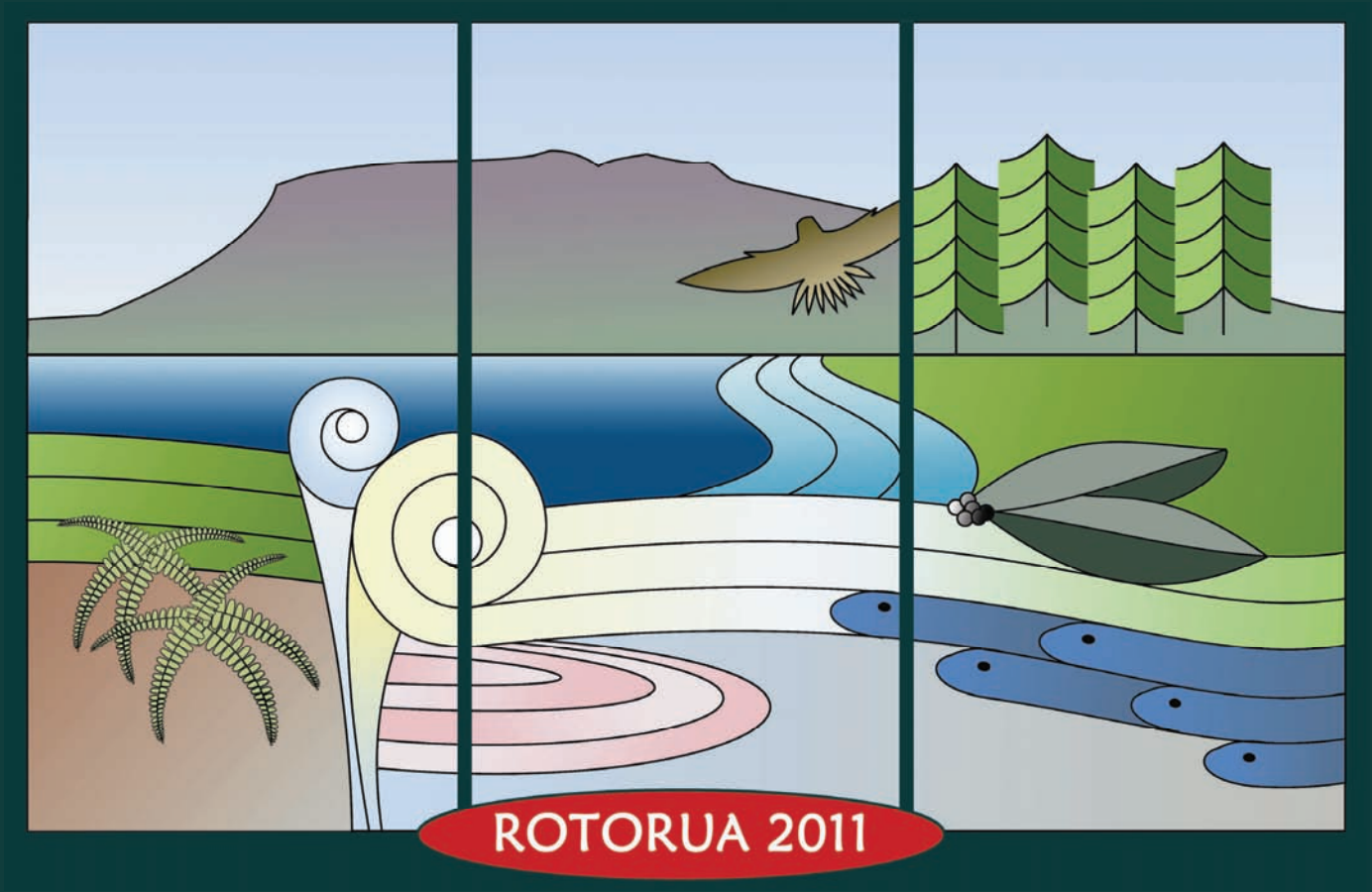
Ecology in the Heartland



Celebrating 60 years of the New Zealand Ecological Society

28 August — 1 September 2011

Energy Events Centre, Rotorua

Hosted by: NEW ZEALAND ECOLOGICAL SOCIETY

In partnership with: NZSPB New Zealand Society of Plant Biologists

Lead Sponsor: THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato

www.nzecologyconference2011.com

CONNEX event innovators

Lead Sponsor

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Gold Event Sponsors

Department of Conservation
Te Papa Atawhai

Shaping Rotorua
DESTINATION ROTORUA
ROTORUA DISTRICT COUNCIL

Landcare Research
Manaaki Whenua

Wildlands
ecology@wildlands.co.nz, www.wildlands.co.nz

Silver Event Sponsor

OPUS

Bronze Event Sponsors

Bay of Plenty
REGIONAL COUNCIL

NIWA
Taihoro Nukurangi

SCION
forests · products · innovation

waiariki
Centre of Excellence in Environmental Sustainability
Te Pūtahi Tiketike Ōranga Taiāo
Whare Takiura

Kessels & Associates Ltd
ECOLOGY AND ENVIRONMENTAL PLANNING

Event Supporters

HRS
Hoare Research Software Ltd

FOREST OWNERS ASSOCIATION

New Zealand Institute of Forestry

WILEY-BLACKWELL

WAIMANGU
volcanic valley

Clearwater Cruises
Rotorua New Zealand

Ecology in the Heartland

28 August – 1 September 2011, Energy Events Centre, Rotorua

Welcome and Conference Overview

He aha te mea nui o tenei āo
He tangata, he tangata, he tangata

What is the most important thing in this world today?
It is people, people, people.

Welcome to 'Ecology in the Heartland' in Rotorua; the 2011 joint annual conference of the New Zealand Ecological Society (NZES) and New Zealand Society of Plant Biology (NZSPB). The organising committee is really pleased with the excellent selection of symposia and papers. We are sure you will enjoy your time at the excellent venue we have for a conference in Rotorua.

This conference has a good mix of ecological research and plant biology papers, with *c.*130 oral presentations. A number of papers are also of interest to researchers in animal ecology. This year is the 60th year of the NZES, and it is a remarkable achievement that the Society has had an annual conference in every year of its existence. We welcome members of the NZSPB as we celebrate this achievement and we hope the interactions between the two societies will strengthen the science and contributions made to New Zealand society by both organisations.

The theme for this year's conference is "Ecology in the Heartland", which recognises that this year's conference is in Rotorua, the most inland city of New Zealand. Many of the themes are relevant to research of importance to the New Zealand heartland, with ten symposia and an excellent selection of oral presentations and posters. We have twelve plenary speakers from the United States, Australia, and New Zealand. During this conference we will recognise the contributions of two people that have had a major contribution on New Zealand Ecology and conservation: John Nicholls and Don Merton.

We would like to thank the contribution of our organising committee and the staff of the University of Waikato and Wildland Consultants. The organising committee also includes staff from the Department of Conservation, Bay of Plenty Regional Council, Waiariki Polytechnic, Scion, Rotorua District Council, P.F. Olsen Ltd, and NIWA. A remarkable amount of time has been contributed by many of these people in organising field trips, the student day, the conference programme, and other components of the conference, and all of this has been voluntary. The contributions of individuals who organised the many symposia of this conference have helped to ensure we have an interesting and exciting programme. We also thank "Connex" and its staff for their professional management of this event.

This conference would not have been possible without the generous support of all of our sponsors (see opposite page). Our lead sponsor is the University of Waikato, which has made a remarkable contribution to this conference, both financially and in staff time. The staff of Wildland Consultants (in association with the professional conference organiser) have led the on-the-ground organisation of this year's conference in a relatively short timeframe. We particularly thank our other gold level sponsors: Landcare Research, Rotorua District Council, and the Department of Conservation.

We trust that you enjoy the conference programme and the ecological environment of Rotorua. In conference breaks take the opportunity to get outside and check out the Rotorua lakefront, lakeshore birds, and geothermal features close to the venue. We are sure you will enjoy the opportunity to visit a selection of iconic sites within the Rotorua region during the conference field trips.

Welcome to Rotorua, and have a great 60th anniversary conference.

Chris Bycroft and Willie Shaw
Conference Co-convenors

NEW ZEALAND ECOLOGICAL SOCIETY

NZSPB
New Zealand Society of Plant Biologists

Presidents Welcome

On behalf of the New Zealand Ecological Society and the New Zealand Society of Plant Biologists we would like to welcome you to the 'Ecology in the Heartland' conference in Rotorua. The name of the conference recognises (1) Rotorua's central location in the North Island set amongst many key natural and managed ecosystems, (2) Rotorua's role as a key founding hotbed of ecological knowledge and ideas in New Zealand, and (3) a focus of the conference on discussing core current themes in our disciplines. The conference also recognises the 60th anniversary of the establishment of the New Zealand Ecological Society, an opportunity to reflect on past successes and future opportunities.

We are excited by holding a joint meeting between the two societies, and the synergies and potential for collaborative links this gathering will provide. Meeting together means we can offer an exciting range of high profile plenary speakers, recognised as international leaders in their field. We can also enjoy a diverse selection of symposia – with contributions from the scale of global change biology and ecosystem function, to plant cell biology and functioning.

The last time the two societies met together was in 1983 in Auckland. We understand that this occurred soon after the arrival in Auckland Harbour of the nuclear-powered warship the USS Texas which was greeted by much protest on land and on sea. We even understand that a couple of members of the societies were arrested during these protests and there was a collection carried out at the conference dinner to support the two being held at 'her majesty's leisure'. With that history, we wonder what memorable events will transpire in Rotorua to mark our friendship!

We want to thank the local organizing committee for putting together what promises to be a great conference. We also hope all participants take advantage of the symposia, contributed talks, workshops, field trips, and social events provided to share ideas, gain inspiration, find new collaborations, and develop novel and innovative science.

Bruce Burns (President NZES) and Mike Clearwater (President NZSPB)

Lead Sponsor Comment

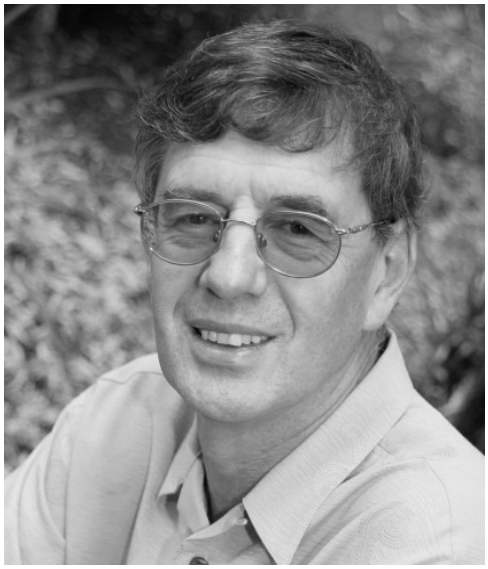
THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

It is my pleasure to represent the University of Waikato as lead sponsor of the New Zealand Ecological Society conference to be held here in Rotorua, marking the 60th year of the society. My university is a strong contributor to ecological research and teaching and is the only university located in central North Island. We have made a concerted effort to maintain a balanced teaching programme that provides a background in the latest molecular approaches as well as retaining some of the more traditional approaches in botany and zoology, to give students a well rounded foundation as ecologists. Our programmes have a high proportion of laboratory and field based activities, access to the full range of modern analytical and field equipment, and teachers passionate about New Zealand's unique flora and fauna. We encourage our students to participate in conferences like "EcolSoc" and you will see many of them giving presentations this week - at least 10 are attending. Our graduates are very successful in finding employment in government agencies such as regional and district councils, DOC, research providers and environmental consultancies.

I have good memories of attending my first ever EcolSoc conference here in Rotorua in 1982, not long after I had gained my first permanent job with DSIR Botany Division at Rotorua. I was most impressed by presentations such as those by John Nicholls on the Mamaku Plateau indigenous forests and Ruud Kleinpaste on kiwi populations in Waitangi State Forest - and fast-weight-gain Beverley in particular. Yes I can remember that detail. I also made many friends and began developing a network of valuable colleagues many of whom I still collaborate with today. Unfortunately several of our inspirational leaders like John Nicholls and Don Merton will not be here to share their knowledge with us this time. But I am sure they would have been impressed by the vigorous new cohort of ecologists attending and noticed the improving gender balance which we, at universities, have been aware of for several years. I hope you all have a successful conference and if you have any questions about what we have to offer in terms of research or teaching programmes at the University of Waikato, please contact me.

Bruce Clarkson
Dean of Faculty of Science and Engineering
The University of Waikato

Email: b.clarkson@waikato.ac.nz



It's our environment
Let's explore it together.

It's an exciting time to be an ecologist, and there is no better place to study ecology than the University of Waikato's Biological Sciences Department. Our 'backyard' has an abundance of streams, forests, lakes and wetlands. The University's labs have the best teachers, equipment and technical support.

Help contribute to the restoration of original native ecosystems or prevent the future loss and degradation of wetlands. Look at how we can control pests, and improve habitats, in collaboration with other researchers, community and tangata whenua.

Waikato graduates are highly sought after. Our ecology research was ranked number 1 in the last national grading. If you want a world-class education in the heart of New Zealand, then choose the University of Waikato – bold ideas, smart people and unlimited ambition.

Bold Ideas. Smart People. Unlimited Ambition.
Whakaaro Pūkenga. Hinengaro Koi. Pito Mata Mutunga Kore.

For more information freephone 0800 WAIKATO or visit waikato.ac.nz

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Acquire the skills to save the environment.

Environmental Chemistry is shaping the world we live in. For worldwide issues such as global warming, through to local concerns such as the state of the Waikato River, there's no place better to study these effects than the University of Waikato's Department of Chemistry.

Investigate the life cycle of antibiotics in pasture lands, convert nuisance aquatic weeds into biofuel or analyse fish pheromones in river water. All this and more can be studied using the University's state-of-the-art analytical instrumentation.

Undergraduates can take part in project-based research and secure a Summer Research Scholarship to work on environmental projects under the guidance of our talented academics.

Choose the University of Waikato - the university representing the best of New Zealand.

There's no stopping you

E kore e taea te aukati i a koe

For more information freephone 0800 WAIKATO or visit waikato.ac.nz

THE UNIVERSITY OF WAIKATO

Te Whare Wānanga o Waikato

Don't just attend a conference – wring it out for all it's worth

Conferences are an expensive investment for most of you. You will have worn the costs of travelling to and from the venue, you'll need to meet the costs of accommodation and meals, there are the registration fees and of course, the expense of you being away from your workplace has to be built in. How many of you have attended a conference like this before, worked your way through the proceedings, made a few notes and then never looked at them again?

We expect many of us fall into this category. The workplace takes over after returning from the conference. Often, even when attending a conference, many of us can't escape the urgent calls from our normal day-to-day operations. There are so many more facets to attending a conference than listening to speakers.

Conferences like these should provide you with a range of new low cost tools that you can take back to immediately improve your company's performance. They will open your eyes to new technologies that may be adopted or opportunities that can be followed up. Conferences are the ideal place for new ideas and concepts to be created. Conferences also provide you with excellent opportunities to network, make valuable contacts and deals. They provide you with a break from your normal operating environment, assist in your development and may even boost your morale.

But getting the most from conferences takes a little planning.

Before the conference:

1. Check the programme in advance.
2. Challenge yourself to set some personal and business objectives for the conference. Write them down before you leave. What do you want to accomplish from attending?
3. Find out who's going to be there and what organisations are going to be represented. If you can, check with the event organisers before the workshop begins.
4. Make appointments in advance. Phone or e-mail before the conference and arrange an informal get-together with your key contacts.

At the conference:

1. Plan to be at the conference early so you can begin networking with the other attendees before the presentations begin.
2. Exchange business cards with key contacts so you can follow up leads that you may establish during the event.
3. Force yourself to switch off the mobile phone – both during the presentations and in the breaks.
4. Ask questions of the speakers – both formally during the conference - and informally during the breaks – to answer any queries you may have. Share your ideas and experience with other attendees.

5. Listen. When listening to a presentation, listen for content – not just entertainment value.
6. Take notes. Detailed papers will be provided for all of our events. Don't listen for notes but listen for ideas, quotes, questions and actions that you can take. When you hear an idea worth recording, do it right away.
7. Before leaving the conference, write down three key ideas or concepts that you have learnt or leads that you'll follow up when getting back to the workplace. Alongside these, ensure you set a time for completion – days rather than weeks – otherwise the idea will be lost.

After the conference:

1. Act on your three key ideas that you have noted.
2. Follow up immediately on any leads or contacts made at the conference.
3. Organise a short presentation for other interested staff that were unable to attend the conference. Ensure the information, including the proceedings, is circulated within the company.

Ecology in the Heartland

Table of Contents

Ecology in the Heartland — Symposia Details

Bryophyte Ecology – from evolutionary strategies to ecosystem functions

Convenors: Pascal Michel (Landcare Research) and Anne Gaskin (The University of Auckland)

Bryophytes (mosses, liverworts, hornworts) and lichens are a distinctive and major component of the local biodiversity, with New Zealand having over 3000 native species. Frequently overlooked in ecological investigations, recent research suggests they often play a key role in the functioning of forest and grassland communities by creating microhabitats for plants and invertebrates, enhancing nitrogen inputs, and modifying local hydrology. Furthermore, bryophytes and lichens are ancient survivors providing insight into past patterns of evolution and adaptive radiation, and how organisms can persist despite ongoing environmental change. They are increasingly used in habitat restoration to control soil erosion, and monitoring to indicate pollution levels. The symposium aims to present bryophytes and lichens' functions in New Zealand ecosystems, including physiology and adaptive strategies, population dynamics, ecosystem services, associated fauna and response to disturbance.

Ecology and Plantation Forests

Convenor: Nod Kay (Scion)

Although plantation forests are usually seen as mono-specific habitats they are far from sterile and must conform to the same ecological principles of natural communities. After all, many temperate forests are 'monospecific'. However, the exotic species plantations that dominate New Zealand's commercial forests, do offer a very simplified ecosystem open to exploitation. The symposium will explore why New Zealand has largely gone with exotic species for its plantations; and the communities that have been affected by them, or established within them, from a milieu of introduced and endemic species.

Fauna Conservation and Threatened Fauna

Organiser: Avi Holzapfel (Department of Conservation)

This symposium is held in honour of Don Merton, and his remarkable contribution to fauna conservation, both within New Zealand and internationally.

New Zealand has a long history of fauna conservation, something to be both proud and concerned about. Proud, because of the successes that are worldwide benchmarks, and the attitude, science, expertise and skills that underlie these projects and are gained from them. Concerned, because it reflects the scale of the issues and the vulnerability of New Zealand Biodiversity - we still have so much to lose, and without action, we will lose much of it.

This symposium will bring together examples of fauna conservation in New Zealand, wider philosophies that underlie our approaches, and some of the agents of decline and pressure points faced by species. Alongside case studies that include three species often associated with Don's work - Black Robins, Saddleback and kakapo, research will be presented on impacts of human development on New Zealand bats, behaviour of bird and reptile species and methods to control their threats, and the genetic consequences of small population size. Dr. Marieke Lettink, in her plenary talk, will discuss whether the "farming" of threatened species is viable tool to enhance the populations of a select group of threatened New Zealand vertebrates, while Alison Balance will present highlights of the contribution Don Merton made to fauna conservation in New Zealand and abroad.

Forest Dynamics

Convenor: Chris Lusk (The University of Waikato)

The United Nations General Assembly has declared 2011 as the International Year of Forests to raise awareness on sustainable management, conservation, and sustainable development of all types of forests. To acknowledge this, it was decided to include forest ecology as one of the major themes of this conference, primarily looking at themes of forest pattern and process. The symposium begins with recognising the contribution of John Nicholls contribution to our understanding of New Zealand forest ecology. The symposium will look at elements of conservation and management of indigenous forests, the impacts on the management of carbon on biodiversity and the role of forests for carbon storage, tree pollination and patterns of seed dispersal and production, and community ecology in forests.

Freshwater Ecology – linking theory and practice

Convenor: Ngaire Phillips (NIWA)

Fresh water is essential to New Zealand's economic, environmental, cultural and social well-being. New Zealand faces challenges in managing our fresh water to provide for all of the values that are important to New Zealanders. The quality, health, and availability of our fresh water are under threat and climate change is likely to exacerbate the situation. With the upcoming implementation of the National Policy Statement for Freshwater Management, it is timely to reflect on how science can contribute. Management of freshwater resources should be based on the application of practical scientific methods and have a sound theoretical basis. In this session we will present a range of studies illustrating the diversity of theoretical constructs within which freshwater environments are managed.

Global Change Biology

Convenors: Luitgard Schwendenmann and Cate Macinnis-Ng (The University of Auckland)

Terrestrial ecosystems of New Zealand have been degraded by human activities such as deforestation and alteration of fire regimes. Changes in climate will also have considerable impacts on ecosystems. Understanding and forecasting the consequences of human-induced environmental change on biodiversity, ecological processes, and ecosystem functions is without doubt one of the key challenges for ecological research in New Zealand and elsewhere. The aim of the symposium is to bring together scientists of various disciplines, who are involved in research on responses of terrestrial ecosystems to human driven changes. The symposium provides an opportunity to integrate perspectives on the changing nature of terrestrial ecosystems across New Zealand and overseas. Presentations in this symposium include analysis of past and future climates and carbon stocks and fluxes ranging from microbial to ecosystem scales using measurement and modelling approaches.

Landscape Ecology

Convenor: Thomas Etherington (The University of Auckland)

Landscape ecology has a keen interest in quantifying landscape structure in order to try and understand how landscape structure may affect ecological processes such as the distribution and movement of organisms. This landscape ecology symposium brings together talks that demonstrate how landscape structure can be examined and described, and ways in which the movement of native and non-native organisms can be measured and modelled.

Mires Matter! Wetland Science 60 Years On

Convenors: Tarnia Hodges (Massey University) and Bev Clarkson (Landcare Research)

Wetland ecosystems have long been recognised as being under threat, with only 10% of our wetland ecosystems remaining. New Zealand wetlands are unique in nature, containing an amazing range of plants and animals and including distinctive wetland types, such as lowland restiad mires. Resurgence in interest in wetland ecology in recent decades has resulted in the expansion of wetland science beyond descriptive studies into aspects of modelling eco-hydrological relationships, wetland restoration and rehabilitation at various scales (including the Arawai Kākāriki wetland restoration programme), taxonomic changes, nutrient and carbon cycling. This symposium aims to review recent advances in wetland science, celebrate 40 years since the signing of the Ramsar Convention on wetlands, and provide a forum for wetlands researchers from across New Zealand to discuss future research needs.

Plant Physiological Ecology (NZSPB President's Symposium)

Convenor: Mike Clearwater (The University of Waikato)

NZSPB
New Zealand Society of Plant Biologists

The discipline of plant physiological ecology seeks to describe the plant physiological mechanisms underlying ecological processes. 'Ecophysiology' connects processes occurring at the molecular, cellular, biophysical, and individual organism scales to higher levels of integration – ecology in its broadest sense, encompassing evolutionary, population, community and ecosystem processes. The need to understand these processes at a mechanistic level increases steadily as our demands on natural and agricultural ecosystems also increase. A good example is the fascinating work of one of our plenary speakers, Tim Brodribb, which explains broad patterns in plant evolution and ecological preference based on detailed investigation of leaf hydraulic functioning. The topic of plant physiological ecology also represents an obvious connection between the interests of the two societies meeting here in Rotorua. The title 'President's Symposium' is a mechanism that the NZ Society of Plant Biologists can use to 'show-case' a dynamic and active area of research for its members.

Restoration Ecology

Convenors: Andy Garrick (Wildland Consultants) and Thalia Sachtleben (Department of Conservation)

With the increasing interest and participation of community groups in ecological restoration, an element of this symposium will focus on community inspired or implemented projects with an ecological and social science component. The symposium will look at Māori and other community group involvement in restoration, management of pest plants and pest animals as part of ecological restoration, key outcomes for flora and fauna, and methods for prioritising where restoration resources will be spent. Other symposia at the conference will also have elements of restoration ecology, specifically Mires Matter, Forest Ecology, and Fauna Conservation.

Ecology in the Heartland — Presentation Instructions

Instructions for Oral Presenters

Please read the following instructions carefully to ensure all presentations run smoothly:

- Please note the day, time and session number of your talk in the conference programme.
- Oral presentations need to be loaded onto the system by 5pm the day before you are presenting. To do this, speakers should report to the registration desk in the main foyer of the venue, with their presentation on a USB or CD in Power Point Windows format. A technical assistant will load it onto the system.
- For those presenting on Monday please ensure your presentation is loaded onto the system by 9am on Monday morning.
- The filename should include your last name and first initial, the day and the stream number (see the conference programme) so that it can be filed correctly (eg. *BloggsJ_Monday_Stream3*).
- Speakers are asked to report to their specified lecture room and identify themselves to the session chairs 10 minutes before the start of their session. This will allow you time to familiarise yourself with the presentation setup and ensure your presentation is running correctly.
- Please keep to your allocated time.
- For plenary presentations, the time allocations vary, but please allow 10 minutes for questions.
- For all other papers the time allocated is 15 minutes plus 3 minutes for questions.
- The chairperson will inform you when 12 minutes and 14 minutes have passed, and will stop you after 15 minutes.

Instructions for Poster Presenters

- Posters will be displayed in the main foyer of the Events Centre throughout the conference.
- Each poster has been allocated a number and a place on the poster boards.
- Please get your poster number from the programme and locate the corresponding space.
- Posters must be put up no later than 1:15 pm on Monday.
- Velcro dots will be available for mounting your poster. These are available at the conference registration desk.
- Please be next to your poster during the poster session on Monday 29th August at 4:50pm – 6.30 pm.
- Posters must be removed by Wednesday at 5:30 pm.

Instructions for Session Chairs

- Thank you for agreeing to chair a session. Below are some guidelines to keep the sessions running smoothly.
- Identify talks presented by students which are eligible for the Best Student Presentation Award. These are identified by the symbol: 
- Take the time to meet with your speakers before the session starts.
- Check that all your speakers have loaded their talks before the session begins.
- Make sure all your speakers are familiar with their timetable and know how to run the AV system. There will be someone in the lecture theatre to help with equipment if needed.
- Ensure the session starts on time, regardless of whether people are still arriving.
- **Please keep speakers within time**, give them a warning at 12 minutes and 14 minutes AND STOP THEM AT 15 MINUTES.
- Leave time for changing rooms between speakers: roughly 2 minutes.
- **If the speaker finishes early, don‘t start the next talk early**. Invite questions or discussion on previous talks until it‘s time for the next speaker.
- Session chairs will need to announce any housekeeping at start and finish of sessions.

Ecology in the Heartland

Student Day – Sunday 28 August 2011

Hosted by Waiariki Institute of Technology

The NZES Conference Student Day provides students with an opportunity to practise presentations on their own research in an informal, social and friendly environment; meet and network with peers from other institutions; and attend talks by experienced ecologists. The two talks this year are by Professor Bruce Clarkson, of the University of Waikato, and Shona Myers, of Wildland Consultants Ltd. Professor Clarkson is currently the Dean of Science and Engineering at the University of Waikato, and has been part of the academic staff at the university for twelve years. Bruce is a passionate advocate for ecological restoration, particularly in urban areas, and leads a $300,000 a year government-funded research programme looking at the best methods to restore indigenous biodiversity in cities. He has also been a driving force behind local gully restoration initiatives and the Waiwhakareke Natural Heritage Park project near Hamilton Zoo among others. His talk is about publishing and making the most of postgraduate study, with hints on topics from how to structure a paper, to how to get published in top journals. Shona Myers is currently a senior ecologist and Manager of the Auckland Office of Wildland Consultants Ltd. She has over 26 years experience as an ecologist and conservation manager and has worked widely at a national and regional level. She has particular expertise in ecological survey methodologies, assessments of ecological significance, lowland forest, riparian and wetland ecosystems, mainland island restoration, biodiversity policy and strategy development, and assessments of environmental effects. Shona's talk will touch on her experience in working in ecology and her tips on what students need to be successful in this industry.

Ecology in the Heartland — Field Trips

Thursday 1 September 2011

Four field trips are planned for Thursday 1 September. Please note that field trip start and finish times vary.

- Field trip 1: Waimangu and Lake Tarawera - a volcanic and geothermal experience.
- Field Trip 2: "Production and Podocarp" Forest Trip to Kaingaroa and Whirinaki.
- Field Trip 3: The "K-Bird" Field Trip (kokako/kiwi/karearea)
- Field Trip 4: Mokoia Island

Field Trip 1: Waimangu and Lake Tarawera - A Volcanic and Geothermal Experience

Organisers: Pete Corson, Sarah Beadel, and Chris Bycroft

This field trip will begin with a bus ride to Waimangu Volcanic Valley - the world's youngest geothermal system which was formed following the 1886 eruption of Mt Tarawera. The field trip will be led by people experienced in the botany, pest plant and pest animal management, and geothermal features of the site. Waimangu supports examples of most of the vascular flora unique to geothermal sites of the Central North Island, including significant populations of "At Risk" plant species (eg. *Dicranopteris linearis*, *Christella, Nephrolepis flexuosa*, and prostrate kanuka). Management issues relating to this site include pest animals (e.g. wallabies and deer) and pest plants. The field trip will walk near several outstanding geothermal features, including Frying Pan Lake, Echo Crater, Inferno Crater, geothermal terraces, hot springs, and geysers.

The walk will be followed by a boat trip on Lake Rotomahana. This will be a good opportunity to see many of the water birds of the Central North Island, including New Zealand dabchick. The steaming cliffs and the restoration work on Patiti Island will be viewed and discussed from the boat. Mt Tarawera, which can be viewed from the lake, will be discussed, including the wilding pine control operations and the regenerating vegetation following the 1886 eruption.

The field trip will then cross the isthmus to Lake Tarawera, cross the lake and returning by bus to Rotorua for 5 pm. Some of the field trip party will do this trip in the reverse direction, starting at Lake Tarawera and returning by walking up through Waimangu Geothermal Valley. Lake Tarawera is almost entirely bounded by indigenous vegetation and is a fantastic place to observe re-establishment of secondary indigenous vegetation following natural disturbance.

Field Trip 2: "Production and Podocarp" Forest Trip to Kaingaroa and Whirinaki

Organisers: Rhys Burns and Willie Shaw

Travel across the Kaingaroa Plateau through the largest planted exotic plantation production forest in the southern hemisphere to see how these forests contribute to indigenous biodiversity, and even provide enhanced habitat for some threatened indigenous species, such as karearea (New Zealand falcon). This is an opportunity to understand the factors taken into account by forestry managers to provide opportunities for indigenous species to persist and flourish, and hear of some of the similarities between these forests and indigenous forest management.

The field trip continues via special monoao frost flat communities into the magnificent high-density podocarp Whirinaki forest, where Department of Conservation rangers will explain the current biodiversity management programmes and recreational opportunities occurring at in the valley. In addition to the world class towering podocarp forest, saved from logging and protected following considerable controversy in the 1970s-1980s, this forest has tremendous habitat value for species such as kaka, kiwi, kakariki, whio, and others, and is now subject to intensive pest management to enhance populations of threatened and common species. There will be plenty of time for a variety of walks at Whirinaki, catering to a wide variety of abilities.

Field Trip 3: The "K-Bird" Field Trip (kokako/kiwi/karearea)

Organiser: Dale Williams

This field trip will depart from the Bus Park outside the Te Runanga Tea House on Hinemaru Street at **8:00am sharp.** If you are keen on an earlier start to catch the Kokako "Dawn Chorus", please contact Dale directly **(Dale.Williams@envbop.govt.nz)**

Kaharoa Kokako Trust

The first stop will be the Kaharoa Conservation Area about 30 km north-east of Rotorua. At this site a community-driven restoration project, spearheaded by volunteers from the Kaharoa Kokako Trust, has successfully increased kokako numbers from 26 adults in 1997 to 121 in 2007. A brief bush walk guided by Trust members will give participants the opportunity to experience the interior of the lowland podocarp hardwood forest typical of this area, followed by a discussion of the Trust's programme and future vision. Depending on the weather, participants will have a chance of seeing and hearing New Zealand's most beautiful song bird!

Kiwi Encounter

The group will then visit Rainbow Springs one of Rotorua's most popular tourist attractions.

In 1995 Rainbow Springs became involved in the Bank of New Zealand's "Save the Kiwi" Recovery programme. Since they received the first wild kiwi egg from the Tongariro Forest Kiwi Sanctuary they have successfully hatched, raised and released 492 kiwi chicks into the wild. Though September is outside of the main breeding season for kiwi, this will be a great opportunity to experience, first hand, the facilities that play such a big part in the "Operation Nest Egg" programme. The group will have lunch at the on-site café before proceeding on to Wingspan.

Wingspan Birds of Prey Trust

The trip will conclude with visit to the Wingspan Birds of Prey Trust at Paradise Valley. Wingspan cares for sick, injured or orphaned raptors. Their work includes research into habits and habitat, captive breeding, public awareness and rehabilitation of raptors back into the wild. Participants will get to look around Wingspan's museum and aviaries prior to witnessing a flight display from karearea, New Zealand's endemic falcon.

We will return to the Tea House between 3:30 and 4:00pm.

Field Trip 4: Mokoia Island

Organisers: Andy Garrick and Alana Smith

Mokoia Island (135 ha) is a sanctuary for a number of the North Island's indigenous and endangered flora and fauna including the saddleback, kokako, robin, weka, kiwi, speckled skink, white mistletoe and *Dactylanthus*. Located in Lake Rotorua, Mokoia is New Zealand's largest inland island, and a Wildlife Refuge since 1953. The island is privately (Maori) owned, and administered by the Mokoia Island Trust Board, with the management of its flora and fauna undertaken by the Department of Conservation. This field trip will integrate ecological and historical components of the island, with an emphasis on both past and present research.

The field trip will commence at the Rotorua Lake front at 8:15am (five-minutes walk from the conference venue) with an introduction to Mokoia Island from a Department of Conservation representative, followed by an overview of the island and its cultural significance. The group will then depart by boat for the island where a number of researchers and key people will provide further insights into its unique features, and past and present projects. There will be a guided walk to the summit for those who want to take advantage of the photographic opportunities that provides, before returning to the Rotorua lakefront with a scheduled arrival time of 3:00pm for those needing to get back a little earlier than other field trips.

Ecology in the Heartland — Plenary Speakers

Professor Donald R. Strong

University of California

Davis Professor Donald Strong is a Distinguished Professor in the Department of Evolution and Ecology and the Bodega Marine Laboratory at the University of California, Davis. His research is focussed on trophic ecology, salt marsh ecology, biocontrol and ethics. Professor Strong has published over 190 peer-reviewed publications, including several in the journal Science. He has served as the Editor-In-Chief for *Oecologia, Ecology* and *Ecological Monographs* and was recognised in 2011 for his contributions to these publications with the Ecological Society of America's Distinguished Service Citation award. Professor Strong has received funding from the National Science Foundation, the US Fish and Wildlife Service and the California Department of Fish and Game and is a member of the Ecological Society of America, American Society of Naturalists, Royal Entomological Society and the American Association for the Advancement of Science.

Professor Strong's presentation has been made possible by the generous sponsorship of the University of Waikato.

Professor Corey Bradshaw

The University of Adelaide

Professor Bradshaw co-directs The Environment Institute's Climate and Ecology Centre and the School of Earth and Environmental Sciences' Global Ecology Group. He has a joint appointment with the South Australian Research and Development Institute (via Marine Innovation South Australia) and is also a member of the Australian Centre for Evolutionary Biology and Biodiversity.

Professor Bradshaw has a broad range of research interests including population dynamics, predicting the vulnerability of species to environmental change, optimal foraging theory, sustainability harvest & density reduction, disease dynamics, vector ecology and environmental drivers of population change, including climate change biology. His specific research foci include analytical and computer simulation modelling, quantitative behavioural ecology, foraging dynamics, impacts of tropical habitat modification on biodiversity, wildlife population management and sustainable harvest, evaluation of the minimum viable population size concept, examining the relative contribution of intrinsic (density regulation) factors on population trajectories and the ecology of invasive species.

Dr Tim Brodribb

University of Tasmania
ARC Future Fellow

Tim completed his PhD at the University of Tasmania with the well known paleobotanist Professor Bob Hill. During his PhD he became interested in plant water transport and the hydraulic properties of the xylem as a means of explaining conifer extinction in Australia during the Cenozoic. He then worked as a post-doctoral fellow at Harvard University for 5 years, working on water transport systems in tropical deciduous forests. He briefly held a position as a Putnam Fellow at the Arnold Arboretum before being enticed back to the Southern Hemisphere and the University of Tasmania by a prestigious Australian Research Council Future Fellowship. His current research focus is on the transport and regulation of water content in leaves, examining the links between evolution of stomatal and vein systems and major shifts in plant ecological success over geological time. His research provides a fresh perspective of plant evolution, and includes a recent contribution to the journal *Science* which demonstrates that the stomata of lycophytes and ferns lack the active control mechanisms considered fundamental to the regulation of water use by higher plants.

Tim is a leader amongst a group of plant physiologists who are providing us with radical new insights into the links between plant functioning, ecology and evolution. Tim's work has demonstrated the way plants transport and use water is an important determinant of their success in different environments, and has been a major factor in the evolution of the major plant groups (ferns, gymnosperms, angiosperms). Tim's research extends to many of the plant groups that are so important in New Zealand, including ferns and the southern conifers, especially our iconic podocarps.

Dr Kevin Collier

Waikato Regional Council and The University of Waikato

Kevin Collier holds a joint position with Environment Waikato and also the Centre for Biodiversity and Ecology Research at University of Waikato. His work at the university is focused on the ecology of large rivers, in particular the Waikato River. He aims to provide information that enables effective ecological monitoring and underpins future restoration work. Kevin co-ordinated a national survey of large rivers in association with collaborators at Cawthron Institute, to test the responses of macroinvertebrate and functional indicators to human pressures, and continues his involvement in several ongoing studies on the Waikato River. He is editor-in-chief of the *Waters of the Waikato*, a contemporary synthesis of ecological knowledge of the Waikato River below Taupo Gates, involving over 45 authors. Kevin's other research interests include the ecology and restoration of urban streams, and the use of macroinvertebrates for biological monitoring and as indicators of aquatic ecosystem health. He was senior editor of a book synthesizing information on the ecology of New Zealand stream invertebrates. Kevin is on the Editorial Board of *Freshwater Reviews* and is the past President of the New Zealand Freshwater Sciences Society.

Dr George W Gibbs

TE TOHU TAIAO AWARD FOR ECOLOGICAL EXCELLENCE RECIPIENT:

George W. Gibbs took a very early interest in ecology under the guidance of his grandfather, G.V. Hudson, who was one of New Zealand's earliest and most influential natural historians. George went on many insect collecting trips as a boy and marvelled at his grandfather's collections. These early experiences started George on a long and productive career in ecological entomology.

George has had a long relationship with Victoria University of Wellington, graduating with a BSc in 1959, and an MSc in 1961. He then spent three and a half years doing a PhD at Sydney University with Professor L.C. Birch before returning to Victoria University of Wellington to a lecturing position in 1965. Since this time George has remained at this university. He retired in 2000, but has continued teaching his Flora & Fauna course, which has long maintained a reputation as one of the best courses in the School of Biological Sciences. Not only is it popular with those who take it, but also with the teaching assistants, and every year graduate students fight to determine who will be demonstrating the course.

George pursued a career researching butterflies, tiny moths, weta, and in particular the origin and evolutionary background of our flora and fauna. He is the author of five books on these topics. His first book, "New Zealand butterflies", published in 1980, remains the foremost reference on butterflies in New Zealand, even today 30 years after its publication. His most recent book is the Montana Award winning publication "Ghosts of Gondwana: The History of Life in New Zealand" (2006), which was based on the lecture notes of his popular flora and fauna course. This book has received wide acclaim as essential reading for anyone interested in the natural history of New Zealand. Before, in between and after these books, George has published widely in journals, including the prestigious journal *Science*, on topics such as the insect-pollinator interactions. He continues to be an active researcher, especially in moth taxonomic and phylogenetic studies, combining molecular and morphological techniques. His dedication to research is exemplified in a 6-year mark-recapture dataset on the tree weta population of Somes Island, which has and is providing unique insights into the mating and movement behaviour of weta populations on Somes Island.

Ruud Kleinpaste

Born in Indonesia, Ruud Kleinpaste was schooled in The Netherlands and studied plant sciences at Wageningen University, eventually earning a degree in silviculture. After immigrating to New Zealand in 1978 he worked in various environmental jobs before settling down to 14 years with the Ministry of Agriculture and Fisheries (MAF). In 1987 he started a talkback radio show ("Ruud's Awakening") offering environmentally friendly horticultural tips to gardeners. The success of this show led him to become known as "The Bugman".

