to Fur I**<br>**Chair: Dave Kelly** | |
| **8.45** | **Gibbs:** Why are New Zealand invertebrates different? |
| **9.15** | **Lee:** Is there a legacy of avian-dominated plant-herbivore systems in New Zealand? |
| **9.45** | **Tennyson**: The History and Origin of New Zealand's Terrestrial Vertebrates: Recent Advances in Knowledge |
| **10.15-10.45: Morning tea** | |
| **2. Feathers to Fur II**<br>**Chair: Jon Sullivan** | |
| **10.45** | **McDowall:** Historical and ecological context, pattern and process, in the changing New Zealand's freshwater fish fauna |
| **11.15** | **Johnston:** Hyphae amongst the feathers and fur: the causes and consequences of changes to New Zealand's fungal biota |
| **11.45** | **McGlone:** Climate change and the ecology of New Zealand: past influences, present legacies and future prospects (NZES Te Tohu Taiao address) |
| **12.15-1.15: LUNCH** | |
| **3. Feathers to Fur III**<br>**Chair: John Ogden** | |
| **1.15** | **Holdaway:** Moa biology and ecology in the 21st Century: perspective and retrospective |
| **1.40** | **Forsyth:** Are deer moas? Impacts of introduced deer in New Zealand forests |
| **2.05** | **Duncan:** Regeneration gaps and vegetation change in New Zealand forests: earthquakes and climate |
| **2.30** | **Condron:** Soil fertility and ecosystem development in New Zealand |
| **2.55** | **Kelly:** Bird-plant mutualisms with the wreckage of an avifauna |
| **3.20-3.50: Afternoon tea** | |
| **4. Feathers to Fur IV**<br>**Chair: Matt McGlone** | |
| **3.50** | **Brockerhoff:** Impacts of invasive invertebrates on New Zealand's indigenous ecosystems |
| **4.15** | **McIntosh:** Salmonid impacts on New Zealand galaxiid fish |
| **4.40** | **Innes:** Predation and other factors currently limiting New Zealand forest birds - a review |
| **5.05** | **Wilmshurst:** The Polynesian Revolution and the prehistoric transformation of New Zealand |
| **5.30** | **Bellingham:** Changes on islands: seabirds, predators, and the importance of history |
| | |
| **6.00-7.30: NZ Ecological Society AGM, in C1** | |
| | |
| **7.00-11.00pm: BBQ, at the Staff Club** | |

| Wednesday 21 November | | |
|---|---|---|
| **Time** | **Venue: C1** | **Venue: C2** |
| | **5. Symposium: Toxins And Pest Control I**<br>**Chair: Shaun Ogilive** | **6. Conservation Management**<br>**Chair: Angus McIntosh** |
| **8.50** | **Eason**: Extending the use of humane, low residue, multispecies control tools | **Sawyer**: Mapping the flora – a biogeographic basis for plant conservation |
| **9.10** | **Gillies**: Diphacinone bait for ground control of rats on the mainland conservation estate | **Rutledge**: Development and Application of the Protected Areas Network New Zealand (PAN-NZ) Database |
| **9.30** | **Spurr**: Protecting islands from rodent (re)invasion – evaluation of long-life baits and bait station types | ***Whitehead**: Predicting the potential range of threatened species: the use of long-term data to assess suitable habitat for whio throughout New Zealand. |
| **9.50** | **Fisher**: Not just little rats – optimising toxic baits for house mice | **Whelan**: Plants for Constructed Mine Wetlands in New Zealand: A Case Study at Golden Cross Mine |
| **10.10** | **Murphy**: Developing a new toxin for the control of feral cats, stoats and wild dogs | **Deng**: Numerical Frameworks used to Prioritise Areas for Biodiversity Management in the Waikato Region |
| **10.30-11.00 Morning tea.** A demonstration of the NZ Biodiversity Recording Network website will be held in C2 at the beginning of the tea break | | |
| | **7. Symposium: Toxins And Pest Control II**<br>**Chair: James Griffiths** | **8. Landscape Ecology**<br>**Chair: Ecki Brockerhoff** |
| **11.00** | **Kemp**: Aerial 1080 for multi-pest knockdown: results from a series of large-scale field experiments in New Zealand forests with a focus on ship rats | **Pawson**: Plantation forests as habitat for native species: The impact of clearfell harvesting |
| **11.20** | **Nugent**: Multispecies pest control: Killing more animals with fewer baits | ***Hutchison**: An experimental test of the influence of landscape context on exotic plant invasions into native forest fragments, West Coast, New Zealand |
| **11.40** | **Veltman**: Uncertainties remaining about non-target effects of aerial 1080 operations and experimental designs for exploring them. | **Wiser**: New Zealand's shingle beaches: significant rare ecosystems or exotic-dominated wastelands? |
| **12.00** | **Green**: Ecological toxins and public tipping points: lessons from the 1080 re-assessment | **Woodford**: The role of habitat patterns in controlling the impact of predatory trout on non-migratory galaxiid distributions across riverscapes |
| **12.30-1.30: LUNCH** | | |

* = eligible for student prize

| Wednesday 21 | | |
|---|---|---|
| **Time** | **Venue: C1** | **Venue: C2** |
| | **9. Symposium: Biodiversity And Ecosystem Function**<br>**Chair: Bill Lee** | **10. Plant Ecology**<br>**Chair: KC Burns** |
| **1.30** | **Dickie**: Fungal communities: small-scale drivers of large-scale ecosystem processes | **McAlpine**: Potential invasion of *Berberis darwinii* (Darwin's barberry) into New Zealand *Nothofagus* (beech) forest |
| **1.50** | **Kay**: Invertebrate biodiversity associated with *Nothofagus* and its consequence for ecosystem function. | *__Dickinson__: The Root Systems of Selected New Zealand Short Tussock Grassland Species: Description and Functional Classification |
| **2.10** | **Yeates**: Scale and nematode contributions to ecosystem processes | *__Harsch__: Taking a step back: historical disturbances as indicators of current and future forest dynamics |
| **2.30** | **Tompkins**: Parasites, Populations, Communities and Ecosystems – The Role of Parasites in the Natural World | **Bishop**: Seed bank dynamics of New Zealand forest and shrubland ecosystems |
| **2.50-3.20: Afternoon Tea** | | |
| | **11. Interactions**<br>**Chair: Alastair Robertson** | **12. Birds I**<br>**Chair: John Innes** |
| **3.20** | **Hoare**: Attempting to manage complex predator-prey interactions fails to avert imminent extinction | **Brockerhoff**: Effects of land cover type on indigenous forest birds in Canterbury |
| **3.40** | **Newstrom-Lloyd**: Native and exotic plant-pollinator mutualisms in New Zealand | **Galbraith**: Motu Kaikoura - degraded avifauna diversity the result of fallow deer? |
| **4.00** | **Burns**: Heteroblasty in the Chatham Islands: Reversion to homoblasty in the absence of moa? | *__Hegg__: A stochastic model to evaluate different management scenarios for the Fiordland takahe |
| | | |
| **4.20-6.00: Poster session, Upstairs foyer C block** | | |
| | | |
| **7.00-midnight: Conference Dinner at the Hotel Grand Chancellor** | | |

## Thursday 22 November

| Time | Venue: C1 | Venue: C2 | Venue: C3 |
|---|---|---|---|
| | **13. Symposium: LENZ and Threatened Environments**<br>**Chair: Philip Grove** | **14. Populations and Communities**<br>**Chair: Peter Bellingham** | **15. Birds II**<br>**Chair: Adrian Paterson** |
| **C1: 8.40**<br>**C2: 8.50**<br>**C3: 8.50** | **Leathwick**: Five years after LENZ – would we do it the same? Starting time of **8.40am** | **Wilson**: Dynamics of house mouse populations in an alpine landscape. Starting time of **8.50am** | **Castro**: Avian Malaria in New Zealand Saddlebacks living on Mokoia Island, Lake Rotorua. Starting time of **8.50 am** |
| **9.10** | **Rutledge**: Using scenarios to estimate the condition and trend of coastal environments | **Robertson**: Interactions among pollinators, flower herbivores and forest fragmentation determine fruit set in declining *Peraxilla* mistletoes | *__Minson__: Improving the diet for captive kiwi |
| **9.30** | **Ward**: LENZ - is it fit for purpose yet? | *__Guthrie__: Tastes like home. Regional patterns of adaptation by specialised arthropod herbivores of *Cordyline australis* : plant genetics or host quality? | **Stevens**: Kaupapa Kererû count day: estimating the number and distribution of kererû on Banks Peninsula |
| **9.50** | **Lloyd**: Use of LENZ and LCDB2 for determining the representative value of stands of indigenous vegetation | *__Greig__: Multiple time constraints across habitats lead to life history specialization in a temporary pond caddisfly | *__Cunningham__: The kiwi bill-tip organ - a new prey-detection system for kiwi? |
| **10.10** | **Maseyk**: Biodiversity Protection on Private Land - applying the LENZ framework to regional biodiversity policy | *__Affeld__: Canopy microclimate and epiphyte community composition in northern rata (*Metrosideros robusta*) | **Miskelly**: Impact of introduced mammals on the genetic diversity and conservation status of New Zealand snipes (*Coenocorypha* spp.) |

**10.30-11.00 Morning tea.** A demonstration of the NZ Biodiversity Recording Network website will be held in C2 at the beginning of the tea break

| | Venue: C1 | Venue: C2 |
|---|---|---|
| | **16. Vegetation Change**<br>**Chair: Richard Duncan** | **17. Invertebrate Ecology**<br>**Chair: Ruth Guthrie** |
| **11.00** | **Husheer**: Variable responses of New Zealand's indigenous forests to the exclusion of ungulates | *__Painting__: Catch me if you can: interceptions and establishments of exotic longhorn beetles (Cerambycidae: Coleoptera) in NZ, USA and the world |
| **11.20** | *__Gatehouse__: People and urban land cover explain the number and composition of the naturalised plants of New Zealand. | *__Sarfati__: Mast seeding and the importance of predictive diapause in a seed insect predator and its parasitoids |
| **11.40** | **Mark**: Results of long-term (>35-yr) vegetation monitoring in Mt Aspiring National Park and Secretary Island, Fiordland, in relation to contrasting trends in feral deer impacts. | *__Bassett__: Effects of alligator weed invasion on lakeside invertebrate communities. |
| **12.00** | *__Day__: Changes in plant species composition in New Zealand's South Island tussock grasslands over two decades | *__Chappell__: Phylogeography, Morphology and Reproductive Behaviour of Ground Weta (*Hemiandrus pallitarsis*). |

**12.30-1.30: LUNCH**

| Thursday 22 November | | |
|---|---|---|
| **Time** | **Venue: C1** | **Venue: C2** |
| | **18. Symposium: Island Restoration: Where To From Here?**<br>**Chair: Rod Hay** | **19. Urban Ecology**<br>**Chair: Colin Meurk** |
| **1.30** | **Jones**: Combining science and Hauraki matauranga to manage grey-faced petrels on New Zealand's offshore islands | **Morgan**: A survey of mammalian pest species in Hamilton city |
| **1.50** | **Jamieson**: Founder effects, inbreeding and loss of genetic variation, and their impact on island restoration | **Wehi**: Urban weta in forest fragments: marooned survivors or successful dispersers? Ecological genetics of *Hemideina thoracica*, the northern tree weta, in urban forest fragments |
| **2.10** | **Hutchings**: A Myriad of Reserve Types - the need for an Offshore & Outlying Island Management Strategy | **Hostetler**: Sustainable Urban Developments: Barriers and Solutions to Creating Communities that Conserve Natural Resources |
| **2.30** | **Towns**: Island biodiversity research strategy (interactive discussion) | *__Doody__: Urban realities: Converting urban gardens from sinks to sources in urban plant conservation |
| **2.50-3.20: Afternoon Tea** | | |
| **Time** | **Venue: C1** | |
| | **20. The Barlow Session** (showcasing three early-career scientists from the local region) and concluding talk | |
| **3.20** | **Pitt**: Simulating the invasion history of Argentine ant with Modular Dispersal in GIS | |
| **3.40** | **Wotton**: Consequences of dispersal failure: effects on recruitment in large-seeded trees | |
| **4.00** | **MacLeod**: Parasites lost: did they 'miss the boat' or 'drown on arrival'? | |
| **4.20** | **Ogden**: Feathers to Fur V - Past to Future? | |
| **4.40-5.00: Student Prizegiving and conference close** | | |

# Poster Session Programme

| | **Wednesday 21**<br>**Time: 4.20-6.00**<br>**Venue: Upstairs foyer C block** |
|---|---|
| 1 | **Ball**: Search for the Te Paki *Mecodema* : Part two |
| 2 | **Ball**: Forest-floor ground beetles (Coleoptera: Carabidae) of Te Paki, Northland: Biodiversity and conservation |
| 3 | **Barkla**: 37-years of vegetation monitoring in Mt Aspiring National Park |
| 4 | *__Bassett__: Altered nutrient cycling as a novel non-target effect of weed biocontrol. |
| 5 | **Jones**: The effect of pest control on the regeneration of canopy and understorey species at Acker's Point, Stewart Island |
| 6 | **Gautam**: National Biodiversity Metadata Database |
| 7 | *__Kikillus__: Exotic reptiles: A risk analysis for New Zealand |
| 8 | **Ladley**: Reproduction by ornithophilous-flowered plants when birds are rare: *Sophora prostrata* in Canterbury. |
| 9 | **Magaña**: Are species' distribution patterns correlated with ecological traits? A multiscale analysis of the New Zealand flora |
| 10 | **McNutt**: Inventory and Monitoring Toolbox - establishing inventory and monitoring standards for the Department of Conservation |
| 11 | **Morgan**: Causes of nesting failure in urban birds using time-lapse video |
| 12 | *__Newbold__: Can Predators Detect IR Monitoring? |
| 13 | **Pryde**: Performance of mark-resight population estimators using two robin populations of known size |
| 14 | **Sullivan**: Food or sex: which would you choose? |
| 15 | **Van Horik**: The management of risks associated with importing new organisms into New Zealand (HSNO Act) |
| 16 | *__Waring__: Altering native foodwebs: Indirect effects of ragwort (*Senecio jacobeaea*) invasion and naturalisation in New Zealand |
| 17 | *__Watkins__: Patchy distribution of mice, rats and stoats in relation to population density index |
| 18 | **Wehi**: Hutia te rito o te harakeke: Understanding harakeke ecology and Maori historical management |

## Canopy microclimate and epiphyte community composition in northern rata (*Metrosideros robusta*)

**Presentation type:** Oral Presentation

Kathrin Affeld
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Kathrin Affeld[1]*

[1]*Bio-protection and Ecology, Lincoln University*

Microclimate is an important determinant of epiphyte distribution and community composition in canopy habitats, but few studies contain direct micrometeorological measurements to support such observations. In this study temperature, relative humidity and vapour pressure deficit (VPD) were measured for epiphyte mats on inner canopy branches to investigate correlations between these climatic variables and epiphyte species richness and biomass. Measurements were taken at 30 min intervals over a one year period at two temperate rain forest study sites on the South Island's West Coast. Microclimatic differences in temperature, humidity and VPD were evident between epiphyte mats at similar growth sites from within the same tree and communities from different trees. Increased temperatures, expressed as degree days, and VPDs were significantly correlated with a decline in total species richness ($R^2 = 0.497$; $p < 0.05$) and cryptogam biomass ($R^2 = 0.399$; $p < 0.05$) respectively. VPD was an important factor in explaining much of the compositional variation between epiphyte communities and was strongly linked to aspect. Extreme climatic conditions that could potentially be harmful to epiphytes were experienced by all mats, but at only few occasions. Microclimatic conditions within the three dimensional canopy environment are as variable and complex as the architectural structure of the rainforest canopy itself. Continuous and prolonged microclimatic measurements are necessary at the epiphyte growth site to understand the effects of climatic changes on the dynamics of epiphyte communities and potential flow on effects on ecological processes within a forest.

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## Search for the Te Paki *Mecodema* : part two

**Presentation type:** Poster Presentation

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Olivier Ball[1]*, Patrick Whaley[2]*, Andrea Booth[2]

[1]*NorthTec,* [2]*Department of Conservation*

The distribution of an undescribed *Mecodema* species (Coleoptera: Carabidae) in the Te Paki Ecological District was investigated between July 2006 and July 2007. Two separate pitfall trapping studies were conducted during this time. In one study, clusters of traps were non-randomly deployed in and around areas of comparatively high habitat quality that had been fenced from stock. Live trapping was conducted at these sites with traps being opened for seven continuous days every month. In the other study, pitfall traps were deployed at nine random locations, three in native forest, three in pine forest plantations and three in scrub. Kill trapping was conducted at these sites. Traps were left continuously open and cleared and

reset once a month. *Mecodema* sp. individuals were trapped at two sites, Whareana (non-random study) and Unuwhao (random study). This species has been previously recorded at both of these sites. The habitat at both sites is native forest. No *Mecodema* sp. individuals were found in pine plantations or scrub indicating that native forest may be a preferred habitat. Results from Unuwhao suggest that, where present, the species may be more abundant than previously thought, an aspect requiring further study. This study has also shown that pitfall trapping is an efficient means of detecting the species.

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## Forest-floor ground beetles (Coleoptera: Carabidae) of Te Paki, Northland: biodiversity and conservation

**Presentation type:** Poster Presentation

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Olivier Ball[1]*, Stephen Thorpe[2], Patrick Whaley[3]*, Andrea Booth[3]

*[1]NorthTec, [2]Landcare Research, [3]Department of Conservation*

An investigation of the forest-floor ground beetle (Coleoptera: Carabidae) fauna of the Te Paki Ecological District was initiated by deploying clusters of eight pitfall traps at three forest sites (Radar Bush, Unuwhao and Kohuronaki). Trapping was conducted on four separate occasions throughout the year during spring, summer, autumn and winter. Traps were left continuously open for one month on each occasion. Four species of carabids in two tribes (Harpalini and Broscini) were recorded. The harpalines found were *Kupeharpalus embersoni* , *Tuiharpalus moorei* and *"Parabaris" hoarei*. The broscine was an undescribed *Mecodema* species. All four taxa are Te Paki endemics. *T. moorei* was recorded at all three sites but in very low numbers. All *" P ". hoarei* and *Mecodema* sp. were recorded at Unuwhao but in higher numbers. Most *K. embersoni* individuals were recorded at Kohuronaki, but a single individual of this species was also found at Unuwhao. The lack of platynine or pterostichine carabids, even at this early stage of sampling, was surprising. The *Mecodema* species is listed as "Nationally Critical". Our data suggest that the conservation status of *T. moorei* may also need to be assessed. Further studies should clarify the conservation status of this (and other carabid) species.

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## 37-years of vegetation monitoring in Mt Aspiring National Park

**Presentation type:** Poster Presentation

John Barkla
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John Barkla[1]*, Geoff Rogers[1], Alan Mark[2]

*[1]Department of Conservation, [2]University of Otago*

We report on vegetation community trends from 89 representative permanent photopoints established in 1970 across environmental and vegetation gradients within 355 000 ha Mt Aspiring National Park. Six measurements occurred at

approximately 8-year intervals in the expectation of following vegetation recovery from the onset of aerial commercial deer recovery in the late 1960s.Non-forest communities showed consistent and sometimes dramatic increases in biomass, height, and species richness from originally highly depleted states. Forest understoreys are now dense, herb turfs in open shrubland have vanished with canopy closure, snow tussock has replaced unpalatable large herbs in low-alpine grasslands, but high-alpine communities showed little change.Two community transformations are unfolding: some previously low-alpine tussockland is now shrub-tussockland; and some previous shrubland is now scrub or low forest.Palatable woody plants have increased in subalpine shrubland as have palatable megaherbs in alpine tussockland. These are sensitive indicators of the early return of ungulates and hares to alpine communities.The recording of faecal pellets initiated in the most recent remeasurement showed only one third of photopoints with animal sign: hares were concentrated in the east; there are small numbers of deer throughout, and chamois are rare.The technique is an efficient and relatively economic method of vegetation monitoring for predominantly open vegetation across large tracts of backcountry. It has direct application to existing and potential high country parks. It can highlight trends in ecosystem services such as carbon sequestration, water supply, and altered recreational experiences. Digital image processing software may provide quantitative measures of community changes.

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### Effects of alligator weed invasion on lakeside invertebrate communities.

**Presentation type:** Oral Presentation

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Imogen Bassett[1]*, Quentin Paynter[2], Jacqueline Beggs[1]

[1]*University of Auckland,* [2]*Landcare Research*

Alligator weed is an aggressive exotic invader of waterways and damp ground. Its impacts in agricultural systems have been well documented, but little is known about its effects on native ecosystems. Invertebrate communities on alligator weed were sampled, and compared with those on two native sedges that formed the dominant native vegetation in lakeside habitats that are being invaded by alligator weed. Emergence traps and hand sorting of invertebrates from bagged vegetation were used in the study, which was conducted in lake margin vegetation in northern New Zealand. Order-level analyses detected some differences in invertebrate community composition based on vegetation type. The orders Araneae (spiders) and Hemiptera (bugs) were among those varying most markedly between plant species. Trends within these orders will be discussed in more detail.

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## Altered nutrient cycling as a novel non-target effect of weed biocontrol.

**Presentation type:** Poster Presentation

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Imogen Bassett[1]*, Jacqueline Beggs[1], Quentin Paynter[2]

*[1]University of Auckland, [2]Landcare Research*

Investigation of non-target effects of biological control agents often focuses on feeding on non-target hosts. Little is known about the potential of biocontrol agents to influence ecosystem processes such as nutrient cycling. The Alligator weed flea beetle (*Agasicles hygrophila :* Chrysomelidae) has been introduced to a number of countries to control the invasive plant Alligator weed (*Alternanthera philoxeroides*). This study investigated the combined roles of Alligator weed and its biocontrol agent in altering nutrient cycling. Seasonal changes in Alligator weed biomass were compared to those of two native sedge species, *Schoenoplectus taberneamontani* and *Isolepis prolifer* . Decomposition rates of litter from the three plant species were also compared using litterbags. Alligator weed biomass decreased by 75% between November and February due to biocontrol herbivory, whereas in the absence of biocontrol senescence is typically more gradual and occurs in cooler months. In contrast, neither native sedge species showed such rapid or substantial changes in biomass. Furthermore, alligator weed litter loss from litterbags was significantly faster than that of either native sedge species. Thus, relatively large amounts of nutrients may be released over a short period of time. Sudden availability of nutrients and open space during other plants' growing season may lead to ecosystem effects, including facilitation of further weed invasion. Our data therefore suggests that alligator weed and its biocontrol agent have the potential to alter nutrient cycling in invaded ecosystems.

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## Changes on islands: seabirds, predators, and the importance of history

**Presentation type:** Oral Presentation

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Peter Bellingham[1]*, Dave Towns[2], David Wardle[13], Janet Wilmshurst[1], Christa Mulder[4]

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New Zealand's offshore and outlying islands have been a focus of conservation biology as last refuges for many species and as sites of local endemism. As recently as the 1960s, mammalian predators invaded islands and caused complete extinctions. By the late 1980s, translocations of birds to predator-free islands to safeguard against extinctions were well underway. New Zealand has led international efforts in island restoration; by the late 1980s, introduced herbivores on islands, such as goats, and some predators (cats) had been eradicated from some

remote islands. A breakthrough in island restoration in the mid-1980s was eradication of rats from small forested islands. The technology pioneered there has been refined since so that dozens of islands, including remote Campbell and Raoul Islands, are now free of rodents. New Zealand is an acknowledged world leader in island restoration. Restoration technology has vaulted ahead of ability to predict the ecosystem consequences of restoration. Most New Zealand islands, especially those without predatory mammals, are home to large numbers of breeding seabirds. We now have better knowledge of how seabirds influence ecosystem processes on islands through enhancing soil fertility and disturbance by burrowing. We also understand how predators, especially rats, alter ecosystem processes, and cause population reductions or extinctions of native animals and plants. Islands have been upheld as touchstones of a primeval New Zealand. A view is now prevailing that most islands have been substantially modified since human settlement of New Zealand. Acknowledgement that islands have been important mahinga kai for Mâori has led to better understanding of how people have modified many islands. Current research is directed to helping make better decisions about restoration and management of islands that take account of island history and key drivers of island ecosystem function.

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### Seed bank dynamics of New Zealand forest and shrubland ecosystems

**Presentation type:** Oral Presentation

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Craig Bishop[1]*

[1]*Golder Associates*

Many plant seeds have mechanisms to delay germination after dispersal from their parent plant. These seeds are incorporated into the soil seed-bank, which has been shown to be an important factor in the dynamics of some plant communities. Seed banks also contribute to the overall genetic diversity of a particular plant species. However, the small number of published seed-bank studies carried out in New Zealand over the past 25 years or so suggest the role of soil seed-banks in the regeneration of New Zealand forest communities is not of primary importance. That is, seeds of most indigenous forest plants have only a transient presence in the soil seed bank. This paper will present previously un-published seed-bank data the author has collected from three different forest and non-forest New Zealand ecosystems; coastal kanuka forest, frost flat heathland, and indigenous ‘grey’ shrubland. The results will be compared with data from previously published seed bank work. Discussion will focus on assessing the general characteristics and importance of seed-banks to the ecology of New Zealand shrubland communities, comparing seed banks in forest and shrubland ecosystems, and possible areas to focus future research.

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## Genetic restoration of pateke; assessing the extent of genetic diversity loss though captive breeding

**Presentation type:** Student Day

Gemma Bowker-Wright
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Gemma Bowker-Wright[1]*, Ben Bell[1], Peter Ritchie[1], Murray Williams[1]

[1]*Victoria University of Wellington*

Pateke (brown teal/ *Anas chlorotis*) have experienced a severe population crash leaving only two remnant wild populations (at Great Barrier Island (GBI) and Mimiwhangata, Northland). Recovery attempts have focused on an intensive captive breeding program which breeds pateke (sourced from GBI) for release into re-established populations. While this important conservation measure may have increased pateke numbers, it is unclear how much of their genetic diversity is being retained. The goal of this study is to determine the current levels of genetic variation in captive and wild populations of pateke. Feathers were collected from pateke at GBI, Mimiwhangata, the captive breeding program and four re-established populations (Coromandel, Mana Is., Karori Sanctuary, Tiritiri Matangi Is). DNA was extracted from the base of the feathers, the mitochondrial DNA control region was sequenced, and DNA microsatellites markers were used to genotype individuals. The GBI population, the captive breeding populations and all four re-established populations were found to have the same mtDNA haplotype. In contrast, the Mimwhangata population contained genetic diversity and 5 haplotypes were found, including the GBI haplotype which was introduced by captive-bred releases in early 1990. There is no haplotype diversity within the GBI population, and since all the captive breeding stock has been sourced from there, similarly there is no diversity at this level in the re-established populations. Historically, the GBI population may have been very small. Ongoing work will determine if there has been a further loss of genetic diversity at microsatellite level as a consequence of the captive breeding program. This research may assist DoC's Pateke Recovery Group to maintain a broader representation of genetic diversity in the captive breeding program.

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## Effects of land cover type on indigenous forest birds in Canterbury

**Presentation type:** Oral Presentation

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Eckehard Brockerhoff[1]*, Marc Deconchat[2], Luc Barbaro[2], Sabrina Luecht[1], James Muir[1], David Henley[1], Thomas Paul[1]

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Forest loss and fragmentation are significant concerns for biodiversity, and they are partly responsible for the decline or extinction of numerous forest birds. In New Zealand, Banks Peninsula, the Canterbury Plains, and parts of the Canterbury Foothills have lost most of their natural forest cover although

there has been considerable regeneration of shrubland on Banks Peninsula and much planting of exotic trees throughout. Since 2005 we have conducted about 900 point counts in 25 sample landscapes measuring 5 by 5 km that varied in forest cover from almost none to over 80%. Land cover types we surveyed included native forest or shrubland, exotic forest, pure grassland, and mixed farmland with open areas and some tree cover. Preliminary analyses indicate that the richness of native forest bird species was highest in native forest and shrubland, followed by plantation forests in areas where native forest is present. On the Canterbury Plains, some native forest birds were present in plantation forests, mainly fantails, grey warblers and shining cuckoos, whereas only exotic birds were found in pure grassland (pasture). The results will be discussed with regard to bird conservation in regions that experienced considerable forest loss.

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## Impacts of invasive invertebrates on New Zealand's indigenous ecosystems

**Presentation type:** Oral Presentation

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Biological invasions have significantly affected New Zealand's indigenous species and ecosystems. Most prominent are the effects of invasions by non-indigenous mammals and plants whereas few invasive invertebrates are known to have major effects on indigenous ecosystems, apart from the well-known case of *Vespula* species. This is surprising because over 2000 non-indigenous invertebrates are established in New Zealand, among them many pests of (non-indigenous) crop plants. Furthermore, overseas numerous non-indigenous invertebrates have invaded forests and other indigenous ecosystems where many have become important pests. An overview will be given of known invasions by non-indigenous invertebrates and several examples will be explored, including defoliators, wood and bark borers, *Vespula* wasps, and parasitoids introduced for biological control. Several hypotheses have been proposed to explain the comparative scarcity of such invasions that affect New Zealand's indigenous ecosystems. These hypotheses will be summarised, and recent advances in our understanding of invertebrate invasions will be highlighted.

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## Heteroblasty in the Chatham Islands: reversion to homoblasty in the absence of moa?

**Presentation type:** Oral Presentation

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We tested for reversions to homoblasty in Chatham island plants that are heteroblastic in New Zealand. Leaf heteroblasty, or abrupt changes in leaf morphology during plant development, is hypothesised to be an adaptation to avoid damage caused by large browsers. New Zealand, New Caledonia and Madagascar have unusually high incidences of heteroblasty and all three archipelagos were once home to large, avian browsers. The Chathams are a group of small islands located 800 km off the east coast of New Zealand that have clear floristic links to New Zealand. However, unlike New Zealand, the Chathams never housed large browsers. We hypothesized that morphological differences between adult and juvenile leaves would be less pronounced in the Chathams and tested this hypothesis with field measurements and by conducting a glasshouse experiment. Reversions to homoblasty were observed in all four species investigated. Results were therefore consistent with bird browsing as a explanation for leaf heteroblasty on isolated islands.

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## Avian malaria in New Zealand saddlebacks living on Mokoia Island, Lake Rotorua.

**Presentation type:** Oral Presentation

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Avian malaria is responsible for the extinction of 32% of endemic Hawaiian birds and for keeping 62% of the remaining species at risk. Recent deaths from epidemic outbreaks of malaria in South Island saddlebacks and Mohua have sparked New Zealand's interest in this disease. Our study is the first to establish the prevalence, distribution, taxonomy, and vectors of avian malaria at a single location, Mokoia Island, in NZ. We report results from the first three surveys in January, May and October 2007. PCR was used to detect malarial parasites from blood samples. Malarial strains were identified by sequencing. The prevalence of *Plasmodium* in saddlebacks was low between 3.8% and 7.8%. Known birds changed infectious status between surveys suggesting that they may suffer chronic infections. *Haemoproteus* spp. was found in tui at a prevalence of 23.5%. Possible mosquito vectors (*Aedes notoscriptus ; Culex quinquefasciatus , Cx. pervigilans and Cx. Rotorua*) were caught in CO 2 traps although in low numbers. We argue that

our results reflect an evolutionary history between saddlebacks and malaria. Epidemic malaria outbreaks such as the ones in the South Island may result from birds confronting malaria strains for which they have no immunity to or to the combined effect of new (introduced) malarial strains, bottlenecks and small population sizes. To effectively manage avian malaria outbreaks in the wild, we need to learn about the distribution of malarial strains and their vectors; confirm the taxonomy of the malarial strains found so far; and investigate the epidemiology and pathogenicity of these parasites.

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**Phylogeography, morphology and reproductive behaviour of ground weta (*Hemiandrus pallitarsis*).**

**Presentation type:** Oral Presentation

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Ground weta (Anostostomatidae*: Hemiandrus*) are one of the most speciose and widespread group of ensiferan orthopterans in New Zealand. They are flightless, nocturnal insects which spend the day in burrows in the ground. In New Zealand there are currently nine named species and more than twenty eight undescribed species of *Hemiandrus* , and several *Hemiandrus* species are known from Australia. *Hemiandrus pallitarsis* (formerly *H. furcifer* Walker) is a widespread species, recorded through the lower North Island and is found in several locations further north, including on some of the islands east of the Coromandel Peninsula. This species of ground weta is unusual in that the 6th abdominal sternite of females is modified into an elaborate elbowed structure that is thought to have evolved under sexual selection to acquire nuptial gifts from males. Variation in the size and shape of this structure, as well as several general morphological measurements and sequence data from the mitochondrial genome (COI), was used to examine the phylogeography of *H. pallitarsis* in order to test hypotheses that: 1) genetic differences would exist between geographic locations; 2) these genetic differences would correspond to known geological events; and 3) phenotypic divergence will reflect the genetic divergence within and between populations. Preliminary results of this study will be presented.

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## Soil fertility and ecosystem development in New Zealand

**Presentation type:** Oral Presentation

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The process of ecosystem development is driven to a significant extent by changes in the inputs, outputs and bioavailabilty of phosphorus and nitrogen in the soil. Most soil parent materials are rich in readily-soluble primary phosphorus minerals (apatite), and initial plant establishment and succession is therefore dominated by nitrogen-fixing legumes. Subsequent phosphorus loss via drainage combined with chemical and biological transformations of soil phosphorus mean that later stages of ecosystem development are characterised by increasing phosphorus limitation. This presentation will describe recent detailed studies of phosphorus and nitrogen biogeochemistry in two different chronosequences developed under temperate rainforest vegetation at Franz Josef (c. 120,000 years) and Haast (c. 6,000 years). Both sequences demonstrated a rapid decline in topsoil phosphorus with concomitant increases in phosphatase enzyme activity and the ratio of nitrogen to phosphorus in the microbial biomass. Levels of organic phosphorus in soil increased steadily during the initial stages of development, and declined slowly thereafter. However, the proportion of total organic phosphorus present as inositol hexaphosphate, conventionally considered to be recalcitrant in the soil environment, declined markedly in the older soils, while relative amounts of more readily bioavailable deoxyribonucleic acid organic P increased continually over time. These unexpected temporal changes in the nature of soil organic phosphorus were attributed to a combination of shifts in plant and soil microbial communities and changes in soil mineralogy linked to podzol development.

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## The kiwi bill-tip organ - a new prey-detection system for kiwi?

**Presentation type:** Oral Presentation

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Kiwi are traditionally assumed to detect their soil-dwelling invertebrate prey using their sense of smell. However, studies of prey-detection by kiwi using smell alone have produced mixed results. Shorebird species that forage by probing find their prey using specialised vibration/pressure-sensitive nerve

endings located in pits in the bill-tip. This specialised system allows them to detect prey without physically touching it with the bill (known as “remote touch”). We studied kiwi foraging patterns using probe-holes as an indicator of foraging activity, because direct observation of these secretive nocturnal birds is very difficult. Results showed that aspects of the foraging patterns of North Island brown kiwi (*Apteryx mantelli*) are like those of some shorebirds, suggesting that kiwi may use a similar prey-detection mechanism. We examined the bone structure of the bills of all five kiwi species and examined the tissues of the bill of North Island brown kiwi. We found that kiwi possess an arrangement of sensitive nerve-endings within pits in the bill, similar to those found in shorebirds. They may therefore be able to localise prey using a similar “remote touch” sense, which may function in conjunction with, or be dominant over, olfaction. Because kiwi and shorebirds come from widely separated lineages, this may be an example of convergent or parallel evolution.

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### Changes in plant species composition in New Zealand’s South Island tussock grasslands over two decades

**Presentation type:** Oral Presentation

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New Zealand’s South Island tussock grasslands are highly modified, largely due to agricultural development, introduced pests, and invasion by exotic weeds. As part of the Tenure Review process, many areas have recently been retired from grazing. This is likely to result in significant changes in the vegetation; however, what these changes will be is unclear. This research investigated changes in tussock grassland vascular plant communities that have occurred since the 1980’s in Otago and Canterbury. We used data collected from 90 permanently marked transects to assess spatial and temporal changes in plant species composition. Transects represented land in both conservation and pastoral tenure. A cluster analysis (two-way indicator species analysis: TWINSPAN) identified four compositionally different communities present in these 90 transects, which were strongly related to elevation. A refined data set, containing only transects that represented short- and tall-tussock grassland communities, was analysed using ordination (detrended correspondence analysis). The nature of compositional change over time was weakly related to the property a transect was located on, or whether it was in a short- or tall-tussock grassland community. Changes in composition were not related to tenure. These results indicate that changes in plant species composition in the South Island’s tussock grasslands are complex and unpredictable at the spatial and temporal scales examined.

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## Numerical frameworks used to prioritise areas for biodiversity management in the Waikato region

**Presentation type:** Oral Presentation

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Environment Waikato aims to prioritise areas in the Waikato region, based on different ecosystems for biodiversity management. The primary object of this project is to develop a GIS-based methodology that incorporates the existing spatial information, and to assign a biodiversity "score" to spatial units derived from their contributions to national and regional biodiversity goals. The two numerical frameworks are both based on quantitative and qualitative parameters that were set up in complementary to make priority settings more systematic and explicit and to justify a baseline for biodiversity monitoring with community outcomes in the Waikato region. The first numerical method is to rank different ecosystems, by allocating scores to each ecosystem within the Nationally Significant Areas using GIS data inventories. Scores are given according to the following criteria: indigenous vegetation cover; threatened environment; extinctions; rarity of ecosystem; diversity; naturalness; ecosystem condition; protection level; vulnerability; and funding support. Of these, indigenous vegetation cover, threat of extinction and vulnerability, all play important roles in the priority setting process. The scores are then combined for each candidate, and the ecosystems are ranked to compile a priority list. The higher ranked ecosystems are then plotted in the spatial scale, and a picture of the most significant areas representative of the region's ecosystem can be plotted. The second method is to set biodiversity indicators after the priority areas have been decided, and this is achieved by establishing biodiversity indicators in the Waikato region, for further measurements of biodiversity levels at the spatial scale. This framework includes four main areas: status and trends of the components of biodiversity; sustainable use; threats to biodiversity; and ecosystem integrity. Each of which encompasses a number of indicators for assessing progress towards the biodiversity target at regional and national levels.