On his retirement from MAF in the middle 1990s he began a career as an ecological consultant. He regularly works as a consulting entomologist for Government departments and private companies, lectures on ecology and entomology, and is also deeply involved in New Zealand conservation efforts. Mr Kleinpaste promotes environmentally friendly agricultural techniques, the protection of endangered native New Zealand birds, and, most famously, the understanding and appreciation of insects, spiders, and other terrestrial arthropods.

Dr Marieke Lettink

Fauna Finders, Christchurch
ECOLOGY IN ACTION AWARD 2010 RECIPIENT

Marieke obtained a PhD from the University of Otago in 2008 based on research investigating the use of artificial retreats for monitoring and restoring lizard populations. Her work with artificial retreats has revolutionised survey and monitoring of lizards in New Zealand. Marieke is now working as an independent ecologist/herpetologist and running her own business, Fauna Finders, based in Christchurch. Throughout her doctoral research and since completing her PhD, Marieke has been extremely dedicated to promoting ecology in the local community through education of landowners, community groups and the general public.

Marieke has a long history of raising community awareness about reptiles and is a strong advocate for their conservation in Canterbury, and particularly on Banks Peninsula. She has provided hands-on advice at two BioBlitz events held in Canterbury (a BioBlitz is a public event in which scientists, students and the public take on the challenge of counting as many species as possible in a 24 hour survey of a large urban area). She has held two highly successful lizard workshops for the Banks Peninsula Community Trust and has opened her own garden (full of lizards) to the public on numerous occasions to promote their awareness of lizard conservation.

Marieke has worked with the local Council to identify important sites for lizard conservation around Banks Peninsula and to rescue lizards from sites destined for destruction. She is currently working with landowners on Banks Peninsula to help conserve jewelled geckos and their habitats in a project funded by the Biodiversity Advice Fund. Marieke is also an advisor to the Otamahua/Quail Island Ecological Restoration Trust and has worked with the Department of Conservation to promote lizard-friendly gardens. She has authored pamphlets on "Attracting lizards to your garden" and "Jewelled gecko/moko-kākāriki conservation", which were distributed to homes in lizard hotspots across Banks Peninsula. She developed an excellent rapport with local iwi who are kaitiaki at her PhD field site on Kaitorete Spit and enhanced their awareness of the lizard taonga on the Spit.

In addition to contributing so much to community and outreach work, Marieke continues to conduct contemporary and relevant research in applied herpetology and demonstrates her commitment to producing high quality scientific publications. Since 2008 she has also initiated and produced a newsletter dedicated to green gecko issues, titled 'Moko-kākāriki Matters', which has gained fame and momentum among the herpetological community.

Dr Chris Lusk

The University of Waikato

Chris is a forest ecologist interested in how plant traits shape species responses to disturbance, their role in forest succession, and they grow in relation to factors such as temperature, latitude and soil fertility. Chris is well known for his research on forest ecology, shade tolerance and succession, with contributions to high profile publications including journals such as *Nature* and *Trends and Ecology and Evolution*. He is the recipient of a number of competitive research grants, including multiple ARC Discovery grants in Australia, and is a long serving Associate Editor of the New Zealand Journal of Ecology. His current work examines light environments and the functional diversity of rainforest tree assemblages along a latitudinal gradient in Australasia, from tropical Queensland to cool temperate sites in New Zealand and Tasmania. Chris currently holds a position as a senior research fellow at the University of Waikato. In previous appointments in Chile and Australia, his students have worked on a wide range of topics including natural selection on the morphology and physiology of *Blechnum* ferns, vascular constraints on the geographic distribution of lianas, and leaf display and light interception by seedlings of tropical vs. temperate rainforest trees.

Professor Michael McMannas

Massey University

Professor Michael McManus holds a Chair in Plant Physiology at Massey University. Michael gained his D.Phil in Plant Physiology from The University of Oxford, investigating the sensitivity and responsiveness of target cells to ethylene, within abscission zones in plants. Since then he has become internationally recognized for research both on ethylene biosynthesis and action in plants, as well as plant nutrition and sulphur assimilation. Michael uses biochemical and molecular techniques to investigate the regulation of individual gene family members of the biosynthetic genes. His research has demonstrated the complexity of the regulation of ethylene synthesis, which is elegantly controlled by a combination of transcriptional, translational and post-translational mechanisms in response to developmental and environmental cues and stimuli. Michael is a long serving member of the New Zealand Society of Plant Biologists, a previous President, and a tireless supporter of Society activities and the study of plant biology in general. He is also well known for his teaching abilities and his supervision of many successful graduate students.

Alan Saunders

Landcare Research, Hamilton

Alan has been involved in biodiversity conservation management and research for nearly 40 years. He worked on a number of threatened species recovery projects and wildlife habitat surveys with the New Zealand Wildlife Service and its successor, the Department of Conservation. In DOC he managed national units responsible for the recovery of threatened species (the Threatened Species Unit) and ecological restoration at sites on the New Zealand mainland (the Mainland Island Programme). Over the last 20 years Alan has provided technical advice outside New Zealand including assessing the feasibility of proposed eradication and sustained control projects, preparing strategic and operational plans, reviewing the effectiveness of biosecurity programmes and evaluating the outcomes of projects for implementing agencies and donors. Between 2003 and 2008 Alan coordinated the Pacific Invasives Initiative, a partnership programme focused on conserving biodiversity and enhancing people's livelihoods in the Pacific. Through this programme a number of conservation "firsts" were achieved in the region. In 2008 Alan was appointed by Landcare Research to manage its international invasive species management programme (Invasive Species International). His roles are to promote effective restoration partnerships through the application of effective management underpinned by sound science. Alan has an M.Sc in Zoology from Victoria University, Wellington.

Dr David Whitehead

Landcare Research, Lincoln

Following Post Doctoral work on the biophysical regulation of water use in relation to wood structure resulting after thinning in forests at the University of Edinburgh, David moved to Forest Research Institute (now Scion) at Rotorua where he continued to investigate the processes regulating carbon, water and energy exchange in *Pinus radiata* forest. Moving to Landcare Research, David's focus changed to investigating the response of forest ecosystems to elevated carbon dioxide concentration and carbon exchange in indigenous forest ecosystems. Most recently, David has worked on above- and below-ground carbon balance, with an increasing focus on soil carbon dynamics in his role leading research on soil carbon in the New Zealand Agricultural Greenhouse Gas Centre.

Dr Jan Wright

Parliamentary Commissioner for the Environment

Dr Jan Wright was sworn in as Parliamentary Commissioner for the Environment for a five-year term on 5 March 2007. Jan has a multidisciplinary background with a Physics degree from Canterbury, a Masters degree in Energy and Resources from Berkeley in California, and a PhD in Public Policy from Harvard.

Prior to her current role, Jan worked as an independent policy and economic consultant for many different government agencies and as a member of various Crown Entity Boards.

In the last year she has released reports on four major investigations – mining on conservation land, a strategic approach to biofuels, the greenhouse gases associated with large scale use of lignite, and most recently, an evaluation of 1080. Another major part of her role is the provision of independent advice on Bills and other matters of interest before Select Committees. Jan is assisted in her role by a small office of talented staff.

New Zealand Ecological Society Awards

Best Student NZES Conference Paper

The society makes an annual award to the student who is judged to have presented the best oral paper at the Society's annual conference. All papers (including joint papers) presented solely by students at the main conference are eligible for consideration. Note that this award does not consider papers presented at the student session of the conference.

At conference registration you will have received a voting form. Please vote for the best student presentation you saw during your time at the conference. You do not have to have seen every student presentation to vote. Please consider factors such as the presentation, the quality of research and/or results, the length of the talk (in the allocated time; was there time for questions?), the response to questions, and the use of good and appropriate visual aids.

Presentations by students who are eligible for this award are identified in this handbook by the symbol: 

On the voting form, please vote for your favourite and second favourite student talks and rank them as "1" and "2" respectively. Votes will be collected at the end of Session 3, Wednesday 31 August, look for the ballot box.

Best Student NZES Conference Poster

The society makes an annual award to the student (senior author) who is judged to have presented the best poster at the Society's annual conference.

At conference registration you will have received a voting form. Please vote for the best student poster you saw during the wine and cheese poster session on Monday 29 August. You do not have to have seen every student poster to vote. Please consider factors such as presentation, quality of research and/or results, visual appeal, clarity of message, whether the poster is easily read, and good understanding of the research by the student.

Posters by students who are eligible for this award are identified in this handbook by the symbol: 

On the voting form, please vote for your favourite and second favourite student poster ranking them as "1" and "2" respectively. Votes will be collected at the end of the poster session on Monday 29 August.

Both the **Best Student NZES Conference Paper** and **Best Student NZES Conference Poster** awards will be presented at the closing ceremony of the conference.

Other New Zealand Ecological Society Awards, Grants and Scholarships

The New Zealand Ecological Society offers several other awards, prizes and scholarships.

These include:

- Te Tohu Taiao – Award for Ecological Excellence
- Honorary Life Membership
- NZES Ecology in Action Award
- Best Publication by a New Researcher
- Student Travel Grants
- The Kauri Seed Programme Scholarship

For further information about these Awards/Grants and Scholarship please refer to the New Zealand Ecological Society website, or contact the NZES Awards Convenor at www.newzealandecology.org/awards-grants

Ecology in the Heartland — Organisers

Co-convenors:

- William Shaw (Wildland Consultants)
- Dr Chris Bycroft (Wildland Consultants)

Scientific Committee:

- Dr Mike Clearwater (The University of Waikato)
- Professor Bruce Clarkson (The University of Waikato)
- Dr Ngaire Phillips (NIWA)
- Avi Holzapfel (Department of Conservation)
- Dr Chris Bycroft

Organising Committee:

- Andy Garrick (Wildland Consultants)
- Sarah Beadel (Wildland Consultants)
- Fiona Wilcox (Wildland Consultants)
- Pete Corson (Department of Conservation)
- Rhys Burns (Department of Conservation
- Thalia Sachtleben (Department of Conservation)
- Dale Williams (Bay of Plenty Regional Council)
- Tom Lynch (Waiariki)
- Craig Morley (Waiariki)
- Warren Webber (Waiariki)
- Nod Kay (Scion)
- Kit Richards (P.F. Olsen Ltd)
- Annabella Vidal (Rotorua District Council)

Field Trips:

1. Waimangu and Lake Tarawera – Pete Corson, Sarah Beadel and Chris Bycroft
2. Production and Podocarp" Forest Trip to Kaingaroa and Whirinaki – Rhys Burns and Willie Shaw
3. The “K-Bird” Field Trip (kokako/kiwi/karearea) – Dale Williams
4. Mokoia Island – Andy Garrick and Alana Smith (Massey University)

Student Day Organisers:

- Fiona Wilcox (Wildland Consultants)
- Fiona Clarkson (The University of Waikato)
- Marie Brown (The University of Waikato)
- Catherine Bryan (The University of Waikato)
- Emma Coleman (The University of Waikato)

Ecology in the Heartland

28 August – 1 September 2011, Energy Events Centre, Rotorua

The 2011 Annual Conference of the New Zealand Ecological Society
also incorporating
The New Zealand Society of Plant Biologists Annual Conference.

Programme

- Sunday 28 August - Student Day
- Monday 29 August to Wednesday 31 August - Main Symposia and Concurrent Sessions
- Wednesday 31 August - 60th Anniversary Celebration Dinner.
- Thursday 1 September - Field Trips

Symposia

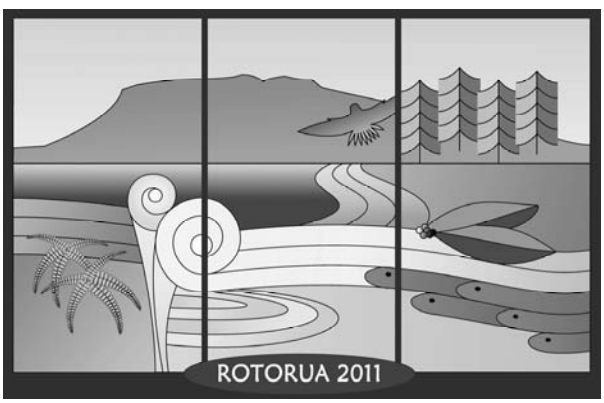
- Bryophyte Ecology – from evolutionary strategies to ecosystem functions
- Ecology and Plantation Forests
- Fauna Conservation and Threatened Fauna
- Forest Dynamics (2011 is the International Year of Forests)
- Freshwater Ecology – linking theory and practice
- Global Change Biology
- Landscape Ecology
- Mires Matter! Wetland Science 60 Years On
- Plant Physiological Ecology (NZSPB President's Symposium)
- Restoration Ecology

Other Themes

- Regional/Central Government Protection Mechanisms and Monitoring
- Plant Biology
- Plant Dispersal and Reproduction

Conference Logo

This conference logo represents the ecological diversity of the Rotorua region, including Mt Tarawera, kārearea (NZ falcon), trees representing indigenous and/or plantation forests (2011 is the United Nations International Year of Forests), mangaeo leaves and fruit, a geyser and the pink terraces, freshwater rivers and lakes, and the kōaro (fish). The fern in the lower left corner is *Dicranopteris linearis*, representative of the geothermal vegetation that surrounds Rotorua. This logo was designed by Teresa McConchie of Natural Talent.



Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

MONDAY 29 AUGUST 2011			
Time	**Presenter**	**Organisation**	**Title**
8:15 a.m.	**Opening**		
Keynote Address			**Session Chair: Bruce Clarkson**
8:30 a.m.	Donald Strong	University of California, Davis	Invasive spartina as model of current and future ecological research
Plenary Speaker			
9:30 a.m.	Alan Saunders	Landcare Research	Invasive species management in the eastern Pacific – Lessons for New Zealand
10:10 a.m.	**Morning tea**		
Stream 1 - Restoration Ecology			**Session Chair: Andy Garrick**
10:40 a.m.	Andrew Glaser	Department of Conservation	Te Urewera: Communities in Conservation
11:00 a.m.	Rob McGowan	Nga Whenua Rahui	Maori perspectives on restoration – restore the land, restore the people, incorporating insights from Nga Whenua Rahui and/or Matakana projects
11:20 a.m.	Phil Lyver	Landcare Research	The cultural precautionary principle when valuing ecological restoration of coastal forests by Māori in New Zealand
11:40 a.m.	Souad Boudjelas	The University of Auckland	Social dimension: how communities view island restoration
12:00 p.m.	Jenifer Iles	University of Canterbury	Is Maungatautari Ecological Island restoring pollination and dispersal services to native plants?
Stream 2 - Global Change Biology			**Session Chair: Cate Macinnis-Ng**
10:40 a.m.	Louis Schipper	The University of Waikato	Changes in soil carbon stocks in New Zealand pastures over the last century
11:00 a.m.	Jordan Goodrich	The University of Waikato	High-frequency measurements of methane ebullition over a growing season at a temperate peatland site
11:20 a.m.	Samantha Grover	Landcare Research	Carbon dynamics of shrubland regeneration
11:40 a.m.	Susanna Rutledge	The University of Waikato	Effects of climate variation and management practises on the carbon balance of a Waikato dairy farm
12:00 p.m.	Miko Kirschbaum	Landcare Research	Climate change and its ecological and ecophysiological impacts
Stream 3 - Bryophyte Ecology - from evolutionary strategies to ecosystem functions			**Session Chair: Pascale Michel**
10:40 a.m.	George Gibbs	Victoria University	An ancient insect-host plant association: primitive jaw-moths (Micropterigidae: Lepidoptera) and their reliance on hepatics
11:00 a.m.	Pascale Michel	Manaaki Whenua-Landcare Research	Bryophyte contribution to ecosystem services in New Zealand landscapes: hydrology and litter decomposition
11:20 a.m.	Anne Gaskett	The University of Auckland	Carrion- and dung-mimicry by New Zealand Splachnaceae mosses
11:40 a.m.	David Burritt	University of Otago	Could gender related differences in stress tolerance influence sex ratios in *Marchantia?*
12:00 p.m.	Benjamin Myles	Allan Wilson Centre for Molecular Ecology and Evolution	Evolutionary ecology of a lichen symbiosis: a case study using New Zealand *Menegazzia* (Parmeliaceae, lichenized Ascomycetes)
12:20 p.m.	**Lunch**		

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

MONDAY 29 AUGUST 2011			
Time	**Presenter**	**Organisation**	**Title**
Plenary Speaker			**Session Chair: Willie Shaw**
1:15 p.m.	Jan Wright	Parlimentary Comminsioner for the Environment	Predators, poisons and silent forests
Stream 1 - Restoration Ecology			**Session Chair: Dale Williams**
2:00 p.m.	Dave Kelly	University of Canterbury	Effects of wasp, stoat and rat control on bird counts in Nelson Lakes National Park
2:20 p.m.	Carolyn Lundquist	NIWA Hamilton	Impacts of mangrove mulching on estuarine communities
2:40 p.m.	Catherine Bryan	The University of Waikato	Vascular epiphytes in urban ecological restoration
Stream 2 - Global Change Biology			**Session Chair: Luitgard Schwendenmann**
2:00 p.m.	Matt McGlone	Landcare Research	Past warm events and future New Zealand climates
2:20 p.m.	Cate Macinnis-Ng	The University of Auckland	A soil-plant-atmosphere (SPA) model for investigating responses of kauri to climate perterbations
2:40 p.m.	Gavin Lear	Lincoln University	Bacteria as sentinels of ecological health: An exploration of the relationships between anthropogenic impacts and bacterial biodiversity
Stream 3 - Regional/Central Government Protection Mechanisms and Monitoring			**Session Chair: Shona Myers**
2:00 p.m.	Simon Stokes	Bay of Plenty Regional Council	Biodiversity management in the Bay of Plenty
2:20 p.m.	Shona Myers	Wildland Consultants Ltd	More than just trees – the role of District Plans in providing protection for the ecological values of urban vegetation
2:40 p.m.	Fleur Maseyk	Horizons Regional Council	Bridging the gap of frustration – Local Government & the RMA
3:00 p.m.	**Afternoon Tea**		

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

MONDAY 29 AUGUST 2011			
Time	**Presenter**	**Organisation**	**Title**
Stream 1 - Restoration Ecology			**Session Chair: Astrid van Meeuwen-Dijkgraff**
3:30 p.m.	Samantha Jamieson	Taranaki Regional Council	Sand dune restoration in New Zealand: Are we caring for our native fauna?
3:50 p.m.	Guyo Gufu	Victoria University of Wellington	Functional ecology of iceplant and its role in eco-restoration of New Zealand sand dunes
4:10 p.m.	Emma Coleman	The University of Waikato	Mechanisms of interference between kahikatea and grey willow in the Waikato
4:30 p.m.	Habteab Habtom	Victoria University of Wellington	Effect of *Linepithema humile* , the Argentine ant on beetle species abundance and richness
Stream 2 - Mires Matter! Wetland Science 60 Years On			**Session Chair: Louis Schipper**
3:30 p.m.	Bev Clarkson	Landcare Research NZ Ltd	Wet, wild and wonderful: recent advances in wetland research
3:50 p.m.	Dave Campbell	Department of Earth and Ocean Sciences	CO_2 exchange in peatlands with vegetation dominated by *Empodisma minus*
4:10 p.m.	Steven Wagstaff	Landcare Research	Biome conservation, niche partitioning and assembly of restiad wetlands in New Zealand
4:30 p.m.	Gillian Rapson	Massey University	Comparative nutrient relations of *Empodisma minus* and *Chionochloa rubra* across mire margins, Urewera National Park, New Zealand
Stream 3 - Plant Dispersal and Reproduction			**Session Chair: Dave Kelly**
3:30 p.m.	Fiona Thomson	Landcare Research	Do small-seeded species disperse further than large-seeded species?
3:50 p.m.	Michelle Kelly	The University of Auckland	Pollination Ecology of the native New Zealand orchid *Corybas cheesemanii*
4:10 p.m.	Alastair Robertson	Massey University	Making sense of flower colour in the New Zealand alpine
4:30 p.m.	Laura Young	University of Canterbury	Which animals are dispersing New Zealand's alpine fruits?
4:50 p.m.	**Poster Session**		
6:30 p.m.	**Finish**		

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

TUESDAY 30 AUGUST 2011			
Time	**Presenter**	**Organisation**	**Title**
8:30 a.m.	**Opening**		
Plenary Speaker			**Session Chair: Chris Bycroft**
8:40 a.m.	Chris Lusk	The University of Waikato	Latitude, light environments and functional diversity in rainforest tree assemblages
Plenary Speaker			
9:20 a.m.	Kevin Collier	The University of Waikato	Reconnecting theory with management: lessons from large rivers
10:00 a.m.	**Morning tea**		
Stream 1 - Forest Dynamics (2011 is the International Year of Forests)			**Session Chair: Chris Lusk**
10:30 a.m.	Mark Smale	Landcare Research	Forest ecology in the golden age of New Zealand science: the life and work of John Nicholls
10:50 a.m.	Carolyn King	The University of Waikato	A brief history of Pureora Forest Park: foodbasket to battleground to conservation icon
11:10 a.m.	Craig Bishop	Auckland Council	Fires, frosts and forestry; the vegetation history and dynamics of Kaingaroa
11:30 a.m.	Rob Allen	Manaaki Whenua-Landcare Research	Resources and climate as determinants of mountain beech seed production: a review
11:50 p.m.	George Perry	The University of Auckland	Using spatial models to understand fire-driven landscape transformation during New Zealand's initial burning period
12:10 p.m.	Jessica Costall	Massey University	A bug's-eye view of bovine impacts: livestock disturbance alters forest floor habitat and invertebrate community composition in native forest remnants
Stream 2 - Fresh Water Ecology			**Session Chair: Ngaire Phillips**
10:30 a.m.	Deniz Özkundakci	The University of Waikato	On Liebig's law of the minimum and ecosystem modelling as a lake restoration decision support tool
10:50 a.m.	Marie Dennis	Scion	Bacterial/viral and algal interactions in freshwater lakes
11:10 a.m.	Ngaire Phillips	National Institute of Water & Atmospheric Research	Biological trait responses to landuse development: an example of theory in action
11:30 a.m.	Kimberley Roberts	University of Canterbury	Factors limiting colonisation and recovery of sensitive stream invertebrates in restoration
11:50 p.m.	Aurélien Vivancos	Otago University	Evidences of social structure within shoals of juvenile non-diadromous galaxiids
12:10 p.m.	Matthew Bloxham	Bay of Plenty Regional Council	The life and times of inanga in the Bay of Plenty - I need a place to spawn
Stream 3 - Plantation Forest Ecology			**Session Chair: Nod Kay**
10:30 a.m.	Nod Kay	Scion	Herbivory and bioloigical control in plantation forestry
10:50 a.m.	Ian Hood	Scion	Wood-colonising Basidiomycete fungi in radiata pine plantations
11:10 a.m.	Richard Seaton	Wingspan Birds of Prey Trust	The conservation values of plantation forests for New Zealand's indigenous birds
11:30 a.m.	Richard Yao	Scion	Valuing biodiversity enhancement in New Zealand's planted forests: socioeconomic and spatial determinants of willingness to pay
11:50 p.m.	Brenda Baillie	Scion	Freshwater ecology in plantation forest streams
12:10 p.m.	Thomas Paul	Scion	Impacts of wilding conifers and their control on grassland and shrublands in New Zealand

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

TUESDAY 30 AUGUST 2011			
Time	**Presenter**	**Organisation**	**Title**
Stream 4 - Restoration Ecology			**Session Chair: Sarah Beadel**
10:30 a.m.	Hugh Robertson	Department of Conservation	Progress and challenges in wetland restoration: insights from the Arawai Kākāriki programme
10:50 a.m.	Peter Ellery	Maketu Taiapure Trust	Restoration of inanga rearing habitat on the Kaituna river floodplain
11:10 a.m.	Kay Griffiths	The Conservation Company Ltd	Controlling English ivy (*Hedera helix*) in precious lowland podocarp
11:30 a.m.	Elizabeth Overdyck	The University of Waikato	Experimental sowing of large-seeded, fleshy-fruited native tree species for urban forest restoration in Hamilton City, New Zealand
11:50 p.m.	Dale Williams	Bay of Plenty Regional Council	Dama wallabies: "Eating the Heart out of the Heartland". After nearly 100 years, are we any closer to knowing how to manage them?
12:10 p.m.	Chris Bycroft	Wildland Consultants Ltd	Geothermal Vegeation in the Taupo Volcanic Zone: Priorities for Ecological Restoration and Implementation of Restoration management at Selected Sites
12:30 p.m.	**Lunch**		
Plenary Speaker			**Session Chair: Michael McManus**
1:25 p.m.	David Whitehead	Landcare Research	Forests as carbon sinks – benefits and consequences
Stream 1 - Forest Dynamics (2011 is the International Year of Forests)			**Session Chair: George Perry**
2:10 p.m.	Fiona Carswell	Landcare Research New Zealand Ltd	Is management for carbon compatible with biodiversity protection on conservation land?
2:30 p.m.	Peter Beets	Scion	Carbon stocks in dense podocarp forest at Whirinaki
2:50 p.m.	Christophe Amiot	Massey University	Auckland urban woodland quality by comparison of urban and non-urban ecosystems
Stream 2 - Fauna Conservation and Threatened Fauna			**Session Chair: Sarah Herbert**
2:10 p.m.	Stuart Parsons	The University of Auckland	Assessing the potential impact of wind turbines on endemic bats
2:30 p.m.	Darren Le Roux	OPUS International Consultants, Ltd	Preliminary evidence of differential long-tailed bat activity recorded at varying distances from a State Highway in Waikato, New Zealand
2:50 p.m.	Alana Smith	Massey University	Foraging behaviour and time-activity budgets of the North Island saddleback (*Philesturnus carunculatus rufusater*)
Stream 3 - Plant Physiological Ecology (NZSPB President's Symposium)			**Session Chair: David Collings**
2:10 p.m.	Ari Kornfeld	University of Canterbury	Alternative respiration in Arctic plants responds to environment in a species dependent manner
2:30 p.m.	Marykate Black	The New Zealand Institute for Plant & Food Research	Soil respiration and root growth in a kiwifruit (*Actinidia deliciosa*) orchard
2:50 p.m.	Scott Graham	University of Canterbury	Effects of soil warming and nitrogen fertilisation on net carbon balance of a tussock grassland
Stream 4 - Regional/Central Government Protection Mechanisms and Monitoring			**Session Chair: Fleur Maseyk**
2:10 p.m.	Les Molloy	Nature Heritage Fund	The achievements of the nature heritage fund in reducing biodiversity loss on private land
2:30 p.m.	Karen Denyer	National Wetland Trust	Describing and monitoring the ecological character of New Zealand's Ramsar sites: combining science, policy and advocacy
2:50 p.m.	Craig Bishop	Auckland Council	Wetland monitoring in the Auckland region: a comparison of some alternative methodologies
3:10 p.m.	**Afternoon Tea**		

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

TUESDAY 30 AUGUST 2011

Time	Presenter	Organisation	Title
Stream 1 - Forest Dynamics (2011 is the International Year of Forests)			**Session Chair: Tim Martin**
3:40 p.m.	Kevin Burns	Victoria University of Wellington	Are blackbirds (*Turdus merula*) important seed dispersers in New Zealand forests?
4:00 p.m.	Rocio Jana	University of Canterbury	Differential roles of fleshy-fruited trees as attractors and/or sources of bird-mediated seed dispersal in lowland temperate-mixed forests of New Zealand
4:20 p.m.	Ray Blick	University of New South Wales	Climbing the forest interior: the distribution of mistletoes, lianas and epiphytes from a network perspective
4:40 p.m.	Fiona Clarkson	The University of Waikato	Population genetics and autecology of the endemic shrub *Pittosporum cornifolium*
Stream 2 - Mires Matter! Wetland Science 60 Years On			**Session Chair: Dave Cambell**
3:40 p.m.	Monica Peters	NZ Landcare Trust	How do community wetland restoration projects measure up?
4:00 p.m.	Tarnia Hodges	Massey University	*Empodisma minus* engineers the Fen-Bog Transition in New Zealand Mires
4:20 p.m.	Corrine Watts	Landcare Research	Willows and weevils: beetle community responses to grey willow (*Salix cinerea*) invasion within three Waikato wetlands
4:40 p.m.	Rebecca Eivers	The University of Waikato	Lake restoration and the dual benefits of constructed wetlands - habitat provision and pollutant attenuation
Stream 3 - Landscape Ecology			**Session Chair: Thomas Etherington**
3:40 p.m.	Robert Holdaway	Landcare Research	A threat assessment of New Zealand's naturally uncommon ecosystems
4:00 p.m.	Victoria Froude	Pacific Eco-Logic Ltd	Quantitative measurement of coastal natural character
4:20 p.m.	Tim Park	Greater Wellington Regional Council	Connecting fragmented forest ecosystems at the landscape scale in the Wellington Region
4:40 p.m.	Ross Martin	Waikato Regional Council	Predictors of stoat (*Mustela erminea*) activity in Tongariro Forest
Stream 4 - Plant Biology			**Session Chair: Mike Clearwater**
3:40 p.m.	Rubina Jibran	The New Zealand Institute for Plant & Food Research Ltd	Identification and mapping of key genetic regulators of postharvest senescence
4:00 p.m.	Daniel Morrison	The University of Waikato	The phloem unloading pathway in the developing kiwifruit berry
4:20 p.m.	Afsana Islam	Massey University	A role for Kunitz proteinase inhibitors in plant development and defence
4:40 p.m.	David Collings	University of Canterbury	Artefactual stabilisation of actin microfilaments following transient expression of GFP reporter proteins inhibits cytoplasmic streaming and induces microtubule-like cortical bundles
5:00 p.m.	**Finish**		
5:15 p.m.	**AGMs**		
7:15 p.m.	**Finish**		

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

WEDNESDAY 31 August 2011			
Time	**Presenter**	**Organisation**	**Title**
8:30 a.m.	**Opening**		
Plenary Speaker			**Session Chair: Mike Clearwater**
8:40 a.m.	Marieke Lettink	Fauna Finders	Farming our native fauna: ecological menace or economic opportunity?
Plenary Speaker			
9:20 a.m.	Tim Brodribb	University of Tasmania	Beyond sex: how evolution in the vegetative plant body has changed the world
10:00 a.m.	**Morning tea**		
Stream 1 - Fauna Conservation and Threatened Fauna			**Session Chair: Avi Holzapfel**
10:30 a.m.	Alison Ballance	Radio New Zealand	Don Merton – conservation work in the Indian Ocean
10:50 a.m.	Deidre Vercoe-Scott	Department of Conservation	Recent progress in kakapo conservation
11:10 a.m.	Nicole Sutton	Department of Conservation	Kiwi management with aerial 1080: does aerial 1080 improve kiwi chick survival?
11:30 a.m.	Roseanne Grant	Massey University	The effect of light intensity on the behaviour of brown kiwi (*Apteryx mantelli*)
11:50 p.m.	Isobel Castro	Massey University	The secret life of wild brown kiwi: studying behaviour of a cryptic species by direct observation
12:10 p.m.	Euan Kennedy	Department of Conservation	Have today's chronically inbred Chatham Island black robins really dodged the genetic bullet?
Stream 2 - Plant Physiological Ecology (NZSPB President's Symposium)			**Session Chair: David Whitehead**
10:30 a.m.	Matthew Turnbull	University of Canterbury	Flowering in snow tussock (*Chionochloa spp* .) is influenced by temperature and hormonal cues
10:50 a.m.	Ellen Cieraad	Landcare Research	Nothing anomalous about them: New Zealand treelines in a global context
11:10 a.m.	Matthew Krna	Massey University	Plant productivity, litter decomposition and soil carbon sequestration associated with *Chionochloa* species in New Zealand tussock grasslands
11:30 a.m.	David Burritt	University of Otago	Cyanotoxin containing water: direct and indirect impacts on plants
11:50 p.m.	Kate Calcott	Victoria University of Wellington	The functional role of betalains in vegetative plant tissues
12:10 p.m.	Ignatius Menzies	Victoria University of Wellington	Red Warning: Anthocyanic leaves are a reliable cue of leaf chemical defenses and deter herbivorous insects in the New Zealand horopito (*Pseudowintera colorata*)
Stream 3 - Landscape Ecology			**Session Chair: Mick Clout**
10:30 a.m.	Andrew Veale	The University of Auckland	Detecting invasion and/or survival post eradication using genetic methods: the stoat on New Zealand's islands
10:50 a.m.	Todd Dennis	The University of Auckland	Acute effects of trapping, handling, and tagging on the movement behaviour of wildlife revealed by high-resolution GPS telemetry: a case study of the common brushtail possum
11:10 a.m.	Thomas Etherington	The University of Auckland	Designing a model landscape to model movement of brushtail possums
11:30 a.m.	Debra Wotton	Landcare Research	Satellite tracking reveals kereru occupy large home ranges at landscape scale
11:50 p.m.	George Perry	The University of Auckland	Using spatially-explicit individual-based models to reconstruct seed dispersal by kereru in northern New Zealand forests
12:10 p.m.	Doug Armstrong	Massey University	Modelling dispersal from reintroduction sites as a function of landscape connectivity

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

WEDNESDAY 31 August 2011			
Time	**Presenter**	**Organisation**	**Title**
Stream 4 - Forest Dynamics (2011 is the International Year of Forests)			**Session Chair: K.C. Burns**
10:30 a.m.	Daniel Laughlin	The University of Waikato	The importance of intraspecific trait variation to forest community assembly
10:50 a.m.	Clayson Howell	Department of Conservation	From beech to fir: emergence of a new sub-alpine forest ecosystem?
11:10 a.m.	Alastair Jamieson	Wild Earth Media Ltd	Aerial surveillance of kauri dieback disease
11:30 a.m.	Sarah Wyse	The University of Auckland	Kauri, the ecosystem engineer
11:50 p.m.	Tim Martin	Wildland Consultants Ltd	Flora in the mist: conservation status of the endemic cloud forest species of Rarotonga, Cook Islands
12:10 p.m.			
12:30 p.m.	**Lunch**		
Plenary Speaker			**Session Chair: Bruce Burns**
1:25 p.m.	Corey Bradshaw	Univeristy of Adelaide	Rocket science? That's easy! – the mathematical challenges of global change ecology
Stream 1 - Fauna Conservation and Threatened Fauna			**Session Chair: Isabel Castro**
2:10 p.m.	Moira Pryde	Department of Conservation	Ruru – what is happening in the darkness?
2:30 p.m.	Andrew Blayney	Massey University	Heather and skinks – an interesting finding through an unfortunate event
2:50 p.m.	Trent Bell	EcoGecko Consultants Ltd	Following up Duvaucel's gecko (*Hoplodactylus duvaucelii*) on Mana Island: post-translocation monitoring 11-13 years on
Stream 2 - Plant Physiological Ecology (NZSPB President's Symposium)			**Session Chair: Fiona Carswell**
2:10 p.m.	Luitgard Schwendenmann	The University of Auckland	Water use characteristics of cacao and associated shade trees in an agroforestry system, Indonesia
2:30 p.m.	Mike Clearwater	The University of Waikato	Effects of heteroblastic variation in leaf form on the energy balance of leaves of lancewood
2:50 p.m.			
Stream 3 - Open			**Session Chair: Craig Morley**
2:10 p.m.	Renée Davies	Unitec Institute of Technology	Invertebrate species abundance and diversity on a NZ indigenous living roof
2:30 p.m.	Stephen Reay	AUT University	Re-designing walls as ecosystems in urban areas: a collaboration between ecology and design
2:50 p.m.	Bridget Johnson	Victoria University of Wellington	Processes influencing the establishment and survival of native woody vegetation at Wairio Wetlands, Wairarapa
Stream 4 - Landscape Ecology			**Session Chair: Laura Young**
2:10 p.m.	Emily Weeks	Landcare Research	Vulnerability of New Zealand's indigenous grasslands based on statistical models of recent land use intensification
Stream 4 - Open			
2:30 p.m.	Jane Gosden	University of Canterbury	What prevents hybridisation in *Celmisia*?
2:50 p.m.	Gaius Wilson	Victoria University of Wellington	Is *Lantana camara* a cause or symptom of biodiversity decline in dry tropical forests?

Conference Programme - Ecology in the Heartland - Rotorua - 29 to 31 August 2011

WEDNESDAY 31 August 2011			
Time	**Presenter**	**Organisation**	**Title**
3:10 p.m.	**Afternoon Tea**		
Plenary Speaker			**Session Chair: Matthew Turnball**
3:40 p.m.	Michael McMannas	Massey University	Talking to plants – What constitutes an external signal in an ecosystem?
Plenary Speaker			**Session Chair: Mel Galbraith**
4:20 p.m.	George Gibbs	Victoria University	Why New Caledonia? A biogeographers's interpretation of evolution on a drowned Zealandian island
5:00 p.m.	**Closing**		
5:15 p.m.	**Finish**		
7:00 p.m.	**Conference Dinner**		
	After Dinner Speaker		
	Ruud Kleinpaste		Ecology, research and conservation - Why the heck do we bother?

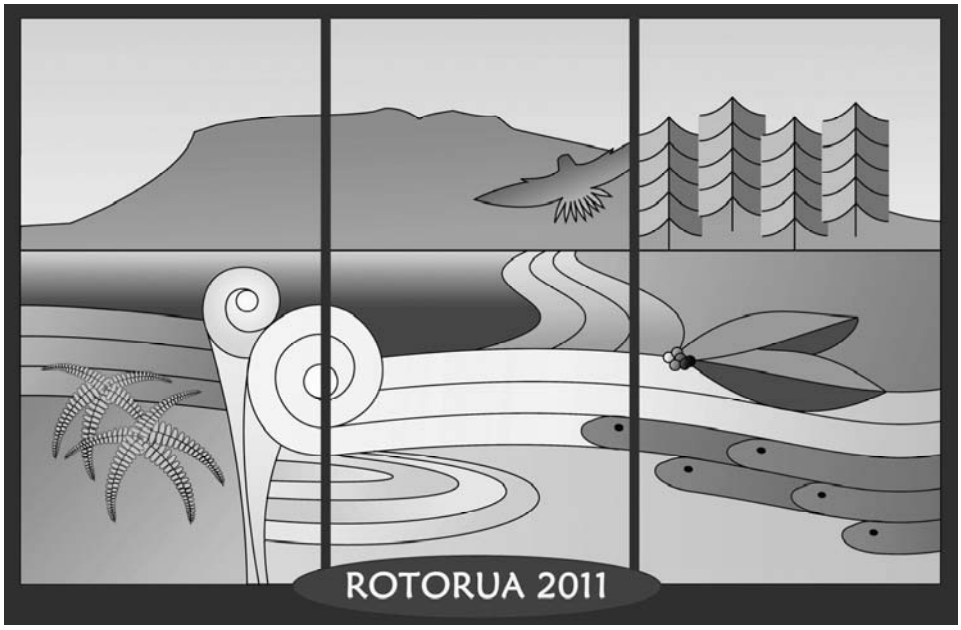
Ecology in the Heartland - Poster List

Poster Session - 4:50pm Monday 29 August 2011

Poster #		Presenter	Organisation	Title
8	🎓	Michelle Blydenburgh	University of Auckland	The introduced brown garden snail: inconspicuous threat to indigenous sand dune flora?
13	🎓	Kerry Borkin	University of Auckland	Are long-tailed bat populations in plantations limited by roost numbers?
20	🎓	Marie Brown	The University of Waikato	Towards robust exchanges: evaluating the use of ecological compensation under the Resource Management Act 1991
14		Margaret Dick	Scion	Kauri (*Agathis australis*) under threat from *Phytophthora*?
15		Margaret Dick	Scion	Comparative efficacy of disinfectants against *Phytophthora* taxon *Agathis* (PTA)
16		Margaret Dick	Scion	Approaching the origins of *Phytophthora* taxon Agathis
21	🎓	Emily Geck	University of Waikato	Valuing urban ecological restoration-market valuation using carbon credits
17		Ian Hood	Scion	Fungi decomposing coarse woody debris in native forests
23	🎓	Bridget Johnson	Victoria University of Wellington	Patterns of native turf species vegetation during summer desiccation at Wairio Wetlands, Wairarapa
7	🎓	Srishti Joshi	Massey University	Characterization of nitrite reductase and similarities with sulfite reductase from onion (*Allium cepa L.*)
22	🎓	Susanne Krejcek	Victoria University of Wellington	Do dead plants act as facilitators or competitors in stressful environments? The stress gradient hypothesis in New Zealand's coastal dune restoration.
1		Susanna Leung	Massey University	Localisation of onion O-acetylserine (thiol)-lyase (OAS-TLI)
2	🎓	Narkis Morales	University of Auckland	Inhibitory effects of *Beilschmiedia tawa* leaf leachate on *Lactuca sativa* seed germination and early growth
12	🎓	Moniqua Nelson-Tunley	Massey University	Investigating historical dispersal and recent gene flow in the small-scaled skink (*Oligosoma microlepis*)
24		Karen Palmer	Massey University	Effects of urban development on wetland riparian condition
18	🎓	Sharada Paudel	Victoria University of Wellington	Flowers, fruits and frugivores: How do they inter-relate?
9		Thalia Sachtleben	Department of Conservation	Trends in waterbird numbers on the Rotorua Lakes over a quarter-century
10	🎓	Idan Shapira	Massey University	Foraging in predator-naïve invasive house mice population: effects of predatory cues and possible implications for management
3	🎓	Calab Sixtus	Massey University	Abscisic acid (ABA) accumulation and improved water use efficiency (WUE)
4	🎓	Diantha Smith	Massey University	Characterisation of P nutrition responses in selected genotypes of white clover (*Trifolium repens L.*)
6		Sheryl Somerfield	The New Zealand Institute for Plant & Food Research Limited	Variation in dietary fibre and pectin content in potatoes
5	🎓	Jimmy Thomas	University of Canterbury	Cell wall organisation in radiata pine tracheids visualised with Pontamine Fast Scarlet 4B
11	🎓	Joshua Thoresen	Massey University	Monitoring gecko diversity at predator controlled and uncontrolled sites
19		Jamie Wood	Landcare Research New Zealand Ltd	A quaternary vegetation database for New Zealand

🎓 Eligible for Student Awards

Ecology in the Heartland



Celebrating 60 years of the New Zealand Ecological Society

Oral Presentation Abstracts

NEW ZEALAND ECOLOGICAL SOCIETY

NZSPB
New Zealand Society of Plant Biologists

CONVEX event innovators

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Resources and climate as determinants of mountain beech seed production: a review

Rob Allen[1]

[1] Landcare Research, PO Box 40, Lincoln 7640

Email: allenr@landcareresearch.co.nz

Variation in seed production by trees has vital consequences for population demography, consumer dynamics, and ecosystem processes. This paper presents progress on understanding the variation in seed production by mountain beech. Inter-annual variation in seed production data (initiated in 1965) from a mountain beech forest is among the highest in the world, is highly synchronised at local scales, has distinctive periodicity, and does not exhibit bimodality in the frequency distribution of seed crop size. It has long been known that summer temperatures, and more recently summer rainfall, bear a strong relationship to seed production. These relationships were not markedly strengthened by including net carbon gain from a climatically driven carbon balance model. To further resolve whether climate factors are merely cues for seeding events or instead operate through altering resource availability and forest productivity, a Nitrogen (N) fertilisation experiment was undertaken in the mountain beech forest. In unfertilised stands, foliage N concentration over 10 years was highly and positively correlated with summer rainfall and seedfall. In fertilised stands, foliage N concentration increased in all years, as did fine root and seed production. Importantly, summer rainfall is a much stronger predictor of seed production in unfertilised stands. A demonstrated decadal level trend of increasing mountain beech seed production maybe a consequence of the demonstrated trend of increasing summer rainfall, as increased summer rainfall potentially increased N availability. Such results suggest spatial (site nutrient availability) and temporal (stand development and climate trend) variability in the factors related to tree seed production.