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## Fungal communities: small-scale drivers of large-scale ecosystem processes

**Presentation type:** Oral Presentation

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Subtle differences in fungal community composition, and even the order in which species arrive can have dramatic effects on ecosystem outcomes. This directly questions the validity of focusing ecosystem research solely on broad functional groups,

such as saprotrophs or mycorrhizas. We present two studies. First, we present data suggesting that it is the community composition of ectomycorrhizal fungi that drives *Pinus* invasion of grasslands, where native *Nothofagus* has been slow to establish. Molecular examination of *Pinus* contorta roots using T-RFLP (Terminal restriction fragment length polymorphism) and DNA sequencing shows that Pinus is co-invading New Zealand largely by associating with North American and European fungi, and that it is these particular species of fungi that permit *Pinus* to be invasive, both in New Zealand and elsewhere around the globe. We then switch trophic levels to examine wood decay fungi, and show that not only fungal species composition, but even the order in which those species arrive can determine ecosystem outcomes. Simply varying the order in which 10 fungal species are inoculated onto wood disks in microcosms results in significant changes in decomposition, substrate stoichiometry, carbon respiration rates, and ecosystem responses to nutrients. Wood decomposition is a key determinant of nutrient cycling and carbon fluxes in forests and we show that these processes can be controlled by the order of arrival of specific taxa within broad functional groups. Both studies suggest that species composition at fine scales and assembly history can have dramatic effects on ecosystem level outcomes.

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### The root systems of selected New Zealand short tussock grassland species: description and functional classification

**Presentation type:** Oral Presentation

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The underground competition of roots is thought to be a key interaction shaping grassland ecosystems but is generally poorly understood in semi-natural ecosystems. Root system architecture or morphology is related to many of the functions of roots and therefore the competition between individuals. The use of morphology as a soft trait in functional classifications is generally accepted where more detailed data is not yet available. Based on morphological descriptions of the root systems of 35 New Zealand short tussock grasslands species, three published root morphological classification systems are evaluated. Based on this, a revised functional root classification is proposed for New Zealand tussock grasslands involving seven classes; fibrous roots, rhizomatous or stoloniferous roots, long dominant tap root, tap root with dominant deep laterals, short tap root with shallow laterals, weakly rooted and cryptograms. Application of this to a Mackenzie basin tussock grassland system indicates that plants with a short tap root and shallow lateral roots are significantly more abundant in modified vegetation at lower altitudes, in contrast with plants that have a long dominant tap root or a tap root with dominant deep laterals which are significantly more abundant in unmodified vegetation at higher altitudes. Rhizomatous or stoloniferous rooted plants are the only class not to demonstrate strong trends across environmental or management gradients, having highly variable abundance.

## Urban realities: converting urban gardens from sinks to sources in urban plant conservation

**Presentation type:** Oral Presentation

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Urbanisation has destroyed and fragmented previously large areas of habitat. Many of the small remnants that still exist in numerous cities will be unable to sustain many viable plant populations without expanding these populations into the surrounding urban matrix. Residential domestic gardens form a significant component of urban green space in many cities and therefore could play a role in redressing this problem. Our ecological and social study examined the factors influencing the dispersal and regeneration of 12 bird-dispersed native woody species from Riccarton Bush, an urban 7.8 ha forest remnant, into surrounding residential properties in Christchurch, New Zealand. Over 125 years, the reported number of native vascular plants in the bush has declined by a third. Presently, some species, particularly kahikatea (*Dacrycarpus dacrydioides*), the dominant emergent canopy tree in the bush, are being dispersed by birds into residential gardens primarily within 250 m of the forest margin. Although germinating, these juveniles are not surviving to reach maturity in gardens as most gardeners frequently remove all non-planted woody species. This suggests that natural processes alone will not create self-sustaining populations and a different approach which involves the active intervention of people is required. In Christchurch, this is including the restoration of habitat on other public lands and making locally sourced native plants available for gardeners. Our results show that people are willing to plant woody species if provided with plants, information, and, most importantly, control over the location of plantings. Increasing plant sales from specialist native nurseries and increasing media attention on the use of natives in gardens show that attitudes are changing towards natives. Residential gardens have the potential to play a huge role in the conservation of urban plant species so long as the everyday lives of residents are understood and respected.

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## Regeneration gaps and vegetation change in New Zealand forests: earthquakes and climate

**Presentation type:** Oral Presentation

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A feature of New Zealand forests that has long puzzled ecologists is the over-abundance of mature conifer trees and the lack of small to intermediate sized trees over large regions. This lack of recent conifer regeneration was termed the ‘regeneration gap’ and was attributed initially to a changing

climate that favoured conifer regeneration in the past but not recently. By the 1980's many ecologists had recognised the role that major disturbance plays in initiating conifer regeneration, and had pointed out that 'regeneration gaps' are a consequence of recruitment following infrequent stand-initiating disturbances. Nevertheless, in the South Island at least, the puzzle remained as to why stands of mature trees were so widespread. Here I update progress over the last two decades in answering that question, focussing on the role that massive Alpine Fault earthquakes have played in structuring forests of the South Island.

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## The effect of pest control on the regeneration of canopy and understorey species at Acker's Point, Stewart Island

**Presentation type:** Poster Presentation

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Changes in the regeneration pattern of canopy and understorey species following pest control was investigated at Acker's Point, Stewart Island, New Zealand, using twelve 25m 2 permanent vegetation plots. Density of seedlings increased almost four times and saplings more than three times, with density of large seedlings (45-135 cm height class) and saplings being significantly ($P<0.05$) higher than pre-control values. Similarly, species diversity of large seedlings and saplings more than doubled. Amongst the seedling and sapling species, *Coprosma areolata* was the most dominant, post control, comprising 79% of all seedlings, though only 32% of all trees recorded belonged to this species. The only gymnosperm seedling recorded was a *Prumnopitys ferruginea* seedling. The marked increase in abundance of seedlings and saplings was a clear indication of the positive effects of pest control on regeneration of native species though the relative abundance of juvenile *C. areolata* could be due to reduced densities of more palatable species and subsequent reduced competition or possibly because it is better adapted to browsing

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## Extending the use of humane, low residue, mulitspecies control tools

**Presentation type:** Oral Presentation

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Conventional control targets single species and is sometimes associated with non-target impacts, welfare concerns, fluctuating pest numbers and unexpected ecological

consequences. In future we will need to increasingly focus on formulations and toxins that are effective at killing pests but also less hazardous to other wildlife, and have more acceptable welfare profiles. Responding to difficulties with 1080 and brodifacoum in terms of secondary poisoning and persistence, cholecalciferol (Feracol®) and diphacinone (RatAbate®) have been registered for field use. In addition, zinc phosphide and a combination of cholecalciferol and coumatetralyl are being developed to provide more effective multispecies control. Feratox® was first registered in 1997 and provides a humane kill of possums without secondary poisoning risk. Research will be reported on initial progress towards Feratox® for Dama and Bennett's wallabies, ferrets, foxes in Australia and pigs. There is a major challenge in developing formulations of cyanide for humane culling of species other than possums. In parallel we are pursuing the registration of para-aminopropiophenone (PAPP) – a new poison undergoing field trials for humane control of stoats and cats. PAPP and alternative red blood cell toxicants are being explored for other species. We have the ability to choose compounds that have limited residue and welfare concerns and are targeted at specific species or groups of pest species based on formulation technology or selective toxicity. Finally, improved baits more effectively targeting possums, rats and mice are being developed with conventional and new toxicants. The development of new formulations and new vertebrate pesticides is part of the Smart Pest Control (SPC) product development and registration pipeline. We are making headway with new tools being developed for safer, humane and more effective control of rodents and other vertebrate pests.

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## Protecting islands from rodent (re)invasion – evaluation of long-life baits and bait station types

**Presentation type:** Oral Presentation

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Subsequent to successful eradication of introduced rodents from offshore islands, effective detection and prevention of rodent reinvasion is essential to maintain 'rodent free' status. Bait stations containing toxic anticoagulant baits may be deployed as sentinels, especially on remote islands. To be most cost-effective as a detection and prevention measure against arriving rodents, baits need to retain high acceptability and efficacy over relatively long periods and the station design needs to be one that rodents will readily enter and consume bait from. We conducted laboratory trials with wild-caught ship rats (*Rattus rattus*), Norway rats (*R. norvegicus*) and house mice (*Mus musculus*), to investigate relative acceptance and efficacy of commercially-available bait formulations. Individuals of all three species were presented with one of six different bait formulations and a familiar, non-toxic palatable food in a two-choice test over 10 nights. Contrac® All Weather Blox and Pestoff® Rodent Blocks had the highest acceptance and efficacy and were used to test acceptability of weathered bait. Individuals of the three species were presented with a two-

choice of non-toxic food and bait had been weathered for 1, 3, 5, 8 or 12 months. Acceptance by mice and ship rats remained high over time, despite the presence of surface mould on the baits from 2 months onwards. Acceptance of weathered baits by Norway rats was reduced at all time points tested. In separate pen trials, the behavioural responses of wild-caught ship and Norway rats to four different types of bait station were monitored. All bait stations contained the same bait type (non-toxic Pestoff® Rodent Bait Block) and the responses of the rats were recorded using a time-lapse video recorder under low white light, and the tapes analysed to determine time to first approach, time to first entry, duration of first entry, and frequency and duration of subsequent entries. We also calculated the amount of bait eaten. Overall, the 'yellow plastic pipe' or 'wooden motel' station types were considered the most suitable for surveillance of ship and Norway rat presence.

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## Not just little rats – optimising toxic baits for house mice

**Presentation type:** Oral Presentation

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As effective techniques for broad-scale control and island eradication of rats have become more established and widely applied, a relative lack of parallel methods for house mice is highlighted. In cases where 'multiple pest' operations in New Zealand have controlled mice effectively, the reasons for success are not well understood. Where such control is not effective against mice, their populations may then benefit from the removal of rats. As most toxic bait applications have been developed to target possums, and more recently rats, it is timely to investigate factors that influence encounter, acceptance and efficacy of toxic baits in mice. A series of ongoing laboratory trials with wild-caught mice is being undertaken. The effect of factors (toxin, cereal type, pellet size, presence of dye or cinnamon lure) on the uptake of pellet baits by mice was screened in a factorial design incorporating paired choice against a standard food over 10 days. Toxin was the only factor that significantly influenced acceptance; mice clearly avoided eating bait containing 0.15% 1080 but not those with 0.002% brodifacoum. Further trials found; (i) very low acceptance and only 25% mortality from baits containing 0.08% 1080, (ii) significantly higher acceptance of non-toxic food over food containing a low concentration (0.001%) of 1080 (iii) prefeeding for 3 days with non-toxic pellets did not affect the very low acceptance of 0.15% 1080 pellet baits. Interestingly, mice in these trials responded to the introduction of 1080-treated food by significantly decreasing their intake of all food for 2 days, then gradually increasing their intake (mostly non-toxic food) back to daily amounts similar to those measured pre-1080, and by control mice. Avoidance of 1080 by mice appears to be mediated by one or both of taste and conditioned taste aversion. Further trials are planned to investigate whether 1080 can be 'disguised' in bait presentations to overcome the avoidance response, and to further investigate the influence of

small bait size ('portability') and previous food experience on acceptance of pellet baits.

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## Are deer moas? impacts of introduced deer in New Zealand forests

**Presentation type:** Oral Presentation

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There has been much debate about the extent to which the impacts of introduced deer on native vegetation have replaced those of moas. Batcheler (1989: 57) concluded that '... on easier low altitude country, their (i.e., moa) feeding pressure would have been equivalent to that exerted by the introduced mammals.' Since the 1980's there have been major changes in thinking about the impacts of introduced ungulates and ratites on vegetation. First, although it has long been known that deer preferentially eat fast-growing angiosperms that colonise disturbed fertile sites, it has recently been shown that the foliage of those preferred species contains lower concentrations of fibre than avoided species. Second, analyses of long-term permanent plot data indicate that those preferred species are failing to regenerate in nearly all forest types where ungulates are present. Third, recent experiments have shown that ungulates and extant ratites have more similar feeding preferences than previously believed. Fourth, overseas work has emphasised the role of ratites as seed dispersers in forests, but there is no evidence of a similar role for ungulates in New Zealand. We conclude that the impacts of deer and moas on vegetation have been markedly different. Pollen analyses of soil cores from extant forests in New Zealand can test our conclusion by quantifying changes in the relative abundances of preferred and avoided understorey taxa before and after moa extinctions, and following the introduction of deer.
Reference: Batcheler, C.L. 1989. Moa browsing and vegetation formations, with particular reference to deciduous and poisonous plants. New Zealand Journal of Ecology 12 : 57-65.

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## Motu Kaikoura - degraded avifauna diversity the result of fallow deer?

**Presentation type:** Oral Presentation

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Motu Kaikoura, located on the western side of Aotea/Great Barrier Island in the Hauraki Gulf, was purchased as a scenic reserve for the public of New Zealand in 2004. The island has a rich history of human occupation with an associated legacy of

ecological degradation. Much of the 564 ha island is covered by a relatively low, but dense, canopy of kanuka, manuka, gorse and Hakea , with emergent pines dominating the south-eastern slopes. The low vegetation diversity of the island is the result of failed farming ventures and the impact of at least 70 years of browsing by deer, pigs and goats. Rats, mice and feral cats are also present on the island. Surveys and observations carried out 2006 indicate that the bird diversity and abundance is low on Motu Kaikoura. A comparison with the avifauna of other Gulf islands at a similar pre-restoration stage suggests that this low status of bird diversity can be attributed largely to the impact of fallow deer. A 'minimal interference' ecological restoration strategy adopted for the island offers an opportunity to assess these impacts as the mammal species are progressively eradicated.

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## People and urban land cover explain the number and composition of the naturalised plants of New Zealand.

**Presentation type:** Oral Presentation

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The naturalisation and subsequent spread of exotic species is a major problem for most regions of the world, including New Zealand. Managing plant invasions requires greater understanding of why some regions have more naturalised species. We compiled a comprehensive list of the seed plant species naturalised in New Zealand by 2000, and determined which of 10 New Zealand regions each species had been recorded in. We collated land uses and populations, and regional mean values for environmental variables, such as mean annual temperatures, mean vapour pressure deficits, and elevations. We examined the effects of these variables on the number of naturalised species found in each New Zealand region, using generalised linear models (GLM) with gaussian distributions. We also examined the effects of the same variables on species composition, using non-metric multidimensional scaling (NMDS). Of the 1773 fully naturalised plant species in New Zealand by the year 2000, Northland/Auckland and Canterbury regions each had about 65% and at the other end of the scale, Southland and Westland regions each had about 28%. As expected, regions with more people and built areas had more species. Temperature was the most significant predictor in explaining the dissimilarity of species composition between regions. Urban cover, populations and cropland cover were also significant. The most dissimilar are Northland/Auckland and Canterbury, with Northland/Auckland being more similar to Waikato/Bay of Plenty and Wellington, and Canterbury being more similar to Otago and Nelson/Marlborough – both regions have much smaller populations. With global warming and changes in land cover, compositions of species in regions are likely to change.

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## National Biodiversity Metadata database

**Presentation type:** Poster Presentation

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Many agencies-from government departments to community groups-collect biodiversity data through inventory and monitoring projects. Projects come and go. Some are completed and closed. Others continue over long periods and new projects are established. The metadata from all these projects needs to be catalogued and stored in a national repository to ensure managers, researchers and the general public can easily access past and present research to inform their planning and work. Currently there is no such national system, and this project aims to provide national repository for metadata of biodiversity projects.

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## Why are New Zealand invertebrates different?

**Presentation type:** Oral Presentation

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Today's biota is a product of its history, not only the last 7000 years, but more probably the last 7 million or 70 million. Since the Oligocene, the New Zealand archipelago has been subjected to major geological and biological upheavals that have been responsible for numerous special characteristics that we admire now. Within the animals, invertebrates are no less susceptible to upheaval than vertebrates, possibly more so due to their rapid turnover and ectothermic requirements, but the evidence of our past invertebrate life is truly pathetic. Because of a dearth of fossils, speculation about past history must come largely from interpretation based on today's living fauna. This paper reviews landscapes of the past and considers the biotic and abiotic factors that might have influenced the nature of the fauna, critically examines the fossil data, and makes some bold claims as to what has been driving the changes.

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## Diphacinone bait for ground control of rats on the mainland conservation estate

**Presentation type:** Oral Presentation

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The objective of this project was to test the field efficacy of the first-generation anticoagulant rodenticide diphacinone (at a concentration of 0.05 g/kg) in Sentinel™ blocks and Pestoff® 50D pellet baits using currently accepted best practice rat control techniques at Mapara, Whirinaki, Trounson, Moehau and Boundary Stream, New Zealand. The Sentinel™ blocks effectively controlled rats to below target indices of abundance at Mapara and Whirinaki after two baiting rounds. The inclusion of Feratox® capsules in the Sentinel™ blocks not only offset the problem of possum interference with the baits, but also reduced possum abundance at the Whirinaki site. The Pestoff® 50D pellet baiting operation at Trounson successfully (and repeatedly) controlled rats to below target indices, and at Boundary Stream continued to suppress rats to non-detectable levels. However, at Moehau, the Pestoff® 50D pellet baiting operation failed to reduce rat abundance, possibly because of interference by possums.

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## Ecological toxins and public tipping points: lessons from the 1080 re-assessment

**Presentation type:** Oral Presentation

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The ERMA decision in August 2007 to approve the continued use of Compound 1080 (sodium fluoroacetate), albeit with additional controls, might tempt management agencies to adopt a ‘business as usual’ approach. That could turn out to be a risky strategy. A major operational mistake, or malevolent behaviour by opponents, could be manipulated into an ‘outrage’ and tip public support for 1080 into strong opposition. The ERMA hearings on 1080 were the most extensive and exhaustive ever held on any HSNO Act application. They revealed a deep divide over the aerial use of 1080 between the pro- and anti-1080 factions, despite the science which indicated benefits outweigh the risks. The two factions agreed only on their wish to protect indigenous biodiversity, but at least agreement on the ‘protection’ goal provides the basis for dialogue, even if the means are strongly disputed. That dialogue has yet to take place.I will argue that the lessons from the 1080 hearings have both social and ecological implications for future use of 1080 and other ecological toxins. Potential public tipping points against aerial 1080 (or its successors) will be averted not by just promoting the science around 1080 use, but from constructive engagement at community levels over the goals and means of achieving shared conservation objectives. A

second lesson was that ecologists need to do more to reduce remaining uncertainties around ecological risks, thereby strengthening public support. They also need to do a better job of researching and monitoring the ecological benefits of aerial 1080 use. While much work has been done with respect to benefits, it needs a more experimental approach in a range of different areas, as well as integration with other studies on forest ecosystems and key species. Subsequent generations of toxins are more likely to be accepted if benefits can be more rigorously demonstrated.

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## Multiple time constraints across habitats lead to life history specialisation in a temporary pond caddisfly

**Presentation type:** Oral Presentation

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Populations that span environmental gradients are exposed to contrasting selection pressures, and phenotypic plasticity often facilitates persistence along the gradient. The caddisfly Asynarchus nigriculus differs from this scenario in that it exhibits fixed development traits across habitats that appear to differ in the strength of selection on those traits. In ephemeral ponds at our study site in Colorado, mortality associated with early drying should exert strong selection pressure for rapid development. Surprisingly, development is more rapid in late-drying ponds where there are no abiotic time constraints. In these ponds, the appearance of predatory larvae of a beetle (*Dytiscus*) coincides with pupation and emergence. Laboratory experiments provide evidence that the last two instars of beetle larvae pose a significant threat to *Asynarchus* larvae, but that threat declines after the caddisflies pupate. Rapid development in late drying ponds also facilitated asymmetric intraguild predation on a later developing caddisfly species (*Limnephilus externus*). Thus, multiple biotic time constraints should select for rapid development in Asynarchus in late drying ponds where there are no physical time constraints (drying). Surprisingly, we did not observe antipredator responses (reduced activity, large cases, and accelerated development) by *Asynarchus* to *Dytiscus* , suggesting that the high activity level and minimal investment in cases that facilitates rapid development is a fixed trait across habitat types. We propose that predictable abiotic and biotic time constraints across multiple habitats have led to fixed rapid larval development in Asynarchus across a range of habitats, rather than the phenotypic plasticity observed in other species.

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## Tastes like home. regional patterns of adaptation by specialised arthropod herbivores of *Cordyline australis* : plant genetics or host quality?

**Presentation type:** Oral Presentation

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Local adaptation leading to higher performance on local hosts is a well known pattern that occurs in many host-parasite systems. This pattern has been observed at individual, population and regional scales; and is demonstrated by herbivorous insects performing better on local than on foreign host plants. It is expected that by specialising on local hosts, insects increase their mean fitness, and may experience a trade-off leading to reduced performance on foreign hosts. We investigated patterns of regional adaptation by arthropod monphages of the endemic New Zealand cabbage tree, *Cordyline australis* (Agavaceae). The phylogenetic structure of *C. australis* populations has three genetically distinct groups following a latitudinal gradient; Northern, Mid-latitude, and Southern. We sampled specialist and generalist insects from 13 genotypes of *C. australis* trees from across the three phylogenetic groups, all of which were grown under uniform garden conditions at two sites located at Lincoln and Auckland. We predicted more instances of local adaptation by insects in the Northern region where forest persisted through the ice ages. At Lincoln we found evidence for adaptation by monophages onto regionally local trees, with a trend of increasing abundance with increasing genetic similarity. However, contrary to our predictions, in Auckland only endophagous *Lepidoptera* were found to be locally adapted. Our results suggest that monophagous arthropods of cabbage trees are able to track fine-scale genetic variation in their host. These patterns are being explored using rearing experiments to tease out the effect of host quality versus genetic variation in contributing to patterns of local adaptation.

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## Taking a step back: historical disturbances as indicators of current and future forest dynamics

**Presentation type:** Oral Presentation

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Identifying the scale and magnitude of historic disturbance events is critical for understanding current forest dynamics. Failure to recognize historic disturbance events can result in inaccurate and potentially misleading conclusions regarding the stable age structure, recruitment profile and species composition of forests. In addition, reconstructing historic disturbances may improve predictions of future disturbance

regime changes resulting from climate change. Dendrochronology has been used extensively to identify historic disturbances; however, current methods can be highly subjective. We developed a new method to identify disturbance events that reduces bias and controls for species and site specific sensitivity. The effectiveness of the method in identifying between disturbance agents (earthquake, volcanic, wind, snow, and flood) was tested using dendrochronology records from 102 sites throughout New Zealand. Published disturbance records were used to validate disturbances identified in the dendrochronology records. We were able to identify three disturbance agents (earthquake, volcanic, and wind), the origins, extent, and intensity. Ability to detect disturbance events depended upon proximity of the disturbance origin to sample sites and disturbance intensity. The method has several promising implications, including identifying changes in disturbance regime (type, frequency, and intensity) through time, identifying unknown historic disturbances, and predicting future disturbance regimes in relation to climate change.

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## A stochastic model to evaluate different management scenarios for the Fiordland takahe

**Presentation type:** Oral Presentation

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A demographic model for the Fiordland population of the takahe (*Porphyrio hochstetteri*) was developed after analyzing 25 years of data held by the Department of Conservation, Te Anau. The model was created in a Bayesian framework; it accounts for parameter uncertainty and for demographic and environmental stochasticity. All demographic parameters were modeled as a function of population density and of climatic factors in the Murchison Mountains (beech and tussock seeding, precipitation and temperature). Current management strategies such as captive rearing of chicks, stoat trapping and nest management were all included in the model. A simulation of the population trends over the past 25 years confirms that the population increase observed in the last decade is real, and is largely due to the captive rearing in Burwood. Modeling of different management scenarios suggests that captive rearing of chicks and stoat trapping both make a substantial positive difference to the viability of the takahe population. Furthermore, the model indicates that a continued operation of the captive rearing facility in Burwood is required until the remaining threats to the takahe in its natural environment have been removed.

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## Attempting to manage complex predator-prey interactions fails to avert imminent extinction

**Presentation type:** Oral Presentation

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The current primary threats to biodiversity on a global scale are species invasions and habitat modification. Management of vulnerable populations often involves a sequence of: (1) research to identify threats and recommend management strategies, (2) active management, and (3) results monitoring to assess effectiveness of management. The case of the last mainland population of the large, endemic New Zealand skink *Cyclodina whitakeri* provides an opportunity to test this process in a system where the synergistic effects between invasive species (introduced rodents and grasses) have predicted outcomes. Low abundance of *C. whitakeri* at the Pukerua Bay Scientific Reserve in the 1980s prompted management recommendations to remove grazing stock and revegetate the site to simultaneously restore habitat and provide protection against introduced mammalian predators. Due to low detectability of *C. whitakeri , sympatric C. aenea* were recommended as an indicator species of management effectiveness. Grazing stock were removed in 1987, but efforts to revegetate the site were ineffective. Long-term monitoring (1984-2006) of the *C. whitakeri* population and 4 other sympatric lizard species within a 336 m 2 area at the site resulted in 1693 lizard captures over 7597 trap days. *Cyclodina whitakeri* represented 2.8 % of all captures in 1984-88, but declined relative to other species to represent only 0.2 % of captures in 2000-06 (representing 2 individuals). Congeneric *C. aenea* showed a similar decline with capture rates also approaching zero by 2006. Removing grazing stock did not result in increased abundance of *C. whitakeri* or *C. aenea* through improving habitat quality, as intended by management recommendations. Instead, reduced grazing has allowed introduced seeding grasses to proliferate, which may have led to periodic rodent irruptions, supporting a guild of introduced mammalian predators and depleting populations of *C. whitakeri* and *C. aenea* . In this instance, attempted protection may have driven a vulnerable population towards extinction. We recommend investigating the feasibility of constructing a mammal-proof fence around the core *C. whitakeri* habitat, as the last remaining management option to salvage the population.

## Moa biology and ecology in the 21st century: perspective and retrospective

**Presentation type:** Oral Presentation

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By 1986, the systematics and palaeobiology of moa (Aves: Dinornithiformes) were thought to be relatively well known. Advances in the previous decade had included more sophisticated approaches to their morphometrics, increased application of 14C dating, especially outside the archaeological context, and consideration of possible ecological interactions between moa and their environment through evolutionary time. The advent of new technologies such as ancient DNA, and application of established technologies such as stable isotopic analysis, in conjunction with a more question- based approach in general, have led to major advances since 1986. These advances involve not just reinterpretations of 1986 knowledge; they are significant additional fields of research that deal with kinds of data and analyses not available in 1986. In this paper, the strands of moa research are traced and changes, developments, and recent results and interpretations are summarized and placed in their ecological context.

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## Sustainable urban developments: barriers and solutions to creating communities that conserve natural resources

**Presentation type:** Oral Presentation

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Sustainable or “green” developments are being built throughout the world and one goal is to conserve natural resources. Even with the best site design, decisions made by residents determine whether a community actually conserves natural resources such as wildlife, water, and energy. We conducted a series of studies on multiple subdivisions to evaluate whether residents living in green communities differed from residents in conventional communities in terms of their environmental knowledge, attitude, and behaviour. Overall, environmental measures were quite low for most communities, regardless of subdivision type. Residents in green communities were no different in terms of environmental knowledge, attitude, and behavior, and in many cases, they were sometimes worse. These results call into doubt whether green communities would be managed appropriately over the long term. In our last study, we developed an environmental education program, consisting of educational kiosks along walking trails, a Web site, and

brochure, and implemented this program within Harmony, Florida in 2005. Tracking Harmony and conventional community residents through mailed surveys (pre- and post-tests), the educational program did have a positive impact on Harmony residents, though limited. We will discuss the barriers and solutions to raising environmental awareness and engaging local residents in any community.

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### Variable responses of New Zealand's indigenous forests to the exclusion of ungulates

**Presentation type:** Oral Presentation

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Nearly all of New Zealand's indigenous forests have been colonised by ungulates (i.e. deer, feral pigs and goats) over the past three centuries. Immediately following colonisation ungulates reduce the density of understorey vegetation and alter composition by preferentially browsing palatable species, but their ongoing effects in the post-irruptive phase of colonisation are still poorly understood. Analysis of data from a New Zealand-wide network of 20 m x 20 m paired fenced and unfenced plots was undertaken to determine if regeneration of palatable tree species can be restored following culling or eradication of browsing ungulates. At many sites, recruitment of ungulate-palatable trees (e.g. *Coprosma grandifolia , Griselinia littoralis , Schefflera digitata* and *Weinmannia racemosa*) into the >75 cm height class was suppressed by ungulate browsing. Exclusion of ungulates through fencing generally led to a restoration of palatable species regeneration, but there was considerable variation in results within and among Department of Conservation Conservancies. The variability in response to exclusion of ungulates illustrates the difficulty of making generalised conclusions on ungulate impacts in the absence of properly replicated studies. The effect of predictive variables such as culling intensity (DOC, recreational or commercial culling), primary productivity, altitude and latitude were used to explain this variation. The results of this study suggest that ungulates need to be culled to low densities for at least several decades to assure regeneration of palatable tree species.

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### An experimental test of the influence of landscape context on exotic plant invasions into native forest fragments, West Coast, New Zealand

**Presentation type:** Oral Presentation

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Habitat loss and biological invasions are arguably the most significant threats to global biodiversity, and synergistic interactions between them have the potential to cause even

greater biodiversity loss. Habitat fragments are affected by processes in the surrounding landscape, and are increasingly exposed to invasion by exotic species. Landscape context, and the proportion of habitat remaining in a landscape, have recently been recognized as important factors influencing invasions in fragmented landscapes. Despite this recognition, there has been very little theoretical or empirical research on the interactions between landscape structure and invasive spread. The aim of my research was to investigate whether landscape context affects plant invasion processes and examine which factors are driving plant invasions into native forest fragments. Because of the complexity of factors involved in invasion processes, an experimental approach was needed to tease apart the different mechanisms underlying invasions. Experiments were conducted to estimate the proportion of exotic plant propagules that may establish in fragments, and reveal whether propagule availability and/or habitat suitability are limiting invasions. Exotic seeds and seedlings were added at different distances from fragment edges in landscapes with varying amounts of native forest cover, in order to investigate potential landscape and edge effects on germination, seedling survival and growth rates. The responses of exotic species from different functional groups were compared in order to examine the effects of species' traits on invasiveness.

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### Predation and other factors currently limiting New Zealand forest birds - a review

**Presentation type:** Oral Presentation

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Holdaway (1986) described three phases of historical extinctions and declines in New Zealand avifauna, the last of which (Group III, declining 1780-1986) was associated with European hunting, habitat clearance, and predation and competition from introduced European mammals. Some forest bird species have continued to decline since 1986, while others have increased, usually after intensive species-specific research and management programmes. In this paper, we review what is known about major causes of current declines or population limitation, including habitat loss and fragmentation, predation, and competition for food or another resource. Much circumstantial and experimental evidence suggests or demonstrates that predation by introduced mammals is the primary cause of declines. Adult loss is especially damaging, and gender imbalance due to loss of the incubating gender is a classic signature of predation impact. However, sustained recruitment failure despite good adult survival is the key mechanism of kokako and kiwi decline, and causes apparent coexistence between a bird and its predator(s). While predation alone can explain many declines, complex interaction between factors that vary between species and sites are likely to be the norm, but are hard to study. Currently, evidence for food shortage is mostly circumstantial, and may be obscured by a predation outcome. Climate and food supply determine the number of breeding attempts made by herbivorous species, but

predation by introduced mammals ultimately determines the outcome of those attempts. After predator removal, populations are soon limited by other factors including habitat area, food supply, inbreeding depression or disease, and management of these is likely to assist the effectiveness and resilience of management programmes.

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### Founder effects, inbreeding and loss of genetic variation, and their impact on island restoration

**Presentation type:** Oral Presentation

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Genetic factors may be the rate-limiting step in ensuring population recovery and long-term survival in restoration programs focused on small isolated islands. Most of the evidence for inbreeding increasing the risk of extinction of small island populations comes from models that assume such populations harbour considerable genetic load and are highly inbred. We are in the unique position of testing these assumptions by collecting pedigree and fitness data from several species of endangered New Zealand birds that have been translocated as part of reintroductions to small islands. Our studies indicate that even when the number of founders is relatively small, the mean level of inbreeding increases only slowly as long as the reintroduced population grows steadily and the carrying capacity of the island is large. Inbreeding depression, when detected, affected some life history stages but not others, did not prevent populations from establishing, and is likely to play a minor role only in increasing the risk of extinction relative to the risk of re-invasion by exotic predators. We see the management of genetic factors in reintroductions as potentially enhancing the recovery process of threatened species rather than directly reducing the risks of extinction.

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### Hyphae amongst the feathers and fur: the causes and consequences of changes to New Zealand's fungal biota

**Presentation type:** Oral Presentation

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As with other groups of organisms, New Zealand has a depauperate fungal biota, comprising perhaps 20–25,000 species. Since 1980 significant advances have been made in our knowledge of New Zealand's fungi. The species recorded have doubled, and molecular techniques are revolutionalising studies on fungal phylogeny and our understanding of fungal distribution, biology and origins. The origins of New Zealand's fungi are diverse, a few appear to be ancient, many have arrived in geologically more recent times following trans-

oceanic dispersal. Some of these more recent arrivals have subsequently evolved to form local endemic species, while others may be part of larger populations maintained through regular, trans-oceanic gene flow. Although questions remain about which fungi truly are indigenous and which are exotic, about one-third of the fungi recorded from New Zealand are likely to have been introduced since human settlement. While most exotic species are confined to human-modified habitats, there are some exceptions. These include species with potential to have significant impacts at the landscape scale. Examples from pathogenic, endophytic, and ectomycorrhizal fungi will be used to discuss the factors driving the distribution and dispersal of New Zealand's fungi at both global and local scales, the impact that historical changes to New Zealand's vascular plant and animal biota have had on indigenous fungi, and the broader ecological impact of some of the exotic fungal species which have become naturalised in native habitats.

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### Combining science and Hauraki matauranga to manage grey-faced petrels on New Zealand's offshore islands

**Presentation type:** Oral Presentation

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*Pterodroma macroptera gouldi* is variously known as the grey-faced petrel, and by its onomatopoeic Maori name "oi or kuia oi titi". The customary small take of chicks from the Ruamaahua (Aldermen) Islands off the Coromandel and, in the recent past, from Moutohora (Whale Island) in the Bay of Plenty represents one of few remaining traditional seabird harvests in New Zealand. Concerns over declining harvest and the need to understand the impacts of harvest and other factors such as climate change and interactions with fisheries on oi populations has led to the development of a collaborative "Mauriora ki nga Oi" (the life-force of the oi) project between Manaaki Whenua (Landcare Research) and the Hauraki and Ngati Awa. We describe how this collaborative approach is examining the effects of fisheries by-catch, oceanic and atmospheric events, and harvest on oi populations and how we will use our results to guide sustainable oi management by Hauraki in the future.

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### Invertebrate biodiversity associated with *Nothofagus* and its consequence for ecosystem function.

**Presentation type:** Oral Presentation

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The apprehension about scaling the insights from microcosm experiments and synthetic autotrophic communities to predictions for natural ecosystems, stems from a growing

recognition of the roles of space and trophic complexity in the mediation of ecosystem function. This concern may be overcome through biogeographic comparisons of the natural ecological relationship between species diversity and ecosystem function in large-scale, natural systems. The differential break-up of the Gondwana continent effectively fragmented the forest ecosystem of *Nothofagus* (Fagales: Nothofagaceae) over evolutionary scales of space and time. Bioassays of a naïve, polyphagous invertebrate defoliator show that the allocation of resources to defence against defoliators of Nothofagus species that form spatially different ecosystems, was not only inversely proportional to the geographic range of the host plant, but also to leaf nitrogen, the primary determinant of forest productivity. The results refute long-standing plant defence theories and suggest that ecosystem function and stability is not derived from biodiversity per se, but from the evolutionary resolution of the relative strengths of top-down and bottom-up processes dictated by community trophic complexity.

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### Bird-plant mutualisms with the wreckage of an avifauna

**Presentation type:** Oral Presentation

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There has been great recent interest in how well bird-plant interactions are functioning, especially in New Zealand which Jared Diamond famously said no longer has an avifauna, just the wreckage of one. A very influential paper by Clout & Hay (1989) concluded that inadequate bird pollination was unlikely to threaten any NZ plant, mainly because very few plants had flowers that were visited only by birds. In contrast, they argued that dispersal mutualisms were widespread, important, and at risk because only one bird (kereru) was large enough to disperse the largest-fruited tree species. Burrows added to concern about dispersal when he showed that seeds of many fleshy-fruited species apparently did not germinate from undispersed fruits. However work since 1989 has completely reversed that assessment. We have documented widespread pollen limitation in many of the relatively small number of native species with ornithophilous flowers. Castro & Robertson showed that birds also frequently visit flowers of many other apparently entomophilous-flowered native trees. Anderson showed that excluding birds from such plants significantly reduced seed set in all four tested species. So pollination is more at risk than first thought. Lord showed that fleshy fruit are uncommon in the NZ flora, except in trees where 70% are fleshy-fruited. We found that germination of large-fruited species is not dependent on removal of the fruit pulp by a bird. The few studies of dispersal mostly show adequate removal rates. So dispersal is less at risk than first thought. Finally an analysis of both species number, and total woody basal area, surprisingly shows that a larger proportion of NZ forests are dependent on bird pollination than are dependent on bird

dispersal. It seems bird pollination is far more important in NZ than was realised. We were misled by the assumption that only obviously ornithophilous flowers would be dependent on bird visitors.