Auckland urban woodland quality by comparison of urban and non-urban ecosystems

Amiot Christophe[1],Dale James[1], Brunton Dianne[1], Ji Weihong[1]

[1] Ecology and Conservation Research Group Institute of Natural Resources Massey University (Albay Campus)

Email: C.Amiot@massey.ac.nz

Urban development in cities in response to human needs has permanently altered the natural landscape and created a new type of ecosystem: urban ecosystems. In such ecosystems, reserves and parks play an important role in harbouring wildlife populations. Maintaining healthy animal populations in such urban landscapes will depend on the quality of urban habitats and the ability of a particular species to disperse between habitats fragmented by urban infrastructures. This study investigates the effects of urbanisation on wildlife habitats. We compare abiotic (microclimate, sound and light pollution) and biotic (vegetation structure, invertebrate diversity and abundance, predator diversity and abundance and human disturbances) factors between forest ruminants in Northshore area, Auckland, the largest city in New Zealand and non-urban forest remnants in Tawharanui Regional Park. We investigate the degree of divergence between urban and non-urban ecosystems and evaluate habitat quality in urban areas for native and endemic avian species.

Modelling dispersal from reintroduction sites as a function of landscape connectivity

Doug P. Armstrong[1], Elizabeth H. Parlato[1], Yvan Richard[1,2]

[1]Wildlife Ecology Group, Massey University, Palmerston North, [2]Dragonfly, 154 Victoria St, Wellington

Email: D.P.Armstrong@massey.ac.nz

It is important to be able to predict dispersal from reintroduction sites, both to assess site suitability and to decide how many individuals should be released. The key parameter is connectivity of the target site to surrounding habitat, and this can be assessed a priori using GIS-based indices reflecting the dispersal behaviour of the species. We apply a connectivity index developed from dispersal data from juvenile North Island robins to predict post-release dispersal of the same species in two different circumstances. First, we modelled data from 147 radio-tracked robins translocated to 17 small (5-56 ha) forest fragments near Benneydale in the central North Island from 2005-2009. Here we simultaneously modelled the probability of leaving the fragment and the probability of transmitter failure over time to account for uncertainty about fates of undetected birds. We included effects of sex, time since release, and time of year released in the model as well as connectivity. Second, we modelled data on "apparent survival" of robins reintroduced to 14 sites (31-1100 ha) around the North Island from 1997-2007. Here we only knew which birds were known to be present next breeding season, which is affected by survival and detection probabilities as well as dispersal. Nevertheless, apparent survival was strongly correlated with the connectivity index, presumably due to dispersal. In both cases we were able to estimate the probability of the birds remaining at a release site as a function of connectivity, and put a confidence interval around that probability, providing useful guidance for future mainland reintroductions.

Freshwater ecology in plantation forest streams

Brenda R. Baillie[1], Steve M. Pawson[1]

[1]Scion (NZ Forest Research Institute Ltd)

Email: Brenda.Baillie@scionresearch.com

New Zealand was a predominantly forested landscape prior to human arrival. Streams below the natural timber line were largely heterotrophic, characterised by forested riparian areas, high shade, and cool water temperatures, with allochthonous inputs providing an important energy source. Organic material such as riparian tree roots and in-stream wood, contributed to the structure and diversity of habitat in these waterways. The replacement of extensive areas of indigenous forest with agriculture has had a profound effect on the ecology of streams. In particular, increases in light levels, sedimentation, and water temperature, a shift to autochthonous energy sources and a reduction in allochthonous inputs and large structural pieces of wood have significantly altered biological communities. Reforestation with plantation forests of predominantly *Pinus radiata* D. Don began in the early 20th century and plantation forests now cover approximately 7% of New Zealand's land area. Although plantation forests are dominated by a single tree species, a number of studies show that they support stream ecosystems similar to those in indigenous forests. This presentation examines similarities and differences between indigenous forest and plantation forest streams, the contribution of plantation forest streams to the provision of habitat for rare, threatened and endangered species and presents results from recent studies on the influence of wood in our forested stream ecosystems. In summary we discuss the potential for plantation forests to mitigate some of the adverse effects of historic deforestation on stream ecosystems.

Don Merton – conservation work in the Indian Ocean

Alison Ballance

Radio New Zealand

Email: alison.ballance@radionz.co.nz

Don Merton was well-known in New Zealand for his work on threatened native species. Internationally, he was also renowned for his conservation work on islands in the tropical Indian Ocean. He was the first Government Conservator on Christmas Island, working towards the creation of the island's first National Park to protect Abbott's booby. He was involved in the first translocation attempts for the noisy scrub bird in Western Australia. At the request of the Durrell Wildlife Conservation Trust he spent time in Mauritius, advising on echo parakeet conservation, and leading the project to eradicate rabbits from Round Island. He also worked on a number of projects in the Seychelles, at the request of Birdlife International and various island owners. This included species conservation work with the Seychelles magpie robin, and a number of rat eradication projects.

Carbon stocks in dense podocarp forest at Whirinaki

Peter Beets, Mark Kimberley, Greg Steward

Scion

Email:peter.beets@scionresearch.com

The amount of carbon stored in live biomass and dead wood in windfalls from cyclonic storms since 1982 was estimated in a high density podocarp forest at Okurapoto. Rimu, miro, matai and totara contained large amounts of carbon, with a small contribution from hardwood species. Carbon stocks per hectare in above ground live biomass was estimated from tree diameter of all stems ≥ 30 cm DBH, tree height, and a breast height basic density survey by species. Stem carbon was estimated by multiplying stem volume by the corresponding whole stem wood density, using local stem volume equations parameterised by species, coupled with a ratio estimator to estimate whole stem density from survey samples. Carbon in the dead wood pool was estimated taking into consideration density loss owing to decay. Losses owing to decay were determined from discs cut from sample trees that fell approximately 20 years previously during dated windfall events. Expected diameter growth rates were coupled with tree mortality and decay rates to estimate gross and net periodic mean annual increment in above ground biomass carbon. National estimates by forest type and region, based on New Zealand's Land Use and Carbon Analysis System (LUCAS), are discussed and compared with estimates at Okurapoto.

Following up Duvaucel's gecko (*Hoplodactylus duvaucelii*) on Mana Island: post-translocation monitoring 11-13 years on

Trent P. Bell, Sarah M. Herbert

EcoGecko Consultants Ltd, 212 Pembroke Rd, Wilton, Wellington, New Zealand 6012

Email: trent@ecogecko.co.nz

There is currently little known about the techniques and methods required for successful gecko translocations in New Zealand, including a lack of empirical evidence on outcomes of such translocations. We followed up the translocation of forty individual Duvaucel's geckos to Mana Island in 1998 from the North Brother Island, which represents the first significant translocation event for New Zealand geckos. In the first ten years (1998-2008) since their release, only 26 geckos had been captured or encountered, due to their cryptic nature, and the status of the translocation has remained unknown over this time. Since 2009, we have been monitoring this population at the original release location using capture-mark-recapture methods and radio telemetry studies. We examined population size, individual condition, area inhabited, movements, habitat use, home range, and population structure and also parasite loads. We report on our initial results to date, which are encouraging for future translocations of geckos to mammal-free sanctuaries.

Wetland monitoring in the Auckland region: a comparison of some alternative methodologies

Craig Bishop[1], Matt Baber[2], Karen Denyer[3]

[1] Auckland Council

[2] Tonkin and Taylor

[3] Papawera Consulting

Email: craig.bishop@aucklandcouncil.govt.nz

The Auckland Council's Wetland Biodiversity Monitoring Programme aims to obtain a comprehensive verifiable assessment of the region's wetland biodiversity, key threats, and management actions. Monitoring includes collation and analysis of information from databases and records (i.e., desktop monitoring), as well as systematic field measurements at around 200 wetlands on a five-yearly cycle. Data collection includes the use of standardized 10 minute bird counts, vegetation data collected in nested 15 m x 15m, 10m x 10m and 2m x 2m plots, and wetland condition assessment using the standard national protocols for assessing wetland condition. To date, preliminary analyses on the first two years of field data (n = 74 wetland sites) has been conducted to determine the strengths, weakness and relative efficiency of the different plot sizes for measuring changes in wetland biodiversity. A number of interesting patterns and relationships are evident. A large number of potential biodiversity indicators were also extracted from the plot data and this paper will discuss the relative merits of the various indicators we have examined. Further details of the monitoring programme will be discussed including the major practical and technical challenges we faced in getting this programme off the ground, and recommendations for further improvement.

Fires, frosts and forestry; the vegetation history and dynamics of Kaingaroa

Craig Bishop[1]

[1] Auckland Council

Email: craig.bishop@aucklandcouncil.govt.nz

Recognition of the importance of land-use history and its legacies, which has can continue to influence ecosystem structure and function for decades or centuries after those activities have ceased, has become more widespread in recent years. The Kaingaroa Plateau forms the (approximately) north-eastern quarter of the Volcanic Plateau region. It consists of ignimbrite sheets deposited in a series of massive eruptions from the Taupo volcanic centre around 250 - 300K BP. The use of the term 'frost flat' to describe a specific *vegetation* association is usually restricted to heathland vegetation on extremely frosty and infertile sites in the Volcanic Plateau. Locations with climatic and edaphic conditions that are extreme enough to exclude forests from lowland sites are found in a number of widespread localities throughout the Volcanic Plateau; including Moawhango, Rangipo, Kaimanawa and Kaingaroa. The biogeographically distinct flora of many of these sites suggests that stable associations of non-forest vegetation may have occupied these sites for much of the Holocene, despite the spread of forest vegetation. This paper investigates the impact and legacy of human induced vegetation changes on the wider Kaingaroa Plateau. It also examines the long term stability of frost flat heathland vegetation remnants on and around the plateau.

Soil respiration and root growth in a kiwifruit (*Actinidia deliciosa*) orchard

Marykate Black[1], Kevin Patterson[2], Peter Minchin[1], Eng Chye Ong[1], Michael Clearwater[3]

[1] The New Zealand Institute for Plant & Food Research, 412 No. 1 Road, RD2, Te Puke, 3182, New Zealand

[2] Plant & Food Research, Private Bag 92169, Auckland, New Zealand

[3] School of Biological Sciences, University of Waikato, Hamilton, New Zealand

Email: mary.black@plantandfood.co.nz

Soil respiration and root growth of kiwifruit (*Actinidia deliciosa*) vines were monitored, with the objective of determining the contribution of roots to soil respiration. Autotrophic respiration is suggested to contribute significantly to total soil respiration. The reliance of root growth and metabolism on the supply of recently accumulated carbohydrates was investigated by trunk girdling. A modification of the mini-rhizotron technique was used to monitor root growth, over a period of 18 months. Rectangular, plastic sleeves were installed vertically, to 1.3 m depth and a desktop scanner was used to collect images of root growth. Soil respiration was measured fortnightly using a soil CO_2 flux chamber (LI-COR). The contribution of autotrophic respiration to total soil respiration was determined using the mass regression technique. Root growth was evident throughout the year, with peaks in summer and autumn. The seasonal pattern of soil respiration closely resembled the seasonality of root growth. Soil respiration was negatively correlated with soil moisture and positively correlated with soil temperature. Using mass regression analysis, a relationship between root

biomass and total soil respiration was not evident over winter months. It is suggested that the contribution of autotrophic respiration to total soil respiration is seasonal and likely to be related to root activity as well as populations. Annual girdling resulted in reduced root populations. There was no evidence of reduced root growth or respiration during the period the girdle wound was open, suggesting that kiwifruit root growth and metabolism was maintained by utilising carbohydrate reserves.

Heather and skinks – An interesting finding through an unfortunate event

Andrew Blayney[1], Paul G Peterson[2]

[1] Institute of Natural Resources – Ecology, Massey University, Palmerston North, New Zealand.

[2] Landcare Research, Palmerston North, New Zealand.

Email: andrewbuggin@gmail.com

Since its introduction to New Zealand heather (*Calluna vulgaris*) has become an aggressively invasive weed in the central North Island, particularity within the native tussock grasslands of the Tongariro National Park. A biological control program, using the foliage feeding heather beetle (*Lochmaea suturalis*), was initiated in 1992 with the first releases in 1996. We have been investigating the effects on invertebrate communities of the subsequent reduction in heather density over the 2010/2011 summer. During this research an unfortunate by-catch of the native common skink (*Oligosoma nigriplante polychroma*) occurred revealing a rather unexpected deleterious effect of heather invasion. In replicated blocks where heather density was experimentally manipulated we found skinks were almost completely absent from areas where heather density was high. The reason why the presence of heather appears to exclude skinks is unknown, but possibilities may include shading of basking sites or heather posing a barrier to foraging activities.

Climbing the forest interior: the distribution of mistletoes, lianas and epiphytes from a network perspective

Blick, Ray, Burns, K.C.

Evolution & Ecology Research Centre, University of New South Wales, Sydney

Email: rayblick@yahoo.co.nz

The forest interior is home to many arboreal plants, however they are often overlooked. We used a network approach to comparatively evaluate three types of arboreal plant metacommunities. Interactions between mistletoes, lianas and epiphytes and their host trees were quantified in two New Zealand forests and individual-based null models were used to test for non-random patterns in network degree, nestedness and negative co-occurrence patterns. Results showed that mistletoes, lianas and epiphytes had very different network properties. Mistletoe and liana degree distributions exhibited fewer links than expected under the null model, indicating strong host preferences. Conversely, degree distributions for epiphytes

were consistent with randomised expectations. Mistletoes and lianas were less nested than null model expectations and instead showed support for negative co-occurrence patterns, meaning mistletoe and liana species tended to have mutually exclusive host preferences. Conversely, epiphytes were more nested than expected by chance and showed positive co-occurrence patterns. Overall results indicate that plant–plant interactions exhibited by different types of arboreal plants have very different network properties. We hypothesize that these differences result from (1) coevolutionary dynamics between arboreal plants and their hosts, and (2) biotic interactions among arboreal plant species for access to host trees.

The life and times of inanga in the Bay of Plenty - I need a place to spawn

Matthew Bloxham[1]

[1] Organisation: Bay of Plenty Regional Council

Email:matthew@envbop.govt.nz

In most districts inanga make up the bulk of the whitebait catch. Revised threat rankings for inanga indicate that this species is now in decline. Anecdotally, whitebait catches have been in a state of decline for many decades. Threat rankings for inanga might have been revised sooner but the way in which the fishery is managed prevents the gathering of empirical catch data. However, collectively enough information existed on population pressures, crucially the diminishing area of rearing and spawning habitat available to inanga, to increase the specie's threat ranking.

The Bay of Plenty Regional Council has an environmental code of practise relating to its Natural Hazard Section's rivers and drainage maintenance activities. The code outlines environmentally sensitive approaches for protecting adjacent landowners from flooding, while at the same time achieving positive environmental outcomes. In practise the Natural Hazard Section's dual functions, that of land drainage and river protection versus freshwater habitat protection and restoration, can be at odds with each other.

This paper will précis some of the issues facing lowland fisheries in the Bay of Plenty focusing primarily on inanga spawning constraints, and suggest possible solutions at both local government and community levels.

Social dimension: how communities view island restoration

Souad Boudjelas[1], David Towns[2], Bill Nagle[1]

[1]Pacific Invasive Initiative, University of Auckland, Auckland, New Zealand

[2]Research and Development Group, Department of Conservation, Auckland, New Zealand

Email: s.boudjelas@auckland.ac.nz

Island restoration will often not be possible without participation by local communities. We review the forms of community involvement in seabird island restoration for 25 projects in 8 countries. The projects involved the eradication of predators; were in remote locations; included some habitats sensitive to high levels of public traffic; required considerable technical and institutional support; and, in developing nations, were all initiated by outside NGOs. Some agency-led projects had minimal citizen

participation beyond public outreach, (public engagement); other projects included devolution of responsibility to local communities (stakeholder participation); and some were initiated by citizens themselves (stakeholder instigation). We use case studies from the Pacific islands and New Zealand to illustrate how communities can be motivated to become involved in island restoration. However, we found that even the most highly motivated and well resourced groups must confront issues with capacity, continuity of funding and enthusiasm, and long (decadal) timeframes. We conclude that most projects with high community involvement are in their infancy, the long term issues these projects face are poorly understood, and there is often little dedicated capacity within government agencies or outside funders to provide long term support.

Rocket science? That's easy! – The mathematical challenges of global change ecology

Professor Corey J. A. Bradshaw

The Environment Institute and School of Earth & Environmental Sciences, University

E-mail: corey.bradshaw@adelaide.edu.au

Ecology has evolved over the last 100 years from a largely descriptive endeavour into a predictive science that rivals the complexity of physics. Mathematical development has been the heart of this maturation, for only mathematics can tease pattern from chaos in systems where a multitude of species interact and are all, in turn, influenced by their environmental setting. As the momentum of the Anthropocene accelerates and the scale of Earth's latest mass extinction event unfolds, ecologists are increasingly tasked with predicting the response of ecosystems to mounting perturbations, and demonstrating the explicit links between biodiversity health and ecosystem service provision. Complex multi-model platforms and simulation experiments are now possible with the advent of powerful computer networks, and rapid advances in genetic technology has increased the demand for bioinformatic prowess. Coupled with climate change predictions from global circulation models, ecology is quickly becoming one of humanity's most important disciplines.

Beyond sex: how evolution in the vegetative plant body has changed the world

Tim Brodribb

University of Tasmania

Email: timothyb@utas.edu.au

Traditionally land plant evolution has been described by a reproductive narrative, and this story is largely supported by modern phylogenetic analysis. However reproductive biology offers only a limited perspective on the impact evolution on competition between plant groups or possible interactions between plants and the atmosphere over geological time. This talk examines some new perspectives on plant evolution based upon adaptive changes in the function of the vegetative plant body over the last 400+ million years. Focussing on photosynthesis and water transport I show how evolutionary changes in these fundamental plant systems may explain the demise of ferns, the rise of flowering plants and the formation of the modern equatorial rainforest belt.

Vascular epiphytes in urban ecological restoration

Catherine L. Bryan[1], Bruce D. Clarkson[1]

[1] Centre for Biodiversity and Ecology Research, University of Waikato

Email: cbryan@waikato.ac.nz

Urban environments present multiple challenges for ecological forest restoration. Many native plant guilds such as midstorey trees and shade tolerant shrubs are absent in urban forests and accordingly become priorities in restoration projects that aim to restore ecosystem function. Here, we focus on another guild of native plants that are underrepresented in urban forests but rarely prioritised in restoration; the vascular epiphytes and vines.

Communities of epiphytes and vines were surveyed on 750 host trees in urban and nonurban forests of the Waikato and Taranaki regions along with canopy microclimate monitoring. A total of 31 species were identified, with comparable diversity and a wide range of growth forms in both regions. Population comparisons showed that urban Waikato forests were relatively depauperate. Epiphyte and vine diversity and abundance was found to be correlated to host tree characteristics, associations with nest epiphytes, and canopy microclimate; all of which were less conducive in the highly modified urban Waikato forests.

A physiological drought tolerance experiment on the shrub epiphyte *Griselinia lucida* was undertaken to further explore microclimatic requirements for establishment and survival. This species postponed desiccation through reduced photosynthetic and stomatal activity which facilitated rapid recovery with rewatering.

Strategies for inclusion of epiphytes and vines in forest restoration were developed to assist restoration planning. Future planned research includes reintroduction trials for the establishment of best practise methodology. This study has highlighted the importance of New Zealand's vascular epiphytes and vines and presents a case for their explicit inclusion in restoration projects.

Are blackbirds (*Turdus merula*) important seed dispersers in New Zealand forests?

K.C. Burns[1]

[1] School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington

Email: kevin.burns@vuw.ac.nz

Many species of native birds regularly consume fleshy-fruits and form important mutualistic partnerships with plants as seed dispersers. However, introduced bird species are becoming increasingly important components of New Zealand forests. Do introduced birds develop viable mutualistic partnerships with native plants? To answer this question, I observed both native and introduced birds forage for fruits in the Karori Wildlife Sanctuary at bi-weekly intervals for five years. I then compared fruit consumption patterns of European blackbirds (*Turdus merula*) to several native bird species. I also compared the fruit diets of blackbirds in New Zealand to previously published dietary records from similar latitude forests in the U.K. Results showed that blackbirds were the most common fruit consumer in the Karori Wildlife Sanctuary.

They exhibited similar levels of dietary diversity to native bird species and consumed an unusually broad range of fruit species. Blackbirds in the Karori Wildlife Sanctuary also exhibited remarkably similar patterns in dietary diversity and composition to conspecifics in their native range. Therefore, blackbirds and native bird species appear to form similar mutualistic relationships with native plants at the initial stages of seed dispersal. Blackbirds also form similar mutualistic relationships with plants in their native and introduced ranges, indicating that coevolution is not a prerequisite for properly functioning seed dispersal mutualisms.

Cyanotoxin containing water: direct and indirect impacts on plants

Dr David J. Burritt

Department of Botany, University of Otago, P.O. Box 56, Dunedin, New Zealand

Email: d.burritt@botany.otago.ac.nz

Cyanobacterial blooms are becoming increasingly common in lakes, rivers and streams in many countries throughout the world, due to eutrophication. Many bloom forming cyanobacteria produce toxins that can be released into the surrounding water following the senescence and lysis of the cyanobacterial cells. These toxins then come into contact with a wide variety of aquatic organisms including, invertebrates, fish, mammals and aquatic plants. In addition, most countries use water obtained from lakes, rivers and streams for the irrigation of agricultural crops, therefore terrestrial plants are also potentially at risk of exposure to cyanotoxins.

This presentation will give an overview of the direct and indirect impacts of exposure to cell-free crude extracts from *Microcystis* and pure microcystin-LR on the physiology of monocotyledonous plants. The influence of microcystins on the production of reactive oxygen species (ROS), oxidative damage to proteins, lipids and DNA and the activation of the plants antioxidant defence systems will be discussed. In addition, the ability of microcystins to disturb jasmonate signal transduction and potentially influence the susceptibility of plants to attack by insects, will be considered.

Could gender related differences in stress tolerance influence sex ratios in *Marchantia*

Dr David J. Burritt

Department of Botany, University of Otago, P.O. Box 56, Dunedin, New Zealand

Email: d.burritt@botany.otago.ac.nz

An interesting, but unexplained pattern in some species of bryophytes is the absence or rarity of one sex at the patch, population or regional level. In most bryophytes, including several species of *Marchantia,* it is usually males that are absent or rare. One reason for male rarity suggested by several researchers is that males do not initiate sexual reproduction as often as females and hence are “shy”. This has lead to the so-called “shy male hypothesis” that predicts the existence of a pool of vegetative male plants in which the production of sexual structures has not been induced (Mishler and Oliver, 1991). In addition to the “shy male hypothesis” is has also been suggested that local environmental conditions, combined with competitive interactions between genders, could be the cause of gender imbalances (McLetchie and Puterbaugh 2000).

In this presentation I will give an overview of my work using biochemical, molecular and physiological markers to compare the stress tolerances of male and female plants

of two common *Marchantia* species, in both vegetative and reproductive developmental stages. A possible link between gender imbalance and gender related differences in stress tolerance, and colonization and growth potentials will be discussed.

Mishler and M. J. Oliver. 1991. Gametophytic phenology of *Tortula ruralis*, a desiccation-tolerant moss, in the Organ Mountains of southern New Mexico. The Bryologist 94: 143–153.

McLetchie and M. N. Puterbaugh. 2000. Population sex ratios, sex- specific clonal traits and tradeoffs among these traits in the liverwort, *Marchantia inflexa*. Oikos 90: 227–237.

Geothermal Vegetation in the Taupo Volcanic Zone: Priorities for ecological restoration and implementation of restoration management at selected sites

Chris Bycroft[1], Sarah Beadel[1], William Shaw[1], Andy Garrick[1]

[1]Wildland Consultants Ltd, P.O. Box 7137, Te Ngae, Rotorua 3042, New Zealand.

Email: chris.bycroft@wildlands.co.nz

Geothermal vegetation - influenced by surface expressions of heat from the Earth's interior - is naturally rare in New Zealand, and internationally. The varied nature of geothermal manifestations, due to varying combinations of temperature, chemistry, hydrology, and localised protection from frosts, produces rare and unusual habitats for plants. These include habitats for threatened and naturally rare plant species, as well as species occurring outside 'normal' latitudinal and altitudinal ranges. The varied nature of geothermal vegetation, one of the most threatened ecosystems in New Zealand, has important implications for management, including retention of existing areas and the maintenance and enhancement of ecological values. The extent of geothermal vegetation has been significantly reduced and is still threatened by exploitation for energy production (thermal and hydro-electricity, heating, and industrial uses), land use changes such as mining, farming, forestry, urban development, tourism, fire, and pest plant invasion. Invasion of pest plants, particularly introduced conifers and other woody plants, is a major threat at many sites. Restoration management of key ecological threats is now a priority for the maintenance of ecological values at many geothermal sites. Priorities for restoration management of geothermal sites in the Waikato Region based on key ecological values (e.g. diversity of habitat types present and presence of threatened species), and ecological threats (wilding pines, other pest plants, and pest animal threats) will be discussed. Examples will be given of ecological restoration progress at select sites in the Taupo Volcanic Zone.

The functional role of betalains in vegetative plant tissues

Kate E. Calcott[1], Kevin M. Davies[2], Kathy E. Schwinn[2], Kevin S. Gould[1]

[1]Victoria University of Wellington, PO Box 600, Wellington, New Zealand

[2]Plant & Food Research, Private Bag 11600, Palmerston North, New Zealand

Email: Kate.Calcott@vuw.ac.nz

Betalains are remarkably similar to anthocyanins in their appearance and the types of tissues in which they occur, yet no plant has been found to contain both pigment types. It is for this reason that betalain pigments are said to replace anthocyanins in many species within Caryophyllaceae. However, it is unknown whether the function of betalains in vegetative plant tissues mimics that of anthocyanins. There is substantial evidence that anthocyanins mitigate stress exacerbated by abiotic factors such as high light, cold, and salinity. Research into whether betalains have a similar role in protection against environmental stressors is limited, but it has been shown that light, low temperature and salt are able to induce betalain pigment production. The aim of this project is to investigate whether betalains ameliorate the effects of environmental stressors in the same way as anthocyanins. Using the betalain-producing species *Beta vulgaris* var. cicla cv. "Bright Lights", the responses of entirely red plants will be compared to closely related unpigmented plants during the physiological experiments. Plants will be exposed to the stressors excess light, chilling and excess salt, both individually as well as in combination. Plant health will be monitored using chlorophyll fluorescence. Histological and developmental studies of nine different betalanic plant species have provided evidence for locational importance of betalains in addition to developmental timing of betalain production. These results indicate that betalain pigmentation of particular tissue types may enhance plant growth under certain environmental conditions.

CO_2 exchange in peatlands with vegetation dominated by *Empodisma minus*

Dave Campbell[1], Blair Thornburrow[2], Brian Sorrell[3] and Susanna Rutledge[1]

[1] Department of Earth & Ocean Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand

[2] Sinclair Knight Merz Ltd, PO Box 9806, Auckland, New Zealand

[3] Department of Biological Sciences, Aarhus University, Aarhus, Denmark

Email: davec@waikato.ac.nz

Peatlands have been globally important carbon sinks for millennia; the C stored representing a long-term imbalance between the uptake of CO_2 via photosynthesis and the loss of C via decomposition of organic matter.

We investigated the key biophysical drivers of CO_2 exchange in a Waikato peatland with vegetation dominated by *Empodisma minus*, for a one-year period using eddy covariance. Net ecosystem exchange of CO_2, NEE, was depressed by high light levels during all seasons. Maximum CO_2 uptake occurred at moderate light (500–800 μmol m^{-2} s^{-1}) whereas the ecosystem frequently became a net CO_2 source at both very high and low light levels. The measured annual uptake of CO_2 by the ecosystem (NEE = –72.5 gC m^{-2}) was approximately one third of simulated uptake based on saturating light response. Ecosystem gross primary production, GPP, was

depressed during 42% of all daytime half-hour periods during the year (51% in summer and 28% in winter). For two clear-sky days in summer, GPP was compared to stem-level measurements of net photosynthesis (*A*) and similar light responses were observed. The depression of *A* under high light was accompanied by reductions in quantum yield of PSII while rapid recovery of the maximum yield of dark-adapted stems suggested dynamic photoinhibition, probably accompanied by extensive photorespiration. We hypothesize that photosynthetic capacity in this ecosystem is severely constrained by nitrogen limitation, while limited self-shading of the photosynthesizing parts of *E. minus* was responsible for the similar light response observed at both stem and ecosystem scales.

Is management for carbon compatible with biodiversity protection on conservation land?

Fiona Carswell[1], Norman Mason, Larry Burrows, Mark St John, Jake Overton, Robert Holdaway

[1] Landcare Research, PO Box 40, Lincoln 7640

Email: carswellf@landcareresearch.co.nz

Conservation land has significant potential to mitigate greenhouse gas emissions, but can management for carbon sequestration also confer biodiversity benefit? Using a framework of ecological integrity to quantify biodiversity change we examined both national and local scale trade-offs between carbon gain and ecological integrity. Ecological integrity comprises indigenous dominance, indigenous species occupancy and full environmental representation of ecosystems. We investigated the promotion of natural regeneration of forest successions and wild animal control as actions that may benefit carbon sequestration. Each action is primarily targeted towards either establishment of "new" (post-1990) forests or management of existing forests. As a consequence, different measurement criteria are required to demonstrate the effectiveness of management in promoting carbon gain. Increases in both carbon stocks and ecological integrity occurred during natural succession of two lowland forests (Marlborough and Canterbury). However, national scale optimisation of conservation lands for carbon versus biodiversity gain through new indigenous successions showed poor spatial correlation. This is because the greatest potential gains in ecological integrity are in areas where the existing vegetation has no biodiversity value and the land environment type has very little indigenous vegetation remaining nationally – these locations rarely favour rapid regrowth of tall indigenous forest. National-scale analysis of management of existing forests for biodiversity protection (e.g., by deer control) makes little difference to carbon sequestration of that forest but does increase understorey plant diversity.

The secret life of wild brown kiwi: studying behaviour of a cryptic species by direct observation

Isabel Castro, Susan Cunningham

Massey University, Institute of Natural resources, Palmerston North

Email: i.c.castro@massey.ac.nz

The behaviour of nocturnal species is difficult to study using traditional observational techniques and data is often collected indirectly using methods like radio-telemetry. Here we present the first study of wild brown kiwi behaviour by direct observation. We

obtained c. 6 hours of video footage of kiwi (*Apteryx mantelli*) over 19 months using inexpensive hand-held infrared cameras. Kiwi time-activity budgets were dominated by foraging (75% of active time) and prey capture rates were significantly higher in exotic pasture edges than in native forest. Direct social and courtship interactions were observed rarely. The senses of hearing, olfaction and touch seemed most important to active kiwi and we observed no behaviours that appeared to be guided by vision. Touch was used for investigating terrain, negotiating obstacles and in social interactions. Hearing was used in response to sounds made by observers, conspecifics and other sources. Olfactory search behaviours were used in the direction of these sounds, and olfaction was also apparently used to assess odours on the ground. We describe an olfactory search behaviour, we termed bill hover, for the first time. Behavioural repertoire size and diversity, and prey capture rates all increased in winter when kiwi begin breeding. Microhabitat use was also more diverse in winter. Female kiwi at our study site had 30% longer bills than males, and probed into soil substrates on average 30% deeper. No other fine-scale behaviours that might reduce competition between kiwi sexes were observed.

Nothing anomalous about them: New Zealand treelines in a global context

Ellen Cieraad[1,2], Matt McGlone[1]

[1] Landcare Research, Lincoln, New Zealand

[2] Durham University, Durham, United Kingdom

Email:cieraade@landcareresearch.co.nz

New Zealand treelines are low, but it has been suggested that they are also anomalously warm. Continuous temperature records at treelines across the globe indicated mean temperatures of the growing seasons at New Zealand stations were 2-4°C warmer than the global average of 6.7°C. Exotic conifers can grow up to 300m above *Nothofagus* (beech) treelines, seemingly confirming the inability of native trees to reach the potential thermal limit to tree growth. Temperature records from 6 new sites (2 beech, 4 West Coast mixed conifer-broadleaf) put the non-beech treeline growing season averages at 6.8°C (within 0.1°C of the global mean) and the beech treelines at 7.7°C, that is within the global range. New Zealand treelines are therefore not unusually warm. West Coast non-beech treelines tend to be gradual, that is with trees steadily reducing in height with altitude to shrub stature. Our results suggest this is because they are approaching an absolute limit to tree growth. Beech treelines are normally abrupt, and somewhat warmer, being truncated at a point when still made up of tall trees. Cold winters prevent regeneration further upslope. Abrupt treelines such as those of *Nothofagus* are rare on a global scale. Their prevalence in New Zealand is due to the absence of tree taxa (such as pines) which combine fast summer growth with winter cold resistance. Eastern low alpine areas are therefore exposed to exotic pine invasion, but not those above western non-beech treelines where the growing season is long and the winters are milder.

Wet, wild and wonderful: recent advances in wetland research

Bev Clarkson[1], Tim Moore[2]

[1]Landcare Research, Private Bag 3127, Hamilton

[2]Department of Geography and Global Environmental & Climate Change Centre

McGill University, 805 Sherbrooke St. W., Montreal, QC, Canada H3A 2K6

Email: clarksonb@landcareresearch.co.nz

Ecological research in New Zealand wetlands has expanded considerably over the last few decades, from studying individual wetland sites to understanding regional and national scale patterns and processes. Recent advances centre on putting New Zealand systems in an international context. Wetland development and dynamics theory is largely based on data from the Northern Hemisphere and, as many of our wetlands are compositionally unique, we are exploring similarities and differences. Recently completed research in restiad bogs indicates functional processes are similar, e.g., bog development is associated with similar declines in nutrients and pH as in northern *Sphagnum* bogs. A 5-year litter decomposition study was established along a swamp-fen-bog gradient, representing wetland succession, using foliage and root material from the main species (*Baumea, Leptospermum*, *Empodisma, Sporadanthus*), and *Typha latifolia* leaves from a Canadian wetland. Litter bags were placed on the peat surface and at depths of 10, 20 and 50 cm at each site. Surface litter *k* values ranged from 0.11 to 0.55, with the fastest decomposition in *Baumea* culm litter and slowest in *Sporadanthus*, with the rates generally slower at the early successional (swamp) sites. Buried litter *k* values ranged from 0.03 to 0.24, decreasing with depth and increasing from early to late successional sites. The differences in decomposition rates between Southern and Northern Hemisphere wetlands relate to the characteristics of the litter and the site environmental conditions, particularly water table position.

Population genetics and autecology of the endemic shrub *Pittosporum cornifolium*

Fiona M. Clarkson[1], Chrissen E.C. Gemmill[1], Bruce D. Clarkson[1,]

[1] Centre for Biodiversity and Ecology Research, University of Waikato, Private Bag 3105, Hamilton

Email: f.clarkson@waikato.ac.nz

Habitat loss and fragmentation are recognised as major drivers of the extinction of specialist species. *Pittosporum cornifolium* (Pittosporaceae) is an endemic dioecious shrub with lifestyles ranging from epiphytic to rupestral and terrestrial. The primary habitats of *P. cornifolium* are lowland and coastal ecosystems which, in recent times, have been widely cleared and fragmented resulting in major reductions to the species potential range.

We investigated the population genetics and autecology of *P. cornifolium* across five populations on North Island where habitat loss and fragmentation have been significant. Genetic analysis revealed relatively low genetic diversity at the population-level, which is indicative of geographic isolation caused by habitat fragmentation. Demographic parameters such as sex ratios and population structures were investigated to determine current ecological status of these populations and results did not reveal any substantial limitations to regeneration and dispersal. Environmental

profiling identified the major determinants of the species distribution throughout New Zealand. *Pittosporum cornifolium* is absent from areas where mean daily temperature minimums of the coldest month are <0.6°C.

We also assessed levels of intra-specific divergence in *P. cornifolium* individuals from the Poor Knights Islands, which are morphologically distinct from mainland forms. Significant differences were observed across multiple lines of evidence (genetics, morphology and anatomy), and suggest recognition at subspecies or even species level may be warranted.

The results of this research have provided a framework for the development of species specific conservation and restoration strategies for *P. cornifolium* and reintroduction trials are currently being initiated.

Effects of heteroblastic variation in leaf form on the energy balance of leaves of lancewood

Michael J. Clearwater[1], Kevin S. Gould[2]

[1] Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton

[2] School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington

Email: m.clearwater@waikato.ac.nz

Abrupt ontogenetic changes in plant form ('heteroblasty') may have a variety of consequences for plant functioning, including effects on photosynthetic performance, water use and herbivory. This study tested the hypothesis that heteroblastic variation in leaf shape, orientation and optical properties has a significant effect on the energy balance and functioning of leaves of lancewood (*Pseudopanax crassifolius* (Cunn.) C. Koch.). Detached, non-transpiring leaves from juvenile and adult trees were used as leaf models, and their temperatures measured while they were held at a series of predetermined angles relative to the sun. The effect of differences in width between the two leaf forms on convective heat exchange was examined by comparing measured leaf temperatures and estimated boundary layer conductances. Model leaves from adult plants consistently reached higher temperatures than leaves from juvenile plants at all angles of incidence, and leaf temperature increased in direct proportion to intercepted solar radiation, up to a maximum of 5 °C (juveniles) or 9 °C (adults) above air temperature. Differences in optical properties between juvenile and adult leaves were not large enough to affect their net radiation balance. Differences in leaf temperature between juvenile and adult plants were therefore caused by differences in leaf shape and effective length in the prevailing wind direction. The results support the conclusion that the effects of leaf size and shape on energy dissipation could have been a factor in the evolution of the pronounced heteroblasty characteristic of this species.

Mechanisms of interference between kahikatea and grey willow in the Waikato

Emma Coleman[1]

[1] University of Waikato

Email: ecoleman@waikato.ac.nz

Research was undertaken to determine the nature of the coexistence between kahikatea and grey willow in the Waikato. Specifically; does grey willow inhibit kahikatea recruitment (via mechanisms of interference?), and is site disturbance influencing this interaction?