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### Aerial 1080 for multi-pest knockdown: results from a series of large-scale field experiments in New Zealand forests with a focus on ship rats

**Presentation type:** Oral Presentation

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Results are presented from a series of recent experimental 1080 drops where different baiting recipes were played off against each other in adjacent 1000-hectare blocks. Relative abundance indices were used to assess knockdowns of rats, mice, stoats and possums. Bait spreading contractors routinely achieved coverage sufficient to control rats, and, in some cases, mice. Pre-feeding was a key to achieving high rat knockdowns, and very low levels of pre-feeding may be all that is required. Pre-feeding also improved mouse kill, but more research is required to improve the consistency of high mouse knockdowns. RS5 bait (Waimate) was better than W#7 (Wanganui) for rats, mice and possums when pre-feed was not used, possibly due to a higher sugar content. This implies that RS5 might be better when pre-feed is used, but we did not detect a difference with the pest indexing methods used: both performed to the limit of our ability to detect differences. In a wet West Coast site, RS5 and W#7 baits both performed extremely well for rats and possums, suggesting that the current aversion (among managers) to RS5 in wet areas may be exaggerated. Both 1080 concentrations (0.08% and 0.15%) performed well for all pest species, making it difficult to detect subtle differences in performance. A high stoat kill was recorded incidentally at a site with a high rodent kill. Future research directions toward optimised and integrated pest knockdowns are outlined. Multi-pest knockdown with pre-fed aerial 1080 is consistent enough that an adaptive management programme should proceed to determine optimum return times for biodiversity recovery.

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### Exotic reptiles: a risk analysis for New Zealand

**Presentation type:** Poster Presentation

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This project aims to determine the level of biosecurity risk posed by the 15 species of exotic reptile currently traded in New Zealand. Are they capable of establishing and spreading in New Zealand? What economic and ecological threat do they

pose? These questions will be addressed through a semi-quantitative risk analysis including bioclimatic modeling and disease screening. Reptiles are successful invaders worldwide, often implicated in serious ecological and economic disruption. One exotic species has already established in New Zealand (the Australian rainbow skink, *Lampropholis delicata*). The potential for further establishments is ever present as more than a dozen species of exotic reptile are legally traded in New Zealand and escapes and intentional releases are commonly reported. Control measures for invasive species are costly, but with no known methods for successful eradication of invasive reptiles, their cost could be even higher. For those exotic reptiles currently within New Zealand that are found to have the ability to establish wild populations, appropriate and cost-effective management actions can be taken to avoid negative consequences to the environment and economy. On the other hand, for those species found to pose no threat to New Zealand, commercial breeders will be able to safely supply reptiles to the lucrative local pet trade without further regulation.

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## Can predators detect IR monitoring?

**Presentation type:** Poster Presentation

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Ferrets are Unwanted Organisms under New Zealand's Biosecurity Act (1993), due to their predation on native protected species and their status as potential vectors of Bovine Tuberculosis. There have been suspicions that ferrets could detect the infrared light-emitting equipment used to monitor predator and prey behaviour. This behavioural study describes how ferrets were taught to respond to lights of varying frequencies and intensities for food rewards. When the light stimulus was changed to infrared (870 nanometres), two of the five ferrets showed strong evidence (average response accuracies of 77% ± 4 and 72% ± 2) and one ferret showed relatively weaker evidence (66% ± 3) that they could see this wavelength of light, even when it was very dim. Extraneous cues such as ultrasound or a predictable schedule of stimulus presentation were eliminated as potential response cues; hence the ferrets were reacting to the infrared light. It is possible that a proportion of ferrel ferrets can detect the light emitted from infrared monitoring equipment that produces light wavelengths at or below 870 nm. This light may potentially attract the predator towards threatened native species, with significant implications for conservation.

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## Reproduction by ornithophilous-flowered plants when birds are rare: *Sophora prostrata* in Canterbury.

**Presentation type:** Poster Presentation

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*Sophora prostrata* occurs in isolated populations, scattered throughout Canterbury. It has large ornithophilous (bird-adapted) flowers but little is known about its pollination ecology. Bellbirds and tui, the most likely native birds to visit the flowers, are uncommon in Canterbury. We studied how well reproduction of *S. prostrata* was working with the present day low bird numbers. Four sites around Christchurch were used. All sites were in modified landscapes and while bird densities varied, bellbirds occurred at all sites. Flower visitor observations showed bellbirds visiting at just one site (the least modified). At all sites bumblebees and honeybees robbed the vast majority of flowers. Natural fruit set was low with just 6.9 to 19.1% of flowers setting fruit. Fruit set using self pollen was not significantly different from natural fruit set. Hand outcrossed pollination significantly increased fruit set in four of six cases but fruit set was still low (< 37%). Pollen tube studies showed pollen tubes successfully reached the ovules for both self and outcrossed pollen. However, 38% of all mature naturally pollinated and 40% of hand pollinated flowers had no pollen deposited on them at all. We studied whether there was a physical barrier on the stigma limiting pollen deposition. SEM imaging revealed a ring of hair cells around the outer edge of the stigma. We concluded that while the plants are self compatible the pollen has to be physically deposited on the stigma. Overall reproduction levels of *S. prostrata* are poor. However, observed low fruit set levels seem to be due to both pollination failure and other factors.

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## Five years after LENZ – would we do it the same?

**Presentation type:** Oral Presentation

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John Leathwick[1]*

[1]*NIWA*

The Land Environments of New Zealand classification (LENZ) was an attempt to provide an environment-based spatial classification of New Zealand landscapes for conservation management. This was motivated by recognition that robust data describing biological character are inadequate over large parts of the New Zealand landscape, and particularly in the lowlands where conservation management of surviving natural ecosystem fragments is most required. With LENZ we used largely subjective techniques to select, weight and transform candidate environmental variables to maximise the ability of the resulting classification to discriminate variation in biological character. In subsequent classifications produced to facilitate

the management of aquatic ecosystems we have moved increasingly towards use of more objective and robust techniques for selecting and weighting candidate variables. In freshwater and marine classifications, this has resulted in a significant improvement in classification strength, i.e., the ability of classifications to capture variation in biological patterns. While these technical improvements might enhance our ability to define a second generation LENZ, the gains that might be achieved have to be carefully weighed against the practical management costs involved in changing the classification.

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## Is there a legacy of avian-dominated plant-herbivore systems in New Zealand?

**Presentation type:** Oral Presentation

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William Lee[1]*

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Avian herbivores dominated pre-settlement terrestrial ecosystems in New Zealand, to an extent unparalleled elsewhere, and ecologists have long attempted to construct adaptive explanations involving birds for some of the more distinctive plant habits in the indigenous flora. Although most avian herbivores became extinct during the early phase of human settlement, over the past 20 years our understanding of the ecology and distribution of the Holocene avifauna has expanded, and we now recognise several herbivore guilds. Knowledge of the largest herbivore, the moa, has increased through gizzard and coprolite analyses, and the use of stable isotopes. We now have evidence that structural, constitutive plant defences prevail in trees and shrubs, and that the “wire syndrome” functioned to limit plant off-take to below animal maintenance levels for major terrestrial avian herbivores. Similar plant defence structures occur in other bird-dominated herbivore systems. However, no analogous plant defence strategies have been developed against arboreal avian herbivores in New Zealand. Inducible defences appear rare, perhaps reflecting long-standing resource limitations in our ecosystems. The impact of moa on forest structure and composition remains speculative, but many broadleaved woody species would have experienced markedly reduced niches pre-settlement. As well as browsers, avian grazers were widespread, feeding on herbs and grasses. Recently two distinctive avian-mediated vegetation types have been proposed; shrub/herb associations in dryland areas, and turf associations around ephemeral wetlands. The transition from an avian- to a mammal- dominated herbivore system was interspersed by several centuries when New Zealand lacked mega-faunal herbivores. This hiatus in herbivory complicates comparisons between pre-settlement and current mammal-dominated herbivore systems in New Zealand. However, predation levels, animal mobility, mode of feeding, nutrient transfer patterns, and soil impacts, were quite different under avian herbivory compared with recent mammalian herbivore systems. Conservation should focus on enhancing elements of the avian herbivore system that remain and restoring large avian herbivores in order to retain the “wire syndrome” and representative parallel ecosystems.

## Use of LENZ and LCDB2 for determining the representative value of stands of indigenous vegetation

**Presentation type:** Oral Presentation

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The significance of indigenous vegetation is an important issue for many resource management decisions in New Zealand. One of the most important aspects considered in the evaluation of vegetation significance is representativeness, which is usually assessed at a regional or sub-regional scale or within the relevant ecological district. This necessitates a good understanding of the regional distribution of vegetation types, but comprehensive regional vegetation maps are rarely available. The recent development of remote sensing techniques and models incorporating environmental drivers of vegetation variation have led to the growing use of desktop assessments of representativeness. Two recently developed tools, LENZ (Land Environments of New Zealand) and LCDB2 (New Zealand Land Cover Database 2) are being used increasingly for this purpose. However the limitations of the databases and models used in these desktop analyses are not always understood, leading to representativeness assessments of questionable value. Use of these databases and models also drive assessments that focus on the extent of indigenous vegetation cover remaining in particular LENZ environments, which is a departure from traditional concepts of representativeness that also incorporate information on vegetation type and quality. In this presentation we illustrate some of the pitfalls of desktop analyses of representativeness. We also suggest that extent-based assessments of representativeness are a poor substitute for assessments that incorporate up-to-date information on vegetation type and quality.

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## Are species' distribution patterns correlated with ecological traits? A multiscale analysis of the New Zealand flora

**Presentation type:** Poster Presentation

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Here we present some of the ideas behind a PhD study proposed for the next three years. Plant distribution patterns will be characterised as "clumped" or "diffuse" at three different spatial scales (national, regional and local) to determine if they are correlated with ecological traits related to growth, dispersal and reproduction, e.g., seed dispersal mechanism, woodiness and pollination system. Distributional data will be obtained from

the National Vegetation Survey, and various regional and local surveys, complemented with our own surveys at local scales. Specifically, we will examine the local distribution patterns of Hebe species at the Molesworth Station. Correlograms will be used to summarise the data of the three spatial scales of analysis for each species. There is a pressing need to understand and manage declining rare species and expanding exotics. Comparative studies of the different distribution patterns achieved by such species may provide general guidelines for the management of rare and invasive species, in the absence of much needed, but longer term, autoecological studies. In summary, we ask: are there traits that are characteristic of low-abundance, narrowly distributed and/or rapidly declining threatened species.

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**Results of long-term (>35-yr)vegetation monitoring in Mt Aspiring National Park and Secretary Island, Fiordland, in relation to contrasting trends in feral deer impacts.**

**Presentation type:** Oral Presentation

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Periodic monitoring of representative photo-points in Mt Aspiring National Park since a vegetation survey in the late 1960s when it was degraded by feral deer, has shown remarkable recovery, particularly in non-forest communities. Subalpine shrublands and low-alpine grasslands may now be close to their pre-disturbed state. By contrast, monitoring on Secretary Island,revealed highly selective use of the natural vegetation when deer first invaded in the early-1970s and steadily increased until very recent drastic intervention by the Department of Conservation with an ecological restoration programme. The importance for restoration of inaccessible refugia and the serious impacts on palatable species of even small deer numbers has been confirmed.

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**Biodiversity protection on private land - applying the LENZ framework to regional biodiversity policy**

**Presentation type:** Oral Presentation

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Horizons Regional Council (Manawatu-Wanganui Region) recently notified the 'One Plan' – the second generation Regional Policy Statement and Regional Plans. For the first time, terrestrial biodiversity issues have been addressed comprehensively within Horizons regulatory framework. Analysis was based on the national spatial biodiversity datasets; LENZ, LCDB2, and the Predicted Potential Natural Vegetation of New Zealand. The national framework for

identifying originally rare ecosystems was also incorporated. Habitat types that were predicted to be present within the Region in the past were identified, as were those habitat types that are present today. From this, a degree of loss for each habitat type was established. Consequently the need for protection and/or management of each habitat type was determined. Based on remaining extent, habitat types were classified (Rare, Threatened, At Risk or No Threat Category) and a regulatory framework applied accordingly. Horizons non-regulatory biodiversity programme is an important component of the policy framework, and the priorities for this programme are also underpinned by LENZ analysis. The proposed policy for terrestrial biodiversity protection within the Manawatu-Wanganui Region is a good example of how tools like LENZ can inform decision making for biodiversity protection on private land. This talk will focus on the application of LENZ to terrestrial biodiversity policy development within the Manawatu-Wanganui Region, and the resulting regulatory framework.

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## Potential invasion of *Berberis darwinii* (Darwin's barberry) into New Zealand *Nothofagus* (beech) forest

**Presentation type:** Oral Presentation

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Intact New Zealand broadleaf–podocarp forest is relatively resistant to invasion from Darwin's barberry (*Berberis darwinii*), likely because low light levels inhibit early seedling establishment. This study investigated whether New Zealand beech (*Nothofagus*) forest is more susceptible to invasion by Darwin's barberry, since a) light levels are potentially higher, and b) Darwin's barberry grows in intact *Nothofagus* forest in its native range (southern Chile and Argentina). Four sites were chosen where Darwin's barberry occurs on the edge of beech forest. At each site, five 50 m transects were laid out from the Darwin's barberry edge leading into the beech forest. Darwin's barberry seed dispersal and subsequent seedling survival were estimated by surveying newly germinated seedlings at peak germination time (spring), then again five months later (summer) along these transects. Newly germinated seedlings were found at all distances along transects, indicating that seeds are being dispersed at least 50 m into the interior of the beech forest. Canopy cover was similar across all transects and sites, and was not correlated with distance in from edge of forest or with seedling survival. Rates of seedling survival were compared with results from previous studies done in broadleaf–podocarp forest sites with similar levels of canopy cover. Average (± 1SE) five month seedling survival in beech forest was 24 % ± 4.5%, whereas in broadleaf–podocarp forest it was 5.5 % ± 1%. These results suggest that intact beech forest may be more susceptible to invasion by Darwin's barberry than intact broadleaf–podocarp forest.

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## Parasites lost: did they 'miss the boat' or 'drown on arrival'?

**Presentation type:** Oral Presentation

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Host species losing parasites upon introduction to, or invasion of, new regions is a common phenomenon. Parasite loss may occur via three different mechanisms. First, a parasite species may be absent on individuals in the host founder populations simply due to chance associated with sampling (termed 'missing the boat'). Second, a parasite species may fail to persist if none of its potential host species persist in the new region. Finally, the parasite may fail to persist on those of its host species that are available in the new region. The latter two processes have been collectively termed 'drowning on arrival'. The relative importance of these different mechanisms in causing parasite losses within introduced host populations is largely unknown. We will present the first complete assessment of the suite of factors that potentially influence parasite introduction, making use of a host/parasite system for which sufficient information is uniquely available - New Zealand's introduced birds and their Mallophagan ectoparasitic chewing lice.

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## Historical and ecological context, pattern and process, in the changing New Zealand's freshwater fish fauna

**Presentation type:** Oral Presentation

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Some Gondwanan influence is possible, though most of the fauna is derived by transoceanic dispersal. There are a few Miocene Central Otago fossils that reveal ancient components of the fauna, comprising are fossils confamilial with Present galaxiids and eleotrid, and also fossils of percichthyids comparable with Present Australian freshwater basses. This fossils are lacustrine whereas the Present fauna is almost exclusively fluvial. Lack of a distinctly lacustrine Present fish fauna derives from the youth of existing lakes. We have no knowledge of the Miocene fluvial fauna, and though the Miocene landscape was of low relief, there must have been rivers in which there were fish. Lacustrine Miocene galaxiids are generally distinct from living forms, whereas there are no extant percichthyids. Thus the known Miocene fauna is largely no longer here. Ignorance of a Miocene fluvial fauna prevents even general comparisons with the Present fish fauna. Another way to determine patterns of change is to seek integration of distributions and relationships across the landscape with known

geomorphological history. However, this is confounded by about half the fauna being diadromous (species spend part of their lives at sea). A consequence of diadromy is that species disperse around coastlines obscuring effects of historical geomorphology or landscape perturbation resulting from glaciation and volcanism. These diadromous species are New Zealand-wide. But, non-diadromous species exhibit distribution patterns that reflect local processes of taxonomic diversification and impacts of macro-scale events like land submergence, bridging of present sea straits, mountain building, glaciation and volcanism, and of micro-scale events such as headwater stream captures.

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## The Annual NZES Te Tohu Taiao Address

## Climate change and the ecology of New Zealand: past influences, present legacies and future prospects

**Presentation type:** Oral Presentation

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Our knowledge of the ecology of the Quaternary (the last 2.6 million years) has increased dramatically over the 20 years since the Ecological Society Symposium Moa, Mammals and Climate. The quantity and quality of New Zealand palaeoecological studies has vastly improved, and has expanded beyond a focus on pollen to encompass many different organisms. The increased availability of dating, isotopic, DNA and other analytical tools has transformed the resolution and reach of these studies. In 1986, other than glacial moraine mapping, we had few reliable direct or proxy climate records from New Zealand. Now we have an abundance of quantified climate records including sea surface temperatures from marine cores, and speleothem, pollen and invertebrate based estimates from terrestrial sites. Finally, our understanding of how the ecosphere operates has been transformed by long global records and modeling of vegetation, climate and carbon dioxide. I will use this large accession of new knowledge to address a set of key questions. • How has the biota been shaped by past climates?• Is the biota currently in equilibrium with climate?• What are the likely outcomes of predicted greenhouse gas increases?

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## Salmonid impacts on New Zealand galaxiid fish

**Presentation type:** Oral Presentation

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Trout and salmon were introduced to New Zealand for angling in the 1880s, but researchers were slow to investigate their

influence on native fish species. We still know little about effects on diadromous galaxiids and impacts in lakes, and only in the 1990s were the severely fragmented non-diadromous galaxiid populations in Otago streams well documented. These galaxiids were found almost exclusively above trout-access barriers. Subsequent identification of new and rare non-diadromous galaxiid species has heightened the need for conservation and understanding of their interactions with trout. Although the patterns from Otago implicated intense predation by trout in galaxiid declines, elsewhere galaxiids and trout co-occur more frequently. New work indicates that co-occurrence is highly contingent on connection to trout-free source populations. Despite galaxiid fry production in trout-invaded reaches, virtually no fry survive the summer in those habitats. The occurrence of these source-sink metapopulations is also linked to physical habitat conditions. In Canterbury rivers, trout distributions contract in response to flooding. Benign hydrological conditions are associated with trout population expansion and subsequent reductions in galaxiid abundance, especially in small streams. Both predation and competition from trout could contribute to making trout-invaded reaches sinks for galaxiid populations, but predation by trout >150 mm in length is probably more important. In fact, facilitation of galaxiid feeding by trout suppressing the movement of the invertebrates fed on by galaxiids may make trout-invaded reaches attractive to galaxiids, catching them in an ecological trap. In total, recent research indicates stream network patterns and habitat conditions mediate trout effects on non-diadromous galaxiids. This conclusion highlights the potential for human-induced hydrological change to exacerbate trout impacts. Thus, managers will need to be more proactive in their response to the plight of galaxiids. Moreover, the occurrence of metapopulation dynamics across stream networks, largely off the conservation estate, means a new approach is needed.