Kahikatea and grey willow populations were measured at six sites to reconstruct population histories and to determine kahikatea regeneration status. Results indicated grey willow populations established after kahikatea at five sites, and once grey willow reached the canopy, no further canopy recruitment of kahikatea occurred. No kahikatea saplings were present in high grey willow densities (>2 per 10 m^2). Sites containing the highest sapling frequencies were those most recently exposed to moderate to large-scale disturbance or connected to a large seed source.

Dendrochronological and experimental methods were undertaken at Totara Park (Hamilton City). Grey willow exhibited comparable diameter growth rates to kahikatea (2.96 ± 1.37 mm yr^{-1} (n = 68) and 2.45 ± 1.37 mm yr^{-1} (n = 75), respectively). Growth rates were recorded for introduced (n=40) and naturally established (n=20) kahikatea seedlings, under varied grey willow canopy treatments. The fastest seedling growth rates were in canopy gap treatments (>30% summer transmitted light), while negative growth effects are observed in light environments under 5%.

This research suggests grey willow inhibits kahikatea regeneration via overtaking kahikatea height growth, shading out further recruitment, and maintaining dominance through vegetative reproduction. Active management is required to ensure dominance of kahikatea in the Waikato and highly disturbed or well-connected sites can provide novel opportunities for restoration.

Reconnecting theory with management: lessons from large rivers

Kevin J Collier

Centre for Biodiversity and Ecology Research, The University of Waikato, Hamilton; Waikato Regional Council, Hamilton.

Email: kcollier@waikato.ac.nz

Ecological theory is often seen by management practitioners as something developed between consenting academics in the privacy of their institutions with little relevance to the real world of avoiding, remedying or mitigating adverse environmental effects. However, if we delve deep enough there are many examples in river ecology where widely accepted management tools are grounded historically in basic science underpinned by ecological theory. Internationally, there is renewed interest in the ecological management of large rivers which historically have been viewed as resources to be controlled, harnessed and exploited. In Europe and North America, several ecological theories have been developed to help explain the processes and flow of energy that sustain large river structure and function, such as the Riverine Productivity Model, the Inshore Retention Hypothesis and the Flood Pulse Concept. These theories have played key roles in developing policies and restoration strategies for iconic rivers such as the Danube. Recently, a vision was developed for restoring

and protecting the health and wellbeing of our own Waikato River so that it will sustain "abundant life and prosperous communities". This talk will explore the linkages between the theory and ecological management of large rivers drawing on overseas experiences to see what lessons can be learned for large river restoration in New Zealand.

Artefactual stabilisation of actin microfilaments following transient expression of GFP reporter proteins inhibits cytoplasmic streaming and induces microtubule-like cortical bundles

Ben Smith, Patrick Collins, David Collings

School of Biological Sciences, University of Canterbury, Christchurch, New Zealand

The introduction of GFP fusion proteins in which GFP tags the actin-binding domain of proteins such as fimbrin (GFP-fABD2) and talin (GFP-hTn) has greatly simplified observations of microfilament dynamics in plant cells. These fusion protein probes are not, however, without problems as their expression in whole plants can cause aberrant growth phenotypes, changes in cell structure and microfilament organisation [1,2,3] and alterations to cytoplasmic streaming [4].

Labelling artefacts induced by GFP-fusion proteins need not always be considered a problem. In this study, we have observed and quantified the effects of transient expression of both GFP-hTn and GFP-fABD2 constructs in *Allium* (onion and leek) epidermal cells, and use observations of induced artefacts to investigate possible interactions of the actin microfilaments with microtubules. Because transient expression generates highly variable expression levels, we have been able to confirm that over-expression of these transgenes modifies microfilament organisation from dynamic, longitudinal bundles that support rapid cytoplasmic streaming into highly structured and stabilised arrays that are unable to generate streaming. These aberrant arrays are also resistant to microfilament depolymerisation with latrunculin B. Furthermore, in elongating leek epidermal cells, the aberrant microfilament bundles often form into a helical pattern organised in a similar manner to the cortical microtubule array. To investigate whether the organisation of the actin microfilaments depends on cortical microtubules, we are co-expressing the microfilament-labelling constructs with RFP-MBD which labels microtubules, and investigating the effects of microtubule depolymerisation on the actin artefacts. Our initial data suggest that not only does transient expression of GFP-hTn and GFP-fABD2 reorganise and disrupt the microfilament cytoskeleton, but that in elongating cells, this reorganisation is controlled by over-stabilised cortical microfilaments directly interacting with the cortical microtubule cytoskeleton.

References

1. Ketelaar T, Anthony RG, Hussey PJ. 2004. GFP-mTalin causes defects in actin organisation and cell expansion in *Arabidopsis* and inhibits ADF's actin depolymerising activity *in vitro*. Plant Physiology 136, 3990-3998.
2. Sheahan MB, Staiger CJ, Rose RJ, McCurdy DW. 2004. A green fluorescent protein fusion to actin-binding domain 2 of *Arabidopsis thaliana* fimbrin highlights new features of a dynamic actin cytoskeleton in live plant cells. Plant Physiology 136, 3968-3978.
3. Wilsen KL, Lovy-Wheeler A, Voigt B, Menzel D, Kunkel JG, Hepler PK. 2006. Imaging the actin cytoskeleton in growing pollen tubes. Sexual Plant Reproduction 19, 51-62.
4. Holweg CL. 2007 Living markers for actin block myosin-dependent motility of plant organelles and auxin. Cell Motility and the Cytoskeleton 64, 69-81.

A bug's-eye view of bovine impacts: livestock disturbance alters forest floor habitat and invertebrate community composition in native forest remnants

Jessica Costall[1], Russell Death[1]

[1] Ecology Group – Institute of Natural Resources, Massey University, Private Bag 11-222, Palmerston North

Email: jesscostall@gmail.com

Much of New Zealand's remaining native forest exists as small, heavily disturbed remnants on private farmland. Although often highly degraded, these remnants have high conservation value by simple virtue of being all that remains of once continuous ecosystems.

In this study we compared forest floor invertebrate habitat and community composition in 19 native forest remnants in a fragmented landscape in southern Waikato. The 19 study sites were divided into three management categories:

1) Four larger forest reserves representing the largest remaining patches of native forest in the study area, and managed by the Department of Conservation (138 – 30490 ha),

2) Five small, unfenced remnants which were regularly grazed by livestock, predominantly cattle, at the time of the study (0.3 – 15.1 ha),

3) Ten small remnants which had been fenced to exclude livestock for a minimum of ten years (0.9 – 28.6 ha).

At each site we carried out a comprehensive assessment of several habitat variables pertaining to forest floor invertebrates, and sampled the invertebrate community using pitfall-trapping.

In this talk we will discuss some of our key findings, including how forest floor habitat changed with distance to forest edge, and also differed between grazed, fenced and reserve sites. We also found that invertebrate communities in grazed remnants exhibited marked reductions in several common taxa, and the loss of many rarer taxa, compared to the fenced remnants and forest reserves.

Invertebrate species abundance and diversity on a NZ indigenous living roof

Richard Toft[1], Renée Davies[2], Robyn Simcock[3]

[1] Entecol Ltd

Email: rdavies@unitec.ac.nz

With increasing urbanisation and associated loss of native flora and fauna habitat, living roofs offer an opportunity to increase biodiversity within cities by providing islands of habitat suitable for a range of native invertebrates. Few studies have quantified invertebrate diversity on living roofs and nearly all research is recent (published post-2000). Extensive living roofs, generally 150mm or less deep are particularly valuable as habitat as they are not designed to support people and so are rarely disturbed.

New Zealand's first corporate extensive living roof using only New Zealand indigenous plant species was completed on the Waitakere City Council building in winter 2006. Concurrent with monitoring of the plants. invertebrate abundance and diversity indices (both native and exotic) have been quantified and compared three times over four years using methods suited to windy environments and low-stature vegetation (a first for NZ living roofs).

The ability to monitor from first year of planting has provided data on ad-hoc invertebrate colonisation and changes to invertebrate populations over time once plant cover and leaf humus layers have increased. Wooden refugia, pitfall and emergence traps and ant baiting were set each November and captured invertebrates were identified to morphospecies (except where taxonomic expertise was available).

Invertebrate diversity and abundance has progressively increased, and native invertebrate diversity has improved as vegetation cover has increased.

A range of native and exotic insect species are making the living roof their home with a surprisingly diverse fauna, supporting the concept that these islands of habitat can contribute to, sustaining biodiversity in urban environments.

Bacterial/viral and algal interactions in freshwater lakes

Marie Dennis[1], Susie Wood[2] and David Hamilton[3]

[1]Sustainable Design, Scion, Rotorua

[2]Cawthron Institute, Nelson

[3]Centre for Biodiversity and Ecology Research, The University of Waikato, Hamilton

Email: marie.dennis@scionresearch.com

The Te Arawa/Rotorua lakes are located in the central North Island of New Zealand within the Taupo Volcanic zone. Increased anthropogenic activity has led to eutrophication of several of these lakes resulting in prolonged periods of poor water quality and recurrent cyanobacterial blooms. While much work has been done to understand the phytoplankton component of these lakes little is known about the bacterial assemblages and in particular the bacterial and viral component. The activity and equilibrium between viruses, bacteria and phytoplankton has an effect on community dynamics and also on nutrient cycling. Micro-organisms of functional significance involved in carbon and nutrient cycling are defined by the oxic state of the freshwater environment and may also be dictated by the trophic state.

This aim of this study was to investigate the relationship between viral, bacterial and algal components of two Rotorua lakes, Lake Okaro and Lake Tikitapu, and the possible effects environmental factors have on these organisms and the abundance of important functional groups.

Molecular methods were used for quantitative enumeration of functional groups and flow cytometry as a rapid and effective method for enumeration of bacteria, algae and viruses.

Acute effects of trapping, handling, and tagging on the movement behaviour of wildlife revealed by high-resolution GPS telemetry: a case study of the common brushtail possum

Todd E. Dennis[1], Shabana F. Shah[1]

[1] School of Biological Sciences, University of Auckland

Email: t.dennis@auckland.ac.nz

Trapping, handling, and deployment of tracking devices ('tagging') are essential aspects of many research and conservation studies of wildlife. However, often these activities place animals under considerable physical and/or psychological distress, which may disrupt normal patterns of behavior, ultimately resulting in deleterious effects on animal welfare and the validity of research results. Knowledge of how trapping, handling, and tagging alter the behaviour of research animals is essential, if measures are to be taken to ameliorate stress-related effects and to ensure the accuracy of study findings. This presentation describes how time-stamped location data obtained by global-positioning-system telemetry can be used to retrospectively characterize acute behavioural responses to trapping, handling, and tagging of free-ranging research animals. Methods are demonstrated in a case study of the common brushtail possum. Possible physiological causes of observed effects are discussed, and general suggestions are offered regarding simple means to reduce trapping-handling-and-tagging related stress in field studies of vertebrates.

Describing and monitoring the ecological character of New Zealand's Ramsar sites: combining science, policy and advocacy

Karen Denyer [1], Hugh A. Robertson[2]

[1] National Wetland Trust

[2]Department of Conservation

Email: karen.denyer@wetlandtrust.org.nz

The Resource Management Act (1991) directs those enacting it to protect the natural character of New Zealand's wetlands, but does not define 'natural character'. An additional imperative to explore this concept is our international obligation under the Ramsar Convention on Wetlands of International Importance (1971), to monitor and report on change in ecological character of our six Ramsar-listed wetlands.

The Convention defines ecological character as the combination of the ecosystem components, processes and benefits/services that characterise a wetland at the time they were added to the Ramsar List. Ramsar site managers are expected to provide a baseline description of ecological character and monitor for human-induced changes to their wetland's ecological and hydrological attributes. Changes beyond limits of acceptable change may signal that impacts of human activities on the site are unsustainable. There is an emerging scientific challenge to define and quantify the limits of acceptable change that trigger a management response.

Despite this international monitoring obligation, few nations have attempted to develop a process for ecological character descriptions (ECDs). We have developed a framework for preparing an ECD for New Zealand's Ramsar sites, and present a case study of the Awarua peatlands. Our approach is to describe, and report on indicators of those key natural features that define and distinguish the Ramsar wetland.

When nationally adopted, the framework will be applied to New Zealand's Ramsar sites. It may also form a useful basis for monitoring other wetlands and ecosystem types.

Lake restoration and the dual benefits of constructed wetlands - habitat provision and pollutant attenuation

Eivers, Rebecca S.[1], Hamilton, David H., Quinn, John M., Duggan, Ian C.

[1] Centre for Ecology and Biodiversity Research, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand

Email: rse1@waikato.ac.nz

New Zealand lakes and rivers are under increasing pressure from elevated sediment and nutrient loads associated with intensification of agriculture. To support peat lake restoration end-of-drain treatment systems (constructed wetlands, silt traps and infiltration filters) have been implemented as management tools to reduce sediment and nutrient inputs. While designed to attenuate pollutants, treatment systems may also provide habitat for aquatic communities.

Eight drains and twenty six treatment systems on six shallow peat lakes within the Waikato region were surveyed for a range of physico-chemical parameters and aquatic communities (phytoplankton, zooplankton, macroinvertebrates, macrophytes, and fish).

Preliminary results indicate sediment and nutrient loads frequently exceed treatment capacity based on treatment system volume to subcatchment size ratios. However, total suspended solids, total nitrogen and total phosphorus were reduced in a number of systems, suggesting some benefits despite suboptimal sizes.

Aquatic communities varied across sites. Three native fish species (short fin eel, common bully and the regionally significant black mudfish), three exotic fish species, (mosquito fish, goldfish, and koi carp), as well as tadpoles of the Green and Golden Bell frog were caught. Lakes Kaituna, Komakorau, Kainui and the Serpentine lakes also support populations of rudd, perch and brown bullhead catfish.

Aquatic macroinvertebrates comprised nine orders; Odonata, Trichoptera, Hemiptera, Coleoptera, Mollusca, Oligochaeta, Nematoda, Hirudinea, and Crustacea. Sixty six zooplankton species were identified and preliminary analyses indicate community composition is significantly driven by pH, macrophyte cover and connectivity with the lake ecosystem. Further analyses aims to determine environmental drivers shaping other aquatic communities within these systems.

Restoration of inanga rearing habitat on the Kaituna River floodplain

Peter Ellery - Supervisor: Ass. Prof. Brendan J. Hicks of Waikato University

Maketu Taiapure Trust

Email: p.ellery@wave.co.nz

The loss of wetland habitat in the watershed of the Kaituna River, and many other New Zealand rivers, has impacted most detrimentally on the whitebait runs of those rivers.

In the Kaituna River, the whitebait catch has dropped from reported 20-ton harvests just after the 2nd world war to less than 100 kg per season in some recent years. While overfishing, and trout predation have been cited as possible causes for whitebait run reductions, the widespread conversion of swamp to farmland has probably had the major influence on the reductions of whitebait runs in this river.

Aimed at the provision of more habitat for rearing inanga, recently excavated wetland ponds at The Borrow Pits have been readily colonized by inanga. A further 12 small, interconnected ponds will soon be excavated in the river berm upstream from the current Borrow Pits ponds.

The other potential habitat for inanga from which they are currently denied access on most rivers is the floodplain farm drains. Another project will soon begin with the installation of a culvert through the stop-bank including a fish-friendly floodgate, to provide access to a lagoon of connected ponds on the farm side of the river stop-bank.

This lagoon will be a "staging area" to establish an inanga population on the edge of the farm and improvements to the nearest drains will be undertaken and then connection made back to the lagoon.

Designing a model landscape to model movement of brushtail possums

Thomas R. Etherington[1], George L. W. Perry[1], Mick N. Clout[1]

[1] Centre for Biodiversity and Biosecurity, School of Environment, The University of Auckland, Auckland, New Zealand

Email: teth001@aucklanduni.ac.nz

Ecological models that incorporate movement of an organism are often used within decision-making processes that aim to control invasive species, prevent disease spread, and design protected area networks. Landscape structure can have profound effects on organism movement, and should ideally be incorporated into movement models. However, given the complexity of landscape structure, for such incorporation to occur some form of landscape generalisation is required. This provides a significant challenge, as it is usually unclear how best to represent landscape structure from the perspective of the organism whose movement is being modelled. Unfortunately, both the pattern and scale used to design a model landscape can have profound effects on the outcomes of movement models. Therefore, the design of a model landscape is an important part of the modelling process, and where possible

decisions on the pattern and scale used should ideally be based upon empirical movement data. We demonstrate how measurements of movement can be used to design a model landscape for the brushtail possum (*Trichosurus vulpecula*). The key to this approach is recognising that different types of movement occur over different time scales. After choosing a relevant time scale, spatio-temporal radio-telemetry data can be used to identify a relevant spatial scale. By repeating this process for multiple time scales it is then possible to produce a hierarchical patch-based model landscape that could form the basis of possum movement models.

Quantitative measurement of coastal natural character

Victoria Froude[1]

[1] University of Waikato/Pacific Eco-Logic Ltd

Email: vfroude@slingshot.co.nz

Anecdotal evidence indicates that there has been a loss of New Zealand coastal natural character since preserving the natural character of the coastal environment first became a statutory policy-goal in 1973. Today the preservation of the natural character of the coastal environment is one of the matters of national importance in the Resource Management Act 1991 and one of the purposes of the Reserves Act 1977.

A comprehensive definition of natural character was developed for the New Zealand environmental, legal and policy contexts. This definition (which also addresses the role of perception) was used to underpin the development of the QINCCE (Quantitative Index for measuring the Natural Character of the Coastal Environment) methodology. The QINCCE methodology uses indicators (and environment-specific parameters) within a consistent framework to measure natural character across terrestrial, freshwater and marine coastal environments. It can be applied at a range of scales and for a range of purposes. For each broad class of coastal environment there is a core set of parameters that are used to calculate three sub-indices for each plan-view unit:

- An ecological naturalness index
- A hydrological and geomorphological naturalness index
- A freedom from buildings and structures index

These three sub-indices are combined to give an overall natural character index for each unit, which can be multiplied by 100 to give a natural character score between 0 and 100. Northland case studies will be used to demonstrate methodology application at the landscape scale.

Carrion- and dung-mimicry by New Zealand Splachnaceae mosses

Anne Gaskett[1], Nathan Camp[1], Georgia Cummings[1]

[1] School of Biological Sciences, The University of Auckland.

Email: a.gaskett@auckland.ac.nz

Bryophytes and are not well known for their dynamic interactions with animals but microarthropods and insects can be important vectors of moss sperm and spore

dispersal. Splachnaceae mosses provide no rewards for their insect visitors, and instead appear to actively attract and exploit insects with deceptive mimicry. Splachnaceae mosses uniquely grow only on decaying carcasses, bone, or dung. This scarce and patchily distributed habitat may be difficult for most mosses to colonise given their reliance on passive dispersal by water. To achieve dispersal, New Zealand's apparently primitive Splachnaceae appear to have sophisticated adaptations that attract and exploit flies, much like Asia's famous carrion-mimicking *Rafflesia* flowers. To test for evidence of carrion mimicry and insect exploitation by native Splachnaceae moss, we analysed signalling and insect attraction to *Tayloria callophylla* during peak reproductive season. We used gas chromatography–mass spectrometry to compare the appalling rotting odours of the moss spores and sporophytes with odours produced by gametophytes, underlying rotten substrates, fresh carnivore and herbivore dung, and synthetic compounds typically associated with carrion-mimicry by other plants. In the field, insects visiting spore-producing *Tayloria callophylla* moss, carrion, and fresh herbivore and carnivore dung, were trapped with hand nets, bottle traps and pitfall traps. Comparison between treatments reveals the importance of New Zealand's native fly and dung beetle fauna in interactions with bryophytes.

An ancient insect-host plant association: primitive jaw-moths (Micropterigidae: Lepidoptera) and their reliance on hepatics

George Gibbs

School of Biological Sciences, Victoria University

george.gibbs@vuw.ac.nz

The explosive radiation of moths and butterflies is normally considered in a coevolutionary sense associated with the rise of angiosperms over the same time period (late Cretaceous-early Cenozoic). However the jaw-moths, which represent the basal lineage of Lepidoptera, remain strongly linked to pre-angiospermous plants, with larval feeding on hepatics and adult moths on fern or lycopod spores, although frequently adapting also to the modern world of angiosperm pollen. Jaw-moths represent the basal lineage of Lepidoptera with a fossil record extending to 136 Ma end Jurassic (Lebanese amber) and subsequently from 96 and 37 Ma (Burmese and Baltic amber respectively). The family comprises about 130 described species (+113 undescribed) from all continents and continental islands around the world. A well-resolved phylogeny shows five lineages within the family, each more or less confined to specific geographical areas. Two lineages are restricted to northern hemisphere, three to the south with one represented on all southern continents. The larval biology will be reviewed, with a focus on New Zealand and some data from Japan.

Why New Caledonia? A biogeograper's interpretation of evolution on a drowned Zealandian island

George Gibbs

School of Biological Sciences, Victoria University

george.gibbs@vuw.ac.nz

The 93% submerged continent of Zealandia is home to some remarkable endemic terrestrial biota, despite (or because of) the isolation of its modern fragments of land. Explaning how and when these islands acquired their biota is the goal of historical

biogeography which today relies upon the interpretations of tectonic geologists and molecular phylogenetics for its 'modus operandi'. For the islands of Zealandia (New Caledonia, Lord Howe, Norfolk, Kermadecs, New Zealand, Chathams & the Subantarctic Islands of New Zealand) these two lines of investigation can give conflicting results, particularly when we find that all the modern islands might have risen from beneath the sea during the past 37 Ma. The current 'drowning' debates are reviewed and a new case study on primitive jaw-moths in the genus *Sabatinca* (Lepidoptera: Micropterigidae) is presented which challenges the drowning scenarios of both New Caledonia and New Zealand and implies strong terrestrial links between proto-New Zealand and proto-New Caledonia across the intervening Zealandian seas.

Te Urewera: Communities in Conservation

Andrew Glaser[1], Dan Baigent[1], Greg Moorcroft[1]

[1] Department of Conservation

Email: aglaser@doc.govt.nz; gmoorcroft@doc.govt.nz; dbaigent@doc.govt.nz

The Department of Conservation has recently changed its strategic direction regarding working with communities, businesses and tangata whenua in order to engage them in conservation., Staff in Te Urewera Mainland Island have placed more emphasis on working with local communities, especially, tangata whenua. This approach has required a shift in focus and priorities while still achieving positive ecological outcomes. Te Urewera Mainland Island is a landscape-scale conservation project set in rugged hills of Te Urewera. Ngai Tuhoe are tangata whenua and comprise the majority of the local community. Recent strategies to engage communities included increased communication and interaction and the employment of local contractors. Previously, Departmental processes and the lack of experience and skills reduced employment opportunities for many locals. The development of a broad prescription within the project for possum kill-trapping has proved to be an excellent vehicle for the employment of locals. This has allowed newly-employed contractors to build on their existing knowledge and skills and introduce them to contracting and the challenges of conservation field work. Staff have gained valuable lessons about how to work with local contractors, the communities have gained social and economic benefits and there has been increased awareness of conservation issues. Through this approach of local community involvement we have seen the potential benefits that can be gained for all parties. Through a shared vision and collaborative effort we can continue to build a positive relationship and long term conservation benefits for Te Urewera.

High-frequency measurements of methane ebullition over a growing season at a temperate peatland site

Jordan P. Goodrich[1], Ruth K. Varner[1], Steve Frolking[1], Bryan N. Duncan[2], Patrick M. Crill[3]

[1] University of New Hampshire, Complex Systems Research Center, Durham, NH 03824, USA.

[2] NASA, Goddard Space Flight Center Greenbelt, MD 20771, USA.

[3] Stockholm University, Department of Geological Sciences, SE-1069 Stockholm, Sweden.

Email: jordan.p.goodrich@gmail.com

Despite leading to potentially significant positive climate feedbacks, the processes controlling temperate and boreal peatland methane (CH_4) fluxes remain relatively poorly understood. In order to gain a better process understanding of the net efflux of CH_4, automated gas flux chambers were operated continually in a northern hemisphere temperate peatland site to quantify the timing and magnitude of ebullition, one of the three pathways for wetland CH_4 flux to the atmosphere. The resulting datasets offer high temporal coverage of both components (timing and magnitude) of this flux pathway, allowing for analysis of ebullition variability from seasonal to diel timescales. A diel pattern in ebullition was identified with peak release occurring between 20:00 and 06:00 local time, though steady fluxes (i.e., those with a linear increase in chamber headspace CH_4 concentration) did not exhibit diel variability. Seasonal mean ebullition rates peaked at 843.5 +/- 384.2 events m^{-2} d^{-1} during the summer, with a mean magnitude of 0.19 mg CH_4 released in each event.

What prevents hybridisation in *Celmisia*?

Jane Gosden[1], Dave Kelly[1] & Hazel Chapman[1]

[1] School of Biological Sciences, University of Canterbury

Email: jane.gosden@pg.canterbury.ac.nz

Hybridisation is a natural process occurring in approximately 25% of all plant species and 10% of all animal species. New Zealand in particular has incredibly high rates of hybridisation within the native flora. One genus that is well known to demonstrate this is *Celmisia,* New Zealand's third largest plant genus. Yet wild hybrids between *Celmisia* species are rare compared to their abundant parent species. My study investigated the effectiveness of reproductive isolating barriers in the prevention of hybrid formation amongst sympatric species of *Celmisia*. I studied three potential isolating barriers; 1) flowering time separation, 2) pollinator specialisation, and 3) hybrid death in 12 species of *Celmisia* at Craigieburn Valley, inland Canterbury. Overlap in flowering time between species was recorded in permanent transects that were walked weekly throughout the flowering season. Pollen dispersal by insects was examined by observing visitation patterns of visitors to six different types of pair-wise *Celmisia* arrays. I measured hybrid death through counts of seed predators found in the seed heads of the hybrid *C. pseudolyallii* and both its parent species (*C. lyallii* and *C. spectabilis*), as well as through germination experiments that measured germination success and subsequent survival of the same hybrid and its parents.

Initial results suggest substantial overlap of flowering times which may be inevitable given the short alpine summer, considerable overlap in flower visitors among *Celmisia* species, higher counts of seed predators in the hybrid *C. pseudolyallii*, and faster germination in the parent species.

Effects of soil warming and nitrogen fertilisation on net carbon balance of a tussock grassland

Scott Graham[1,2], John Hunt[2], Tony McSeveny[2], Peter Millard[2,3], Jason Tylianakis[1], David Whitehead[2]

[1] University of Canterbury, [2] Landcare Research, [3] The James Hutton Institute

Email: scott.graham@pg.canterbury.ac.nz

Increased rates of soil respiration with rising temperatures are expected to result in greater losses of soil carbon (C) to the atmosphere leading to a positive feedback to global warming. However, C uptake by plants is also expected to increase, resulting in greater ecosystem C storage. Warming affects plant productivity directly, through warmer growing temperatures, or indirectly, by increasing nitrogen (N) mineralisation rates leading to increased plant productivity. In this study we assess the interactive effects of soil warming by 3°C and the addition of 50 kg $ha^{-1}y^{-1}$ nitrogen fertiliser on gross primary productivity (GPP), ecosystem respiration (R_E), and their net effect on C balance in a tussock grassland. GPP and R_E were measured using a chamber-based approach over a wide range of light, temperature and soil water content conditions. Results indicate that maximum rate of ecosystem C uptake is increased by N fertiliser, while the effect of warming is much smaller. Both warming and N increased rates of R_E. We use these data to parameterize a model in order to produce annual estimates of GPP and R_E, which, when balanced, determine the net response to soil warming and N fertilisation.

The effect of light intensity on the behaviour of brown kiwi (*Apteryx mantelli*)

Roseanne Grant

Massey University, Palmerston North

Email: rgrant.nz@gmail.com

Light is one of the “major environmental stimuli affecting bird behaviour and physiology” (Lustick, 1973); this is the result of an endogenous circadian rhythm that is synchronised with environmental cues via complex endocrine pathways (Wikelski et al, 2008). Light intensity, duration and spectrum have all been implicated as having a behavioural impact on a variety of Aves species. No apparent investigation has been done on the nature of light sensitivity in relation to Kiwi behaviour, and there are currently no guidelines for the light regimes of their nocturnal houses; consequently the light regimes of Apteryx nocturnal houses around the country varies greatly. My MSc research project involved quantifying the proportion of time spent in different

areas of their nocturnal house in relation to light intensity. 8 captive adult Brown Kiwi were observed, 6 at Kiwi Encounter and 2 at the National Aquarium of New Zealand. Grids of each nocturnal house were constructed to recorded their location and behaviour exhibited on a minute-by-minute basis, and the light intensity for each grid square measured. Results are in the process of being analysed; I will compare the results of the captive Kiwi with those from wild Kiwi on Ponui Island, collected by Sarah Jamieson from Massey University with the use of chick timers.

Controlling English ivy (*Hedera helix*) in precious lowland podocarp

Kay Griffiths

The Conservation Company Ltd, 7 Tod Rd, RD 1, Waipawa 4271

Email: theconservationcompany@ruralinzone.net

We all know ivy is hard to kill! In the largest documented invasion of English ivy into a native habitat in New Zealand, innovative techniques have been required to get results and save a biodiversity gem.

Puahanui Bush is a 130ha conservation covenant on Gwavas Station, Tikokino, Central Hawke's Bay. The lowland podocarp forest is the largest remnant of its kind within three surrounding ecological districts, and supports regionally rare long-tailed bats, bush falcon, large numbers of tui and kereru, forest gecko, and a range of unusual invertebrates.

Garden escapees have become established in and around Puahanui Bush over the last century. While hawthorn (*Crataegus monogyna*) and Japanese honeysuckle (*Lonicera japonica*) are also well established, English ivy has had the most noticeable impact, has become the most widespread (50% of total area), and has the potential to continue degradation of the forest ecosystem.

Control of the ivy began in 1999 with cutting of adult vines and herbicide application. Progress was slow and results inconsistent. Grazing by sheep and subsequent herbicide application was successfully trialled to emulate mechanical weed-eating which had been a successful pre-cursor to herbicide application in the nearby homestead garden. Over 10 years later initial control is complete. Grazing by sheep has played a vital role in achieving over 90% kills with only one herbicide application.

This presentation tells the story, with detail on impacts of ivy on forest ecology, results of different control regimes and remaining challenges.

Carbon dynamics of shrubland regeneration

Samantha Grover[1], John Hunt[1], David Whitehead[1]

[1] Landcare Research

Email:grovers@landcareresearch.co.nz

Carbon exchange from terrestrial ecosystems dominates the global greenhouse gas cycle. Increasing terrestrial carbon stores by encouraging natural shrubland regeneration on marginal agricultural land can contribute to efforts to mitigate human-induced global warming. We investigated the change in carbon stocks and fluxes that occur when *Kunzea ericoides* invades abandoned pasture lands. Natural shrub encroachment was simulated by removing stock from pasture land and planting with

Kunzea ericoides seedlings. Ecosystem carbon fluxes were measured continuously from October 2005 with eddy covariance. Soil respiration was measured monthly. Above ground and below ground carbon stocks were measured at the site periodically. Our results suggest that the initial increase in carbon storage is driven by the increase in grass biomass following the cessation of grazing. It takes several years before the trees begin to make a significant contribution to the carbon dynamics of the system. Site preparation resulted in a significant negative carbon flux (from the biosphere to the atmosphere) and thus there is a lag time of several years before the net effect of the planted shrubs becomes positive. However, natural shrub encroachment occurs on the decadal time frame, so planting remains a useful mitigation strategy. Long term monitoring continues at this site and will yield valuable information about the ongoing carbon dynamics of native shrubland regeneration.

Functional ecology of iceplant and its role in eco-restoration of New Zealand sand dunes

Guyo Gufu[1], Stephen Hartley[1], Kevin Gould[1]

[1] Victoria University of Wellington

Email: Guyo.Gufu@vuw.ac.nz

The South African iceplant, *Carpobrotus edulis* used in some early restoration projects has become invasive altering the form and function of many of New Zealand's coastal sand dunes. Besides space and nutrient pre-emption, it is thought to have an allelopathic legacy hampering reestablishment of native plants long after its removal. However, there is little quantitative information of how it interacts with other fore-dune species. We initiated a study with the main aim of investigating the effects of *Carpobrotus edulis* on establishment of *Spinifex sericeus* (kōwhangatara) at the fore dune region. We planted *Spinifex* seedlings into three areas: (i) stands of *C. edulis*, (ii) plots from where *C. edulis* has been manually removed, and (iii) in bare spaces. In each plot half of the seedlings were planted at the bottom of the dune face and the other half towards the top to investigate differential response to environmental gradient.

Initial survival of *Spinifex* seedlings was significantly higher at the bottom of the dune suggesting the existence of a stress gradient, but this effect has disappeared over time. Seedlings within iceplant stands appeared slenderer and had significantly fewer leaves suggesting strong competition from these adventives. Higher long-term survival and better performance of *Spinifex* seedlings in the iceplant removal plots indicate that substrate modification by the iceplant improved soil conditions to the advantage of the seedlings. There is no evidence at this stage, to support the notion that these adventives have an allelopathic effect on *Spinifex*.

Effect of *Linepithema humile*, the Argentine ant on beetle species abundance and richness

Habteab Habtom, Phil Lester

Victoria University of Wellington

Email: habteab.habtom@vuw.ac.nz

In the face of other environmental factors, we evaluated effect of the invasive species, *L. humile* on beetle species richness and distribution pattern. Studies were conducted in two urban sites, with different landscapes induced by vegetation structure. Across both study sites, Piha and Bayleys Beach, *L. humile* found to negatively affect beetle species richness and distribution pattern. Habitat disturbance by *L. humile* caused recruitment of more introduced species into that area.

Empodisma minus engineers the Fen-Bog Transition in New Zealand Mires

Tarnia Hodges[1], Jill Rapson[1], Bev Clarkson[2], Louis Schipper[3]

[1] Ecology Group, Massey University

[2] Landcare Research, Hamilton

[3] The University of Waikato

Email: Tarnia.hodges@gmail.com

We proposed a framework outlining the process by which *Empodisma minus* (Restionaceae) might engineer the development of raised bogs in New Zealand. Here we address the proposal that accumulation of decay resistant litter and increased access to scarce nutrients in poor fen conditions result in competitive exclusion of previous co-dominants, by the development of habitat patches where environmental conditions are increasingly ombrotrophic.

We test this hypothesis by assessing the effects of *Empodisma* on the performance of *Chionochloa rubra* (Poaceae), a co-dominant, along nutrient and water table gradients in an artificial wetland. Decomposition of senesced litter of both species was also investigated along internal mire gradients in a litter bag experiment.

High relative yield totals indicate the species exhibit partial resource complementarity, and do not fully share common limiting resources. Capillaroid roots, thought to enable *Empodisma* to access ombrotrophic nutrient sources, were in greatest abundance in monoculture treatments where intraspecific competition for nutrients was greatest.

Empodisma biomass was significantly more long-lived, and our litter experiment suggests the decomposition rate of all these tissues is significantly lower than for *Chionochloa,* whose decomposition rates are unaffected by mire gradients.

Our results support the hypothesis that ecosystem engineering by *Empodisma* promotes the formation of raised mires, by elaborate plant-soil feedbacks involving litter production and decay, and nutrient pre-emption from ombrotrophic sources, and that the process of engineering may accelerate as *Empodisma* increases in density, in response to increasing intraspecific competition for nutrients.

A threat assessment of New Zealand's naturally uncommon ecosystems

Robert J. Holdaway[1], Susan K. Wiser[1], Peter A. Williams[2], Beverley R. Clarkson[3], Mark C. Smale[3]

[1]Landcare Research PO Box 40, Lincoln 7640, New Zealand

[2]Landcare Research Private Bag 6, Nelson 7010, New Zealand

[3]Landcare Research Private Bag 3127, Hamilton 3240, New Zealand

Email: holdawayr@landcareresearch.co.nz

Despite the best efforts of conservationists, a significant portion of New Zealand's ecosystems are being degraded, transformed and in some cases completely destroyed by human activities. Ecosystem-level management offers a potential solution to this decline. Instead of focusing on individual species, ecosystem-level management targets the preservation of ecosystem habitat and ecological integrity, hopefully leading to the conservation of a full suite of species within each ecosystem. Identification of the most threatened ecosystem types is needed to allow prioritisation of ecosystem-based conservation efforts. We apply recently proposed IUCN red list criteria for threatened ecosystems (based on changes in extent and reduction in ecological processes) to New Zealand's 71 previously defined naturally uncommon ecosystems. Our results identify 19 critically endangered, 16 endangered and 10 vulnerable ecosystem types, and a total of 26 that are not currently threatened. Although naturally uncommon ecosystems contain disproportionally more threatened plant species than common ecosystem types, we found no strong relationship between threat status and the number of threatened plant species found within that particular ecosystem. On a species per unit area basis, however, there were more threatened plant species in critically endangered ecosystems than non-threatened ecosystem types. Our findings provide essential information to help prioritise conservation of New Zealand's naturally uncommon ecosystems and form a working case-study for the ongoing development of international red-list criteria for threatened ecosystems.

Wood-colonising Basidiomycete fungi in radiata pine plantations

I.A. Hood[1]

[1]Scion (New Zealand Forest Research Institute Ltd), Private Bag 3020, Rotorua 3046

Ian.hood@scionresearch.com

Plantations of *Pinus radiata* D. Don occur throughout New Zealand on a range of sites experiencing different climatic and environmental conditions. Although composed of a single tree species, these simple monocultures support a complex ecosystem comprising a multiplicity of organisms, including many species of fungi. In particular, the pathogens infecting living needles, stems and roots have been studied extensively because of their potential for reducing stand productivity. Some basidiomycete fungi cause root diseases whereas others form beneficial mycorrhizal associations. Communities of microorganisms also inhabit the woody debris that accumulates in pine plantations, and these include mould, stain and decomposer fungi, as well as bacteria and yeasts. This presentation will collate information gleaned from studies involving stems of fallen trees, thinning stumps, and residues left after harvesting to review our present knowledge of the basidiomycete fungi present in woody substrates in pine plantations. It will discuss their significance and show that although much has now been learned, many questions still remain.

From beech to fir: emergence of a new sub-alpine forest ecosystem?

Clayson Howell

Department of Conservation

Email: chowell@doc.govt.nz

Douglas fir (*Pseudotsuga menziesii*) is the second most important commercial timber tree in NZ but has an increasing profile as a transforming environmental weed. Findings from three recent studies will be drawn upon to illustrate this point. Between 1990 and 2000 a dramatic increase was observed in the number of hectads (100 km2) occupied by Douglas fir in New Zealand. At least part of this expansion appears related to increased availability of ectomycorrhizal symbionts. Fungal partners are typically not shared with manuka (*Leptosperum scoparium*) or kanuka (*Kunzea ericoides*) and successful inoculation of seedling roots can be partially explained by proximity to sources of spores of mycorrhizal fungi associated with established Douglas fir. Because seedling survival is greatest at the canopy edge, Douglas fir is considered to be more shade tolerant than *Pinus* species. Through the long course of an individual Douglas fir trees life, there are many complex ecological impacts above and below ground that are only just beginning to be understood. There remains much work to be done concerning the role of exotic mammals as dispersal agents for ectomycorrhizal symbionts, the likely fate of Douglas fir seedlings in beech (*Nothofagus* spp.) forest and improvements to techniques to rehabilitate sites and mitigate impacts.

Is Maungatautari Ecological Island restoring pollination and dispersal services to native plants?

Jenifer M. Iles[1], Dave Kelly[1]

[1] Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140

Email: jenie.iles@gmail.com

Many restoration projects aim to restore populations of native fauna and flora, but benefits to the ecological interactions between species are unknown. The restoration of bird services to native plants was examined at Maungatautari Ecological Island, in the Waikato Region. At Maungatautari, a pest-proof fence encloses ~3300 ha of native forest, and mammalian pests have been eradicated from within. In December 2010, 140 five-minute bird counts at Maungatautari and a non-treatment site, Pirongia Forest Park, indicated that key pollinating and seed dispersing bird species: tui, bellbirds and kereru, were significantly more abundant at Maungatautari than Pirongia. To determine whether greater bird numbers at Maungatautari translate into enhanced bird services, the pollination and seed dispersal service to tree fuchsia (*Fuchsia excorticata*) and the seed dispersal service to tawa (*Beilschmiedia tawa*) were examined. Pollination and dispersal service to tree fuchsia was greater at Maungatautari, indicated by higher pollen loads on the stigmas of both female and hermaphrodite flowers and faster rates of fuchsia fruit removal at Maungatautari than Pirongia. Observations of bird visitors to fuchsia flowers and fruit support these findings. There was no significant site effect on tawa dispersal service (percent of fruit consumed by birds), but there was a significant site effect on the total fruit crop per m^2 with more fruit at Maungatautari than Pirongia. This study indicates that mammalian pest eradication at Maungatautari benefits both bird numbers, and bird services provided to native flora.