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### Inventory and monitoring toolbox - establishing inventory and monitoring standards for the Department of Conservation

**Presentation type:** Poster Presentation

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The Toolbox is one component of the Department's NHMS (Natural Heritage Mangement System). Reliable and consistent biodiversity data must underpin good management decisions but monitoring methods are often appied inconsistently and inapproporiately. This causes problems for the Department because it cannot reliably report on the changes in the status of biodiversity over temporal and spatial scales. The objective of the Toolbox is to establish national standards for inventory and monitoring methodologies to address these problems. In addition to these standards, decision making frameworks such as decision trees and reference material support users to choose the most appropriate method(s).

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## Improving the diet for captive kiwi

**Presentation type:** Oral Presentation

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The North Island brown kiwi (*Apteryx mantelli*) are in decline due to predation from introduced mammals and habitat destruction. Conservation efforts include intensive predator control in the wild, Operation Nest Egg, and captive breeding and release of birds. A captive management plan is in place to increase the role captive breeding plays in kiwi conservation (Department of Conservation, 2004). As a consequence the health status of captive birds, especially breeding birds, is extremely important. The current problems experienced by captive bred kiwi are high embryonic and adult mortality rates, smaller eggs (Department of Conservation, 2004) and lower hatching rates than wild kiwi (McLennan et al., 1996). Nutrition, physical and physiological parameters, clinical pathology and disease susceptibility have all been highlighted as factors causal to the inability of kiwi to thrive in captivity (Department of Conservation, 2004). Given an adequate diet, the occurrence of disease and detrimental physiological effects are likely to be significantly reduced. The current diet fed to kiwi in captivity is based on one that was formulated over 30 years ago with no reference to the nutrient requirements of the birds. It has been found to be high in organic matter, fat, protein and starch compared with the natural diet (Pindur, 2004). Therefore, the captive diet needs to be updated to provide, as closely as possible, the same nutrient components as the natural diet. Here we present progress made towards the formulation of a new diet for captive kiwi based on the items eaten in the wild.

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## Impact of introduced mammals on the genetic diversity and conservation status of New Zealand snipes (*Coenocorypha* spp.)

**Presentation type:** Oral Presentation

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Snipes of the genus Coenocorypha were the most characteristic birds of the New Zealand biogeographical region. At least four taxa became extinct following the introduction of predatory mammals, with the most recent extinction in 1964. Three further snipe taxa suffered massive mammal-induced range reductions, with Campbell Island snipe (*Coenocorypha undescribed sp.*) and Chatham Island snipe (*C. pusilla*) both disappearing from over 99.7% of their ranges. Although the Auckland Island snipe (*Coenocorypha aucklandica aucklandica*) was extirpated from nearly 83% of its range, it persisted in large numbers on unmodified Adams Island (10,119 ha) plus two

other much smaller islands. We compared the genetic diversity of snipe that persisted on 19 ha Jacquemart Island (Campbell Island group), 218 ha Rangatira Island (Chatham Islands), and Ewing Island and Adams Island in the Auckland Islands. Using blood and feather samples obtained from six Coenocorypha snipe populations, we isolated nine polymorphic dinucleotide microsatellite loci from a DNA library enriched for repeats. We also amplified and sequenced portions of four mitochondrial DNA (mtDNA) protein-coding genes (ATPase6 and 8, COI, COII) for a total of 1980 base pairs. We conclude that predation by introduced mammals combined with habitat disturbance by farm stock (on Rangatira Island) led to almost total loss of measurable genetic variation in Chatham Island and Campbell Island snipes. Auckland Island snipe confined to 57 ha Ewing Island lost 52% (microsatellite) to 89% (mtDNA) of their genetic variation compared to the vastly larger population that persisted on Adams Island 40 km to the south. The measurable loss of genetic variation within Auckland Island snipe provides a model for identifying the likely cause of the extremely depauperate genomes of both Chatham Island and Campbell Island snipes, both of which passed through extreme population bottlenecks. The almost complete lack of genetic diversity in five of the six *Coenocorypha* populations assessed has ongoing management implications in the face of such potential major environmental perturbations as global warming and introduction of avian pathogens.

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## A survey of mammalian pest species in Hamilton City

**Presentation type:** Oral Presentation

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Introduced mammalian pests are important predators of native flora and fauna and threaten the survival of many New Zealand species; reducing their number can increase both survival and reproductive success of native species. Appropriate management strategies require measures of pest species abundance and distribution; although conducting mammalian inventories is common in many ecosystem types, this is the first time that an inventory surveying all pest mammals has been conducted in a New Zealand city. Here we present results from a study where all pest mammals were surveyed in three habitat types (gullies, residential areas, amenity parks) within Hamilton city using a variety of different methods (tracking tunnels, WaxTags™, scat and animal sign surveys, public surveys, and live-trapping). Rat species were most common in gullies, rare in parks and not detected in residential areas; live-trapping of rats revealed that most are ship rats (90%) cf. Norway rat (10%). Possums were only detected in gullies and one park. Mustelids were not detected in any habitat type. Cats were seen in most habitats and a public survey revealed that they were present in all residential areas. Hedgehogs were most common in gullies and parks, but also detected often in residential areas. Rabbits were detected in one gully and two parks only. These data suggest that the most important predators of native birds were

absent (e.g., stoats) or largely confined to gully habitats (e.g., possums and rats).

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## Causes of nesting failure in urban birds using time-lapse video

**Presentation type:** Poster Presentation

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Predation on either eggs or chicks is a major cause of nesting failure in birds. Determining the impact of a suspected predatory species requires that all predators in the study area are identified and the proportion of predation events caused by each is determined. Nest predation has been studied in many different types of habitats in New Zealand, but comparatively few studies have been conducted in urban ecosystems. In the current study, 21 nests (blackbird, song thrush, fantail and silvereye) were monitored over one breeding season using time-lapse recording techniques until an outcome was observed. Five predation events were filmed (two cat, three ship rat), 10 nests successfully fledged chicks and six nests failed for other reasons (poor weather, desertion). These data tentatively suggest that nesting success may be higher in Hamilton city cf. other habitats (e.g., unmanaged forest blocks where nest predation rates are often c. 80%). We recommend, however, that further research with increased sample sizes is carried out to support to this. In addition, future studies on nesting success in urban birds should also focus on the fates of fledglings once they leave the nest, as anecdotal evidence suggested that in residential areas (where domestic cats appeared to be the most common predator) it was at this stage that predation rates may have been highest.

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## Developing a new toxin for the control of feral cats, stoats and wild dogs

**Presentation type:** Oral Presentation

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The endemic fauna of New Zealand evolved in the absence of mammalian predators and their introduction has been responsible for many extinctions and declines. Predator control will have to be on-going if some native species are to survive on the mainland. Currently, predator control relies largely on labour-intensive trapping, so the development of a humane predator-specific toxin would be a valuable additional control method. Para-aminopropiophenone (PAPP) is being investigated as a toxin for feral cats, stoats and wild dogs in New Zealand. The toxic effects of PAPP appear to be related to

the rapid formation of methaemoglobin in some species, which leads to a rapid and lethal deficit of oxygen in cardiac muscle and the brain. Carnivores appear to be much more susceptible than birds, so it potentially has a high target specificity, at least in the New Zealand context. Pen trials with 20 feral cats, 15 stoats and 14 dogs have been undertaken using meat baits containing a proprietary formulation of PAPP at various doses. PAPP-impregnated baits were palatable and eaten by all animals tested. A PAPP dose of 20-34 mg/kg was lethal for feral cats, with death occurring 54-125 minutes after eating a bait. For stoats, doses of 37-95 mg/kg were lethal with death occurring 15-85 minutes later. A dose of 26-43 mg/kg was lethal for dogs and they died within 3.5 hours of ingesting the bait. Our results confirm that PAPP is a humane and effective toxin for feral cat, stoat and wild dog control and we are now continuing studies towards product registration.

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### Native and exotic plant-pollinator mutualisms in New Zealand

**Presentation type:** Oral Presentation

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Disruptions in key ecological interactions, such as plant-pollinator mutualisms can lead to evolutionary changes in community structure. The evolution of New Zealand's flora and fauna proceeded in isolation from other regions but this has been overlaid by the naturalisation of agricultural pollinators such as *Apis mellifera* and *Bombus* spp. and of exotic plant species. Considering their shared origin and evolutionary background, we would expect exotic pollinators to prefer exotic plants and native pollinators to prefer native plants. To determine the extent of the separation between exotic and native pollinators on exotic and native plants in New Zealand, the Landcare Research Community Pollination Project has conducted a broad survey of flower visitors at 7 natural and 2 cultivated sites throughout New Zealand. The number of flower visitors at individual plants along transects in mixed communities of natives and exotics were recorded. Observations of day-active flower visitors were made based on recognisable categories: honey bee, bumblebee, native bee, fly, beetle/bug, and butterfly/moth. A discriminant analysis on the combined data (>200 plant species) did not reveal any overall separation of flower visitor assemblages (based on proportion of visitor categories) on native or exotic naturalised plant species. Although the general survey does not support separation of exotic and native plant-flower visitor associations at the overall community level, there are some exotic plant species that are exclusively or predominantly visited by exotic insects. These are potential invasive mutualisms if these plant species are pollinator dependent and native pollinators are unable to service them.

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## Multispecies pest control: killing more animals with fewer baits

**Presentation type:** Oral Presentation

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In typical aerial 1080 poisoning operations, 200–600 toxic baits (2-3 kg/ha) are sown to kill just 1-10 possums/ha, even though one bait is usually more than enough to kill one possum. Research and operational trial-and-error has identified that this level of overbaiting is needed to minimise the risk of a poor kill, but has not clearly identified why it is necessary. We report the results of recent trials aimed at understanding how possums, ship rats and mice survive aerial poisoning. The first major field trial compared kills in 18 blocks of 100 ha at Whirinaki, using carrot bait loaded with 0.15% 1080 in different combinations of sowing rate (1, 2 and 5 kg/ha), numbers of pre-feeds (0, 1 and 2), and sowing patterns (single-direction or cross hatch). Kills of possums, rats and mice were assessed using ChewTrack Card (CTC) interference rate surveys. Increasing the number of pre-feeds and (to a lesser degree) the sowing rate both increased the kill of possums and rats, but appeared to have little effect on mice. A follow-up trial compared kills at three different levels of toxic bait (0.15% 1080 cereal) aggregation using 1080 cereal baits, and, for most and least aggregated treatments, the effect of pre-feeding. As in the first trial possum and rat kills were as good as or (usually) better in the pre-fed blocks compared with the no-pre-feed blocks, but again pre-feeding appeared to have no effect on kill of mice. Where pre-feed was used, the kill of possums and rats was as good as if not better when toxic baits were aggregated (either hand sown in isolated 50 g clumps at 0.4 kg/ha or trickle sown at 2 kg/ha from a helicopter) than when distributed more evenly by using a spinner to broadcast the bait from a helicopter at 2 kg/ha. Counter intuitively, kills were far poorer for mice when bait was broadcast than when it was aggregated. Overall, the hand-sowing strategy achieved high kills of all three species using >80% less toxic bait than usual, indicating that there is potential to greatly reduce the amount of 1080 used in New Zealand.

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## Feathers to fur - past to future?

**Presentation type:** Oral Presentation

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This paper will review my personal impressions and highlights from the Feathers to Fur Symposium. The previous “Moa” conference, which stimulated this one, was held 20 years ago. It led, directly, to many new research efforts in New Zealand ecology. In particular, it emphasised factual knowledge about the past. The rational was then, as it is now, that such knowledge underpins how we interpret the modern landscape,

how we anticipate the effects of introduced organisms and how we, as ecologists and as members of a wider society, value the remnants of the 'original' biota. What we mean by 'original' has been central to many conservation/restoration debates; what we see as 'future' should be equally important. Time scales are important in both cases. So too is what we know about the systematics and biogeography of many groups. The past provides indications of the temporal scales within which we must plan and better knowledge of biodiversity points to the spatial scales. Understanding the sequential impacts of the pre-human browsers, Maori fires, European introductions, wetland drainage and forest clearance has many lessons for the management of the current mixed ecosystems. That management too is set in a human social context, with which ecologists must urgently engage.

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## Catch me if you can: interceptions and establishments of exotic longhorn beetles (Cerambycidae: Coleoptera) in New Zealand, USA and the world

**Presentation type:** Oral Presentation

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Many longhorn beetles (Cerambycidae: Coleoptera) are important forest pests around the world and pose a threat to forest biosecurity. This research uses a large database of Cerambycidae interceptions in New Zealand and the USA to identify factors associated with the successful transport and introduction of these species around the world. We also compiled a list of worldwide longhorn establishments, to use in conjunction with New Zealand and USA interception records. Few such extensive databases exist for insect pests, and these data allow us to contrast high risk pathways for introduction between New Zealand and the USA. These databases also allow us to identify factors influencing interception frequency, and the successful establishment of Cerambycidae. We found that insects were mainly intercepted in wooden packaging material (dunnage, crating, and pellets), and originated predominantly from Europe and Asia. Interception frequencies for each species were predicted by native range size and worldwide establishment success. Interception frequency, which was used as a proxy for propagule pressure, and native range size did not have a significant effect on establishment success of the nine exotic Cerambycidae in New Zealand. However, worldwide establishment success was positively related to interception frequencies in New Zealand. Our findings highlight the value of historic databases in predicting biological invasions in general and forest insects in particular, and can assist with managing biosecurity risks.

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## Plantation forests as habitat for native species: the impact of clearfell harvesting

**Presentation type:** Oral Presentation

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Plantations of exotic trees species (usually *Pinus radiata*) comprise ~25% of New Zealand's remaining forest cover. Often referred to as biological deserts, the single species canopy provides cover for extensive understorey plant diversity, bird, and invertebrate communities. In some regions plantations are the dominant lowland forest type, as such they represent a significant potential biodiversity conservation benefit. Benefits can be derived in several ways; substitute forest habitat or as a buffer from physical and biological influences, such as microclimate or exotic species. The results of two studies are presented. Firstly an evaluation of the potential of different matrix land use types as habitat for native species in the central North Island where native forest is highly fragmented. It was hypothesised that plantation forests would provide better habitat than pasture (assessed by species richness, similarity in community composition and presence of exotic species), as there is less structural contrast between native forest and plantation stands than pasture. The second study assessed the impact of forest harvesting on beetle community composition. Clearfelling is the standard method for harvesting trees in New Zealand. At present 42% of New Zealand plantation stands are certified by the Forest Stewardship Council (FSC) as well managed forests. Clearfelling is a significant issue for FSC certification in New Zealand and is currently practiced on a scale that is unacceptable in other countries, particularly the managed natural forests in North America. An experimental study of beetle biodiversity in clearfell harvest areas (0.01, 0.05, 0.5, 5, 50 and 500 ha) and adjacent mature pine stands was undertaken to determine the influence of harvest area on beetle biodiversity. Species richness and community composition were compared across recent clearfell, mature stand transects. The potential of a threshold response to harvest area is discussed, as is a threshold mediated edge response to beetle community composition.

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## Simulating the invasion history of argentine ant with modular dispersal in GIS

**Presentation type:** Oral Presentation

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Joel Pitt[1]*

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The characteristics of an invasive species' spread will impact how environmental agencies respond to its incursion. High resolution predictions of how, where, and the speed at which a newly established invasive population will spread across the

surrounding heterogeneous landscape can greatly assist in producing appropriate, and timely, risk assessments and control decisions.The Argentine ant (*Linepithema humile*) is a worldwide invasive species that was inadvertently introduced to New Zealand in 1990. In this study, the simulation model Modular Dispersal in GIS (MDiG) is used to recreate the historical spread of *L. humile* in New Zealand. MDiG is an extensible, modular, spatially-explicit, and high-resolution dispersal simulation model, integrated with a Geographic Information System. High resolution probabilistic maps simulating local and human assisted spread across large geographic regions were used to predict dispersal rates and pinpoint at-risk areas for more informed pest risk assessment. The detailed maps generated by this kind of spatially explicit model can be used not only in invasion biology, but also in other fields where dispersal across heterogeneous environments plays an important role such as conservation biology and climate change studies.

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### Performance of mark-resight population estimators using two robin populations of known size

**Presentation type:** Poster Presentation

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Moira Pryde[1]*, Terry Greene[1]

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The Department of Conservation is testing and validating different bird monitoring methods as part of the Natural Heritage Management System (NHMS) to improve consistency across the country and accurately measure change in response to management actions. Methods producing robust estimates of abundance are needed if detailed population trends are to be monitored. A long-term and detailed study examining population responses of various species to management makes the Eglinton Valley in Fiordland an ideal site to test and validate different bird counting methods. South Island Robins (*Petroica australis australis*) have been identified as a key response species that is easy to monitor and occurs in reasonably good numbers. Two 100 ha sites; Knobs Flat and Walker Creek are being intensively monitored for robin productivity. The abundance of robins in these areas is known, most of the robins are banded and useful comparisons can therefore be made with other monitoring methods.Robin populations at Knobs Flat and Walker Creek were surveyed in August (pre breeding) and March (post breeding). Territory mapping data was collected throughout the survey periods that enabled us to determine the actual population, (N). Two models were tested, the Joint Hypergeometric maximum likelihood Estimator (JHE) and the Bowdens estimator, using programme NOREMARK. At both sites, Walker and Knobs Flat, the 95% confidence interval coverage for the JHE and the Bowden's estimator correspond well with the actual abundance of robins. The under estimates at Walker Creek in August 2006 reflect the fact that robins were already nesting thus all the birds were not available for sighting. These are preliminary results and the study is continuing for another year after this breeding season. The method of choosing the banded birds is biased and tends to slightly underestimate the population. Alternative improved models are

being evaluated and we hope to test these as they become available.

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### Interactions among pollinators, flower herbivores and forest fragmentation determine fruit set in declining *Peraxilla* mistletoes

**Presentation type:** Oral Presentation

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Reproduction in the declining New Zealand endemic mistletoes *Peraxilla tetrapetala* and *P. colensoi* is frequently strongly pollen-limited as a result of the decline in bellbird and tui populations. Recent work at two South Island sites has shown that edge plants have higher fruit set because of higher visitation to edge flowers by both birds and insects, and that edge plants also suffer less florivory from a native moth caterpillar *Zelleria maculata* which consumes the inner parts of the flower. Here we show that flowers infected with Zelleria are less likely to be visited by pollinators, and have a much reduced chance of setting fruit. An analysis of 23 mistletoe populations from throughout New Zealand shows a strong latitudinal gradient in *Zelleria* florivory with plants in the north rarely attacked compared to those in the south, and confirms the importance of edge effects in reducing rates of florivory. Multiple logistic regression shows that plant fruit set is significantly affected by latitude (higher in the south), is lower in areas with high *Zelleria* infestation and with more unopened flower buds (an inverse indication of pollinator visitation rates), and increases with mistletoe height. Together these variables account for almost all of the edge effects seen earlier. Our results show that mistletoe fecundity is driven largely by pollinator visitation rates and *Zelleria* attack, and that both processes interact with habitat fragmentation and with each other. The result is that edge plants have significant reproductive advantages over plants from forest interiors. Mistletoe reproduction is thus buffered to some extent by habitat fragmentation, though ultimately the loss of host plants will rob the plants of suitable habitat. Successful conservation may thus require a careful balance of opposing forces.