A role for Kunitz proteinase inhibitors in plant development and defence

Islam, A[1], Dijkwel, P[1] & McManus, M. T.[1]

[1]Institute of Molecular BioSciences, Private Bag 11-222, Massey University, Palmerston North, New Zealand.

Email: a.islam1@massey.ac.nz

The Kunitz proteinase inhibitor (KPI) family is one of the most widespread groups of proteinase inhibitors found in plants. In addition to roles in regulating endogenous proteolytic activities, these proteins act as potent defensive factors against pathogens and unfavorable growth conditions. The perennial legume white clover (*Trifolium repens* L.), which is a major contributor to pasture productivity in New Zealand, is vulnerable to pests and unfavourable environmental conditions that reduce growth rate and pasture productivity. However, as yet, very little is known about the occurrence of KPI genes or the functions of the gene products in white clover. Therefore, the aim of this study is to characterize the spectrum of KPI genes and the regulation of expression of the gene family in response to different physiological stimuli. The aim is to improve our understanding of the role of KPIs in the regulation of responses triggered by developmental and environmental cues in white clover.

Aerial surveillance of kauri dieback disease

Alastair Jamieson[1], Nick Waipara[2], Stacey Hill[2], Alison Davis[3]

[1] Wild Earth Media Ltd, [2]Auckland Council, [3]Greater Wellington

Email: alastair@wildearthmedia.com

Kauri dieback disease is caused by a microscopic fungus-like plant pathogen, commonly known as PTA (*Phytophthora taxon Agathis*). In New Zealand, it poses a significant threat to kauri (*Agathis australis*) as it can kill seedlings and trees of all ages. The presence of PTA has been confirmed in several forests in Auckland and Northland, including the Waitakere Ranges, Pakiri, Great Barrier Island, Waipoua Forest, Trounson Kauri Park, Omahuta and Raetea Forest.

Field survey and mapping to determine the presence of the disease in the Auckland Region has focussed on regional parks in the Waitakere and Hunua Ranges, where forests containing kauri are extensive and highly valued by the community. Ground surveys found kauri trees displaying kauri dieback symptoms in several widely scattered locations in the Waitakere Ranges, suggesting the pathogen poses a widespread threat. However, ground survey is limited to areas adjacent to tracks, due to the access difficulties of dense bush and steep terrain elsewhere.

A methodology for aerial photographic surveillance of kauri dieback was developed and implemented in Waitakere Ranges, Hunua Ranges and adjacent forest areas. Using recently developed GPS technology, photographs are embedded with position data, so that unhealthy trees can be easily located on the ground later, to sample and verify PTA symptoms. Aerial survey was found to be a time and cost effective method for surveying large, inaccessible areas of forest for kauri dieback. The methodology would also be applicable for the detection of visible disease or damage symptoms in other canopy tree species.

Sand dune restoration in New Zealand: Are we caring for our native fauna?

Samantha Jamieson[1], Stephen Hartley[2], Murray Williams[2]

[1] Taranaki Regional Council, New Zealand

[2] School of Biological Sciences, Victoria University of Wellington, New Zealand

Email: Samantha.Jamieson@trc.govt.nz

Coastal sand dunes in New Zealand are critically endangered ecosystems, supporting a wide variety of specialist native flora and fauna. Dunes have declined significantly in area over the past century, due to coastal development and stabilization using marram grass (*Ammophilia arenaria*). Interest in the restoration of dune ecosystems is becoming increasingly widespread throughout the country. Many groups have carried out small scale rehabilitations, aiming to restore natural character and ensure erosion protection using a limited range of native species. Efforts are generally not monitored, and often rest on the assumption that replacement of exotic vegetation with native will result in restoration of a fully functioning ecosystem. This study aimed to investigate the biodiversity of restored and marram dunes in the Wellington region.

Plant and animal biodiversity was sampled at dunes under restoration with native sand-binding species, paired with nearby dunes dominated by marram grass. Marram dunes contained higher vegetation, with greater projected foliage cover and vegetation than restored dunes. This appeared to give rise to desirable habitat for fauna. Mouse population density was higher in marram dunes, as was population size of common skink (*Oligosoma nigraplantare polychroma*). Marram dunes contained higher abundance and diversity of invertebrates, especially spiders, beetles, mantids and hoppers.

These results suggest that for maximum biodiversity gains, future dune restoration attempts should increase vegetation cover, and include a wider range of plant species. Marram could also be incorporated into restoration, as its mass removal may have considerable consequences for fauna using it as a refuge, and it appears to provide desirable habitat for fauna.

Differential roles of fleshy-fruited trees as attractors and/or sources of bird-mediated seed dispersal in lowland temperate-mixed forests of New Zealand

Rocio C. Jana[1], Dave Kelly[1], Daniel García[2], Sarah J. Richardson[3], Jenny Ladley[1], Mick Clout[4], Brian Karl[2] and Jocelyn Tilley

[1] School of Biological Sciences, University of Canterbury, Christchurch

[2] Universidad de Oviedo, Spain

[3] Landcare Research, Lincoln

[4]School of Environment, University of Auckland, Auckland

Email: rocio.jana@pg.canterbury.ac.nz

New Zealand podocarp-broadleaf forests have a large proportion of fleshy fruited plants dispersed by birds. Birds have the potential to modify the seed dispersal pattern expected from seed fall from trees. Bird foraging across the forest canopy is non-random. This generates functional differences between tree species, given by the

process of seed transfer among heterospecific canopies. Tree species may function as “attractors” (i.e. concentrating many seeds of many species under their canopies) and as “sources” (i.e. transfering many seeds to heterospecific canopies) in the forest landscape.

We evaluated the functional roles of different tree species in two lowland temperate-mixed forests of the South Island. We compared tree canopy composition to bird-generated seed rain captured in seed traps. We identified attractors and sources by, first, estimating an index of seed-transfer for each of the canopy species, based on the proportion of seed crop received from heterospecific canopies. Second, we compared the interaction network describing the frequency of species-species matches in the canopy with that describing the arrival of seeds to the different canopies. Seed rain of *Dacrydium cupressinum* was more frequently associated to heterospecific canopies, and few heterospecific seeds were collected under its canopy. This suggests that *D. cuppresinum* functions as a source in the forest. In contrast, a large proportion of *Beilschmiedia tawa* seeds was found under heterospecific canopies, and large proportions of other species seeds were found below its canopy. Thus, *B. tawa* would act simultaneously as an attractor and a source.

Inequalities in seed transfer between species may ultimately drive community composition within the forest.

Identification and mapping of key genetic regulators of postharvest senescence

Rubina Jibran[1,2] Paul Dijkwel[2] and Don Hunter[1]

[1]The New Zealand Institute for Plant & Food Research Ltd, Palmerston North, New Zealand.

[2]Institute of Molecular BioSciences, Massey University, Palmerston North, New Zealand.

Senescence is a genetically regulated event that is prematurely activated by a variety of stimuli including detachment and darkness. We describe here our progress in understanding the biology behind the dark-detached senescence of harvested immature inflorescences. We show that the immature inflorescences of *Arabidopsis thaliana* ecotype Landsberg *erecta* are an excellent tissue for modelling the dark-induced senescence of harvested immature inflorescences such as broccoli. The detached Arabidopsis inflorescences held in the dark reproducibly de-greened over a five day period. Senescence occured within as little as 24 h as judged by chlorophyll and protein loss and increased membrane leakage. We also report on the identification of the key genetic regulators of inflorescence senescence achieved by screening a population of chemically mutagenised seeds for lines whose detached inflorescences show altered timing of de-greening.

Processes influencing the establishment and survival of native woody vegetation at Wairio Wetlands, Wairarapa

Bridget Johnson[1] and Stephen Hartley

Victoria University of Wellington

Email: curlyread@gmail.com

The Wairio wetland has been adversely affected by anthropogenic activities since the 1960s. In 2005, Ducks Unlimited and the Department of Conservation signed a Land Management Agreement where Ducks Unlimited would commence the restoration of the Wairio Wetland. Survival of the planted trees thus far has been largely unsuccessful; giving opportunity for a large scale design and monitoring field experiment. This experiment has been designed to look at multiple factors affecting the establishment and survival of four native wetland tree species within a 5.6 hectare block at the Wairio Wetlands, South Wairarapa. These trees have been subjected to different methods of site preparation to determine the best combination of treatments for successful establishment of tree saplings. Treatments include: top soil excavation, release spraying, weed mats, nurse trees (with two combinations of species) and the distance between nurse species. Survival and growth over the first six months will be monitored and protocols developed for longer-term monitoring and follow-up studies**.** I will provide an update on progress and demonstrate that it is possible to integrate a large-scale experimental approach into community restoration efforts.

Herbivory and bioloigical control in plantation forestry

Nod Kay

Scion (NZ Forest Research Institute Ltd)

Email: nod.kay@scionresearch.com

Typically, invertebrate herbivory accounts for 4-10% of the loss of canopy in natural forests - so little that it is often dismissed as weak selection force. However, the evolutionary route to this minimal defoliation is rarely considered, but can be demonstrated in structurally simple exotic forest plantations. The early adoption of exotic forestry in New Zealand came from the realisation of the slow growth of the indigenous forest tree species. This slow growth is intriguing given that exotics grow faster in New Zealand than in their home of origin. Our indigenous species can hardly be constrained by climate, yet they don't suffer overly from defoliation either.

The fast growth of exotic forest species may in part be due to a lack of herbivory. Exotic species are removed from their co-evolved associate invertebrates and placed among a usually depauperate suite of novel defoliators. Essentially they are established in enemy-free-space (EFS), and their growth potential is further enhanced through anthropomorphic selection. The main threat to these exotic plantations, apart from new associations, comes from the accidental introduction of old foes that may themselves be entering EFS. The unregulated re-match of past combatants can illustrate the power of herbivory to alter the growth and survival of plants. The balance may be restored through classical biological control, which offers one of the few sustainable responses to such introductions and has extraordinarily successful in New Zealand's exotic forests. However, the evolutionary route without the natural regulation of herbivores, would appear to be slowed tree growth.

Effects of wasp, stoat and rat control on bird counts in Nelson Lakes National Park

Stacey A. Langham, Dave Kelly

Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140,

Email: dave.kelly@canterbury.ac.nz

The Rotoiti Nature Recovery Project in Nelson Lakes National Park undertakes control of stoats (*Mustela erminea*) over 5000 ha and control of ship rats (*Rattus rattus*) and wasps (*Vespula vulgaris*) over ~600 ha. We used existing five-minute bird counts and mammal tracking-tunnel data to test how controlling predators in various combinations affects native birds.

Wasps are a major pest in beech forests, where they prey on invertebrates, competing with native birds. Existing 5MBC data on 14 species were tested against wasp control, allowing for altitude, rat and stoat control. Results suggest that wasp control increases recruitment and survival of some species, and that bellbirds disperse into wasp-control areas. Consistent with this, bellbird time budget data showed significantly fewer foraging and more calling observations in the wasp-control area.

Because of cost, management often targets stoats but not rats. However, this could produce negative impacts through meso-predator release. No direct evidence was found for meso-predator release, however many species (including bellbird, tomtit, and rifleman) demonstrated a negative impact of stoat control, while many (including tomtit, grey warbler, and parakeet) benefitted from rat control. These effects may indicate meso-predator release, or confounding effects of beech mast years. The effects of stoat and rat control usually varied significantly with altitude (eg, rat control increased rifleman numbers mainly at higher altitudes, 800-1400 m).

These analyses show the value of long bird count series in testing bird responses to management, and suggest management changes to allow stronger statistical inference.

Pollination Ecology of the native New Zealand orchid *Corybas cheesemanii*

Michelle Kelly[1], and Anne Gaskett[2]

[1] School of Biological Sciences (The University of Auckland)

Email: Mkel058@aucklanduni.ac.nz

Orchids (family Orchidaceae) often have unique pollination interactions with very specific pollinators. They have evolved many mechanisms to attract pollinators including highly scented floral parts, insect pheromones, colour patterns and structural morphologies. The interactions and relationships involved in the pollination of many New Zealand orchids as well as their phenology is poorly understood. It is thought that the New Zealand and Australian genera *Corybas* are pollinated by female fungus gnats, attracted by orchid mimicry of fungal oviposition sites. However, this has never been tested for New Zealand species nor confirmed in any species in Australia.

The pollination ecology and pheology of the largely unstudied species *Corybas cheesemanii* was examined in the field in a natural population near Auckland. We isolated flowers to test for self-pollination, calculated fruit set, and tested for the presence of a nectar reward for pollinators. To test for orchid mimicry of fungus, we

trapped and identified insects attracted to flowering *Corybas cheesemanii* and sympatric fungal fruiting bodies (mushrooms). We analysed the scents of the living orchid flowers and mushrooms with headspace sampling and gas chromatography-mass spectrometry, and tested the presence of typical fungal volatile odours.

Have today's chronically inbred Chatham Island black robins really dodged the genetic bullet?

Euan S Kennedy [1], Richard Duncan [2], Ian Jamieson [3], Kerry-Jayne Wilson [4]

[1] Department of Conservation, Canterbury Conservancy

[2] Lincoln University

[3] University of Otago

[4] PO Box 70, Charleston

Email: ekennedy@doc.govt.nz

Conservation of New Zealand birds has usually relied on the treatment of deterministic extinction pressures to trigger population recoveries, with few measures taken to minimise genetic threats to viability. Transfers to safe habitats and raising population sizes rapidly are commonly assumed to suffice as strategies to safeguard long-term viability. The success of these pragmatic approaches, often with relatively few founders, appears to have convinced ecologists and wildlife managers alike that our insular endemic birds are less susceptible than outbred continental species to the predicted genetic hazards of reduced numbers. Thus, these practices persist today, in defiance of orthodox genetic thinking and despite growing evidence that the assumption of minimal genetic risk is not universally safe for New Zealand bird species. Recovery of the Chatham Island black robin *Petroica traversi* from a single productive breeding pair followed conventional practice in subordinating management of genetic risks to the goal of boosting numbers quickly. The persistence of today's two small habitat-limited populations has been taken to imply on-going viability. Analyses of demographic data gathered since 1980 indicate however that the black robin may not have dodged the genetic bullet after all, and that survival in enhanced numbers alone—a common fixation of wildlife managers in this country—may not give a reliable measure of mid- and long-term viability.

A brief history of Pureora Forest Park: foodbasket to battleground to conservation icon

Carolyn King

Dept Biological Sciences, University of Waikato, Hamilton

Email: cmking@waikato.ac.nz

This paper will present a broad-scale survey of the history of Pureora Forest Park, the location of some of the most significant events in the development of conservation science in New Zealand. It will set the background with a brief summary of the park, its pre-European history, the evolution of its forests in relation to intermittent volcanic activity and the relatively recent arrival of invasive mammals. The development of the state-sponsored logging operations of the 1950s and 60s, and the dramatic protests against them of the 1970s, led on to the widely debated moratorium and its social consequences, and then to the establishment of the research programmes focussing

on threats to the survival of the kokako and the benefits or otherwise of selective logging. The Park is now a fully-fledged research area that has hosted an impressive record of key advances in bird and mammal ecology, and yet at the same time is also a well-run multi-use recreation area for hunters, campers and trampers.

Climate change and its ecological and ecophysiological impacts

Kirschbaum, Miko U.F. [1]

[1] Landcare Research, Private Bag 11052, Palmerston North, New Zealand

Email: KirschbaumM@LandcareResearch.co.nz

One of the big challenges of our time relates to the prospect of a changing climate. It may profoundly affect any aspect of the environment and the lives of the organisms that depend on it. It is clear that the concentration of greenhouse gases is increasing due to human action. It is also clear that increases in greenhouse gas concentrations lead to an increase in global temperature. The global temperature has increased by about 1°C since the beginning of the last century, and is currently increasing further by about 0.2° per decade. Further global temperature increases by the end of this century could lie between 1° and 6°C depending on the magnitude of future anthropogenic greenhouse gas emissions, the strength of natural biogeochemical feedbacks and the greenhouse-gas sensitivity of the climate system. Climate change is likely to be less extreme in New Zealand because of the moderating influence of the surrounding ocean.

Negative climatic impacts relate to sea-level rise, the intensity of tropical cyclones, increasing pest and disease problems, ocean acidification and ecological problems for many species related to the shift of regions with suitable climates. There could also be some positives such as increasing biological productivity, especially due to CO_2 fertilisation, provided climatic changes remain within narrow bounds. The balance of impacts is, however, likely to be negative. That is in large part because change itself is a difficult impact. This talk will briefly outline the science of climate change and give an assessment of some of the important ecological and ecophysiological impacts.

Ecology, research and conservation - why the heck do we bother?

Ruud Kleinpaste

All our efforts to make sense of the *living world* often seem to fall into a deep void, as lay people and media focus their attention on the stock markets, Ken Ring and Paris Hilton. The constantly reducing sources for research funding reflect the "commitment" of our Government; our balance of payments ain't too crash hot and as we are just emerging from a *Credit Crunch* our economy is almost as fragile as our ecology.

DoC's budget is regularly slashed and endemic species are disappearing in front of our eyes, including our famous species of kiwi.

So... why bother?

Yeah - *"it's our identity"* and all those kinds of *warm-fuzzy* arguments may sound quite touchy-feely, but Nature doesn't give a tinkers about that sort of reasoning, really. I suppose that the best argument for all our efforts is the maintenance or restoration of biodiversity.

Without that biodiversity and its ecosystem services our planet (and especially humanity) is on the slippery down-hill slope.

You'd expect that we - as a Nation - would actually ***value*** that uncompromised biodiversity and reflect that value in our economy (GDP), our laws and our official attitude...

I can feel another Tui ad coming on.

Alternative respiration in Arctic plants responds to environment in a species dependent manner

Ari Kornfeld[1], Kevin Griffin[2,3], Owen Atkin[4], Mary Heskel[2], and Matthew Turnbull[1]

[1] School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand

[2] Department of Earth and Environmental Sciences, Columbia University, New York NY 10027, USA

[3] Lamont-Doherty Earth Observatory, Columbia University, 61 Rt 9W, Palisades NY 10964, USA

[4] Functional Ecology Group, Research School of Biological Sciences, The Australian

25 National University, Canberra, ACT 201, Australia

Email: ari.kornfeld@pg.canterbury.ac.nz

Plants of the Arctic tundra must survive poor soil nutrient status, cool temperatures, and constant daylight during the short growing season. In a field experiment at Alaska's Arctic Long-term ecological research station (LTER), long-term manipulation of nutrients, temperature, and light led to dramatic changes in plant community composition. Whereas untreated plots support diverse tussock grasslands, addition of N and P to the soil, greatly increased growth of the shrub *Betula nana* to the near exclusion of all other species; raising growth temperature enhanced this effect. However in plots covered by shade cloth, the subshrub *Rubus chamaemorus* dominated in response to N and P addition. Since, in laboratory studies, respiration via the alternative oxidase (AOX) pathway has been shown to play a role in plant stress responses, we investigated what role AOX might have had in these arctic community responses. We measured *in-vivo* partitioning of activity between the two terminal oxidases: AOX and cytochrome c oxidase (COX) by collecting respiration samples for mass spectrometric analysis. We also measured the relative abundance of the AOX and COX in the leaf tissue as well as respiration and various leaf attributes. Relative engagement of AOX was reduced in *Betula* leaves grown at high N+P while total respiration increased. These changes are consistent with the hypothesized stress-relief role for AOX. However, responses differed among the species: AOX engagement increased in *Eriophorum* only in response to shade whereas no trend was found for *Rubus*. These results highlight the complexity of respiratory responses in actual field studies.

Plant productivity, litter decomposition and soil carbon sequestration associated with *Chionochloa* species in New Zealand tussock grasslands

Matthew Krna[1], Jill Rapson[1,] Kevin Tate[2], Surinder Sagger[1 & 2], Hannah Buckley[3],

[1]Massey University, Ecology [2]Landcare Research, Palmerston North, [3]Lincoln University

Email: matthew.krna@gmail.com

Heightened concerns regarding climate change have led to increased investigation of elevated atmospheric CO_2 levels and soil carbon (SC) sequestration and storage; which may play a vital role in mitigating the effects of increasing atmospheric CO_2 concentrations. Terrestrial C cycling can be influenced by plant ecophysiological traits and responses. Species with high growth rates tend to contribute greater amounts of easily decomposable litter, whereas species with slow growth rates contribute low-quality litter that is more recalcitrant to decomposition. We hypothesize that plant growth rates will be reduced across altitudinal and latitudinal gradients due to elevated environmental stress and through the increased production of specific compounds (such as lignin, tannins and polyphenols; which are not readily decomposed) to cope with increased abiotic stresses. The production of these compounds may not only lower plant growth rates but also increase SC sequestration. *Chionochloa* species within the tussock grasslands of New Zealand are ideal to investigate this issue since the genus occupies a wide range of habitats with climatic variations, differing soil types and land-use histories. Experimental plots, incrementally spaced at altitudinal intervals of 100m, have been established on both the North and South Islands with down-slope translocation of both living tussocks and litter decomposition bags. Leaf elongation rates, litter decomposition and chemistry as well as soil total organic carbon and nitrogen (TOCN) and bomb radiocarbon analyses are being investigated to better understand the relationship of plant productivity, litter chemistry and decomposition and their combined role in SC sequestration within New Zealand tussock grasslands.

The importance of intraspecific trait variation to forest community assembly

Daniel C. Laughlin[1]

[1] University of Waikato

Email: daniell@waikato.ac.nz

Climatic constraints on plant distributions are well-known, but predicting forest community composition through knowledge of trait-based environmental filtering remains an important empirical challenge. The MaxEnt model of community assembly relies on interspecific trait means and does not incorporate intraspecific trait variation, which can be quite high for some important traits. The new TRICYCLE model takes a different approach and can incorporate intraspecific variation through use of non-parametric density kernels. I compared the predictive abilities of these two trait-based models of community assembly using forest communities occurring along a 9 °C gradient of mean annual temperature in high-elevation forests in the southwestern USA. I measured three functional traits (specific leaf area [SLA], wood density, and bark thickness) on nine trees at sites spanning the entire elevation range of each species. Bark thickness was strongly selected along the gradient (R^2 = 0.80); species

with thicker bark were more dominant in lower elevation sites that burn more frequently. Mean annual temperature explained significant yet small portions of intraspecific trait variation. In contrast, species identity explained the majority of total trait variation suggesting that trait variance is greater between than within species. The MaxEnt model explained 62% of the variance in tree relative abundances. I will compare these results to the performance of the TRICYCLE model. The preliminary results from this study indicate that trait variation within species is less important than the stronger interspecific differences in traits when the objective is to obtain predictions of species relative abundances along environmental gradients.

Preliminary evidence of differential long-tailed bat activity recorded at varying distances from a State Highway in Waikato, New Zealand

Darren Le Roux[1], John Turner, Roger MacGibbon

OPUS International Consultants, Ltd

Email: darren_lrx@yahoo.com

The effect of anthropogenic activities on wildlife is of growing concern as urban expansion continues. This is especially true for cryptic threatened species that are difficult to observe. Roads are ubiquitous and important features of human-dominated landscapes, but these structures may directly and indirectly impact threatened fauna, including mobile animals like bats. The effect of roads on native bats in New Zealand is poorly understood.

We used automated bat detectors to determine if threatened long-tailed bats (*Chalinolobus tuberculatus*) occur in modified habitat situated near two bridge structures and a busy State Highway (SH1) in Hamilton City and Cambridge Town (Waikato, New Zealand).

Only a single bat pass was recorded on a detector situated 30m from one city bridge. Overall, more bat passes were recorded ≥150m from bridges. Bats were recorded on detectors situated 20 and 10m away from SH1 even during peak traffic flow volumes. However, the mean number of recorded bat passes was significantly (P<0.05) lower at 20 and 10m from SH1 compared with activity recorded at 150 and 100m from SH1. Feeding activity was only recorded on detectors situated ≥100m from SH1. Native long-tailed bats are not precluded from using edge habitat adjacent to existing busy road structures; however, differential bat activity at varying distances from SH1 suggests that roads may influence bat behaviour. Additional research is proposed to better evaluate possible indirect effects of existing roads and road related disturbance factors (e.g. artificial light) on bat behaviour with important management implications for roading projects.

Bacteria as sentinels of ecological health: An exploration of the relationships between anthropogenic impacts and bacterial biodiversity

Gavin Lear[1], Vidya Washington[2], Andrew Dopheide[2] and Gillian Lewis[2]

[1] Lincoln University, Christchurch, NZ

[2] The University of Auckland, Auckland, NZ

Email: gavin.lear@lincoln.ac.nz

Can bacterial communities be used as sensitive and reliable indicators of changing environmental conditions? Bacteria are both ubiquitous and taxonomically diverse and it is thought that they may be highly responsive indicators of changing environmental conditions as a consequence of their rapid life cycle. In 2010, we began exploring the biogeographical distribution of aquatic bacteria, comparing the community structure of 1250 stream biofilm samples collected across New Zealand. This nationwide study revealed that at regional scales, the structure of these communities (assessed using ARISA of bacterial 16S rRNA genes) could be largely explained by the nature, and extent of catchment development (e.g., conversion to urban or rural land uses). In light of these findings, a novel bacterial community index has been developed to 'score' the ecological health of freshwater streams, based on the presence and abundance of key molecular markers. We suggest that such indices will become an important tool for managers to detect ecosystem threats to both aquatic and terrestrial ecosystems and consider the current advantages of microbial community analysis for assessments of environmental change. Finally we highlight how recent advances in the molecular detection of functional microbial genes (e.g., encoding for C degradation, N fixation, denitrification, and resistance to various metals) may be used to monitor not only the extent of environmental degradation, but to identify the specific drivers of environmental change, within complex terrestrial and aquatic ecosystems

Farming our native fauna: ecological menace or economic opportunity?

Marieke Lettink

Fauna Finders, 176 Mt Pleasant Road, Christchurch 8081.

Email: marieke_kakariki@clear.net.nz

New Zealand does not currently have a policy that permits the keeping and breeding of threatened native fauna species for primary production, sale and export. In recent times, many people have expressed opinions that such a policy, if adopted, would have significant ecological and financial benefits. However, most proponents of the 'fauna farming' argument fail to adequately consider the ecological factors that limit the survival and productivity of many native species, including their K-selected life-history traits (e.g. slow growth rates, delayed maturity and low reproductive output) and vulnerability to predation by a range of introduced pest species. Despite being poorly-considered, many 'fauna farming' proposals are gaining increased public support in the popular media. For example, in the last 12 months it has been claimed that: (1) kākāpō are too expensive to conserve, and that this problem could be solved by auctioning off half the birds to raise money for conservation of their wild kin; (2) farmers are in a better position to increase the breeding rates of native animals than the Department of Conservation because "no farmed species has ever gone extinct"; (3) establishing legalized trade would help conserve native geckos by preventing illegal collection and export by wildlife criminals, whilst simultaneously providing captive insurance populations off-shore. This talk examines the ecological and

financial sustainability of farming native species with high media profiles, using a combination of population modelling and financial analysis.

Impacts of mangrove mulching on estuarine communities

Carolyn Lundquist[1], Sarah Hailes, Katie Cartner[2]

[1] NIWA Hamilton, PO Box 11-115, Hillcrest, Hamilton 3251

Email: c.lundquist@niwa.co.nz

While there is broad community level support for halting the rapid expansion of mangroves, little information is available on the services provided by mangroves to estuarine and coastal ecosystems to advise on impacts of mangrove removal on ecosystem health. Similarly, removal methods have been inadequately documented to determine a best practice method that minimises local and far-field impacts. In order to provide better information on long term recovery (and likelihood of success) of mangrove removals, we surveyed the effects of a resource consent resulting in clearing of over 100 hectares of mangrove forest in Tauranga Harbour in 2010 and 2011. We quantify impacts of an in situ mangrove mulching method at 2 sites (Te Puna and Waikaraka estuaries), sampled before mulching, and at 1 week, 3 months, and 6 months post-mulching. Our results indicate that mulchate does not disperse, and has adverse impacts on recovery after mangrove removal including direct smothering of benthic fauna resulting in anoxic sediments, and subsequent release of nutrients that would otherwise be bound within the sediments. Mulched plots were also associated with patches of sulphide-reducing bacteria, and seasonal blooms of Ulvaceae. Surprisingly, we saw little difference in recovery after mulching between sites across a gradient of hydrodynamic exposure, distance from estuary mouth, sediment characteristics and other environmental variables. Our results have assisted in informing other resource consents as to impacts of this mangrove removal method, and in designing monitoring strategies to assess recovery of future mangrove removals using other untested methods.

Latitude, light environments and functional diversity in rainforest tree assemblages

Chris Lusk[1], Kerrie Sendall[2], Rob Kooyman[2]

[1]University of Waikato, [2] Macquarie University

Email: clusk@waikato.ac.nz

Do the diverse tree assemblages of tropical rainforests comprise a wider array of niches than other assemblages? I highlight the virtual absence from mid-latitude rainforests of one tree functional type that is common closer to the equator: light-demanding canopy trees with fast foliage turnover and growth. Although often referred to as “tall pioneers”, they are not confined to early succession, also recruiting directly to the canopy of old-growth stands by rapid growth after tree-falls. We also explored the influence of latitude on tree-fall gap light environments as a possible constraint on the geographic distribution of this functional type, using YPLANT to simulate light interception and carbon gain by seedlings of the Australian rainforest pioneer *Polyscias murrayi* beneath idealized gaps at tropical, subtropical and cool temperate sites (latitudes 17, 29 and 42□S, respectively). Results were strongly influenced by latitude, and by the interaction of latitude with position within an idealized tree-fall gap of 100m^2. Net carbon gain of *P. murrayi* was strongly positive beneath gap centre at

latitude 17, and beneath the poleward gap margin at latitude 29, but negative beneath both gap centre and margin at latitude 42. Light interception and carbon gain were also influenced by variation in sunshine hours, which were highest at latitude 29 and lowest at latitude 42. Lack of suitable light environments could thus prevent trees with high metabolic rates from invading old-growth rainforests at mid-latitudes. Geographic variation in forest light environments therefore likely influences the range of viable functional types at different latitudes.

The cultural precautionary principle when valuing ecological restoration of coastal forests by Māori in New Zealand

Phil Lyver[1], Hilary Phipps[1], Ashli Akins[2], Henrik Moller[2], and Viktoria Kahui[3]

[1] Landcare Research, PO Box 40, Lincoln, 7640, New Zealand

[2] Centre for the Study of Agriculture, Food & Environment, University of Otago, PO Box 56, Dunedin, 9025, New Zealand

[3] Department of Economics, University of Otago, PO Box 56, Dunedin 9025, New Zealand

Email: LyverP@landcareresearch.co.nz

Just as the environmental precautionary principle asserts a need to apply uncertainty in favor of environmental protection, we propose an equivalent cultural precautionary principle to give expression to indigenous values in order to maintain and restore and protect links between cultures and their environment. We used qualitative and quantitative analyses to investigate value assigned by 12 environmental managers and 12 kaitiaki (Māori environmental guardians) to ecological restoration of coastal forests in northern New Zealand. Kaitiaki primarily emphasized the importance of Cultural Stewardship in the restoration process, while Environmental managers hardly recognised this value at all. Otherwise, all participants shared common purpose and enthusiasm for five other interrelated value sets, which we labelled: (i) Use, (ii) Personal Engagement, (iii) Connection, (iv) Knowledge & Wisdom, and (v) Ecological Integrity. These value sets demonstrate that benefits to people and community are as important for restoration as the focus on restoring ecological components. The values expressed were often intangible, complex and closely inter-twined, so valuation tools used by Ecological Economists to guide management investment are extremely problematic and most certainly will fail to adequately account for Māori values for ecological restoration in particular. Despite some differences, all stakeholders were united in a broadly common goal to restore social-ecological systems. Their knowledge and shared passion for conservation signal enormous promise for accelerated and effective restoration of coastal forests, if it is conducted using a cultural precautionary principle.

A soil-plant-atmosphere (SPA) model for investigating responses of kauri to climate perterbations

Cate Macinnis-Ng[1]

[1] School of Environment, University of Auckland

Email: c.macinnis-ng@auckland.ac.nz

Tree rings of living, felled and fossilised Kauri (*Agathis australis*) provide a proxy record of patterns in the El Niño-Southern Oscillation (ENSO) phenomenon in New

Zealand dating back thousands of years. Wider growth rings tend to be formed during El Niño events, while narrow rings are associated with La Niña. Up to 50% of Kauri growth occurs during the months of October and November, coinciding with cool-dry conditions during El Niño. The physiological explanation for this response is not yet known because very little work has been done to explore the ecophysiology of kauri. Furthermore, the potential changes in growth as the climate warms and dries have not been investigated. In previous work I have used a mechanistic soil-plant-atmosphere (SPA) canopy exchange model to investigate carbon and water fluxes in Australian woodlands. I intend to apply this model to kauri forest west of Auckland. I will explain the structure of the model, required inputs (including associated fieldwork required to gather those data) and experimental questions to be addressed with model simulations. The SPA model is highly effective for identifying relationships between transpiration, gross productivity and meteorological conditions such as VPD, radiation and soil moisture. This model will be used investigate ecosystem carbon and water fluxes of kauri forests now and into the future, using current climatic data and climate analogues to simulate future climate.

Predictors of stoat (*Mustela erminea*) activity in Tongariro Forest

Martin, R.D., Potter, M.A.P. and Brabyn, L.

Ross.Martin@waikatoregion.govt.nz

Stoats are a widespread invasive pest in New Zealand. Efforts are ongoing to improve the efficacy and cost-effectiveness of station-based stoat control for species protection. This research combines automated Geographical Information Systems (GIS) and iterative logistic regression scripting to identify terrain variables that predict stoat visitation to footprint tracking tunnels. Significant terrain predictors of stoat activity were aspect, slope, altitude, land curvature, topographical position, solar radiation and proximity to tracks and river. Addition of mouse and rat activity indices, as well as autocorrelation representing previous and nearby stoat visitation, improved overall model fit and reduced the statistical effects of most terrain variables. Stoat and rat visitation were negatively correlated, suggesting possible prey avoidance. The study also examines overlap in habitat use between stoats, rats and mice.

Flora in the mist: conservation status of the endemic cloud forest species of Rarotonga, Cook Islands

Tim Martin

Wildland Consultants

tim.martin@wildlands.co.nz

The flora of the cloud forests of Rarotonga is fascinating and unique. Rarotonga is geographically isolated from other land masses, and the mountainous interior of the island supports a suite of species found nowhere else on Earth. These cloud forest endemics inhabit the highest peaks, where frequent rain and cloaking cloud create a humid, cooler environment. The rampant growth of exotic weeds, and the disappearance of previously known populations of some species, is causing growing concern about the future of Rarotonga's endemic flora. Wildland Consultants, and the Cook Islands Nature Heritage Trust, collaborated to undertake an expedition to survey and document the conservation status of Rarotonga's endemic flora in July 2010. The survey documented that several species, such as the Rarotonga *Cyrtandra*, are on the

brink of extinction, and more may head that way if conservation measures cannot be implemented soon. Submissions are now being prepared so that Rarotonga's endemic flora can be assigned threat rankings by the IUCN. This talk will introduce the uniqueness and plight of Rarotonga's flora, and also some of the physical challenges of working in inland Rarotonga.

Bridging the gap of frustration – local government & the RMA

Fleur J.F. Maseyk[1]

[1] Horizons Regional Council

Email: fleur.maseyk@horizons.govt.nz

The Resource Management Act 1991 (RMA) is upheld by some as a great stalwart of environmental legislation, embodying as it does the concept of sustainable management of natural and physical resources. Other sectors of society see the RMA as an extreme frustration, limiting development options and delaying consenting processes. Still others applaud the RMA's high-level intent but despair at the manner in which this intent is diluted and compromised through council plans. Where does the reality lie? Is the RMA the key to maintaining and enhancing indigenous biodiversity on private land in New Zealand? Is vesting this responsibility in local government likely to achieve such an outcome?

In January of this year, the Ministry for the Environment (MfE) released a proposed National Policy Statement on Indigenous Biodiversity for public submission. National policy statements (NPS) are tools enabled by the RMA to manage issues of national importance, and local authorities (district, regional and unitary councils) must develop policy in accordance with an operative NPS. Will the NPS fill the 'gap of frustration' between the purpose and principals of the RMA and the implementation of the legislation?

This presentation explores these questions and suggests that robust ecological science, courageous leadership, and community engagement can combine to produce a formidable framework by which the sustainable management of indigenous biodiversity at a landscape scale could be achieved.

Past warm events and future New Zealand climates

Matt McGlone[1] & Janet Wilmshurst[1]

[1]Landcare Research, PO Box 40, Lincoln 7640, New Zealand

Email:mcglonem@landcareresearch.co.nz

General Circulation Models predict that New Zealand will warm by 2-5°C by the end of this century. Given that this is equal to or greater than any warming over the last 2.6 million years, negative impacts on natural ecosystems are predicted. However, while changing species distributions and ecological disruption has been documented elsewhere in response to recent global warming of c. 1°C, little obvious change has been reported in New Zealand. Mostly this is because warming of New Zealand since the middle of the 19th century has been only a modest 0.4°C. Moreover, our oceanic climates are strongly dominated by interannual variability which dwarfs any long-term trend. As few species or ecosystems are sensitive to a rate of warming of just 0.03°C/decade, the lack of change in New Zealand is expected. As regards the future, our understanding of species or ecosystems responses to climate cannot yet support

robust predictive conclusions. Investigating periods in the past when climates were warmer provides critical insights into the potential impact of future warming on terrestrial ecosystems. We give several examples of how ecosystems have reacted to past warmer climates from the New Zealand mainland and subantarctic islands. The results suggest biome alteration due to drying of eastern regions, some compositional alterations elsewhere, but surprisingly little distributional change. From a strictly native ecosystem point of view, the next 50 or so years of climate change should have an insignificant impact when put alongside the other anthropogenic drivers.

Maori perspectives on restoration – restore the land, restore the people, incorporating insights from Nga Whenua Rahui and/or Matakana projects

Rob McGowan[1], Jason Murray[2] & Aroha Armstrong[2]

[1]Nga Whenua Rahui

[2]Matakana Island Marine club

Email: rmcgowan@doc.govt.nz

The recently released Wai 262 emphasises the importance of Matauranga Maori, and its importance in how New Zealand manages its natural resources. But what is "Matauranga Maori" and how does it relate to ecological restoration and management?

Rob will offer some introductory thoughts on aspects of Matauranga Maori, and comment particularly on how the cultural significance of a site is taken into account in terms of assessing its for a potential Nga Whenua Rahui kawenata, and touch on such factors as Wahi Tapu and Mahinga Kai, and their significance in site restoration on Maori owned land. Jason and Aroha illustrate what that means in practice by looking at their work in restoring the wetlands on Matakana Island in the Tauranga Harbour. They will discuss both the actual restoration but particularly the importance of the involvement of the community and their matauranga in achieving the progress that they have made"

Talking to Plants – What constitutes an external signal in an ecosystem?

Michael T. McManus

Institute of Molecular Biosciences, Massey University, Palmerston North

Email: M.T.McManus@massey.ac.nz

The perception and response of plants to their external environment is a vital regulator of plant growth and development. Further, the exposure of plants to a range of documented abiotic and biotic stresses can often determine plant survival and ultimately the fitness of a species to occupy a specific niche within an ecosystem. The nature of some of these stress factors is known, but it is becoming increasingly clear that plants respond to a wide range of external signals many of which are yet to be discovered. In this group are the large collection of compounds within plants termed the secondary metabolites that comprise a huge array of chemicals with functions yet to be ascribed to the majority. As detection and experimental approaches become more sophisticated, it is clear that many of these are concerned with intra- and inter-

species signalling. However, other compounds produced in primary metabolism are experiencing a renaissance of interest as they too function in a signalling capacity. This talk, therefore, will review what we now know about the nature of plant signals and assess whether the definition needs to be reassessed. Further, the significance of this potential *pot pourri* of signals in terms of the underpinning dynamics of ecosystems will be discussed.

Red Warning: Anthocyanic leaves are a reliable cue of leaf chemical defenses and deter herbivorous insects in the New Zealand horopito (*Pseudowintera colorata)*

Menzies, I.J.[1], Youard, L.W.[2], van Klink, J.W.[3], Perry, N.B.[3], Lester, P.[1], Burns, K.C.[1], Schaefer, H.M.[4], and Gould, K.S[1].

[1] School of Biological Sciences, Victoria University of Wellington, New Zealand

[2] Department of Botany, University of Otago, Dunedin, New Zealand

[3] The New Zealand Institute for Plant & Food Research Limited, University of Otago, Dunedin, New Zealand

[4] Dept. of Animal Ecology and Evolutionary Biology, Faculty of Biology, University of Freiburg, Germany

Email: ignatius.menzies@vuw.ac.nz

In 2001 Hamilton and Brown proposed a radical new function for coloured pigments in leaves – that of a warning signal to advertise a plant's defensive capabilities(1). This hypothesis has attracted much attention and debate in the literature, but there have been few empirical studies and results have been inconsistent. We have carried out the most comprehensive test of Hamilton and Brown's (2001) hypothesis to date, using New Zealand (NZ) horopito to test four predictions: 1) That anthocyanins are a reliable cue of leaf chemical defences. 2) Red leaves will suffer less insect feeding damage. 3) Red bushes will have lower herbivorous insect pressure than neighbouring green bushes. 4) Red bushes will have higher fitness than neighbouring green bushes. We found: 1) a significant positive correlation between anthocyanin concentration and polygodial, a sesquiterpene dialdehyde with potent insect antifeedant properties. 2) A significant negative correlation between the amount of red leaf area and feeding damage. 3) Significantly lower densities of leaf roller caterpillars on red bushes than neighbouring green bushes. 4) No difference in the number of fruits between red and green neighbouring bushes. Therefore, in NZ horopito, foliar anthocyanin concentration is a reliable cue of leaf chemical defences and is associated with a reduction in both feeding damage and insect pressure. However this reduction in herbivore damage did not result in an observable fitness benefit.

Bryophyte contribution to ecosystem services in New Zealand landscapes: hydrology and litter decomposition

Pascale Michel[1], William G Lee[2]

[1]Biodiversity and Conservation Team, Manaaki Whenua-Landcare Research, P.O. Box 10 345, The Terrace, Wellington 6143, New Zealand.

[2]Biodiversity and Conservation Team, Manaaki Whenua-Landcare Research, Private Bag 1930, Dunedin 9054, New Zealand

New Zealand has over 1000 species of native bryophytes, which form dense carpets in several ecosystems, influencing numerous ecological processes. Bryophyte composition and accumulation in native grasslands can drive catchment-scale hydrological processes by intercepting rainfall, dew and fog, and absorbing 8-14 times their dry mass in water. We estimated that the inter-tussock bryophyte carpet of native tussock grassland in New Zealand, predominantly dominated by the pleurocarpous moss *Hypnum cupressiforme,* contributed to a mean additional water storage capacity of 0.2mm, representing 2.6% of the total potential water storage from the above-ground vegetation. Nine years following anthropogenic disturbances the bryophytic landscape remained highly modified with *Polytrichum juniperinum* being dominant after summer and spring burn regimes, and *Campylopus* species following the removal of the top soil and vegetation in the creation of fire breaks. The reduced bryophyte biomass, cover and water content resulted in a mean loss of 90% in the potential bryophyte water storage. The impact of bryophytes on nutrient recycling was investigated using a litter bag experiment in beech forest and tussock grassland ecosystems. In soils lacking bryophytes, decomposition of beech litter (*Nothofagus menzeisii*) was twice faster than that of tussock grasses (*Chinochloa rigida*). Decomposition under dense cushion of moss species increased by up to 73% in both ecosystems. The two studied liverwort species did not affect rate of decomposition, suggesting possible differences in contribution to litter decomposition between Musci and Hepaticae. The influence of bryophytes on decomposition processes however appeared greater in tussock grassland systems than beech forest, and acted primarily through an accumulation of microbial biomass. Alterations in the bryophytic landscape thus can have significant consequences on the ecological processes and potentially on ecosystem services associated with major biomes.

The achievements of the Nature Heritage Fund in reducing biodiversity loss on private land

L.F Molloy and G.D.McSweeney

Nature Heritage Fund, PO Box 10-420, Wellington

Email: NHF-Admin@doc.govt.nz

Since it was established in 1990, government's Nature Heritage Fund (NHF) has provided for the permanent protection of 340,449 ha of indigenous ecosystems (or 1.27% of New Zealand's land area), involving 731 successful applications. This diverse area has been secured at a cost of $155.93 million, or $458 per hectare.

The protected sites are regionally widespread, extending from Northland to Southland and the Chatham Islands (as well as several offshore islands). The ecosystems protected are diverse and especially representative of those which are rare of under threat. They include lowland podocarp forest, wetlands, coastal vegetation on raised marine terraces, dry shrublands and valley floor ecosystems in the eastern South Island high country grasslands, kettleholes, dunelands, limestone ecosystems, and

estuarine areas. The sites involved range in size from less than 100 ha to over 78,000 ha in the case of St James station.

The paper outlines the criteria used by the NHF in deciding on the priority of applications to the fund and illustrates the range of ecosystems protected over the past 20 years. The guiding criteria include representativeness, sustainability, landscape integrity, and amenity/utility, with the greatest emphasis being placed on representativeness and sustainability.

In 2009/2010 the NHF was independently reviewed, with the review concluding that the fund's purchase and operational costs represented "good value for money".

The phloem unloading pathway in the developing kiwifruit berry

Daniel Morrison[1]

[1] The University of Waikato

Email: drm28@waikato.ac.nz

The phloem unloading pathway is a key step in the transport of photoassimilates from source to sink. The importance of this pathway in the kiwifruit berry has been recognized, however the physiological processes involved are not well understood. Based on studies of sink tissues of other species, the potential pathways for the unloading of sugars are an apoplasmic pathway, a symplasmic pathway, or a combination of the two. To determine which pathway operates in the kiwifruit berry, carboxyfluorescein diacetate (CFDA) was introduced into the phloem as a symplasmically mobile fluorescent dye and observations made of how it accumulates in the sink tissue. Radiolabelled sugars were also used to visualise the sugar transport pathway into the fruit. The results suggest a unique change in the dominant phloem unloading pathway during development. A symplasmic unloading pathway operated during the initial 70 DAA, however after this date a change to an apoplasmic step within the unloading pathway was observed. This apoplasmic step was detected up to 91DAA, after which the dye was no longer transported into the fruit past the receptacle. Autoradiography of the radiolabelled sugars showed that phloem unloading continued, even though the symplasmic dye no longer entered the fruit. The significance of this pattern of phloem unloading for fruit development of kiwifruit will be discussed.

More than just trees – the role of District Plans in providing protection for the ecological values of urban vegetation

Shona Myers[1]

[1] Wildland Consultants Ltd, PO Box 132-040, Sylvia Park, Mt Wellington, Auckland.

Email: Shona.Myers@wildlands.co.nz

The Auckland region, although one of the smallest in New Zealand, includes our largest urban area. Urban development has impacted on many natural habitats. Many remaining ecosystem types are much reduced from their former extent. Despite this the urban area of Auckland contains a rich diversity of indigenous vegetation including significant forest areas, riparian and coastal areas, wildlife habitats and ecological corridors. Over 1000ha of urban forest occurs in Titirangi, Laingholm and Waima, in

the foothills of the Waitakere Ranges, The forested gullies and coastal escarpments of the North Shore include hundreds of hectares of indigenous forest and habitat. A declaration to Environment Court was taken by the former Waitakere City, North Shore City and Auckland Regional Councils to gain clarification over the Resource Management (Simplifying and Streamlining Amendment Act 2009). The Act removes from 1 January 2012 the ability for councils to have rules in district plans providing for protection of trees in urban areas, unless the tree or group of trees is specifically identified in the district plan. Rules in the Waitakere and North Shore District Plans provide protection for significant areas of urban vegetation including regionally rare lowland and coastal forest. Vegetation in urban Auckland forms significant linkages and stepping stones between key habitats on the Hauraki Gulf Islands and the Waitakere Ranges, provides riparian and coastal corridors, and supports ecosystem services. The results of the court decision and the role of District Plan zonings in protecting urban vegetation are discussed.

Evolutionary ecology of a lichen symbiosis: a case study using New Zealand *Menegazzia* (Parmeliaceae, lichenized Ascomycetes)

Benjamin Myles[1,2], David Orlovich[2] & Jonathan Waters[1,3]

[1] Allan Wilson Centre for Molecular Ecology and Evolution, New Zealand

[2] Department of Botany, University of Otago, Dunedin, New Zealand

[3] Department of Zoology, University of Otago, Dunedin, New Zealand

Email: mylbe837@student.otago.ac.nz

The close association between lichenized fungi and their algal photobionts is a well known, but poorly understood, example of symbiosis. Several recent studies have suggested the evolutionary influence on this relationship is of less importance than the ecological and regional ones. That is, the same species of algae is not always found with the same fungal host, and vice versa. Instead of co-evolving, the bionts seem capable of associating with a range of taxa, with "photobiont sharing" between unrelated but proximal fungi often taking place. However, just how prevalent this sharing is remains a source of debate. Here modern molecular techniques were employed to investigate the lichenized Ascomycete genus *Menegazzia* and its green algal photobiont *Trebouxia.* Multiple collections were made of 15 *Menegazzia* species throughout New Zealand, and DNA extracted. The fungal evolutionary history was then reconstructed using the nuclear ITS and mitochondrial 12S regions, and the algal evolutionary history was reconstructed using the nuclear ITS and chloroplastic *rbc*L. The phylogenies of both groups were compared for similarity, under the assumption that high levels of topological concordance would indicate co-evolution, whereas discordance would indicate sharing. As expected, the results show support for photobiont sharing in *Menegazzia*, but unexpectedly two striking examples of distribution wide host-specificity are also found. Although the ecological and regional effects on lichen assemblage appear more prevalent, obligate symbiotic relationships have also evolved. These patterns are discussed in light of lichen dispersal strategy differences.

Experimental sowing of large-seeded, fleshy-fruited native tree species for urban forest restoration in Hamilton City, New Zealand

Elizabeth Overdyck[1], Bruce D. Clarkson, Chrissen E.C. Gemmill

Centre for Biodiversity and Ecology Research, Department of Biological Sciences, University of Waikato

Email: eg3@waikato.ac.nz

Restoration of native urban forest patches often occurs in isolation from tracts of intact mature forest. This may limit occupancy, use and recolonisation by native forest flora and fauna. We investigated direct seed-sowing as a method for introducing large-seeded, fleshy-fruited native tree species into early successional forest restoration plantings in Hamilton City to address the limited local abundance of these species and their avian seed dispersers. Results are presented from experimental trials in urban and rural lowland forests using three seed treatments, on three tree species, to assess germination rates and seedling survival: 1) caged vs. uncaged seeds to exclude mammalian seed predators; 2) fruit flesh removal to simulate scarification and deinhibition effects of bird gut passage; and 3) placing seeds in nutritionally enriched clay balls both to simulate fertilisation effects of bird deposition and possibly also to protect seeds from detection by predators. Results for *Beilschmiedia tawa* show that introduced mammalian seed predators caused a significant reduction in germination rates and seedling survival. Removal of fruit flesh significantly increased germination rates of *B. tawa*. The clay ball treatment had no significant effect on *B. tawa* germination rates; however, seedling survival at one year was significantly increased. Seeds of *Elaeocarpus dentatus* and *Litsea calicaris* also had predation losses and very low germination rates. Seed-sowing was found to be a viable method for restoration enrichment with large-seeded tree species and the use of additional seed treatments significantly increased germination and seedling survival. Without concurrent control of introduced mammalian seed predators however seedling establishment will be limited.

On Liebig's law of the minimum and ecosystem modelling as a lake restoration decision support tool

Deniz Özkundakci[1], David P Hamilton[1], Chris G McBride[1]

[1] Centre for Ecology and Biodiversity Research, University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand

Email: denizo@waikato.ac.nz

Numerical models of aquatic ecosystems that couple physics and biogeochemistry are valuable tools in aquatic ecosystem research. These models provide not only for opportunities to extend knowledge, but also to inform environmental management. The objective of our research was to provide an example on how ecosystem modelling can be used as a lake restoration decision support tool while acknowledging the effect of conceptual simplifications on the outcome of various model scenarios. We used the coupled hydrodynamic-ecological model DYRESM-CAEDYM to simulate the Lake Rotorua ecosystem on a daily time step over six 8-year periods within 1920–2100. DYRESM-CAEDYM simulates phytoplankton growth using a temperature-referenced maximum potential growth rate which is multiplied by the minimum value of expressions for limitation by light, phosphorus, nitrogen. We included up to three generic phytoplankton groups in the conceptual model to investigate the response of

phytoplankton growth and abundance to different nutrient loading scenarios. Model-specific output of limiting factors was used to examine the likely response of changes in water column nitrogen and phosphorus on the duration and severity of nutrient limitation in simulated phytoplankton groups. We show that co-limitation of phytoplankton can occur at the community level when one species is limited by phosphorus and the other one is limited by nitrogen supply. While individual phytoplankton species, to a certain extent, can adaptively adjust nutrient uptake to remain co-limited over short periods, the minimum expression provides a reasonable representation of phytoplankton growth limitation when simulated on a daily time scale.

Connecting fragmented forest ecosystems at the landscape scale in the Wellington Region

Tim Park

Greater Wellington Regional Council

Email: tim.park@gw.govt.nz

Regional councils are responsible for the maintenance of biodiversity within their regions. This is reinforced by the recently proposed NPS on Biodiversity.

Regulatory tools can provide baseline protection for habitat loss, but these alone will not achieve biodiversity maintenance. Active protection and intervention by managing threats is essential. The key threats are proven to be invasive pests, stock grazing, contaminants, harvest, and loss of native species from ecosystems. A case study is presented from the Wellington Region examining lowland terrestrial habitat fragments, minimum habitat area for species and connections between habitat areas that are essential for biodiversity maintenance. At a landscape scale, pest animal management has been shown to increase bird numbers, but how this can be coupled with biodiversity restoration throughout our varied landscapes is not clearly understood or applied. Healthy populations of avian pollinators and seed dispersers are essential to enable functional ecosystem processes to operate in heavily reduced and fragmented lowland ecosystems. Modelling how the habitats of pollinators and dispersers are spatially aggregated and connected across the landscape is now possible using new research on habitat preferences of key pollinators and seed dispersers. We can spatially represent how the forests in our landscape are connected by interrogating existing land cover data and applying new research on native bird use of native forest to model habitat requirements. This information can then be used to prioritise pest management which can restore functional natural processes to our diverse landscapes.

Assessing the potential impact of wind turbines on endemic bats

Stuart Parsons

School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland

Email: s.parsons@auckland.ac.nz

Wind energy is seen as a sustainable alternative to electricity generation methods that produce green-house gases, or are perceived by the public as being unsafe. New Zealand has embraced the use of wind energy, with 16 farms either operational or under construction. A further 16 sites are being investigated or have consent

applications underway. Prior to resource consent being given, wind farm developers must assess and mitigate for the potential ecological (and other) impact of the wind farm on the local environment. Internationally, it is now recognised that the species most adversely affected by wind farms are bats. The majority of deaths occurs either as a result of direct contact with turning turbine blades, or through barotrauma where changes in air pressure surrounding the moving blades causes fatal internal damage to bats, without any direct contact. At one site in the United States fatalities are estimated to be 29 bats per Mega Watt, or 3,800 bats per year. The risk posed to bats by wind farms depends heavily on the ecology and behaviour of individual species. This then begs the question: are New Zealand species at risk?

In this talk I will discuss how wind farms negatively affect bats, and assess the potential impact on our two remaining species. Finally, I will discuss how native bats can be protected from the impacts of wind farms in New Zealand.

Impacts of wilding conifers and their control on grassland and shrublands in New Zealand

Thomas Paul[1] & Nick Ledgard[2]

[1] Scion Research, Rotorua, NZ,

[2] Scion Research Ilam, Christchurch, NZ

Invasive conifer species (for example Lodgepole Pine (*Pinus contorta* Loudon) or Corsican Pine (*Pinus nigra* J.F. Arnold)) have invaded native grasslands and shrublands in many areas of New Zealand, changing environmental conditions and outcompeting native species. Methods to control and remove self established conifers (wildings) in such areas have been developed with the focus on removal success and cost effectiveness. However, evaluations of different control methods to assess the success of reverting affected areas to its former appearance and formerly present native composition are rather rare in New Zealand. To improve our understanding of the long term effects of wilding conifers and the methods used to control them we established paired sites trials and long term plots in various affected grasslands and shrublands in the High Country of the North and South Islands of New Zealand. Our studies show the different outcomes of various control methods and the induced vegetation changes that occurred. For example, in depleted grassland in the South Island the cutting and leaving of wilding conifers on site results in a temporary vigorous growth of grasses (native and exotics) on treated sites, reducing the presence of exotic weeds and native woody plants. The same control methods in shrublands of the Kaingaroa Plateau (Central North Island) has resulted in a dramatic shift to a vegetation dominated by exotic grasses, failing to protect and re-instate the previous shrubland vegetation at least for some time.

Using spatially-explicit individual-based models to reconstruct seed dispersal by kereru in northern New Zealand forests

Pegaman, Andrew McK.[1], Perry, George L.W.[1,2], Clout, Mick N.[1,2]

[1]School of Environment, University of Auckland, Private Bag 92019, Auckland

[2]School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland

Email: george.perry@auckland.ac.nz

A suite of New Zealand's large-fruited tree species rely on birds for long-distance seed dispersal. Although not their sole disperser, kererū (*Hemiphaga novaeseelandiae*) are believed to be a keystone agent of dispersal for these species. Because kererū have declined in abundance, there is concern over the flow-on implications for seed dispersal. Measuring long-distance dispersal is notoriously difficult, and so it is often inferred via genetically and non-genetically based inverse modelling. Increasingly, however, spatially-explicit individual-based models (SEIBM) are being used to couple disperser movement and seed dispersal to explore the long-distance component of seed dispersal kernels. Here we present a SEIBM of kererū movement and seed dispersal. We use the model to explore how the nature of the seed dispersal kernel may respond to changes in: (i) disperser population density and (ii) the spatial pattern of fruiting trees – as may occur if the dispersal kernel shifts due to dispersal failure. Changes in disperser density affect the amount of seed dispersed but only subtly alter the *shape* of the dispersal kernel. On the other hand, changes in the spatial pattern of fruiting trees have dramatic effects on the shape of the dispersal kernel. While, at this stage, our model only considers a single season in the future there is the potential to couple it to demographic models and hence explore the implications of disperser decline on the long-term population dynamics of the tree species of interest.

Using spatial models to understand fire-driven landscape transformation during New Zealand's initial burning period

Perry, George L.W[1,2], Wilmshurst, Janet M.[3], McGlone, Matt S.[3], McWethy, Dave B.[4], Whitlock, Cathy[4]

[1]Tree-ring lab, School of Environment, University of Auckland, Private Bag 92019, Auckland

[2]School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland

[3]Landcare Research, PO Box 40, Lincoln 7640, New Zealand

[4]Dept. Of Geography, Montana State University, Bozeman, Montana, USA

Email: george.perry@auckland.ac.nz

At the time of Māori settlement, c. 750 years ago, New Zealand's ecosystems experienced catastrophic change. Among the most significant of these transformations was the introduction of fire to previously ignition-limited ecosystems and the resulting loss of some 40% of forest. Recent high-resolution sediment-charcoal analyses suggest that the majority of this forest loss may have occurred in a short window of time (possibly just a few decades) – a time-period now called the 'initial burning period' (IBP). However, Māori populations were very low during the IBP and there is evidence for widespread fire activity in places where there is little evidence for human settlement or activity. Even given the likely biophysical susceptibility of NZ's dry forests to fire, these observations beg the question how did such small populations manage to transform such large areas so rapidly? Using a spatially explicit simulation model we demonstrate how the relationship between time

since fire and flammability (the hazard function) in NZ's forests has the potential to create positive feedbacks that allow for extensive deforestation. We show that very rapid and widespread forest loss can occur when 'fire begets fire' coupled with the spatio-temporally savvy selection of ignition locations by Māori. New Zealand's IBP is just one of many hundred that occurred across eastern Polynesia when human settlement occurred. Improving understanding of how humans shaped environments in NZ in the past has implications for the region as a whole.

How do community wetland restoration projects measure up?

Monica Peters[1]

[1] NZ Landcare Trust

Email: monica.peters@landcare.org.nz

The number of community-led wetland restoration initiatives has increased dramatically in recent years and there are many impressive and inspiring stories from around the country. This presentation will highlight several flagship projects, drawing together the factors have contributed to their successful ecological and social outcomes. Nation-wide however, there is still a need to quantify community inputs and outcomes for wetland restoration. A survey by the NZ Landcare Trust will address this gap by gathering information from community wetland restoration groups on their activities and seeking ideas on, for example, tools/ information needed to support community-led projects. The survey will form the foundation of an online resource, to be accessed and updated by the community. A user-friendly wetland monitoring toolkit for communities is also in the planning stages – previous dialogs with groups around N.Z. have highlighted that few carry out any form of monitoring. A simple tool will help gather much needed data as well as enhance the public understanding of science.

Biological trait responses to landuse development: an example of theory in action

Ngaire Phillips[1], David Reid[1]

[1] National Institute of Water & Atmospheric Research

Email:n.phillips@niwa.co.nz

Traditional taxonomic-based invertebrate measures of response to disturbance largely focus on diversity or on the presence or absence of key indicator taxa. Biological traits describe the biological characteristics of organisms, including life history, resilience/resistance and general physiological traits. The use of biological traits offers a fundamentally different way of examining ecosystem responses to disturbance, as it reflects the functional role that species play within the ecosystem and how this is affected by disturbance. While taxonomic-based measures generally only indicate that an ecological change has occurred, the trait-based approach provides a mechanistic framework to better understand and predict response patterns associated with particular stressors. The approach is based on sound theoretical principles (the habitat template model), which predicts that trait composition should be similar where environmental conditions are similar. This model has been used in numerous studies to examine the relationships between traits and environmental drivers, and has considerable potential as a powerful diagnostic tool in the applied field of biological monitoring. We will present the results of analysis of stream macroinvertebrate biological trait responses to a landuse stressor (% pastoral development). An analysis

of taxonomically based measures is also presented for comparative purposes. The analysis involved initially developing *a priori* predictions of possible responses based on ecological theory. We illustrate the value of using theoretically based methods to address applied environmental issues.

Ruru – what is happening in the darkness?

Moira Pryde, Terry Greene, Peter Dilks

Department of Conservation, Christchurch

Email: mpryde@doc.govt.nz

There is a perception that rūrū (*Ninox novaeseelandiae*) are widespread and in good numbers but are they? As part of the development of a count method for the species, a number of rūrū were captured, radio-tagged and sexed using DNA. A marked bias in the population sex ratio was observed in the Eglinton Valley, Fiordland, an area which has had several years of intermittent toxin use and longer-term predator control. We compare with these results with those from rūrū captured in Waitutu, Fiordland, as part of a monitoring programme investigating the impacts of aerial 1080 use on non-target species. Possible reasons for the apparent bias in population sex ratio are suggested.

Comparative nutrient relations of *Empodisma minus* and *Chionochloa rubra* across mire margins, Urewera National Park, New Zealand

Gillian L. Rapson[1], Lucy Roberts[2], Dale Redpath

[1] Ecology Group, Institute of Natural Resources, Massey University, Palmerston North, New Zealand. [2]Current address: Department of Conservation, Turangi.

Email: G.Rapson@massey.ac.nz

Ecosystem engineers can modulate the availability of resources by causing physical state changes in materials; in doing so they manipulate habitats to their own adaptive advantage. The wire rush, *Empodisma minus* is considered to be an ecosystem engineer in New Zealand wetlands. We investigate state changes across mire rands as analogues to the engineering process which occurs in hydrologically isolated parts of larger wetlands. At Kaipo Lagoon and Sopps Hollow mires in the Urewera, we compared the above ground nutrient levels of *Empodisma minus* and competitor *Chionochloa rubra* with peat samples. The rand transects show greater microtopographic variation towards the centre of the mires, where *Empodisma* cover is greater. The peat is more acid, and has lower nutrient levels further from the mire margin. Ca:Mg ratios of peat indicate possible ombrotrophy, and C:N ratios show reduced fertility into the mire. This is partly reflected in the tissue composition of both species. Despite lower tissue levels of P and K than *Chionochloa*, *Empodisma* appears more competitive away from the rand. While it appears the rand may be a useful analogue to the fen-bog transitions which occur in larger systems, further analysis is needed to determine if *Empodisma* is engineering these changes.

Re-designing walls as ecosystems in urban areas: a collaboration between ecology and design

Stephen D. Reay

[1] Product + Design, School of Art + Design, Auckland University of Technology

34 St Paul St, Auckland 1011

Email: stephen.reay@aut.ac.nz

The impacts of human development are not sustainable. The product design community has responded by developing concepts and frameworks to guide sustainable design activities. Concepts are centred on ideals of acknowledging ecological limits and demonstrating responsibility, and increased contribution to society and the environment. While many designers may have well meaning intentions and the frameworks they utilise make strong reference to the environment, they often fail to fully appreciate the complexities associated with ecological systems. Consequently decision-making can result in product systems that result in poor ecological outcomes.

This presentation documents the research and design of a 3D ceramic wall tile to be used as a boundary structure, and habitat for plant and animal species. In it's initial installed state the wall will represent an aesthetically appealing clean and simple structure. Over time this structure will weather, require minimal or no maintenance and will start to 'wear' as biological entities colonise, transforming into a dynamic ecosystem that supports on-going ecological activity. The wall will be highly visible and accessible to urban people as an ecological design project to help foster a re-connection with nature and increase awareness of ecosystem processes, as well as support biodiversity in a novel way.

The project encourages designers think beyond current eco-design principles to reveal the abundance of biodiversity and to design products with an underlying ecological integrity that will ultimately benefit natural systems. A specialised designer is required, with new modes of (ecological) thinking, to help negotiate challenges of sustainability, and actively engage with communities and the environment.

Factors limiting colonisation and recovery of sensitive stream invertebrates in restoration

Kimberley J Roberts[1], Angus R. McIntosh[1]

[1] Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140

Email: kim.roberts@pg.canterbury.ac.nz

Many stream restoration projects aim to restore aquatic insect populations, however often restoration attempts only beautify streams without substantial improvements to the aquatic biodiversity. This may reflect the failure of the "field of dreams" (i.e., if you build it they will come) approach. Lack of connectivity of a local restoration site to a regional species pool may explain these failures. We tested this by collecting larval and adult aquatic insects from a Canterbury high country stream impacted by agriculture to determine its connectivity to the regional pool. This stream is surrounded by high quality habitat adjacent Arthur's Pass National Park. Surrounding streams contained diverse assemblages of aquatic insects, but processes in the terrestrial environment meant their adults did not always arrive at the target stream. In addition, I

added oviposition habitat (boulders) for hydrobiosid caddisflies to one section of stream and compared this to an unmanipulated control section to test oviposition site limitation. The addition of oviposition habitat led to more egg masses in the stream than previously recorded, and in comparison to control reaches. Moreover, boulder selection was dependant on surrounding flow and other in-stream conditions. A community remaining connected to an intact regional species pool is expected to show a significant positive response to habitat restoration, in contrast to a community restricted by a colonist source. Thus, improved habitat is an important part of the restoration process, however our study indicates more aspects of the surrounding environment need to be considered when planning a restoration project.

Making sense of flower colour in the New Zealand alpine

Alastair W. Robertson[1], Mascha Bischoff[2], Janice M. Lord[3], Diane R. Campbell[2]

[1]Ecology, Institute of Natural Resources, Massey University, NZ

[2]Department of Ecology & Evolutionary Biology, University of California Irvine, USA

[3]Department of Botany University of Otago, NZ

Email: A.W.Robertson@massey.ac.nz

White, cream or yellow flowers are a conspicuous feature of alpine New Zealand flowers. This feature is often attributed to the lack of long-tongue social bees that elsewhere use colours to make flower-reward associations. This observation raises several interesting questions: are colours irrelevant and shape and scent more important cues to pollinators? Do pollinators ignore all sensory signals and visit indiscriminately? Or do visitors make choices using the narrow gamut of colours available? We have been manipulating flower colours using acrylic paint leaving the other cues intact to test the significance of colour as a visitation cue on the Remarkables ski-field near Queenstown. Our earlier results showed that colour does indeed matter with respect to yellow and white flowers but *Wahlenbergia albomarginata* is unusual in having variably violet-blue to white flowers. We have used a combination of natural colour variation and painting flowers to test the effect on visitation pattern, seed set, and pollen export as well as testing for non-pollination reasons for the variable colour in this species. Our results show some colour preference in the insect visitors with flies preferring white and the native bees either indifferent or, in large experimental arrays, preferring blue. As the native bees are the primary pollinators, pollinator behaviour cannot explain the relatively pale colour of *W. albomarginata*.

Progress and challenges in wetland restoration: insights from the Arawai Kākāriki programme

H.A. Robertson[1], K. McNutt[1], C. O'Donnell[1], C. Gillies[1], D. West[1]

[1] Research & Development Group, Department of Conservation

Email: harobertson@doc.govt.nz

Wetlands in New Zealand have been, and continue to be, subjected to significant changes in land use. Corresponding shifts in abiotic factors such as hydrology and nutrient loading, and the biotic composition, has led to a decline in wetland ecological integrity and ecosystem services. Yet, there are few examples of large-scale restoration of wetland systems. In recognition of this limitation, and to protect some of

New Zealand's foremost freshwater ecosystems, the Department of Conservation initiated the Arawai Kākāriki wetland restoration programme in 2007. The programme is focused on three large and diverse sites; a raised peat dome/riverine swamp system set in an agricultural landscape (Whangamarino), an inter-montane basin and braided river complex containing wetlands shaped by glacial landforms (Ashburton Basin/Ō Tū Wharekai), and a coastal complex supporting an extensive blanket bog and brackish lagoon (Awarua).

The ecological integrity of the Arawai Kākāriki sites varies between wetland types, which is a function of the level of hydrological connectivity to catchment processes. Ombrotrophic wetlands are under pressure from altered biological composition, while surface water fed systems are altered by both biotic and abiotic factors. Due to the range of threatening processes, research to improve knowledge of ecological processes and options for restoration has been a key feature of the programme.

Examples are presented to illustrate the approaches used to set restoration goals, establish monitoring programmes for reporting on restoration outcomes, and the management of invasive weeds, nutrient enrichment, altered water regimes, and introduced mammalian predators. These case studies illustrate the value of Arawai Kākāriki in providing national guidance for wetland restoration, including methods and indicators to measure restoration success.

Effects of climate variation and management practises on the carbon balance of a Waikato dairy farm

Susanna Rutledge[1], Paul Mudge[1,2], Dave Campbell[1], Dirk Wallace[1*], Louis Schipper[1],

[1] Department of Earth and Ocean Sciences, University of Waikato, Private Bag 3105, Hamilton 3240

[2] AgResearch, Ruakura Research Centre, Private Bag 3115, Hamilton 3240

[*] Current address: Plant and Food Research, Private Bag 1401, Havelock North 4157

Email: s.rutledge@waikato.ac.nz

Recent research has shown that soils on flat land used for intensive dairy farming in New Zealand have lost large amounts of carbon (~1 t C ha^{-1} y^{-1}) over the past few decades, and the causes of these losses are poorly understood.

To quantify the effect of climate variability and management practices on the C balance of dairy farms, the net ecosystem CO_2 exchange (NEE) of an intensively grazed dairy pasture on a farm near Hamilton was measured using eddy covariance from December 2007 onwards. The net ecosystem carbon balance (NECB) was determined by combining NEE data with measurements and estimates of other C imports (feed) and C exports (milk, methane, silage and leaching).

2008 and 2009 were characterised by contrasting climate conditions. During 2008, there was a severe drought during late summer and autumn followed by a mild, wet winter, whereas 2009 was characterised by higher moisture availability in summer/autumn, but less favourable growing conditions during a relatively cold winter. Despite these contrasting conditions, the site was a sink for both CO_2 (NEE of -1610 and -2290 kg C ha^{-1} y^{-1} for 2008 and 2009, respectively) and C (NECB of 590 and 890 kg C ha^{-1} y^{-1} for 2008 and 2009, respectively) during both years. In 2010, paddocks surrounding the EC tower were cultivated, and results of preliminary data analysis aimed at quantifying the resulting C loss and recovery following replanting will be presented.

Future work will focus on using a paired tower approach to quantify the effect of different management practices on NECB while accounting for differences in year to year climate.

Invasive species management in the eastern Pacific – Lessons for New Zealand

Alan Saunders

Landcare Research, Private Bag 3127, Hamilton

Email: SaundersA@landcareresearch.co.nz

The number and scale of island restoration projects in the eastern Pacific is increasing. Significant achievements have been reported from the Galapagos Archipelago, Ecuador following a major, multi-facetted invasive species management programme there. A study of the feasibility of eradicating or controlling a range of invasive animals and plants in the Juan Fernandez Archipelago, Chile, has also just been completed. Important lessons have been learned from both of these activities which are relevant to ecological restoration in New Zealand – on islands and at mainland sites. Research aimed at improving our ability to detect animal pests at low densities would improve confidence in declaring eradication success, as well as reducing the costs of on-going surveillance programmes and contingency actions. A focus on new opportunities to more effectively control or eradicate invasive plants would also have significant impacts. Understanding local issues and perspectives may be a critical first-step in gaining community support for conservation outcomes. These and other themes which have emerged from studies and reviews in the eastern Pacific will be discussed in relation to their relevance to New Zealand.

Changes in soil carbon stocks in New Zealand pastures over the last century

Louis Schipper[1], Troy Baisden[2], Mike Dodd[3], Roger Parfitt[4], Craig Ross[4], Graham Sparling[1]

[1] Earth and Ocean Sciences, University of Waikato, Private Bag 3105 Hamilton

[2] GNS Science, PO Box 31-312, Lower Hutt

[3] AgResearch, Private Bag 11008, Palmerston North

[4] Landcare Research NZ Ltd., Private Bag 11 052, Palmerston North

Email: Schipper@waikato.ac.nz

Over the last century, there have been enormous changes in land cover of New Zealand as native bush was converted to grazed pasture. Pasture growth was increased through addition of fertilisers and improved land management practices supporting greater stocking rates. These changes in land cover and management have also altered stocks of soil organic matter, which is a major global carbon store. We summarise a number of research projects that measured changes in soil carbon stocks in pastures. Initially, soil carbon increased as native vegetation was converted to pasture in the early to mid-decades of the 20th century. This soil carbon appears to have reached a steady state in grass grazed by drystock (sheep/beef) on flat land in the last few decades but has declined on flatland grazed by dairy cows. There are numerous hypotheses for this difference in net carbon dynamics. On hill country, grazed by drystock, soil carbon has increased and this has been partly attributed to the long-term recovery of soil carbon following erosion after initial land clearance. We demonstrate that care must be taken when measuring soil carbon stocks because the large temporal and spatial variability can mask changes in soil carbon or lead to apparent changes where carbon content may actually be varying around a steady state. The trajectories of ongoing changes in soil carbon as land use intensifies are not clear and management practices that increase soil carbon are being investigated.

Water use characteristics of cacao and associated shade trees in an agroforestry system, Indonesia

Schwendenmann, Luitgard[1]; Köhler, Michael[2]; Hölscher, Dirk[2]

[1] School of Environment, The University of Auckland, Private Bag 92019, Auckland

[2] Tropical Silviculture and Forest Ecology, Burckhardt Institute, University of Göttingen, Büsgenweg 1, 37077 Göttingen, Germany

Email: l.schwendenmann@auckland.ac.nz

Sap flux and soil water utilization of cacao (*Theobroma cacao*) and associated *Gliricidia sepium* shade trees were investigated in a 6-year-old agroforestry system on Sulawesi, Indonesia. The objective of the study was to (1) determine water use rates of cacao and Gliricidia trees, (2) identify environmental and tree structural factors controlling water use, and (3) assess the soil water use pattern for each tree species. Sap flux density was measured over 13 months in 9 trees per species using thermal dissipation (Granier) sensors. We identified soil water sources by comparing the stable isotope signature of deuterium (δD) in soil water and xylem. Additionally, micrometeorological parameters and tree structure were determined. Cacao and Gliricidia differed significantly in their water use characteristics. For example, cacao had lower average daily water use rates (10 kg day^{-1}) compared to Gliricidia (14 kg day^{-1}) and responded differently to changes in vapour pressure deficit and radiation. Comparisons of δD showed that cacao trees obtained the highest proportion of their water from the upper (0-30 cm) soil horizon. In contrast, Gliricida tented to take up a higher share of their water from deeper layers (30-100 cm soil depth). The vertical partitioning in water uptake may limit competition between cacao and Gliricidia for soil water resources. In summary, in the given agroforestry stand, species differed in their water use and soil water uptake pattern.

The conservation values of plantation forests for New Zealand's indigenous birds

Richard Seaton

Wingspan Birds of Prey Trust, 276 Grey Street, Palmerston North

Email: richseaton@gmail.com

Commercial pine plantations made up of exotic tree species are increasingly recognised as habitats that can contribute significantly to the conservation of indigenous biodiversity in New Zealand.

Many native bird species inhabit plantation forests including several threatened species. The New Zealand falcon (*Falco novaeseelandiae*) or Karearea, is a threatened species that has been found breeding in particularly high numbers throughout the pine forests of the North and South Islands. Commercial interests and the conservation of biodiversity are often seen as opposing interests. However, an increasing body of research illustrates that if suitable land management practices can be identified, exotic plantation forestry and indigenous biodiversity conservation need not be mutually exclusive land-use options.

This presentation summarises what we know about the use of plantation forests by avifauna in New Zealand, and uses a case study on New Zealand falcons to investigate how plantation forests can be managed to encourage indigenous biodiversity on private land.

Forest ecology in the golden age of New Zealand science: the life and work of John Nicholls

Mark C. Smale[1]

[1]Landcare Research, Private Bag 3127, Hamilton

Email: smalem@landcareresearch.co.nz

The recent passing of John Nicholls marks the end of an era in New Zealand forest ecology. John s involvement with the seminal National Forest and subsequent Ecological Surveys laid the foundations for a career that progressed from forest classification and mapping to reserve designation and finally, biogeographic classification, spanning a succession of highs and lows in native forest research at the Forest Research Institute. Although generously resourced in the era when Government policy was to mine native forests for cheap timber to feed the post-war construction boom, at the same time entertaining the hope of some management for continuing timber harvest, native forest research was not free from the whims of new directors. It was later to find itself sandwiched between the demands for preservation by a newly invigorated conservation movement, the existence of long-term timber supply contracts that enabled industry to invest in more efficient sawmills, the intransigent insistence by some Forest Service Conservancy foresters that logging continue, albeit selectively, and the inevitable need to maintain scientific objectivity. Notwithstanding his pioneering North Island forest classification with Peter McKelvey and later crucial contribution to the national Ecological Region and District classification, John's most enduring contribution is perhaps the creation of 'Ecological Areas'. Initially foreseen as representative islands of residual native forest in a sea of monotonous plantation, they are regarded as having intrinsic scientific values on a par with those of National Parks but remain to become the general focus of intensive conservation management.

Foraging behaviour and time-activity budgets of the North Island saddleback (*Philesturnus carunculatus rufusater*)

Alana Smith[1], Isabel Castro[1], Murray Potter[1]

[1] Massey University, Palmerston North

Email: a.smith1@massey.ac.nz

The North Island Saddleback (*Philesturnus carunculatus rufusater*) underwent a huge population bottleneck in the 1900s that decreased their population to about 1000 individuals. Through management, the numbers have increased to the current population size of approximately 6630. Little is known about foraging behaviour and time-activity budgets of saddleback, and how these vary with season and sex. The current study examined the foraging behaviour and time-activity budgets of saddleback between June 2010 and February 2011 on Mokoia Island, Lake Rotorua. Time spent foraging and engaging in other activities varied through time and with respect to breeding. These patterns, along with how and where they forage, will be discussed.

Biodiversity management in the Bay of Plenty

Simon Stokes[1], Annabel Beattie[2]

[1] Bay of Plenty Regional Council

Email:simon.stokes@boprc.govt.nz

Achieving biodiversity management on private land to halt habitat decline and to attain some level of ecological integrity is one of the remaining complex issues that biodiversity managers and ecologists face. Since 2009 the Bay of Plenty Regional Council through its 2009-2019 Ten Year Plan, has focused on this issue of biodiversity management on private land to address the continual decline of our threatened and non-threatened habitats from stock, animal and plant pests and rural subdivision. It has developed a biodiversity programme and standard operating procedures to support the voluntary uptake of biodiversity management on private and when appropriate, public land, where the main focus is applying a long term approach to animal and plant pest management, outcome monitoring, and site infrastructure management. This is new ground for the Bay of Plenty Regional Council as it moves from applying grant funding to the fencing of sites on private land with protection mechanisms in place, to addressing the fundamental problem all biodiversity managers grapple with: the long term planning, monitoring, and funding of a site to halt habitat decline on private land. The Bay of Plenty Regional Council has recognised that fencing and protection mechanisms are important but are not the final solution, and therefore apply an approach that will ensure much more commitment and funding long-term, when the landowner and other partners are willing to 'partner in agreement' long term biodiversity management. A paper and presentation will explore the background to the region's biodiversity, examine the biodiversity programme, and discuss questions that still remain since its inception.