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### Development and application of the Protected Areas Network New Zealand (PAN-NZ) database

**Presentation type:** Oral Presentation

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We discuss the history and development of the Protected Areas Network of New Zealand (PAN-NZ) database, including the

successes and difficulties encountered along the way. Legally protected areas represent the first line of defence in the long-term conservation and sustainability of biodiversity. Society sets aside these areas primarily for the intrinsic value of their natural features, designating places where ecosystems and processes can operate with minimal human interference or disturbance. Knowledge of the location and distribution of protected areas is required to accurately assess representativeness of natural ecosystems and ascertain the ability of native biodiversity to persist into the future. The PAN-NZ database has been developed over the past 3 years to support the development and application of biodiversity policy, primarily at national scales. The database currently combines information on legally protected areas managed by the Department of Conservation, regional councils, and three covenant schemes: Queen Elizabeth II National Trust, Nga Wheuna Rahui, and Nature Heritage Fund. The combination of protected areas, land cover, and land environments generates the threatened environments classification, which parallels the threatened species classification and provides an intuitive tool for conservation management by a range of end-users. The classification has been applied in a number of projects to guide and inform biodiversity management. A current TFBIS project focuses on overcoming some of the hurdles in completing the database, including scoping the effort required to obtain missing information and identifying a pathway forward for long-term development, storage, and dissemination.

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### Using scenarios to estimate the condition and trend of coastal environments

**Presentation type:** Oral Presentation

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Coastal environments are an iconic and highly valued part of New Zealand's landscapes but their complex nature makes them hard to define and delineate in a practical sense. Neither the Resource Management Act nor the National Coastal Policy Statement provides a single definition. Recent computational advances and development of nationally-consistent datasets provide new means for analysing such complex issues. Using national datasets of topography, soils, land cover, land environments, political boundaries and legal protection, we generated scenarios delineating different coastal environments and evaluated their condition and recent trends. Extent of coastal environment scenarios ranged from 133,049 to 582,014 ha nationally. Condition (presence/absence of indigenous land cover) varied from 31.3 to 54.3% of total area, compared to 48.5% nationally. The amount of remaining legally unprotected indigenous land cover varied from 56.1 to 65.9%, compared to 37.9% nationally and was 1.5 to 3.2 times more likely to occur in a threatened land environment. Therefore coastal environments, regardless of their exact delineation, remain vulnerable to further loss of biodiversity and natural character. Coastal environments appeared relatively stable over the past 5-7 years, which mostly reflected insensitivity of underlying databases than actual changes on-the-ground. Despite some

limitations, scenarios represent a useful method for exploring complex issues such as proper coastal environmental management. They provided quantitative, nationally consistent, and transparent estimates of the coastal environment and tested a range of possible definitions of coastal environment. They could also incorporate cultural, economic, and social considerations to examine a more complete range of issues, values, opinions, and options.

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## Mast seeding and the importance of predictive diapause in a seed insect predator and its parasitoids

**Presentation type:** Oral Presentation

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Many insects are capable of perceiving environmental cues such as photoperiod and temperature and respond accordingly with specific physiological, behavioural or morphological modifications. These modifications enable insects to survive unfavourable conditions in a state of reduced metabolism or, in other words, diapause. The recently described *Eucalyptodiplosis chionochloae* (Diptera: Cecidomyiidae) is a specific seed predator of Chionochloa spp. that enters prolonged diapause to escape the extreme mast seeding of its host plant. *E. chionochloae* are parasitized by two specific parasitoid species, an undescribed *Gastrancistrus* sp. (Hymenoptera: Pteromalidae) and an undescribed *Zelostemma* sp. (Hymenoptera: Platygastridae). The two parasitoid species have also been found to enter prolonged diapause that synchronizes with their host's biology. We wanted to find out whether the insects from all three species use external cues to control their diapause. Such cues can be environmental (elevated temperature, water stress), relate to plant physiology (higher levels of plant's gibberellic acid) or a combination of environmental and plant cues. We manipulated plants of two Chionochloa species with the above possible cues at two elevations over two years of insect emergence. Our results suggest that insects from all three species change their diapause or emergence rates according to external cues. We concluded that *E. chionochloae* and its parasitoids have evolved to predict external conditions and use "predictive diapause" to increase their fitness.

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## Mapping the flora – a biogeographic basis for plant conservation

**Presentation type:** Oral Presentation

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Understanding past and current plant distributions has many applications to nature conservation. These include gap

analysis, monitoring environmental change, biological survey, biosecurity, research, restoration and translocation, public awareness, advocacy and education. Since 1993 the Department of Conservation has collated vascular plant occurrence data for populations of plants for New Zealand's lower North Island. This has led to an improved understanding of plant distributions and to constructive changes in indigenous and naturalised plant management. This paper describes the importance of accurate plant distribution data to applied conservation management activities. Examples will be presented to show how species recovery programmes have been improved, centres of plant diversity identified and priorities for habitat protection re-assessed using plant groups such as orchids, mistletoes and threatened plants. An analysis of plant distributions using the New Zealand Land Cover Database (Version 2) and Land Environments of New Zealand (LENZ) was completed to assess relationships and evaluate whether these data sets have any role to play in improving plant conservation management. Urgently needed improvements to national systems for curation of plant occurrence data are presented.

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### Kaupapa Kererû count day: estimating the number and distribution of kererû on Banks Peninsula

**Presentation type:** Oral Presentation

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Kaupapa Kererû is an iwi-lead, community based, multi-agency project that aims to increase the numbers and range of kererû (New Zealand Native Pigeon; *Hemiphaga novaeseelandiae*) on Te Pâtaka o Râkaihautû / Banks Peninsula, Canterbury. In February 2007, Kaupapa Kererû organised a count day, asking members of the Banks Peninsula community to count kererû on the Peninsula. The study utilised the existing New Zealand map grid, and volunteers recorded kererû within 1 km² grids. The count was a huge success with 39% of the peninsula (that's a whopping 362 km²!) surveyed. A fantastic 128 people took part in the survey. A total of 648 kererû were recorded. Kererû were observed within 42% of the surveyed grids. 63% of the kererû observed on the day occurred within native forest or scrub, compared with 29% in exotic forest or farmland. Although only 8% of the kererû observed occurred within urban habitat, 47% of the surveyed grids containing urban habitat had kererû within that urban habitat. The count will be repeated every two years so that trends can be observed.

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## Food or sex: which would you choose?

**Presentation type:** Poster Presentation

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The debate on why sex is usually more beneficial for reproductive fitness than selfing has been continuing for years. The carnivorous plant genus *Drosera* is an ideal study system because there is additional cost to sexual reproduction when pollinators are captured as prey.
To define this pollinator-prey conflict and dependence on insects as pollinators, we measured selfing and outcrossing rates, and pollinator/prey overlap for two morphologically different species: *D. arcturi* and *D. spatulata*. In montane and alpine bogs in New Zealand, we found *D. arcturi* depends on insect pollination less than *D. spatulata*. There is a large overlap in floral visitor and prey taxa for *D. arcturi*, and high variation is exhibited in separation of traps and flowers including complete overlap, suggesting potential for pollinator-prey conflict. Floral visitor taxa are never found in traps of *D. spatulata* and trap-flower separation is much greater and less variable. Seedset varied greatly for all treatments of *D. arcturi* flowers, however high seedset is common for bagged flowers, which implies a large amount of selfing. Phenological observations suggest pseudo-cleistogamy, prior and delayed selfing are the predominant mechanisms for *D. arcturi*, while only delayed selfing was observed in *D. spatulata*. Emasculated flowers tend to abort fruits or produce very few seeds, suggesting low pollinator efficiency for outcrossing in *D. arcturi*. In addition, flower opening of *D. arcturi* is not reliant on weather conditions; flowers open on bad weather days when pollinators are absent, while *D. spatulata* flowers only open with good weather, when pollinators are most abundant. We suspect that plants with more pollinator-prey conflict depend on selfing instead of sex for reproduction. The benefits of capturing pollinators may outweigh the costs of selfing for *D. arcturi*, whereas selfing may be too costly for *D. spatulata*. Determining selfing costs is the next stage for this study.

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## The history and origin of New Zealand's terrestrial vertebrates: recent advances in knowledge

**Presentation type:** Oral Presentation

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Since the 1980s, many significant New Zealand fossils have been described, including more dinosaurs, a crocodilian, a terrestrial 'Mesozoic ghost' mammal and the first Tertiary records of frogs, sphenodontids, lizards and bats. For birds,

there are intriguing Late Cretaceous/early Paleocene remains still awaiting detailed description and the earliest known penguins in the world have been discovered. Other significant Tertiary bird fossils described include a rich avifauna from the Early Miocene near St Bathans and a small terrestrial fauna from the Mid-Pleistocene near Marton. Molecular results have supported the Gondwanan origin of some distinctive New Zealand terrestrial vertebrates, such as moa and New Zealand wrens, but suggest that the ancestors of others, including New Zealand wattlebirds and piopio, arrived through dispersal in the Tertiary. Morphological and molecular research has resulted in significant advances in understanding the relationships and origins of the recent fauna. It has led to many taxonomic changes, with a significant increase in the number of bird and reptile species recognised. It has also resulted in the recognition of several more Holocene bird species extinctions. The conclusion that Holocene extinctions were primarily caused by human-hunting and predation by other introduced mammals (particularly rats and cats) has been supported by new data.

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## Parasites, populations, communities and ecosystems – the role of parasites in the natural world

**Presentation type:** Oral Presentation

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Traditionally, parasites have not been considered as agents that influence either the population dynamics or community structure of wild vertebrate populations, or the large-scale functioning of ecosystems. This is most likely due to the fact that disease effects are often quite subtle, or usually only a few individuals exhibiting clinical symptoms are found. In addition, it has only been relatively recently that we have had the necessary tools available with which to prove the role that parasites can play in the field. Here I present a series of case studies that illustrate the larger scale effects that we now know that parasites acting in often 'invisible' ways can have. When introduced to new localities with either invasive or introduced hosts, parasites can be the driving force behind the ecological displacement of one species by another. For example, it is now clear that an introduced viral agent is playing a key role in the displacement of native red squirrels by invasive grey squirrels in the UK. That such agents can alter the community structure of their hosts to such a degree that it impacts ecosystem functioning is clearly illustrated by the impact of avian malaria in Hawaii; evidence is presented that such an impact of avian malaria may be ongoing in New Zealand today. Finally, how parasites can act as 'ecosystem engineers', altering the resources available for non-parasitised hosts, and the potential scale of climate change effects on ecosystems via effects on parasite interactions, are illustrated.

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## Island biodiversity research strategy (interactive discussion)

**Presentation type:** Oral Presentation

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The New Zealand Biodiversity Strategy (NZBS) proposes that research strategies should be developed in order to meet the strategy goals. We outline the way a research strategy could be developed that reflects the goals of the NZBS for the conservation of biodiversity on islands. Four outcome statements in the Department of Conservation Statement of Intent form the framework for the research strategy: ecological integrity will be maintained and restored; the full range of ecosystems will be conserved; the security of threatened species will be improved; and people will contribute to conservation. We use ecological integrity as our central theme. There are six objectives nested within the definition of integrity that we can use as the basis for input into two questions: where are we now and where do we need to be? Our preliminary enquiries indicate that the focus on ecological integrity raises a need to understand ecosystem processes that are poorly understood. This may be a productive area for further study. Other components of integrity are well known, but present long recognised difficulties. Examples include issues with effective control of weeds and pests, the ecosystem effects of successful pest eradication, the management of genetically constrained populations of threatened species and fuzzy target problems with island restoration. Many studies are attempting to deal with these issues but few have attempted to address a relatively new field: the social and ecological outcomes of biodiversity management by community groups.

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## Cultural evolution of song in kokako (*Callaeas cinerea wilsoni*) at Pukaha Mount Bruce

**Presentation type:** Student Day

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Kokako is one of New Zealand's endangered species, with only a few populations remaining. Kokako are unique because individuals from different areas have different dialects and will generally only mate within their dialect. Translocations of birds originating from different areas have been unsuccessful because the birds do not interbreed. This type of behaviour leads to close relatives breeding with one another and this may lead to extinction as lethal defects appear in populations. It is urgent to find a way for different groups to breed with one another to secure the survival of this species. At Pukaha we have the unique opportunity to study how song affects populations because two different groups of kokako were translocated several years ago. These birds have bred

exclusively within their dialect and their offspring have started to breed themselves. For my Masters project I would like to determine if the song from these young birds is a new dialect for Pukaha which will potentially unify all the birds and allow interbreeding. To address this point I propose to: record song from birds at the original translocation sites; the birds translocated to Pukaha; and the offspring born at Pukaha. From these recordings I will look at the make-up of each bird's song and: compare the Pukaha born birds with the translocated ones and the birds at the original sites; and determine changes to the song over time and whether coexisting at Pukaha may have influenced the song of the translocated birds.

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### The management of risks assoicated with importing new organisms into New Zealand (HAZNO Act)

**Presentation type:** Poster Presentation

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The Purpose of the Hazardous Substances and New Organisms (HSNO) Act is "to protect the environment and the health and safety of people and communities by preventing or managing the adverse effects of hazardous substances and new organisms." This poster portrays the current management of risks associated with importing new organisms by contrasting the approach to introductions prior to the HSNO Act.

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### Uncertainties remaining about non-target effects of aerial 1080 operations and experimental designs for exploring them.

**Presentation type:** Oral Presentation

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Randomized blind replicated experiments may permit strong inference about the risks to non-target forest animals from aerial application of baits containing 1080, but no such experiment has ever been done in New Zealand. Does this mean our ability to predict changes in size of non-target populations is weak, and therefore that conservation managers are taking unjustifiable risks in continuing to control possums and rats in this way? We review studies of non-target populations at sites treated with aerial 1080 and evaluate the power of these studies to detect effects and their generality to other sites or other populations. We describe experimental designs that meet the challenge of detecting effects when the so-called gold standard is neither achievable nor appropriate. Our aim is to identify any remaining uncertainties around the risks to non-target populations at sites where 1080 is applied by air.

## Emerging patterns of abundance and diversity in Wellington's urban avian community

**Presentation type:** Student Day

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Historically, urban landscapes have been the domain of introduced species but more recently we have witnessed their re-invasion by native forest bird fauna. This research aims to describe the nature of this re-invasion by increasing our understanding of how birds, especially native species, use resources in Wellington, New Zealand This study quantifies avian species abundance, its diversity and distribution within the Wellington urban area and documents species use of available resources. The research design uses six routes within a 5 km radius of central Wellington. All routes are strip transects that include a pronounced gradient from urban green space to the central business district. Each route includes stratified random five-minute bird counts (5BMC). Fifty-two 5MBCs were conducted monthly from February to October 2007. Summaries of abundance data indicate that bird biomass is greater in the inner city core, but predominantly reflects three species – sparrows, rock pigeon and gulls. Abundance correlates with time of day particularly for sparrows and rock pigeon. Species richness is uniform across the routes and generally increases with distance from the city.

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## LENZ - is it fit for purpose yet?

**Presentation type:** Oral Presentation

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When LENZ was launched in 2003 it was said that LENZ units are areas of land having similar environmental conditions, allowing prediction of the character of natural ecosystems (or potential ecosystems) on that land. Extensive testing of the Level 4 LENZ mapping against ecological character in East Coast Hawke's Bay (and at reconnaissance level beyond) shows, in my opinion, a high prevalence of large anomalies throughout the classification. Most LENZ units contain widely disparate environments, as shown by indigenous vegetation or related indicators like land-use. Conversely, many areas appearing to be of similar ecological character are classified far apart in LENZ implying a large environmental distance between them. Some anomalies may be attributed to inadequacies (errors or over-generalisation) of the "data" in some of the 15 drivers. While these are undoubtedly important, more generally I infer there may be need for reformulation of some of the drivers (eg drainage, slope, soil age, minimum temperature, solar radiation, rainfall/moisture drivers). Most notably, the current model by which the 15 drivers are combined (which allows wide disparities in one or two drivers to be

accommodated within a single LENZ unit if the data for the other drivers are close) appears to be the fundamental problem. It means for example that LENZ F6.2a can range from sea level to 1300 m, covering a range of mean annual temperature corresponding to NZ's entire latitudinal extent, as well as slopes from near zero to 46 degrees. In my opinion LENZ is a promising tool of enormous potential, but it should be regarded as a work in progress still in its early stages. In its current form it is substantially inadequate and generally not fit for the purposes for which it has been promoted and used, carrying high risks, including to the future of LENZ itself if it is formally discredited. Instead, I suggest it be more systematically evaluated in respect of its core premises of the match to ecosystem character, and that substantial effort go into its re-development.

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### Altering native foodwebs: indirect effects of ragwort (*Senecio jacobeaea*) invasion and naturalisation in New Zealand

**Presentation type:** Poster Presentation

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Indirect effects, particularly apparent competition, are increasingly considered important in structuring natural communities. With the relatively recent increase in species introductions and invasions, indirect effects from such invasions can alter native ecosystems in a number of ways. My research focuses on a specific dimension of this and looks at host-switching and differential herbivory by the native New Zealand magpie moth (*Nyctemera annulata*). My hope in this research is to determine if, and to what extent, magpie moth herbivory has in mediating apparent competition between native and invasive *Senecio* species. To do this I will collate historical evidence of changes in magpie moth and *Senecio* distributions, associations and abundance since European settlement. This will be complemented with a number of laboratory and field assays to uncover host preference and suitability, as well as larval impacts to the respective host plants. Landscape level observations will be combined with this local field data to determine the relative impacts of magpie moth herbivory on each alternate host plant. Similarly I will attempt to determine if the proximity of different species of host plants to one another has an impact on the level of herbivory and the fitness impacts that they experience. Together this data will help to determine if there is any support for a hypothesis of apparent competition mediated by magpie moth.

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## Patchy distribution of mice, rats and stoats in relation to population density index

**Presentation type:** Poster Presentation

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Trap saturation in local patches of high population density represents a significant hurdle to measurement of small mammal populations by most methods. This project reanalysed large historical datasets from two different habitats, using an index of patchiness to estimate local variation in distribution. This poster describes the patchy distributions observed in populations of mice (*Mus musculus*) and stoats (*Mustela erminea*) from the Eglinton and Hollyford valleys in Fiordland, and in ship rat (*Rattus rattus*) populations from Pureora Forest Park. Significantly patchy samples were observed in all of these data sets, and over all density index values for ship rats and mice, but only at low density index values for stoats.