Invasive *Spartina* as a model of current and future ecological research

Donald R. Strong

Department of Evolution and Ecology, University of California, Davis, USA

Email: drstrong@ucdavis.edu

Over a long history, the New Zealand Ecological Society and the other great ecological societies of the world have morphed from endeavors very heavy on the basic science side of research to a hybrid model dominated by environmental research and applications that combines basic with social science. Social science means subjective, potentially incompatible, views of different parties. While we are obliged to engage with the spectrum of points of view (social science), our most basic obligation is to basic science: objectivity, rationality, transparency, and propositions subject to refutation. I will illustrate these ideas with examples from invasive *Spartina*, which has a long history of relevance to the practice of ecology in New Zealand. The basic science has shown *Spartina* species to be powerful ecological engineers that define shorelines of temperate coasts. Where *Spartina* has been introduced, rapid spread and dense monocultures are the norm.

Some introductions have led to highly invasive hybrids between native and introduced *Spartina* species. From the social science side, the potential to terrestrialize shorelines was the rationale of many of the scores of *Spartina* introductions to Europe, China, and around the Pacific. After failing to deliver utility and threatening native species, *Spartina* introductions have come to be seen by the majority as a bane to the ecology and human uses of salt marshes. However, subjectivity is alive and well in the milieu

of invasive species in general and introduced *Spartina* in particular; non-native *Spartina* has its advocates in both the east and the west. With invasive species as with every environmental issue, basic science is the most powerful contributor to rational discourse and value to society.

Kiwi management with aerial 1080: does aerial 1080 improve kiwi chick survival?

Jessica Scrimgeour[1], Nicole Sutton[2]

[1] Department of Conservation

Email: jscrimgeour@doc.govt.nz OR nsutton@doc.govt.nz

Tongariro Forest Kiwi Sanctuary is one of five sanctuaries nationally, with the objective of testing the benefits of aerial 1080 on kiwi populations, particularly kiwi chick survival. An aerial 1080 (sodium fluoroacetate) operation was carried out in Tongariro Forest Kiwi Sanctuary in September 2006. Mustelids, in particular stoats (*Mustela erminea*), are the primary predator of North Island brown kiwi chicks (McLennon *et. al*., 1996). The aerial 1080 operation was targeted at possums and rats (1080 at 0.08% wet weight, applied at four kilograms per hectare over 20,000ha); stoats prey upon the rats and die from secondary poisoning. Result monitoring using small mammal indexing showed promising results. Prior to the 2006 operation, stoats were tracking at 19%. After the 2006 operation, the tracking rate was zero. Using the Kaplan-Meier method, kiwi chick survival in the season before the 1080 operation was calculated as 27%, which increased to 69% in the season immediately after the 1080 operation. The following season it remained high at 59%, but by the third season after the 1080 operation survival decreased to 22%. This experiment is currently being replicated, with another aerial 1080 operation planned for August 2011.

Do small-seeded species disperse further than large-seeded species?

Fiona J. Thomson[1,2,3], Angela T. Moles[2], Tony D. Auld[4], Richard T. Kingsford[2,3]

[1] Landcare Research

[2] Evolution & Ecology Research Centre, University of New South Wales.

[3]. Australian Wetland and Rivers Centre, University of New South Wales.

[4]. Department of Environment, Climate Change and Water, Sydney.

Email:ThomsonF@landcareresearch.co.nz

It is often assumed that there is a trade-off between maternal provisioning and dispersal capacity, leading small-seeded species to disperse further than large-seeded species. However, this relationship has only been quantified for species from particular sites, or with particular dispersal syndromes. We present the first global quantification of the cross-species relationships between dispersal distance and two important plant traits; seed mass and maximum plant height. We found that seed mass was positively related to mean dispersal distance, with a 100-fold increase in seed mass being associated with a 4.5-fold increase in mean dispersal distance across 210 plant species. Interestingly, we found that plant height had substantially

stronger explanatory power than seed mass, and that a 5-fold increase in height was associated with a 4.6-fold increase in mean dispersal distance (across 211 species). Once plant height was accounted for, we found small-seeded species dispersed further than did large-seeded species, although seed mass accounted for only a small amount of the variation in the final model. Within dispersal syndromes, tall species dispersed further than did short species, while seed mass had little influence on dispersal distance. Our results show the key role plant height can play on the mean and maximum distances that plant species disperse.

Flowering in snow tussock (*Chionochloa* spp.) is influenced by temperature and hormonal cues

Matthew H. Turnbull[1], Richard P. Pharis[2], Leonid V Kurepin[2], Michal Sarfati[1], Lewis N. Mander[3], Dave Kelly[1]

[1]School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand;

[2]Biological Sciences Department, University of Calgary, Calgary, Alberta T2N 1N4 Canada;

[3]Research School of Chemistry, Australian National University, Canberra, A.C.T. 0200, Australia

Email: matthew.turnbull@canterbury.ac.nz

Snow tussocks (*Chionochloa* spp.) in New Zealand exhibit extreme mast (episodic) seeding which has important implications for plant ecology and plant-insect interactions. Heavy flowering appears to be triggered by very warm/dry summers in the preceding year. In order to investigate the physiological basis for mast flowering, mature snow tussock plants in the field and younger plants in a glasshouse and shadehouse were subjected to a range of manipulative treatments. Field treatments included combinations of warming, root pruning and applications of native gibberellins (GAs) GA_3 and GA_4, after which flowering intensity was assessed. Warming, GA_3 alone, and especially warming+GA_3, significantly promoted flowering, as did applications of GA_4, alone and GA_4 + CCC (2-chloroethyltrimethylammonium chloride). Our results provide support for the concept that mast flowering events in tussock species are causally related to high temperature-induced increases in endogenous gibberellin levels. It is likely that GAs (endogenous or applied) promote the continued development of a previously long-day induced floral apex. In addition to promoting flowering, applied GA_3 also disturbed the plant's innate resource threshold requirements, as shown by the death, over winter, of many non-flowering tillers. Applied GA_4 did not show this effect, likely due to its rapid metabolism to inactive metabolites. A gibberellin-mediated role for high temperature-induced flowering could have important implications for regulating the evolutionary interaction between these masting plants and their seed predators.

Detecting invasion and/or survival post eradication using genetic methods: the stoat on New Zealand's islands

Andrew Veale[1], Ass. Prof. Dianne Gleeson[1,2], Prof. Mick Clout[1]

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

Email: avea002@aucklanduni.ac.nz

As invasive mammals are eradicated from a growing number of islands around the world, the risk of reinvasion is of increasing concern. Understanding the process of invasion, the structure of isolated populations of invasive mammals, and the detectability of new invaders are important aspects of the growing field of invasion ecology. Within the New Zealand environment, the primary threat to native fauna on coastal islands is the stoat (*Mustela erminea*); a voracious predator that can swim at least 3.0 km. Numerous stoat eradication programs are currently underway on New Zealand's islands, however on many of these islands stoats are still being caught. Using genetic techniques it is possible to assess where these stoats came from – are they surviving residents or invading migrants? Through this we can assess the level of success of eradication programs, and we can model the invasion rate and the population predicted on these islands. Results to date indicate that stoats can swim further, and do so more regularly than previously thought. This reinforces the need for ongoing management and biosecurity after an eradication operation. The results also highlight the need for pre-eradication genetic sampling for invasive species – even in situations where reinvasion is considered unlikely.

Recent progress in kakapo conservation

Deidre Vercoe-Scott[1], Jo Ledington[1], Daryl Eason[2], Graeme Elliott[2], Ron Moorhouse[2]

[1] Department of Conservation, Southern Islands Area Office, Invercargill

[2] Department of Conservation, Nelson/Marlborough Conservancy, Nelson

Email: dvercoe@doc.govt.nz

The kakapo is the only flightless parrot, the heaviest parrot in the world and the only parrot with a lek mating system. Widespread and abundant throughout the main islands of New Zealand before human colonisation, habitat loss and the introduction of mammalian predators drove the kakapo to the brink of extinction. Although the translocation of kakapo to offshore island sanctuaries slowed the species' decline, recruitment remained insufficient to compensate for adult mortality. By 1995 the population had fallen to a nadir of just 51 birds. Intensive management implemented in 1995 has resulted in the population more than doubling to 131 birds in 2011. Young birds hatched on offshore island sanctuaries now outnumber the original founders rescued from Stewart Island and are expected to live for 60 years or more. Poor hatching success due to inbreeding remains a significant cause of lost potential productivity. Artificial insemination and DNA fingerprinting have been used in an effort to improve hatching success and the genetic health of the population; at least three chicks have so far been produced through artificial insemination. The modern conservation history of the kakapo spans 40 years from Wildlife Service expeditions to Fiordland and Stewart Island in the 1970's to the current intensive management programme on offshore island sanctuaries. The late Don Merton played a key role in kakapo conservation throughout this 40 year period. His legacy with regard to kakapo includes the establishment of kakapo on safe, offshore island sanctuaries and the preservation of invaluable genetic material from Fiordland.

Evidences of social structure within shoals of juvenile non-diadromous galaxiids

Aurelien Vivancos[1], Gerry Closs[1], Shannan Crow[2], Mike Paulin[1]

[1] University of Otago, Dunedin, New Zealand

[2] National Institute for Water and Atmospheric research, Christchurch, New Zealand

Email: vivau915@student.otago.ac.nz

Social behavior and interactions between conspecifics can be observed in almost the whole animal kingdom and form the foundation of social structure. Because social structure directly influences important ecological process such as resource partitioning or reproductive success, it is a key element in population biology. Social behaviors are frequently observed in fish competing for food and/or habitat. For potentially large stream-dwelling fish like salmonids, the patchy environment combined with significant variation in fish size generally leads to the formation of a dominance hierarchy, where the dominant (usually largest) fish occupies and defends the most valuable territory. While extensive work has been undertaken on the social structure of juvenile salmonids, the social behavior of smaller fish species where all fish are of a similar size, such as juvenile non-diadromous galaxiids, is yet to be studied in any detail. My research aims to examine social behavior of juvenile non-diadromous flathead galaxiids (*Galaxias anomalus*) and determine if social structure exists. We used stereo video footages taken in vivo from a small stream in the Taieri catchment, Otago. Footages were then processed using VidSync software (developed by Jason Neuswanger, University of Fairbanks, Alaska, U.S.A) that allows a model to be generated of fish movements and behavior in three dimensions. This technique generates quantitative data that allowed a robust analysis of fish behavior. Frequent social interactions between individuals were observed and preliminary results suggest space partitioning within shoals. These behaviors can be considered to strong evidence of social structure.

Biome conservation, niche partitioning and assembly of restiad wetlands in New Zealand

Steven J. Wagstaff[1], Beverley R. Clarkson[2]

[1]Allan Herbarium, Landcare Research, PO Box 40, Lincoln 7640,

[2]Lancare Research, Private Bag 3127, Hamilton

Email: wagstaffs@landcareresearch.co.nz

Theoretical predictions suggest the assembly of insular floras reflects a balance between immigration, colonization, diversification and extinction. Our phylogenetic analysis of three chloroplast DNA regions place the five New Zealand species of Restionaceae into three independent lineages. While microfossil evidence indicates members of the Restionaceae were present in New Zealand during the Oligocene, the molecular–based divergence estimates suggest *Empodisma* and *Sporadanthus* colonized New Zealand during the late Pliocene, whereas *Apodasmia similis* is a more recent immigrant diverging from its MRCA during the Pleistocene. This anomaly can be reconciled if earlier lineages of Restionaceae went extinct and were replaced by the species that persist to the present. Restiads have successfully colonized biomes in New Zealand that are similar to those of their Australian ancestors. We propose they avoided competition by geographical isolation and niche partitioning. *Empodisma*

minus is the most widespread species, and inhabits freshwater bogs and fens of coastal to alpine zones on North, South and Stewart Islands. It is replaced by the newly described species *Empodisma robustum,* north of 38° S. latitude on North Island. *Sporadanthus ferrugineus* is also restricted to north of 38° S latitude, where it dominates old raised bogs. In these systems, *Sporadanthus ferrugineus* and *Empodisma robustum* coexist, but avoid competition by stratification, and utilizing different peat rooting zones. *Sporadanthus traversii* is endemic to freshwater peat bogs on Chatham Island. *Apodasmia similis* is widespread in coastal marshes throughout New Zealand, being tolerant of saline conditions, although it also grows in freshwater marshes associated with lakes.

Willows and weevils: beetle community responses to grey willow (*Salix cinerea*) invasion within three Waikato wetlands

Corinne Watts[1], Maheswaran Rohan[2] and Danny Thornburrow[1]

[1]Landcare Research, Private Bag 3127, Hamilton

[2]Research and Development Group, Department of Conservation, Hamilton

Email: wattsc@landcareresearch.co.nz

In New Zealand, willows (*Salix* species) are major invaders of riparian zones and wetlands. However, the impacts of willows on the invertebrate fauna within wetlands have yet to be quantified. This study investigated the effects of invasion by grey willow (*Salix cinerea*) on the species richness, abundance, and composition of the beetle communities within three Waikato wetlands with varying willow densities and invasion stages. Beetles were sampled using malaise traps within four vegetation types; native wetland vegetation, native wetland vegetation nine years after grey willow removal, native wetland vegetation undergoing grey willow invasion, and dense grey willow-dominated vegetationNative wetland vegetation had a significantly lower species richness and abundance of beetles than willow-dominated vegetation. However, the beetle communities sampled from native wetland vegetation were dominated by native detritivorous beetles compared with willow-dominated vegetation which were characterized by introduced herbivorous beetles. The beetle community composition differed significantly between grey willow-dominated vegetation and native wetland vegetation, and the taxa responsible for the differences seemed to be responding to changes in the structural complexity of the vegetation. The beetle communities within native wetland vegetation after grey willow removal were most similar to those within the native wetland vegetation. From a conservation perspective, these results are encouraging and suggest that although grey willows dramatically alter the composition of beetle communities present, through the removal of the willows these communities can be restored to compositions similar to those found within native wetland vegetation within nine years.

Vulnerability of New Zealand's indigenous grasslands based on statistical models of recent land use intensification

Emily S. Weeks[1], Susan Walker[2], Jake McC. Overton[3], Bruce D. Clarkson[1]

[1] The University of Waikato, Department of Biological Sciences, Private Bag 3105, Hamilton 3240, New Zealand.

[2] Landcare Research, Private Bag 1930, Dunedin 9054, New Zealand

[3] Landcare Research, Private Bag 3127, Hamilton 3240, New Zealand

Email:weekse@landcareresearch.co.nz

To be effective, conservation planning needs to better anticipate the rates and patterns of dynamic threats to biodiversity, such as rapidly changing land use trends. This is a pressing need in temperate grasslands internationally, and New Zealand's indigenous grasslands are a good example. Although the area of formally protected temperate grasslands in New Zealand has increased in recent decades, low to mid-altitude systems continue to be poorly protected and land use intensification has accelerated in recent years. Remaining indigenous grassland areas were reduced by 3% between 1990 and 2008, and assessment is urgently needed to identify remaining areas most in need of protection. We used quantitative spatial models to predict the vulnerability of New Zealand's remaining indigenous grassland to conversion for the first time, based on new mapping of past and current land use in relation to patterns of climate, topography, soils, and proximity to infrastructure (i.e. roads) or existing development. Overall, areas most vulnerable to conversion are located at moderate to high elevations with low slopes that have previously been classified as more suitable for low productivity extensive grazing. We also found regional variation. We show that the most vulnerable grasslands have not been targeted for conservation in recent land reforms despite recognition of their significance in other New Zealand conservation planning tools. We demonstrate how rapidly conservation priorities may change over time, and the importance of regularly-updated spatial land use information, by comparing models based on land use data from earlier time periods and other recent New Zealand conservation prioritization tools.

Forests as carbon sinks – benefits and consequences

David Whitehead

Landcare Research, PO Box 40, Lincoln 7640, New Zealand

Email: whiteheadD@landcareresearch.co.nz

With their ratification of the Kyoto Protocol, many countries have established forests on previously non-forested land with the view of offsetting greenhouse gas emissions. While these forests indisputably result in increased carbon storage in above-ground biomass, consideration of other major implications is often neglected. Forest establishment results in changes in albedo and soil carbon storage, reduced run-off and downstream water supply and effects on biodiversity. Such effects of forest establishment may be less desirable from environmental, economic and social perspectives. While there have been many studies of the impacts of forest establishment on individual aspects, policy makers need to be able to integrate the benefits and consequences to assist in making decisions on land management. Further, the relative magnitudes of the effects of forestry need to be considered in the context of elevated atmospheric carbon dioxide partial pressure and climate change

resulting in increasing temperature and changes in the amount and distribution of rainfall. This introductory review highlights the major benefits and consequences of forest establishment and demonstrates progress in integrating across the services provided by forests. New modelling approaches are being developed that allow analysis of benefits, consequences and trade-offs to assist policy makers in decisions to manage the provision of multiple resources.

Dama wallabies: *"Eating the Heart out of the Heartland".* After nearly 100 years, are we any closer to knowing how to manage them?

Dale Williams[1], Johlene Kelly[2] and David Byers[3]

[1] Bay of Plenty Regional Council

[2] Department of Conservation

[3] Waikato Regional Council

Email: dale.williams@boprc.govt.nz

Dama wallabies (*Macropus eugenii*) were liberated in the Bay of Plenty in 1912. Since then their feral range has expanded to cover approximately 180,000 ha. In 2006 the Department of Conservation, along with the Bay of Plenty and Waikato Regional Councils, implemented a management plan for dama wallabies. This paper reviews the gains made to date, including the establishment of a multi-agency Wallaby Management Team and highlights issues requiring resolution in the attempt to manage wallaby impacts and prevent further expansion of the feral range. A tiny proportion of New Zealand's vertebrate pest research has concentrated on wallabies, so the Management Team faces significant knowledge gaps around wallaby behaviour and has access to few robust monitoring tools and control methods. A low level of public awareness about the threat to biodiversity posed by wallabies and increasing public concern about some pest control methods exacerbates these issues. As the Wallaby Management Team plans to proceed with control operations, targeting new incursions and populations outside of the feral range, an "Adaptive Management" approach will be followed. This will maximise the benefits from knowledge gained during the course of the work. New technologies; DNA analysis, digital trail cameras, and miniaturised GPS tracking devices could shed light on unanswered questions around wallaby behaviour, interactions with baits and other species such as possums. The Wallaby Management Team also requires some "pure science" research on dispersal behaviour, so invasion pathways can be identified and managed.

.Is *Lantana camara* a cause or symptom of biodiversity decline in dry tropical forests?

Gaius Wilson[1] and Wayne L. Linklater[1]

[1]Centre for Biodiversity and Restoration Ecology, School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington, New Zealand

Email: Gaius.Wilson@vuw.ac.nz

Weed invasion is associated with biodiversity decline but also facilitated by habitat disturbance. It is often unclear, therefore, whether the biodiversity decline is caused by weed invasion or the disturbances associated with other forms of habitat degradation. *Lantana camara L*. has invaded tropical dry forests and appears to cause a reduction in the food species of native herbivores, like elephant. The current focus on Lantana sp. removal to manage herbivore habitat, however, may be a case of treating the symptom, not the cause of habitat degradation. We used an information theoretic approach to evaluate alternative hypotheses for Lantana sp. invasion in the 321 km^2 Mudumalai Tiger Reserve, India. Sixty-seven 1-km transects were randomly placed throughout the reserve, each including 11 10×1 m sample plots at 100m intervals, to measure Lantana sp. invasion index (a composite of Lantana sp.stem girth× height × density) and measure sites biological and physical characters. Lantana camara index varied from 0.12 to 477 and 306 or 42% of the strips had no Lantana camara stems present. Grass cover was the only model to receive substantial support ($\Delta AIC<2$, w_i = 0.958) and most models received no support $\Delta AIC>10$, $w_i<0.0005$). Grass cover appears to limit Lantana sp. invasion. A model including forest type and disturbance which included lopping, distance to roads and settlements, received weak some support ($\Delta AIC<7$, w_i = 0.041). Evidence suggests that weed invasion may be facilitated by habitat disturbance. The management of habitat for native herbivores might be more effective if it focussed on mitigating anthropogenic disturbance of grass cover than Lantana sp. as the primary cause of biodiversity decline amongst native herbivore food species.

Satellite tracking reveals kereru occupy large home ranges at landscape scale

Wotton, Debra M. [1,2], Powlesland, Ralph G. [1], and Moran, Les R. [1]

[1] Department of Conservation, [2] Landcare Research

Email: wottond@landcareresearch.co.nz

Kereru (New Zealand pigeon, *Hemiphaga novaeseelandiae*) are major dispersers of fleshy-fruited plants in New Zealand. However, there are few reliable measurements of kereru home ranges. Using satellite transmitters, we recorded the locations of four kereru (one male and three females) in Invercargill, Southland, during 2005–06 for between 42–305 days. Fifty-four percent of locations recorded were accurate to within 1 km, and these locations (603 in total) were used to determine the birds' movements and home ranges. Three kereru crossed Foveaux Strait (a minimum distance of 33 km) to Stewart Island during December to March, coinciding with the breeding season. The fourth kereru remained around Invercargill. One individual flew more than 480 km during a 100-day period, crossing Foveaux Strait at least four times. The maximum distance between successive locations and between locations overall ranged from 8.6–98.6 km and 11.4–101.9 km, respectively. Kereru home ranges, as determined by cluster analysis, ranged from 619 ha to 31,732 ha, 100–1000 times greater than

estimated in previous studies. Such large home ranges may be due partly to the fragmented nature of Southland forests and lower density of fleshy-fruited plants compared to northern regions. Given the long-distance movements kereru make, often to locations far from roads and tracks, satellite telemetry is probably the most reliable and cost-effective method of determining their locations. As long-distance seed dispersers, kereru may play a critical role in maintaining the diversity of fleshy-fruited species in fragmented forests.

Predators, poisons and silent forests

Jan Wright

Parliamentary Commissioner for the Environment

My decision to undertake an investigation into 1080 was not taken lightly. What more could there possibly be to say about this controversial toxin? It turned out to be a fascinating investigation -- there was a lot more to say and how it was said mattered enormously. I will speak on aspects of the investigation that I personally found fascinating.

Kauri, the ecosystem engineer

Sarah V. Wyse, Bruce R. Burns and Shane D. Wright

University of Auckland

Email: swys001@aucklanduni.ac.nz

Ecosystem engineering is a concept describing the mechanisms by which an organism may modify its ecosystem and thus influence its co-habitant species. New Zealand kauri (*Agathis australis*) is known to exert a substantial influence on soil properties and nutrient cycling, however less is known about the potential importance of the species in shaping habitats or its influence on its associated plant communities. In this study we investigated the influence of *A. australis* on plant community composition at stand and individual tree scales, and examined environmental conditions and plant composition along a gradient of proximity to mature *A. australis* specimens. We found a significant effect by this species on both its biotic and abiotic environment that was substantially greater than that of rimu (*Dacrydium cupressinum*), another co-habitant conifer species of almost similar size and lifespan, particularly in regard to nutrient levels, moisture regimes and community composition. We recorded a change in species composition in the vicinity of *A. australis* compared to forest without this species in the same environment. Species that occurred close to *A. australis* were those tolerant of nutrient poor conditions and, depending on underlying site characteristics, either drought or waterlogging, but otherwise show dissimilar habitat preferences. The current reported dieback of *A. australis* as a result of *Phytophthora* taxon *Agathis* may therefore have greater consequences for biodiversity change of these northern forests than anticipated.

Valuing biodiversity enhancement in New Zealand's planted forests: socioeconomic and spatial determinants of willingness to pay

Richard Yao[1], Riccardo Scarpa[2], James Turner[3], Tim Barnard[1] and John Rose[4]

[1] Scion (Forest Research Institute), Rotorua, New Zealand

[2] University of Waikato, Hamilton, New Zealand

[3] AgResearch, Hamilton, New Zealand

[4] The University of Sydney, Australia

Email: richard.yao@scionresearch.com

In this presentation, we report our findings from an economic valuation exercise designed to estimate the non-market values associated with the enhancement of biodiversity in New Zealand's planted forests. Using advance choice models, the panel nature of the choice data set is exploited to calculate the willingness-to-pay (WTP) for biodiversity enhancement of each individual in the sample of survey respondents. Panel random-effects regression models are subsequently employed to determine the factors that influence individual-specific WTP values. The variables examined as determinants of WTP include socioeconomic characteristics and spatial distance to planted forests. To include spatial data into the choice data set, we calculated spatial variables derived from geo-spatial referenced coordinates of each respondent and digital maps with locations of large planted forests (forest stands with areas of at least 5,000 hectares). Results from our choice modelling exercise suggest that, accounting for different sources of biases, New Zealand taxpayers would be willing to pay $26 million per year for five years for a proposed biodiversity enhancement programme in planted forests. Estimates from the random effects regression model suggest that higher education and affiliation with conservation organisations are positively associated with WTP. Model results also indicate that respondents living within a 10 kilometre radius of large planted forests would be willing to pay more for the proposed biodiversity enhancement programme. These findings might be useful in planning for one the country's proposed afforestation scheme.

Which animals are dispersing New Zealand's alpine fruits?

Laura M. Young[1], Dave Kelly[1]

[1] School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

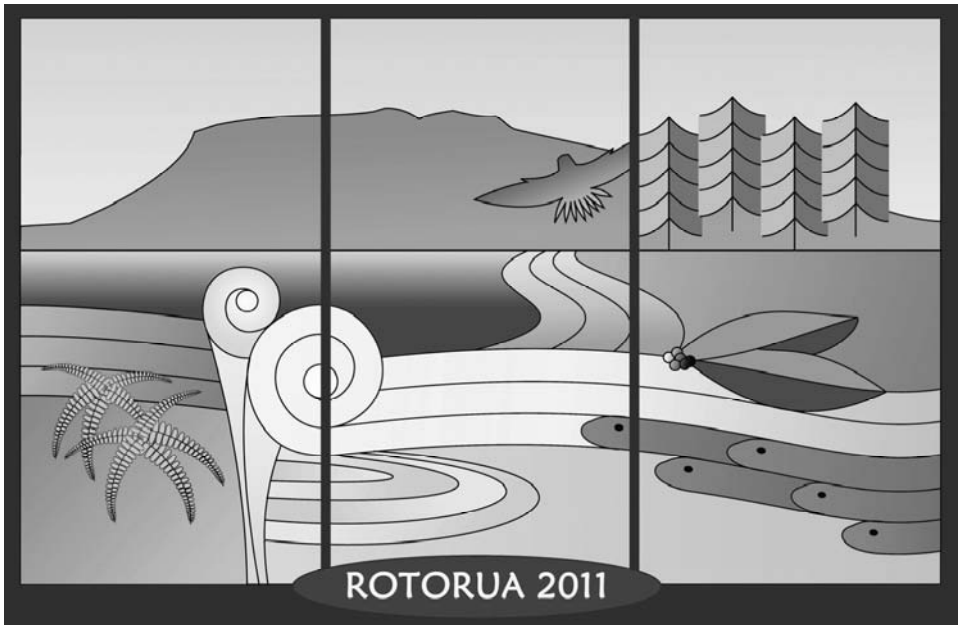
Email: laura.young@pg.canterbury.ac.nz

We conducted the first detailed study of frugivory-seed dispersal mutualisms in New Zealand's alpine ecosystems and investigated the relative roles of the few extant native alpine birds, lizards, and the exotic mammalian fauna and their contributions to seed dispersal. Fixed-area plots covering a total of 300 m^2 representing a range of montane to alpine vegetation types (shrub, open grassland, mat and herbfield and rocky scree) were monitored regularly by clearing all animal pellets over two fruiting seasons to determine the relative contributions of all animal dispersers at a community scale. We examined the relative densities of animals and preferred faecal deposition

sites in relation to vegetation and ground cover (and subsequent germination sites). Faecal analyses revealed quantities of fruit eaten and the effects of gut passage/mastication on seed quality. Additionally, we used infra-red cameras and field feeding observations to record frugivore activity directly. The role of kea in alpine plant seed dispersal has been scarcely investigated until now, and we provide strong evidence for high quality and quantity seed dispersal by kea. There is some dispersal by smaller native and introduced birds but their contribution is small and localised compared to kea dispersal. Mammals (hares, rabbits, possums, hedgehogs, pigs, sheep, deer, chamois) contribute significantly to seed dispersal, introducing mostly intact seeds in often high densities to most microhabitats. We report activity of several species (hedgehogs, possums) at altitudes higher than previously recorded. Overall there have been large shifts in disperser fauna in the mountains, with introduced mammals presumed to have replaced some now-rare or extinct native birds and lizards, but kea are now, and perhaps always were, the most important long-distance disperser.

NOTES

Ecology in the Heartland



Celebrating 60 years of the New Zealand Ecological Society

Poster Presentation Abstracts

NEW ZEALAND ECOLOGICAL SOCIETY

NZSPB
New Zealand Society of Plant Biologists

CONVEX event innovators

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

The introduced brown garden snail: inconspicuous threat to indigenous sand dune flora?

Michelle R. Blydenburgh[1]

[1] University of Auckland

Email: mcan025@aucklanduni.ac.nz

Invasive species are a major cause of global biodiversity loss. The majority of research on biological invasions has largely focused on vertebrate species with the smaller, more inconspicuous invertebrates commonly overlooked. Introduced gastropods in particular have been shown to influence the distribution and abundance of plant species through direct predation of seedlings and preferences to vulnerable species. In New Zealand, the introduced brown garden snail (*Cantareus aspersus*) is the most widespread and abundant land snail. However, few studies have investigated their impacts on New Zealand's flora. The snail is particularly common on North Island coastal dunes. With coastal dune ecosystems threatened in New Zealand, it is important to understand the feeding habits of these nocturnal herbivores on dune plant communities. My research aims to investigate the feeding preferences of snails on dune flora and the densities of snails within these coastal systems. Focus will be on those plants used in restoration and rehabilitation planting schemes as well as rare flora that could potentially be restored in the future. This work will become increasingly important as mammalian pest control increases on the mainland. Invertebrate populations benefiting from the removal of their predators and competitors, such as rats, hedgehogs and rabbits, will include both indigenous and introduced species. Therefore, potential impacts of invasive invertebrates, like the brown garden snail, need to be investigated.

Are long-tailed bat populations in plantations limited by roost numbers?

Kerry M. Borkin[1,2], Stuart Parsons[1]

[1] School of Biological Sciences, University of Auckland, Private Bag 92019 Auckland Mail Centre, Auckland 1142

[2] Current address: 22 Noni Street Turangi 3334

Email: k.borkin@clear.net.nz

Long-tailed bats (*Chalinolobus tuberculatus*) are vulnerable to extinction. Without management some populations may become extinct within 50 years. Long-tailed bats use plantation forests throughout New Zealand, but these populations' status is unknown. Managing these populations would help promote long-term survival of long-tailed bats. More knowledge was required to determine what factors might be limiting population growth before management plans could be developed. During the day bats find shelter – roosts – to protect them from weather and predators. Within roosts colonies (groups of ≥ 2 bats) congregate. Research suggests plantation forests have fewer roosts than native forests, and therefore outside native forests population sizes will be limited. We tested the prediction that bats would be limited by roost numbers by obtaining data on roost re-use and colony size within plantation forest and used literature to compare results with populations from native forest and rural landscapes.

To do this we captured bats and radiotracked them to roosts within Kinleith Forest, a Central North Island plantation forest. We characterised roosts and their re-use within the same summer period. *Pinus radiata* roosts were mainly in dead broken trees under peeling bark in stands near harvest age; such trees are rare. Roosts were re-used at far higher rates than those in native forests or rural habitats; colony sizes were smaller. High re-use of poorly insulated, rare, short-lived roosts, and small colony sizes, suggest roost numbers are limiting bat populations in plantations. If roost numbers are limiting, then increasing numbers of roosts should result in larger populations.

Towards robust exchanges: evaluating the use of ecological compensation under the Resource Management Act 1991

Marie A. Brown[1], Bruce D. Clarkson[1], Barry Barton[2]

[1] Centre for Biodiversity & Ecology Research, University of Waikato

[2] Faculty of Law, University of Waikato

Email: mab57@waikato.ac.nz

Compensating for ecological harm is an established practice under the Resource Management Act 1991(RMA), and elsewhere around the world. Compensatory mechanisms for ecosystem damage can include a range of positive conservation actions such as ecosystem restoration or creation, fencing, pest and weed control and legal protection. While requiring ecological compensation for adverse ecological effects is common; research and monitoring into the effectiveness of the actions is not.

Comprehensive research into the ecological outcomes of compensation agreements has been scarce worldwide, and not carried out in New Zealand to date. Our research is nationwide, and assesses 112 resource consents to determine the ecological outcomes being achieved. The lack of policy guidance in New Zealand has also meant that stakeholders in a development context have driven the use of the concept. The perspectives of these stakeholders are therefore pivotal to understanding the context in which ecological compensation is negotiated and implemented. These perspectives are being collected via a series of structured interviews with relevant stakeholders.

A stronger understanding of the context, processes and outcomes associated with the use of ecological compensation in an RMA context in New Zealand will provide valuable insights into establishing a more robust framework and generating more favourable ecological outcomes.

Kauri Dieback (3 Posters)

- **Kauri (*Agathis australis*) under threat from *Phytophthora*?**
- **Comparative efficacy of disinfectants against *Phytophthora* taxon Agathis (PTA)**
- **Approaching the origins of *Phytophthora* taxon Agathis**

RE Beever, NW Waipara, SE Bellgard, T Ramsfield, IJ Horner, MA Dick

S Tsai, D Park, PD Johnston, D Than

Landcare Research

Kauri (*Agathis australis*) forests are a distinctive component of the landscape in northern New Zealand. In 1972 a species of *Phytophthora* was isolated from dead and dying kauri on Great Barrier Island where it was associated with root and collar rot, and large bleeding lesions on the lower stem of affected trees. Inoculation tests demonstrated that this organism was pathogenic to kauri seedlings, indicating that it was likely to be implicated in the disease. Although identified as *P. heveae*, subsequent study using molecular techniques has indicated that it is a separate, but closely related species currently referred to as *Phytophthora* taxon Agathis (PTA).

Since the early 2000s PTA has been associated with increasing levels of ill-health in kauri in the Northland and Auckland regions. Symptoms include foliage yellowing, canopy thinning, extensive resin bleed from the lower trunk and tree death. Current research includes the monitoring of dieback sites, the pathogenicity of PTA to other tree and shrub species in the kauri ecosystem, surveys to determine the range and disease management methods. Attempts are also being made to resolve whether PTA is an introduction or an indigenous organism whose relationship with its host is influenced by changes in the local environment.

A joint agency response comprised of MAF, DoC and four regional councils has been established to implement measures that will limit the spread and impact of the disease. We illustrate the programme and the research with material from MAF, DoC and from researchers at Landcare Research, Scion, Plant and Food Research and Auckland University.

Valuing urban ecological restoration-market valuation using carbon credits

Emily Geck

University of Waikato with support from Hamilton City Council

Email: erag1@waikato.ac.nz

The field of economics is not well known for its involvement in environmental and ecological issues. However there are an increasing number of economists who recognise the need for collaboration between the two seeming incompatible worlds of the environment and the economy. This study looked into the valuation of urban forests in Hamilton City using carbon credits, a method which uses economic valuation techniques to derive a market for trade-able credits. The long run goal of this

study was to provide a platform for which urban restoration was seen as not only beneficial for the environment but also beneficial to the economic health of the city.

This method was applied to the valuation of carbon sequestered in Hamilton City's urban forests in order to estimate their worth if placed on the New Zealand Emissions Trading Scheme. It was found that currently the value of carbon credits in the city's urban forests was small. However when taking into account the planned and possible urban restoration being carried out by Hamilton City Council on selected natural areas the present value of benefits increased dramatically. A Cost-Benefit Analysis revealed that with a time period of 25 years the study failed the present value test for all three discount rates, while at a period of 30 years the two lower discount rates passed the present value test. A sensitivity analysis revealed that the project time period and a decrease in the discount rate were the two most sensitive parameters which were in line with similar studies.

Fungi decomposing coarse woody debris in native forests

Hood, I.A.; Beets, P.N.; Kimberley, M.O.; Gardner, J.F.; Oliver, G.R.; Pearce, S.; Sandberg, C. J.

Scion (NZ Forest Research Institute Ltd.), Private Bag 3020, Rotorua 3046

Email: ian.hood@scionresearch.com

A research programme has been conducted over a period of 25 years investigating the ecology of decay fungi decomposing fallen trees in central North Island indigenous forests. The information derived will help explain rates of decomposition and release of carbon into the atmosphere. Basidiomycete species were isolated from discs cut from stems that fell during a storm in 1982. Those obtained most frequently from *Dacrydium cupressinum* (rimu), *Prumnopitys taxifolia* (matai), *Beilschmiedia tawa* (tawa), *Nothofagus fusca* and *N. menziesii* (red and silver beeches) were *Ganoderma applanatum* sensu Wakefield, *Armillaria novae-zelandiae*, *A. limonea*, and from the beech species only, *Cyclomyces tabacinus*. Fungal diversity was greater in fallen beech than podocarp stems (more than 90% of basidiomycete isolates comprised 18 species in beech but only 5-6 species in podocarps). *G.* cf. *applanatum* and *C. tabacinus* occupied decomposing stems in the form of numerous vegetative compatibility groups (vcg) suggesting colonisation from airborne basidiospores, whereas vcgs of *Armillaria* species were fewer and often extensive implying growth of mycelium beneath the bark along the fallen stems. Fruitbodies of *G.* cf. *applanatum* and *C. tabacinus* (but not *Armillaria* species, which have more ephemeral fructifications) were reliable predictors of stem colonization. Those of *G.* cf. *applanatum* may be used to distinguish stems that have undergone more rapid decomposition within indigenous forests.

Patterns of native turf species vegetation during summer desiccation at Wairio Wetlands, Wairarapa

Bridget Johnson[1] and Stephen Hartley

Victoria University of Wellington

Email: curlyread@gmail.com

New Zealand's native wetland plant species are repeatedly outcompeted by more aggressive weeds. Wetland plants are most vulnerable during the annual desiccation period. Threatened low-lying plants (*Lobelia perpusilla* and *Glossostigma elatinoides*) inhabit the Wairio wetlands. To conserve these native plants a greater understanding is required of their optimal conditions and their spatial and temporal dynamics. This study investigates how abiotic factors influence temporal and spatial distribution of the native species. Vegetation composition and abiotic variables (such as soil moisture, soil pH, sunshine hours, and rainfall) were sampled in 20 quadrats at Wairio wetlands over a ten week summer period along two 50 metre perpendicular transects. *L. perpusilla* and *G.elatinoides* are restricted to a small band of the wettest soil sites. Smaller number of invasive species can grow in these moist soils, so there are fewer competitors for the natives to contend with. In drier soils, the invasive species can spread easily, giving the vulnerable natives little chance of survival against the invasive species. This indicates the natives have truly specialised ecological requirements, as their time frame of existence and habitat preference is small.

Characterization of nitrite reductase and similarities with sulfite reductase from onion (*Allium cepa* L.)

Srishti Joshi

Institute of Molecular Biosciences, Massey University, NZ

S.Joshi1@massey.ac.nz

Onion (*Allium cepa* L.*),* a biennial vegetable, is New Zealand's fourth highest value horticultural export. The characteristic flavour and health benefits of onions have been attributed to the accumulated reduced sulfur(S)-containing compounds, principally the sulfur-alk(en)yl cysteine sulfoxides (ACSOs). While some information on the regulation of the S-assimilation pathway is becoming known, very little is known about the companion nitrogen (N) assimilation pathway, or the cross-talk involved in the regulation of both pathways. Thus this poster presents some results on the preliminary molecular and biochemical characterisation of the enzyme nitrite reductase (NiR), a much less studied enzyme in the N assimilation pathway to shed some light on the significance of the uncanny similarity that this enzyme shares with another iron-based enzyme in the S assimilation pathway, sulfite reductase(SiR). The possibility of these two enzymes acting as a point of pathway cross-talk is also discussed.

Doexotic plants act as facilitators or competitors in the restoration of native plant communities in stressful environments? The stress gradient hypothesis in New Zealand's coastal sand dunes

Susanne Krejcek[1], Stephen Hartley[1] , David Bergin[2], Jon Sullivan[3]

[1]School of Biological Science, Victoria University of Wellington, PO Box 600 Wellington 6140

[2]Environmental Restoration Ltd, 53 TePuea Road, RD 4, Rotorua

[3]Faculty of Agriculture and Life Sciences, PO Box 84, Lincoln University, Lincoln 7647

Email: Susanne.krejcek@vuw.ac.nz

Coast Care groupsare experiencing poor survival rates of plantings of the native sand binding plants spinifex (*Spinifexsericeus*) and pingao (*Ficiniaspiralis*) when attempting to restore marram grass (*Ammophilaarenaria*)-dominated dunes. Plantings in dunes face a harsh environment shaped by a range of factors and stress gradients including high salt exposure, variable moisture gradients and sand movement. Many of our dunelands are dominated by the exotic sand binder marram grass. Dune communities are structured by direct competition and facilitation. The stress gradient hypothesis predicts facilitation to be greatest where stress is most severe. Whether or not that is true for introduced-native dune systems is yet to be proven. Of interest is whether an existing cover of marram grass could be useful in assisting the establishment of native sand binders (via facilitation) or whether it would prevent establishment of spinifex and pingao (via competition), and whether these processes change along an environmental gradient. Specifically, does marram grass become less facilitative and more competitive as the environmental stress lessens as predicted by the stress gradient hypothesis? Are dead sprayed marram grass structures more beneficial for plantings compared to live marram grass? Transects have been established along exposed marram grass-dominated dunefields near Whanganui, west coast North Island, and native sand binders will be planted along the environmental gradient from the coast landward. Treatments include planting spinifex within dead marram grass (herbicide sprayed), within live marram grass and into bare sand plots to test the stress gradient hypothesis.

Localisation of onion O-acetylserine (thiol)-lyase (OAS-TL)

Susanna C.-S. Leung[1], Anya Lambert[1], Martin Shaw[2], David A. Collings[3], John A. McCallum[2] and Michael T. McManus[1]

[1] Institute of Molecular BioSciences, Massey University, Private Bag 11 222, Palmerston North, New Zealand.

[2] Plant and Food Research Centre, Canterbury Agriculture & Science Centre, Private Bag 4704, Christchurch Mail Centre, Christchurch, New Zealand.

[3] School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand
Email: S.Leung@massey.ac.nz

O-acetylserine (thiol)-lyase (OAS-TL) is one of the enzymes involved in the sulfur (S)-assimilation pathway in higher plants, where the product of OAS-TL is $_{L}$-cysteine. Three isoforms of OAS-TL has been isolated from *Arabidopsis thaliana*: a cytosolic, plastid and mitochondrion isoform, and the evidence suggests that the cytosolic form

is highly regulated and represents the major enzyme in terms of L-cysteine biosynthesis. One isoform of onion OAS-TL has now been isolated, and so this poster describes the characterisation of the enzyme as a recombinant protein in terms of kinetic parameters and regulation by S-supply. Further, the over-expression of an OASTL::GFP fusion in tobacco has shown that the onion OAS-TL is cytosolic which, coupled with the biochemical characterisation, suggests that the OAS-TL may play a key role in L-cysteine synthesis in onion.

Inhibitory effects of *Beilschmiedia tawa* leaf leachate on *Lactuca sativa* seed germination and early growth

Narkis S. Morales[1], George Perry[1,2] and Bruce Burns [2]

[1] School of Environment, University of Auckland,

Private Bag 92019, Auckland, New Zealand

[2]School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland 1142, New Zealand

Email: nmor082@aucklanduni.ac.nz

Plants produce a large number of secondary chemical compounds that are not part of their primary physiological processes. Some of these compounds can have inhibitory or stimulatory effects on the growth of neighbouring plants. Chemical inhibition ('allelopathy') could have negative impacts on the restoration of natural forests. *Beilschmiedia tawa,* a New Zealand endemic tree species, has exhibited a lack of recruitment in many areas. In disturbed sites, germination rates are very poor (c. 4%) while in intact forest, mass germination has been reported. We hypothesise that the low germination rates in disturbed sites are caused by allelopathic effects triggered by physical or biotic factors. Previous studies have shown that *B. tawa* has leucoanthocyanins in the leaves that could cause an inhibition of germination and radicle growth.

To determine the potential allelopathic effects of *B. tawa* on germination and growth, we applied *B. tawa* leaf-leachate at three different concentrations (1:1, 1:20, 1:50,) to lettuce (*Lactuca sativa)* seeds. We used distilled water as a control. After five days the seed germination percentage of the 1:1 treatment was significantly different to the others. The hypocotyl lengths at low leachate concentrations showed a positive effect in comparison with the control and the 1:1 treatment. Results show that there is a significant negative effect on radicle elongation of leaf leachate at high concentrations and a positive effect at low concentrations. These results indicate that there are important chemical processes associated with B. tawa that could hinder restoration/management activities in native New Zealand forests.

Investigating historical dispersal and recent gene flow in the small-scaled skink (*Oligosoma microlepis)*

Moniqua Nelson- Tunley[1]

[1] Ecology Group, Institute of Natural Resources, Massey University, Palmerston North

Email: greengecko42@hotmail.com

The Small-scaled skink (*Oligosoma microlepis*) is an endemic reptile of the central North Island that has a highly fragmented distribution due to its specific habitat requirements. This research aims to investigate genetic and morphological variation between populations, and use this observed variation to assess factors that may have influenced past and current gene flow. Variation between populations is expected to largely adhere to the model of isolation by distance, but several factors are hypothesised to cause deviation from this model. These factors include two major historical events; the last glacial maximum (~20,000 ya), and the Hatepe eruption (~1,800 ya), and braided rivers acting as long-distance dispersal routes by providing temporary refugia between habitat patches. I will also assess small-scale gene flow within habitat patches on farmland. Lack of gene flow in this landscape would mean that connectivity needs to be considered in the future conservation and management strategies of this species.

Effects of urban development on wetland riparian condition

Karen Palmer, Mike Joy, Christine Cheyne, John Holland

Ecology Group, Institute of Natural Sciences, Massey University

Email: katyp@xtra.co.nz

Urbanisation affects the ecological values of wetland riparian zones with increased imperviousness, stormwater run-off and altered or destroyed vegetation. This case study critically reviews the processes associated with the ecosystem modification. Assessment of riparian function included the hydrology, biogeochemical parameters and ecosystem intactness of the riparian zones of 8 wetland sites. These were on the Kapiti coast in Paraparaumu, Te Horo and Waikanae. They comprised 2 reference sites and 6 urban sites – 2 remnant wetlands, 2 excavated wetlands on dryland areas and 2 constructed stormwater collection wetland ponds. The Palmer Index will be derived from the ecological assessments including aquatic invertebrate abundance and diversity, WMCI (Wetland MCI) and QWMCI (Quantitative Wetland MCI), terrestrial invertebrate counts, bird counts and riparian vegetation composition line transects. Also included will be information on housing density, imperviousness, stormwater management and housing design obtained from the district council records. Preliminary results indicate that while all the wetlands investigated were of only fair or poor condition as assessed by the WMCI and QWMCI, there was a clear difference in the superior condition of the riparian ecosystem intactness and habitat in the reference wetlands as compared to the poorer condition of those riparian zones that had urban disturbance.

Flowers, fruits and frugivores: How do they inter-relate?

Sharada Paudel[1], Kevin C Burns[1], Ben Bell[1]

[1]School of Biological Sciences, Victoria University of Wellington,

PO Box 600 Wellington 6140, NZ

Email: sharada.paudel@vuw.ac.nz

The New Zealand flora is characterized by a high percentage of bird dispersed trees (72%) with 33% of them dispersed through ingestion by vertebrates, mainly birds and reptiles. New Zealand's birds are largely non-migratory, which is unusual for temperate latitudes. Instead of migrating, many New Zealand birds switch among different types of food, most notably nectar (August-January) and fruit (February-July). Phenological and physiological adaptations such as alterations in gut length and changes in digestive enzymes have been shown for some bird species in other parts of the world. However, questions remain regarding the temporal pattern involved with these adaptations. My study aims to research if physiological changes are induced by a change in food availability or do changes in physiology determine food preferences in birds? Are these changes genetically defined or environmentally induced? This study takes place within the Wellington region, where research on temporal adaptations in bird digestion is facilitated by distinctive seasonal fruiting and flowering patterns. To answer the research questions, I will be working closely with the Karori Sanctuary and we are anticipating direct conservation recommendations from our research outcomes such as choice of plants to support endemic bird species of conservation concern as well as enhancement of scientific knowledge on the mutualistic relationship of bird-dispersed plants and their respective frugivores.

Trends in waterbird numbers on the Rotorua Lakes over a quarter-century

Thalia Sachtleben[1], Keith Owen[1], Kim Young[1], John Innes[2]

[1] Department of Conservation

[2] Landcare Research

Email: tsachtleben@doc.govt.nz

The Rotorua lakes have changed markedly in the last three decades. In addition to reduced water quality, the aquatic flora of the lakes is now predominantly exotic. For several lakes, water levels are managed and disturbance from human recreational activities is quite constant. Here we document the effects of these changes on wildlife through the results of a quarter-century of census data on the relative abundance and distribution of waterbird species on eighteen of the Rotorua lakes. This survey has been conducted five-yearly since 1985, providing six census counts of all birds observed on the water and surrounding lake shore. This monitoring aims to increase knowledge of the values of the Rotorua lakes for waterbird species generally and more specifically to assess the population status of the Nationally Vulnerable New Zealand dabchick (*Poliocephalus rufopectus*) in the Rotorua lakes area.

We compared relative abundance and distribution through time for 19 species that have been recorded since 1985. At last survey (2011) 24,257 adults were recorded, representing a 16% increase from 2006 (20,852), but a decrease of 7% from the original count in 1985 of 26,105. New Zealand dabchick numbers increased 15% from 2006, and 57% from 1985. The relative abundance of most other species fluctuated

among years, but Canada geese and Australian coots increased, while mallards/grey ducks, grey teal, and pied stilts declined. We provide an overview of temporal trends in relative abundance and distribution of waterbird species and discuss possible explanations including ecological changes in the lakes and elsewhere.

Foraging in predator-naïve invasive house mice population: effects of predatory cues and possible implications for management

Idan Shapira[1], Elizabeth Walker[2], Dianne H. Brunton[1], David Raubenheimer[1]

[1] Institute of Natural Sciences, Massey University, New Zealand.

[2] Department of Biology, The University of York, UK.

Email: i.shapira@massey.ac.nz

Invasive mice (*Mus musculus*) are hard to control, partly owing to lack of knowledge on their field behaviour. We investigated the effects of predatory cues on the foraging of invasive mice in a New Zealand site free of mammalian predators and assessed possible implications for their control based on our observations. We used 68 transparent plastic boxes as seed trays in 17 stations along two lines during three consecutive nights for each of the four moon phases. Each station had four boxes with three unfamiliar mammalian odor treatments (feces from two predators and a herbivore) and a control (water). We calculated mice GUDs and resource encounters. Odor did not have any effect on GUDs or number of foraged trays. Mice had higher GUDs during brighter moon phases (full > waxing > new > waning) during the first day, a trend that was lessened during the second day (waxing > full = new > waning). The proportion of foraged trays was lower during full moon on both the first and second nights. The proportion of foraged trays on the third night was 100% on both new and full moons, apparently as a result of heavy clouds. Our study suggests that as few as five years after the eradication of mammalian predators is sufficient for invasive mice to become predator naïve. Moonlight however, appears to be stronger cue and affects both food consumption and foraging range. We suggest that these behaviours might usefully be considered in management strategies for invasive mice.

Abscisic acid (ABA) accumulation and improved water use efficiency (WUE)

Caleb Sixtus[1], Michael McManus[2]

[1] Massey University, Institute of Molecular Bioscience. Private Bag 11 222, Palmerston North.

Email: cdsixtus@gmail.com

The increased expansion of dairy farming onto soils that are incapable of naturally supporting the growth of nutrient and water hungry cultivars has resulted in a drive to produce germplasm with improved water use efficiency (WUE). The major ryegrass companion species in pastures, white clover (*Trifolium repens* L.) has some limitations in terms of WUE, making it a prime candidate for attempts to generate forage crops

that can tolerate and grow in water-limited conditions. The phytohormone abscisic acid (ABA) is proposed to mediate the responses observed in plants when exposed to a water deficit and the hormone does accumulate in these plants. As such, the biosynthesis genes involved in producing ABA are promising targets when using transgenic technology to produce plants with increased water use efficiency. In this poster, the characterisation of transgenic plants expressing the ABA biosynthetic gene, 9-*cis*-epoxycarotenoid dioxygenase (*NCED*) is described as the first step towards the evaluation of the enzyme as a significant determinant of WUE efficiency in plants.

Characterisation of P nutrition responses in selected genotypes of white clover (*Trifolium repens* L.)

Diantha Smith, Michael McManus

Institute of Molecular Biosciences, Massey University, Palmerston North

Email: diantha@inspire.net.nz

The study of plants that are able to adapt to low nutrient levels, such as depleted phosphorus (P), is important for the selection of germplasm that can survive and grow in adverse environmental conditions. Low phosphorus generally slows plant growth, so reducing biomass, but the interactions of roots and phosphorus in the field are complicated by soil type and phosphate availability. In this study, a hydroponic system was used to compare the development and root architecture of three selected genotypes of white clover (*Trifolium repens* L.). Each of the genotypes was selected for their ability to display some degree of tolerance to P deficiency.

The traits of the three genotypes differ in terms of in leaf development and root architecture. One genotype (designated 47-9) has a shallow root system with medium sized leaves, while the other two genotypes have deep root systems. One of these (designated 43-7) has small leaves, while the other (designated 45-14) has medium sized leaves.

Data on the differences in responses between genotypes in terms of changes to primary root length, the number of lateral roots and lateral root density and how this impacts on shoot biomass will be presented. Differences in acid phosphatase levels and leaf phosphate content has also been monitored, to gain, in part, an understanding of the mechanisms that underpin the adaptations displayed by the three genotypes under low phosphorus conditions.

Variation in dietary fibre and pectin content in potatoes

Sheryl Somerfield[1], Erin O'Donoghue[1], Duncan Hedderley[1], John Anderson[2], Russell Genet[3]

[1] The New Zealand Institute for Plant & Food Research Limited, Private Bag 11 600, Palmerston North, 4442, New Zealand

[2] The New Zealand Institute for Plant & Food Research Limited, Private Bag Pukekohe, 4442, New Zealand

[3] The New Zealand Institute for Plant & Food Research Limited, Private Bag 4704, Lincoln, 4442, New Zealand

Email: sheryl.somerfield@plantandfood.co.nz

Dietary fibre is important in maintaining good bowel health. Depending on the amount present in plant foods, dietary fibre can influence product texture and mouthfeel, as well as providing physiological benefits to bowel health. Soluble fibre (e.g. pectin) influences digesta viscosity and is fermentable by gut bacteria, providing a secondary set of health benefits for the bowel and elsewhere. Although potatoes are not rich in dietary fibre compared with cereals, they are a key source by virtue of the amount eaten in Western diets. Potato dietary fibre content is primarily due to cell wall polysaccharides, although some non-digestible starch is present. We have screened for total dietary fibre content in potato lines grown in Pukekohe, Lincoln and Palmerston North during 2008, 2009 and 2010 and have identified lines with consistently high content on a fresh weight basis. Lines with consistently high and low pectin content (fresh weight basis) have also been identified. This information provides the foundation for further study on the possible genetic and/or environmental influences on cell wall quantity and pectin synthesis in particular, and in the future may lead to selections for better dietary fibre content in potatoes.

Cell wall organisation in radiata pine tracheids visualised with Pontamine Fast Scarlet 4b

Jimmy Thomas[1], David Collings[1]

[1] School of Biological Sciences, The University of Canterbury, Christchurch 8140

Email: jimmy.thomas@pg.canterbury.ac.nz

Fluorescence has increasingly been used to investigate cell wall organisation in plants. We have used confocal microscopy of microtome sections to explore the potential of a newly-introduced, cellulose-specific stain, Pontamine Fast Scarlet 4B (P4B) for studying the structural organisation of radiata pine tracheids, and have investigated the orientation of cellulose microfibrils in the different layers of the tracheid secondary wall.

Using green excitation, P4B fluoresces strongly in the S1 and S3 layers of normal wood, and the S1 and inner S2 layers of compression wood. This fluorescence is polarisation-dependent, and the S1 and S3 walls only fluoresce when they are aligned parallel to the polarisation of the excitation laser. This means that P4B can be used to measure microfibril angles in the different layers of the tracheid cell wall, most notably the S1 and S3 walls which are thin and hard to visualise by usual stains and methods. Moreover, because P4B is more specific for cellulose than traditional cell wall stains (calcofluor white, Congo red) we can directly observe the microfibril bundles in the S1 and S3 layers, and see that these are roughly transverse to the cell axis. Experiments

with delignified wood in which the S2 layer shows P4B fluorescence demonstrate that limited access is the reason why the S2 layer does not normally fluoresce. Our experiments demonstrate that P4B has considerable promise for investigations of the cell wall in plants.

Monitoring gecko diversity at predator controlled and uncontrolled sites

Joshua Thoresen[1]

[1] Massey University, Institute of Natural Sciences, Master of Science degree in Conservation Biology

E-mail: wolvesong@gmail.com

New Zealand geckos do not only face predation by native birds including pukeko (*Porphyrio porphrio*) and morepork (*Ninox novaeseelandiae*), but also introduced mammals, such as rats (*Rattus spp*.), possums (*Trichosurus vulpecula*) and cats (*Felis catus*). There is a current inability to effectively monitor gecko populations in forest ecosystems due to their cryptic and elusive nature and behavioural changes caused by high predator densities. Hence, our current knowledge of population sizes and dynamics as well as predation impacts particularly on arboreal gecko species is scarce. A new survey method developed by Bell (2009) was applied which allows monitoring of low density gecko populations. Cell foam retreats (CFR's) were attached to tree trunks along twenty transects and systematically checked once every two days over two weeks. Populations of forest (*Mokopirirakau* granulatus*), green (*Naultinus elegans*) and pacific geckos (*Dactylocnemis* pacificus*) were monitored in three regional parks around Auckland (Whakanewha, Tawharanui, Shakespear). These parks currently differ in their pest management strategies: poisoning, eradication/exclusion, and no management** (respectively). Preliminary results showed that Whakanewha had the highest densities of geckos (52 per h/a) and densities at Tawharanui and Shakespear were significantly lower (8 and 6.25 per h/a respectively). Surveys conducted in areas without pest control adjacent to Whakanewha (Waiheke Island) also showed high densities of geckos (23 per h/a), despite the presence of rats, mustelids (*Mustelidae spp.*) and cats. This result suggests the intriguing possibility that possums (which have never been present on Waiheke Island) could be exerting significant predation pressure on geckos on the mainland.

*Previously *Hoplodactylus* as newly described in: Nielsen et.al. (2011)
** Shakespear used to run an annual pest control programme but have stopped for several months leading up to a large poison drop in July

A quaternary vegetation database for New Zealand

Jamie R. Wood[1], Janet M. Wilmshurst[1]

[1] Landcare Research, PO Box 40, Lincoln, Canterbury 7640, New Zealand

Email: woodj@landcareresearch.co.nz

We propose to create a database to collate the many disparate and unpublished palaeovegetation records (pollen cores, plant macrofossils) relating to the Quaternary Period (last 2.6 million years) in New Zealand. An associated online interface would allow public and researchers alike to search and visualise the data in ways previously impossible (including time-slice animations), and provide a new appreciation for the dynamic history of New Zealand's vegetation. The database will provide a significant resource to a wide range of people, from the general public to researchers. Potential uses include searching for local vegetation histories to guide replanting schemes, analyses of changing vegetation patterns with physical or climatic factors such as retreating ice sheets, and providing a temporal context for understanding modern ecological patterns. In our scoping exercise, we would like to invite any feedback and suggestions from members of the New Zealand Ecological Society regarding what they would like to see incorporated into such a database, and any potential uses they may foresee for such a database.

NZSPB
New Zealand Society of Plant Biologists

NEW ZEALAND ECOLOGICAL SOCIETY

NOTES

NZSPB
New Zealand Society of Plant Biologists

NEW ZEALAND ECOLOGICAL SOCIETY

NOTES

Ecology in the Heartland - 28 August to 1 September 2011
Conference Delegate List

Printed 13 August 2011

First Name	Surname	Organisation	Email
Rob	Allen	Landcare Research	allenr@landcareresearch.co.nz
Christophe	Amiot	Massey university Albany	c.amiot@massey.ac.nz
Sandra	Anderson	University of Auckland.ac.nz	sh.anderson@auckland.ac.nz
Doug	Armstrong	Massey University Ecology Group	d.p.armstrong@massey.ac.nz
Lisa	Arnold	Victoria University	zephyr16@gmail.com
Brenda	Baillie	Scion	brenda.baillie@scionresearch.com
Laurence	Barea	Golder Associates	lbarea@golder.co.nz
Sarah	Beadel	Wildland Consultants Ltd	Sarah.Beadel@wildlands.co.nz
Simon	Beale	MWH NZ Limited	simon.h.beale@mwhglobal.com
Annabel	Beattie	Bay of Plenty Regional Council	Annabel.Beattie@boprc.govt.nz
Peter	Beets	Scion	peter.beets@scionresearch.com
Becky	Bell	Golder Associates	bbell@golder.co.nz
Trent	Bell	EcoGecko Consultants Ltd	trent@ecogecko.co.nz
Craig	Bishop	Auckland Council	craig.bishop@aucklandcouncil.govt.nz
Mary	Black	Plant & Food Research	mary.black@plantandfood.co.nz
Grant	Blackwell	Office of the Parliamentary Commissioner for the Environment	grant.blackwell@pce.parliament.nz
Paul	Blaschke	Blaschke and Rutherford	paul.blaschke@xtra.co.nz
Andrew	Blayney	Massey University	andrewbuggin@gmail.com
Ray	Blick	University of New South Wales	rayblick@yahoo.co.nz
Michelle	Blydenburgh (Cangero)	University of Auckland	mcan025@aucklanduni.ac.nz
Kerry	Borkin	Private individual	k.borkin@clear.net.nz
Souad	Boudjelas	Pacific Invasives Initiative (PII)	s.boudjelas@auckland.ac.nz
Marie	Brown	University of Waikato	mab57@waikato.ac.nz
Dianne	Brunton	Massey University	d.h.brunton@massey.ac.nz
Rhys	Buckingham	Wildlife Surveys Ltd	rhysin@paradise.net.nz
Bruce	Burns	University of Auckland	b.burns@auckland.ac.nz
K.C.	Burns	Victoria University of Wellington	kevin.burns@vuw.ac.nz
Rhys	Burns	DOC	rburns@doc.govt.nz
David	Burritt	The University of Otago	david.burritt@botany.otago.ac.nz
Anna	Burrows	Greater Wellington Regional Council	anna.burrows@gw.govt.nz
Shane	Butland	Gecko NZ	shanebutland@gmail.com
Matt	Buys	Scion	matt.buys@scionresearch.com
Chris	Bycroft	Wildland Consultants Ltd	Chris.Bycroft@wildlands.co.nz
Kate	Calcott	Victoria University of Wellington	kate.calcott@vuw.ac.nz
Dave	Campbell	University of Waikato	davec@waikato.ac.nz
Susan	Carrodus	Wildland Consultants Ltd	Susan.Carrodus@wildlands.co.nz
Fiona	Carswell	Landcare Research	carswellf@landcareresearch.co.nz
Isabel	Castro	Massey University	i.c.csatro@massey.ac.nz
Brendon	Christensen	DOC	bchristensen@doc.govt.nz
Ellen	Cieraad	Landcare Research & Durham University	cieraade@landcareresearch.co.nz
Bev	Clarkson	Landcare Research	bev@landcareresearch.co.nz
Bruce	Clarkson	University of Waikato	clarkson@waikato.ac.nz
Michael	Clearwater	University of Waikato	mclearw@waikato.ac.nz
Mick	Clout	University of Auckland	m.clout@auckland.ac.nz
Emma	Coleman	Environment Canterbury	ejc6@waikato.ac.nz
David	Collings	University of Canterbury	david.collings@canterbury.ac.nz
Hohepa	Cooper	Unitec Institue of Technology	hohepa@work.ac.nz
Toni	Cornes	University of Waikato	tcornes@waikato.ac.nz
Peter	Corson	Dept. of Conservation	pcorson@doc.govt.nz
Hamish	Dean	University of Waikato / Naturally Native	hamish@naturallynative.co.nz
Britta	Deichmann	Kessels & Associates Ltd	britta@kessels-ecology.co.nz
Yanbin	Deng	Waikato Regional Council	Yanbin.Deng@waikatoregion.govt.nz
Marie	Dennis	Scion	marie.dennis@scionresearch.com
Karen	Denyer	National Wetland Trust	karen.denyer@wetlandtrust.org.nz
Margaret	Dick	Scion	margaret.dick@scionresearch.com
Melanie	Dixon	Thomas Civil & Env Consultants Ltd	melanie.dixon@tcec.co.nz

Ecology in the Heartland - 28 August to 1 September 2011
Conference Delegate List

Printed 13 August 2011

First Name	Surname	Organisation	Email
Michelle	Dublon	Te Ngahere Ltd	michelle@te-ngahere.co.nz
Rebecca	Eivers	University of Waikato	rse1@waikato.ac.nz
Peter	Ellery	Maketu Taiapure Trust	p.ellery@wave.co.nz
Thomas	Etherington	The University of Auckland	teth001@aucklanduni.ac.nz
Adam	Forbes	MWH New Zealand Limited	adam.s.forbes@nz.mwhglobal.com
Frances	Forsyth	Wildlands	frances.forsyth@wildlands.co.nz
Vicky	Froude	Pacific Eco-Logic & University of Waikato	vfroude@slingshot.co.nz
Isobel	Gabites	naturalTEXTures	igabites@xtra.co.nz
Mel	Galbraith	Unitec Institute of Technology	mgalbraith@unitec.ac.nz
Oliver	Gansell	Department of Conservation	ogansell@doc.govt.nz
Andy	Garrick	Wildland Consultants Ltd	Andy.Garrick@wildlands.co.nz
Anne	Gaskett	University of Auckland	a.gaskett@auckland.ac.nz
Emily	Geck	Waikato University	erag1@waikato.ac.nz
George	Gibbs	School of Biological Sciences, Victoria University	george.gibbs@vuw.ac.nz
Nick	Goldwater	Wildland Consultants Ltd	nick.goldwater@wildlands.co.nz
Jordan	Goodrich	University of Waikato	jg138@waikato.ac.nz
Nicholas	Gorman	Massey University Ecology Group	nic_gorman@yahoo.com.au
Jane	Gosden	University of Canterbury	jane.gosden@pg.canterbury.ac.nz
Scott	Graham	University of Canterbury	scott.graham@pg.canterbury.ac.nz
Roseanne	Grant	Massey University	rgrant.nz@gmail.com
Kay	Griffiths	The Conservation Company	theconservationcompany@ruralinzone.net
Samantha	Grover	Landcare Research	grovers@landcareresearch.co.nz
Guyo	Gufu	Victoria University of Wellington	Guyo.Gufu@vuw.ac.nz
Habteab	Habtom	Victoria University of Wellington	Habteab.Habtom@vuw.ac.nz
Leslie	Haines	Unitec	lhaines@unitec.ac.nz
Mark	Hamilton	MBC Ltd	mark@mbc.net.nz
Keiko	Hashiba	Hawke's Bay Regional Council	keiko@hbrc.govt.nz
Sarah	Herbert	EcoGecko Consultants Ltd	sarah@ecogecko.co.nz
Tarnia	Hodges	Massey University	tarnia.hodges@gmail.com
Robert	Holdaway	Landcare Research	holdawayr@landcareresearch.co.nz
Avi	Holzapfel	Department of Conservation	aholzapfel@doc.govt.nz
Ian	Hood	Scion	ian.hood@scionresearch.com
Clayson	Howell	Department of Conservation	chowell@doc.govt.nz
Melissa	Hutchison	Wildland Consultants	melissa.hutchison@wildlands.co.nz
Jenifer	Iles	University of Canterbury	jenie.iles@gmail.com
Afsana	Islam	Massey University	A.Islam1@massey.ac.nz
Melissa	Jacobson	Rotokare Scenic Reserve Trust	educator@rotokare.org.nz
Melissa	Jager	University of Waikato	mmj5@waikato.ac.nz
Alastair	Jamieson	Wild Earth Media Ltd.	alastair@wildearthmedia.com
Samantha	Jamieson	Taranaki Regional Council	samantha.jamieson@trc.govt.nz
Rocio	Jana	University of Canterbury	rocio.jana@pg.canterbury.ac.nz
Rubina	Jibran	Plant and Food reserch centre	rubinajibran@plantandfood.co.nz
Bridget	Johnson	Victoria University of Wellington	curlyread@gmail.com
Brian	Jordan	Lincoln University	Brian.Jordan@lincoln.ac.nz
Srishti	Joshi	Massey University	S.Joshi1@massey.ac.nz
Mieke	Kapa	Wildland Consultants Ltd	Mieke.Kapa@wildlands.co.nz
Nod	Kay	Scion	nod.kay@scionresearch.com
Dave	Kelly	University of Canterbury	dave.kelly@canterbury.ac.nz
Michelle	Kelly	University of Auckland	mkel058@aucklanduni.ac.nz
Euan	Kennedy	Department of Conservation	ekennedy@doc.govt.nz
Carolyn	King	University of Waikato	c.king@waikato.ac.nz
Miko	Kirschbaum	Landcare Research	KirschbaumM@LandcareResearch.co.nz
Ari	Kornfeld	University of Canterbury	ari.kornfeld@pg.canterbury.ac.nz
Susanne	Krejcek	Victoria University of Wellington	susanne.krejcek@vuw.ac.nz
Hamish	Lass	Bay of Plenty Regional Council	hamish.lass@envbop.govt.nz
Daniel	Laughlin	University of Waikato	d.laughlin@waikato.ac.nz
Eila	Lawton	OSNZ/Forest&Bird	elawton@actrix.co.nz

Ecology in the Heartland - 28 August to 1 September 2011
Conference Delegate List

Printed 13 August 2011

First Name	Surname	Organisation	Email
Darren	Le Roux	Opus International Consultants	darren_lrx@yahoo.com
Gavin	Lear	Lincoln University	Gavin.Lear@lincoln.ac.nz
Mei Nee	Lee	Thomas Civil & Env Consultants Ltd	meinee.lee@tcec.co.nz
Marieke	Lettink	Fauna Finders	marieke_kakariki@clear.net.nz
Susanna	Leung	Massey University	S.Leung@massey.ac.nz
Carolyn	Lundquist	NIWA	c.lundquist@niwa.co.nz
Chris	Lusk	University of Waikato	clusk@waikato.ac.nz
Tom	Lynch	waiariki	tom.lynch@waiariki.ac.nz
Phil	Lyver	Landcare Research	lyverp@landcareresearch.co.nz
Roger	MacGibbon	Opus International Consultants	Roger.MacGibbon@opus.co.nz
Cate	Macinnis-Ng	University of Auckland	c.macinnis-ng@auckland.ac.nz
Heather	MacKenzie	Bay of Plenty Regional Council	heather.mackenzie@boprc.govt.nz
Jennie	Marks	Office of the Parliamentary Commissioner for the Environment	jennie.marks@pce.govt.nz
Ross	Martin	Waikato Regional Council	ross.martin@waikatoregion.govt.nz
Tim	Martin	Wildland Consultants Ltd	tim.martin@wildlands.co.nz
Fleur	Maseyk	Horizons Regional Council	fleur.maseyk@horizons.govt.nz
Rachel	McClellan	Wildland Consultants Ltd	Rachel.McClellan@wildlands.co.nz
Andrew	McEwen	NZ Institute of Forestry	am.mcewen@xtra.co.nz
Mary	McEwen	Retired	mary.mcewen@xtra.co.nz
Matt	McGlone	landcare research	mcglonem@landcareresearch.co.nz
Robert	McGowan	Nga Whenua Rahui	rmcgowan@doc.govt.nz
Michael	McManus	Massey University	M.T.McManus@massey.ac.nz
Ignatius	Menzies	Victoria University of Wellington	i.igbot@gmail.com
Pascale	Michel	Landcare Research	michelp@landcareresearch.co.nz
Karen	Middlemiss	Lincoln University	kombi@xtra.co.nz
Elizabeth	Miller	Scion	elizabeth.miller@scionresearch.com
Les	Molloy	Nature Heritage Fund	les.molloy@xtra.co.nz
Narkis	Morales	University of Auckland	nmor082@aucklanduni.ac.nz
Craig	Morley	Waiariki Instititute of Technology	craig.morley@waiariki.ac.nz
Daniel	Morrison	University of Waikato	drm28@waikato.ac.nz
Shona	Myers	Wildland Consultants Ltd	shona.myers@wildlands.co.nz
Moniqua	Nelson- Tunley	Massey University	greengecko42@hotmail.com
Michael	Orchard	The Tree Centre	orchards@xtra.co.nz
Elizabeth	Overdyck	University of Waikato	eg3@waikato.ac.nz
Keith	Owen	Department of Conservation	kowen@doc.govt.nz
Deniz	Ozkundakci	University of Waikato	denizo@waikato.ac.nz
David	Paine	BOP Regional Council	davidp@envbop.govt.nz
Karen	Palmer	Ecology Group, Massey	katyp@xtra.co.nz
Tim	Park	Greater Wellington Regional Council	tim.park@gw.govt.nz
Stuart	Parsons	University of Auckland	s.parsons@auckland.ac.mz
Erin	Patterson	Remnant Restoration	erin@remnantrestoration.co.nz
Thomas	Paul	Scion	thomas.paul@scionresearch.com
Terriann	Payne	Bay of Plenty Polytechnic	trpayne@slingshot.co.nz
George	Perry	University of Auckland	george.perry@auckland.ac.nz
Denis	Peters	Nga Whenua Rahui	dzpeters@doc.govt.nz
Monica	Peters	NZ Landcare Trust	monica.peters@landcare.org.nz
Ngaire	Phillips	NIWA	nr.phillips@niwa.co.nz
Alison	Pickett	independant	alisonpickett@xtra.co.nz
Roland	Pomana	Nga Whenua Rahui	rpomana@doc.govt.nz
Moira	Pryde	Department of Conservation	mpryde@doc.govt.nz
Nan	Pullman	Aqualine Ecology	aqualine@igrin.co.nz
Kit	Richards	PF Olsen Ltd	kit.richards@pfolsen.com
Geoff	Ridley	Environmental Protection Agency	geoff.ridley@epa.govt.nz
Mahuru	Robb	Kessels & Associates Ltd	mahuru@kessels-ecology.co.nz
Cynthia	Roberts	Department of Conservation	croberts@doc.govt.nz

Ecology in the Heartland - 28 August to 1 September 2011
Conference Delegate List

Printed 13 August 2011

First Name	Surname	Organisation	Email
Kimberley	Roberts	University of Canterbury	kim.roberts@pg.canterbury.ac.nz
Tessa	Roberts	Greater Wellington	tessa.roberts@gw.govt.nz
Alastair	Robertson	Massey University	A.W.Robertson@massey.ac.nz
Hugh	Robertson	Department of Conservation	harobertson@doc.govt.nz
Susanna	Rutledge	University of Waikato	s.rutledge@waikato.ac.nz
Alan	Saunders	Landcare Research	saundersa@landcareresearch.co.nz
Alex	Schanzer	unconnected at present	alexschanzer@mac.com
Louis	Schipper	University of Waikato	schipper@waikato.ac.nz
Ann-Kathrin	Schlesselmann	University of Auckland	anne_schlesselmann@yahoo.de
Luitgard	Schwendenmann	The University of Auckland	l.schwendenmann@auckland.ac.nz
Richard	Seaton	Wingspan Birds of Prey Trust	richseaton@gmail.com
Agung	Sedayu	University of Waikato	as284@waikato.ac.nz
Idan	Shapira	Massey University	i.shapira@massey.ac.nz
Willie	Shaw	Wildland Consultants Ltd	willie.shaw@wildlands.co.nz
Caleb	Sixtus	Massey University	leprichornfighter@hotmail.com
Alana	Smith	Massey University	alana.smith86@yahoo.co.nz
Diantha	Smith	Massey University	diantha@inspire.net.nz
Trina	Smith	Unitec	tsmith@unitec.ac.nz
Chris	Smuts-Kennedy	Maungatautari Ecological Island Trust	smuts@hnpl.net
Sheryl	Somerfield	Plant and Food Research Institute	Sheryl.Somerfield@plantandfood.co.nz
Jane	Sparkes	Unitec	sparkj05@wairaka.com
Owen	Spearpoint	Greater Wellington Regional Council	owen.spearpoint@gw.govt.nz
John	Staniland	Waitakere Forest & Bird - Ark in the Park	bushridge@slingshot.co.nz
Simon	Stokes	Bay of Plenty Regional Council	Simon.Stokes@boprc.govt.nz
Nicole	Sutton	Department of Conservation	nsutton@doc.govt.nz
Yvonne	Taura	The University of Waikato	ymt4@waikato.ac.nz
Jimmy	Thomas	University of Canterbury	jimmy.thomas@pg.canterbury.ac.nz
Alice	Thompson	Auckland Council	Alice.Thompson@aucklandcouncil.govt.nz
Joshua	Thorensen	Massey University	wolvesong@gmail.com
Susan	Timmins	Department of Conservation	stimmins@doc.govt.nz
Kristina	Townsend	Selwyn District Council	kristina.townsend@selwyn.govt.nz
Christina	Troup	N.A.	c.t.troup@xtra.co.nz
Matthew	Turnbull	University of Canterbury	matthew.turnbull@canterbury.ac.nz
Ngaire	Tyson	NZ Landcare Trust	ngaire.tyson@landcare.org.nz
Michael	Urlich	Greater Wellington Regioncal Council	michael.urlich@gw.govt.nz
Erik	van Eyndhoven	MAF	erik.vaneyndhoven@maf.govt.nz
Astrid	van Meeuwen-Dijkgraff	Wildland Consultants Ltd	astrid@wildland.co.nz
Deidre	Vercoe	Department of Conservation	dvercoe@doc.govt.nz
Aurelien	Vivancos	Otago Universuty	aurelien.vivancos@gmail.com
Steve	Wagstaff	Allan Herbarium, Landcare Research	wagstaffs@landcareresearch.co.nz
Paula	Warren	Department of Conservation	pwarren@doc.govt.nz
Hilary	Webb	Horizons Regional Council	maria.burgess@horizons.govt.nz
Emily	Weeks	University of Waikato	WeeksE@landcareresearch.co.nz
Carol	West	Department of Conservation	cwest@doc.govt.nz
David	Whitehead	Landcare Research	whiteheadD@landcareresearch.co.nz
Bryce	Wilcox	WEL Networks	robyn.meehan@wel.co.nz
Fiona	Wilcox	Wildland Consultants Ltd	Fiona.Wilcox@wildlands.co.nz
Dale	Williams	Bay of Plenty Regional Council	dale.williams@boprc.govt.nz
Emma	Williams	Massey University	_emma_m_@yahoo.com
Peter	Williams	Landcare Research	williams2@clear.net.nz
Gaius	Wilson	Victoria University of Wellington	Gaius.Wilson@vuw.ac.nz
Jamie	Wood	Landcare Research	woodj@landcareresearch.co.nz
Debra	Wotton	Landcare Research	wottond@landcareresearch.co.nz
Sarah	Wyse	University of Auckland	swys001@aucklanduni.ac.nz
Laura	Young	University of Canterbury	laura.young@pg.canterbury.ac.nz

Map of Central Rotorua

Ecology in the Heartland

Index of Presenting Authors

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: **Post Code:**		
E-Mail:		
Phone Bus:	**Fax Bus:**	**Phone Private:**

B MEMBERSHIP DETAILS

Occupation/Expertise:

Name of Employer:

C TYPES OF MEMBERSHIP AND SUBSCRIPTION RATES (2011)

(please tick the class for which you qualify)

Membership is 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

The New Zealand Journal of Ecology is printed digitally and in hard copy. Please indicate which option you prefer. Receiving the journal digitally will allow more funds to go towards Society projects like the Kauri Fund.

Digital ☐ Hard copy ☐

Signature of Applicant: _____ Date: _____

NZES National Secretariat, PO Box 5075, Christchurch 8542. Tel: (03) 318 1056 Fax (03) 318 1061
Email: nzecosoc@paradise.net.nz Website: www.newzealandecology.org/

NZSPB
New Zealand Society of Plant Biologists

Membership Application

I would like to apply for Full/Associate membership of NZSPB.
I enclose my subscription of (please circle one):

Full Members $50 (one year) or $80 (two years)

Associate Members $30 (two years) or $60 (four years)

N.B.: Associate Membership is intended for full-time students or those who have retired. The membership year runs from 1 January to 31 December.

Full Name and Title:

Department/Research Centre:

Institution:

Street Address or Box/Bag No.:

Town/City:

Telephone: ( )

Fax: ( )

E-mail address:

Research Interests (keywords):

Do we have your permission to publish the above information in our membership list, both in hardcopy and on the NZSPB Website? **Yes** **No** *(Circle one)*

Signature:

Please send a completed copy of this form with payment to the treasurer

NZSPB Treasurer:
Dr Tina Summerfield
Botany Department
University of Otago
PO Box 56
Dunedin
Telephone +64 3 479 7578
Fax +64 3 479 7583
e-mail tina.summerfield**at**otago.ac.nz