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## Hutia Te Rito O Te Harakeke: understanding harakeke ecology and Maori historical management

**Presentation type:** Poster Presentation

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Harakeke is everywhere! But has this always been the case? What did Mâori know of harakeke ecology? Mâori historical resource management of harakeke (*Phormium tenax :* Hemerocallidaceae) was investigated. Harakeke is a weaving plant traditionally used to produce clothing, baskets, mats, fishing nets and other essential items, and it remains highly valued. Mâori identified around 60 specific harakeke varieties for their high quality fibre. I hypothesised that harakeke has historically been actively managed by Mâori, with resulting modification of the New Zealand landscape. Research methods included analysing historical documents, interviews with elders, and distribution modelling of herbaria specimens. Evidence from these sources supports my hypothesis. Many varieties were extensively cultivated using an array of management techniques, some of which are no longer evident because of loss of traditional ecological knowledge. Both historical records and whakataukî provide evidence of Maori knowledge of seed germination requirements that may have promoted the expansion of harakeke distributions. Historical projects such as this illuminate our understanding of past processes of modification to natural areas, and the relationship between people and plants over time. Recovery and support of traditional knowledge helps strengthen the contemporary relationship between communities and plants, particularly where these have high cultural values. Traditional Maori

practices and knowledge can be incorporated into restoration management plans.

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### Urban weta in forest fragments: marooned survivors or successful dispersers? Ecological genetics of *Hemideina thoracica*, the northern tree weta, in urban forest fragments

**Presentation type:** Oral Presentation

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There is widespread recognition that spatial patterns affect ecological processes. Both population and species loss can be driven by land transformations associated with urbanisation, such as habitat fragmentation. Island biogeographic theory predicts that habitat fragmentation can potentially to increase extinction rates, because of Allee and edge effects, and because genetic drift can erode genetic variation in small populations. However, modified habitats, such as the urban matrix that surrounds native habitat fragments, are not necessarily hostile to all native organisms, and it appears that the northern tree weta (*Hemideina thoracica*) may be such a species. As the first part of a project investigating urban weta ecology in Hamilton, we are examining genetic variability in a range of northern tree weta populations. This has involved sampling antennae from weta in large rural forest tracts in the Waikato, the urban matrix itself, and small isolated urban forest fragments. We discuss the likelihood of population isolation in relation to our findings, and the history of fragmentation in the Waikato. What does genetic variability suggest about weta dispersal ability and use of modified habitat in the urban matrix?

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### Plants for constructed mine wetlands in New Zealand: a case study at Golden Cross Mine

**Presentation type:** Oral Presentation

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Phytoremediation is commonly used in mining applications overseas, but no prior research has addressed the efficacy of New Zealand species in this role. This paper evaluates the use of twelve species of indigenous aquatic macrophytes for use in wetlands constructed to treat acid mine drainage in New Zealand. Plants were exposed to raw and semi-treated mine waters, and uncontaminated stream water, in wetland microcosms at Golden Cross mine, Waihi. Above and below ground growth and metal uptake was compared for *Apodasmia similis , Baumea articulata , B. teretifolia , Bolboschoenus fluviatilis , Carex secta , Eleocharis acuta , E. sphacelata , Isolepis prolifer , Juncus gregiflorus , J. pallidus , Schoenoplectus tabernaemontani* and *Typha orientalis* . A

range of native New Zealand species appear to be suitable for use in constructed mine wetlands. There was little evidence of metal toxicity in the trial at Golden Cross. Indeed, the nitrogen and phosphorous content of waters entering the microcosms had more influence on growth characteristics of the trial species than did metal loadings. This research suggests that *B. articulata* and *J. pallidus* possess the most desirable traits for deep water plantings in constructed mine wetlands in New Zealand. Species most suitable for shallow margin plantings included *B. teretifolia , C. secta , E. acuta* and *J. gregiflorus* . These species all exhibited strong year round growth and would thus provide stable environments for metal removal processes.

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**Predicting the potential range of threatened species: the use of long-term data to assess suitable habitat for whio throughout New Zealand.**

**Presentation type:** Oral Presentation

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The conservation of threatened species can be hampered by a poor understanding of habitat requirements, potentially jeopardising the success of management programmes. Traditional assumptions that contemporary population ranges are correlated with habitat quality may be inappropriate for threatened species, which are often restricted to small, fragmented areas. However, the potential range of a species can be assessed by using long-term distributional data to correlate individual sighting records with local environmental variables. These relationships can be used to predict the suitability of habitat in areas outside the current range, providing valuable information to managers. Whio (*Hymenolaimus malacorhynchos*) are a unique riverine waterfowl species endemic to New Zealand. Once widespread, they are now restricted to small, isolated populations due to large-scale habitat loss and predation by introduced mammals. Twenty-five years of whio presence data was used to assess the relationship between the distribution of whio and environmental predictors that characterise their riverine habitat. Modelling was performed using multivariate adaptive regression splines (MARS) and a Geographic Information System to produce a spatially explicit prediction of the relative suitability of habitat for whio across the entire New Zealand river network. The number of high rainfall days described twice as much variation than all other variables, while predictors describing air temperature and river flow were also important. Whio currently occupy a small subset of their potential range but information about habitat suitability will allow managers to identify and prioritise areas where conservation efforts should be targeted for whio.

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## The polynesian revolution and the prehistoric transformation of New Zealand

**Presentation type:** Oral Presentation

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From the mid 1950s up until the early 1980s, climate change was widely accepted as having shaped the pre-European distribution and structure of New Zealand forests. It was only in the mid-1980s that it became apparent from radiocarbon dated pollen and charcoal records that prehistoric anthropogenic fire, rather than climate change, was the most likely cause of the massive and unprecedented deforestation in the drier lowland areas of New Zealand. However, the timing, extent and pattern of change were only determined from a handful of records which were poorly constrained, allowing a number of theories to develop on the timing of initial human arrival ranging from c. 2000 to 1000 years ago. These are seemingly small differences compared with long-settled continental areas, but are enough to hinder the broader understanding of ecological and social transformation in Remote Oceania. Since the 1990s, these theories turned into heated and polarised debates with the addition of more detailed palaeoecological records; a reassessment of radiocarbon dates associated with archaeological sites and deforestation; and the application of new accelerator mass spectrometry radiocarbon techniques (allowing tiny and individual bones and seeds to be dated providing greater precision) to dating the introduction of the commensal Pacific rat (*Rattus exulans*). Here I discuss the various lines of data now available that document the prehistoric transformation of New Zealand, and show the latest radiocarbon dated evidence that suggests initial human settlement was relatively late (c. 1280 AD) and simultaneous with deforestation, faunal extinctions, and the introduction of the Pacific rat.

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## Dynamics of house mouse populations in an alpine landscape

**Presentation type:** Oral Presentation

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Every few years, the snow tussock grasses (*Chionochloa*) dominating New Zealand's alpine grasslands produce large numbers of flowers and later seeds. Whether increased abundance of introduced house mice (*Mus musculus*) in alpine habitats follows these pulses in seed availability has not previously been studied, although the relationship between seedfall from southern beech trees (*Nothofagus*) and mouse population fluctuations is well documented. We assessed the density of house mice by capture-mark-recapture trapping in alpine grassland and adjacent montane beech forest in 2003–

2004, and only in alpine grassland in 2005–2007, in the Borland Valley. We also used snap traps to collect mice for stomach contents analysis, and measured flowering intensity of snow tussocks and production of beech seed. The density of mice was low in both habitats during most of the study. Snow tussocks flowered profusely in summer 2005–2006, and alpine mouse density increased 14-fold by the following spring. Density then declined during the following summer but was still unusually high in the next autumn (May 2007). Beech seedfall was also high in autumn 2006 and mice may have become abundant throughout the landscape. Native biota including birds, lizards and invertebrates may be threatened as the result of fluctuations in populations of alpine mice. For example, ground weta (Orthoptera*: Hemiandrus*) were a common prey item in the stomachs of alpine mice, and capture rates of mice and ground weta in snap traps were inversely related. These results suggest that predation by mice may reduce the abundance of these insects.

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## New Zealand's shingle beaches: significant rare ecosystems or exotic-dominated wastelands?

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In New Zealand, the heterogeneity of the landscape has resulted in a diverse array of small, often widely dispersed, rare ecosystems that tend to occur in extreme, typically treeless, environments. In 2006-07 studied 49 shingle beaches to better understand this naturally rare ecosystem that is widespread nationally, has never been surveyed nationally for plants or invertebrates, is highly threatened by urbanisation, weeds, adjacent agriculture, and introduced animals, and contains both threatened plants and fauna and endemic plants. Worldwide, shingle beaches are relatively rare, occurring mostly at mid-high latitudes that underwent Pleistocene glaciation. In New Zealand shingle beaches occur where rivers deliver large quantities of gravel to the coast or where gravel is being eroded from the coastal cliffs. Although shingle is widely distributed around the coast, at most sites the shingle is largely below the storm surge line. Only 36% of the shingle beaches visited had shingle occurring inland from the foreshore (i.e. the berm and backdune) and so supported vegetation. Many of the sites we sampled are highly modified by exotic plants and animals, but some still have a significant, and often distinctive, native component. Across beaches plant composition varies according to geography, beach stability and substrate particle size. Invertebrate composition is the most rich on the more stable shingle beaches. Invertebrate biodiversity highlights include discovery of a rare egg laying velvet worm, *Ooperipatellus viridimaculatus* , an exotic ant *Hypoponera confinus* , new to NZ, and potentially new species of rove beetle genera harpaline carabids.

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## The role of habitat patterns in controlling the impact of predatory trout on non-migratory galaxiid distributions across riverscapes

**Presentation type:** Oral Presentation

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Introduced trout have been implicated in the decline of non-migratory galaxiid (NMG) fish populations within New Zealand river systems, though the mechanisms underlying these impacts are still poorly understood. Variation in habitat conditions across the landscape of a river network, or "riverscape" may mediate the interactions between trout and NMG, thereby controlling the distributions of the galaxiids. We investigated the seasonal distributions of Galaxias vulgaris and Galaxias paucispondylus across three trout-invaded riverscapes in the upper Waimakariri and Rakaia catchments containing fragmented populations of both species. Analysis of NMG occurrence outside of trout-free "source" streams indicates that both species form source-sink metapopulations within invaded riverscapes. A reach-scale stream-manipulation experiment showed that the presence of large predatory trout is a critical factor controlling local galaxiid distributions. While river disturbance appears to control the distribution of large trout, local channel size and habitat complexity of stream reaches interact to create refugia for recruiting young fish, allowing persistence in "sink" regions of the trout-invaded riverscape. By modeling riverscape habitat structure we aim to predict the presence of NMG in invaded reaches of other catchments based on the prevalence of trout-predation refugia.

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## Consequences of dispersal failure: effects on recruitment in large-seeded trees

**Presentation type:** Oral Presentation

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Kereru (*Hemiphaga novaeseelandiae*) are the sole remaining widespread frugivores capable of swallowing and dispersing large-seeded plant species in New Zealand. The dispersal of large-seeded trees is under threat as kereru numbers have declined due to illegal hunting, habitat loss, and introduced mammalian predators. We investigated the consequences of dispersal failure for the large-seeded tree species taraire (*Beilschmiedia tarairi*) and karaka (*Corynocarpus laevigatus*). We compared the fate of dispersed and undispersed seeds for up to two years in the field. We recorded seed predation, germination, and seedling survival for seeds under conspecific adults ("parents") and 20 m away from the parent, whole fruits vs. hand-cleaned seeds, seeds at high and low densities, and seeds enclosed in mammal-proof cages vs. uncaged seeds.The combined cumulative effects of dispersal failure and introduced

mammals decreased taraire survival after one year from 15% for dispersed seeds protected from mammals to 2% for undispersed seeds with access by mammals (an 87% reduction). For karaka, combined cumulative effects of dispersal failure and introduced mammals decreased survival after two years from 60% for dispersed seeds without mammals to 11% for undispersed seeds with mammals (an 82% reduction). Hence, the effects of pigeon seed dispersal persist beyond the dispersal and germination stages. Both dispersal failure and introduced mammals have negative consequences for the regeneration of taraire and karaka in New Zealand forests.

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## A myriad of reserve types - the need for an offshore & outlying island management strategy

**Presentation type:** Oral Presentation

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The Department of Conservation (DOC) manages hundreds of islands, extending over 23 degrees of latitude, from the cool temperate subantarctic islands ,to the warm temperate islands of the Kermadecs. The New Zealand Archipelago is recognised globally as a hotspot of biological diversity. Many of the organisms, including an exceptional range of land snails, spiders, lizards and seabirds, are found nowhere else. The Department's broad range of management roles on these islands reflects the history of use by people, land tenure and legal classification. Management activities can include eradications, biosecurity, restoration, species management, maintenance of historic and cultural values, research, monitoring, recreation and community participation. Decisions about a specific management regime require not only knowledge of each island's values, but judgements about the relative importance of these values in a regional and national context. To provide a framework that will assist decision making within a context of the Department's own strategic directions, a strategy for offshore and outlying islands has been drafted. The strategy defines the long-term goals and outcome objectives that guide how the Department of Conservation will manage the islands for which it has responsibility. A key component of the Strategy is an island classification system that groups DOC managed islands according to their ecological and legal status for example Nature Reserves, Scientific Reserve and islands in National Parks. The classification has six categories with management goals and outcomes assigned to each. These range from those aimed at maximising ecological integrity through restoration to species management through community involvement. This framework will allow DOC to more effectively manage islands with similar goals, in a nationally consistent way. The Offshore & Outlying Island Strategy is scheduled for completion by the end of 2007. A key step in operationalising the strategy will be to classification of all the islands that DOC manages into the six categories of the framework. Underpinning the implementation of the Island Strategy is DOC's Island

Biosecurity Programme and the development of an island research strategy.

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## Scale and nematode contributions to ecosystem processes

**Presentation type:** Oral Presentation

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Nematodes are the most numerous multicellular animals on earth. As pathogens of plants, arthropods and vertebrates nematodes operate at the scale of the host population. Microbial grazing by soil- and sediment-inhabiting nematodes results in enhanced microbial turnover and excretion of nitrogen surplus to the grazers' requirements. Such grazing interactions occur at several trophic levels, including various micro- and meso-biota. The quality and quantity of above- and below-ground inputs by plants affects the soil biota; microbial colonisation of roots affects nematode access. Predacious and parasitic microflora and predacious micro- and mesofauna may regulate microbial-feeding nematode populations, and thus their impact on soil microbial pools, fluxes and nutrient cycling. Such regulation is compounded by interactions between soil type, natural vegetation and year-to-year climatic variation suggesting that at the ecosystem scale it is integration of local patches that determines overall nematode contribution to ecosystem function. The impact of natural and managed above-ground diversity on below-ground nematode diversity and their contribution to ecosystem processes will be discussed.

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## Presenting Authors Index

# NZ Ecological Society

## Feathers to Fur - the Ecological Transformation of Aotearoa New Zealand - Conference Attendee List

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# NZ Ecological Society

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# NZ Ecological Society

## Feathers to Fur - the Ecological Transformation of Aotearoa New Zealand - Conference Attendee List

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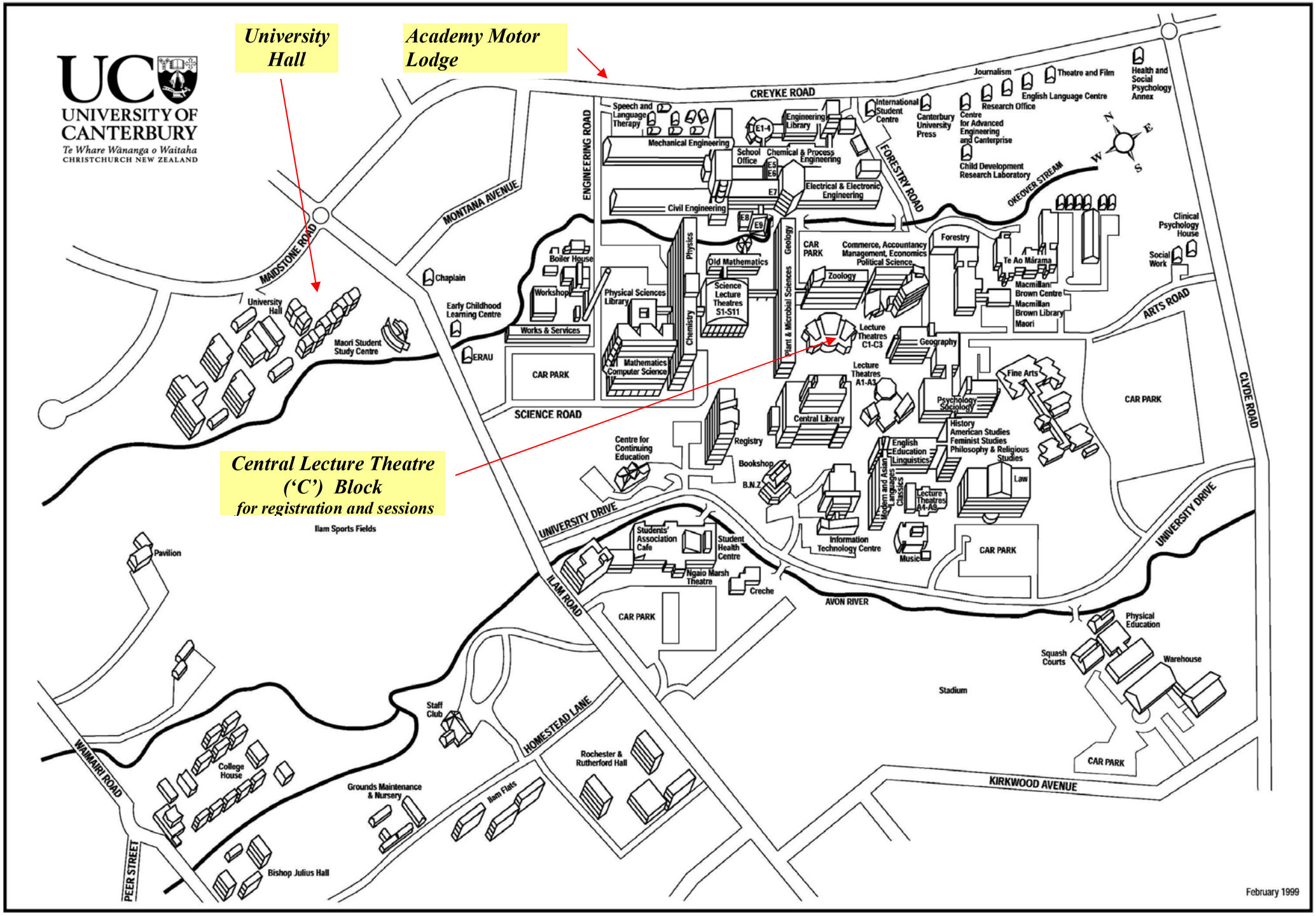
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OKEOVER STREAM
ARTS ROAD
CLYDE ROAD
SCIENCE ROAD
UNIVERSITY DRIVE
ILAM ROAD
AVON RIVER
WAIMAIRI ROAD
PEER STREET
HOMESTEAD LANE
KIRKWOOD AVENUE
Central Lecture Theatre ('C') Block
for registration and sessions
Ilam Sports Fields
Speech and Language Therapy
Mechanical Engineering
School Office
Chemical & Process Engineering
Engineering Library
E1-4
E5
E6
E7
E8
E9
Civil Engineering
Electrical & Electronic Engineering
International Student Centre
Canterbury University Press
Centre for Advanced Engineering and Canterprise
Child Development Research Laboratory
Research Office
English Language Centre
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Stadium
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N
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S
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