Welcome to prospective postgraduate students in Ecology/Zoology/Conservation Biology/Environmental Management

As you near the end of your undergraduate degree you might be thinking about the prospect of undertaking postgraduate studies in the Ecology Group. Alternatively you may have graduated some time ago and are contemplating a return to university. Whatever, we welcome the opportunity to let you know what is available here at Massey University.

The Ecology Group in the Institute of Agriculture and Environment is the largest of its kind in New Zealand. There are 15 academic staff and 6 support staff teaching and researching in a wide range of topics in ecology and zoology. We have many graduate students working on an amazingly diverse range of projects in ecology, zoology and environmental management. Expertise in this group ranges across areas as diverse as population and community ecology of plants and animals to animal behaviour, physiology, conservation, national park management, tourism and environmental economics. The Ecology Group also has strong collaboration links with the Department of Conservation, Landcare Research, AgResearch, NIWA, regional, district and city councils and private sector environmental consulting firms.

We hope that you find this prospectus useful in assessing the range of opportunities available in the Ecology Group, and we wish you all success in your chosen studies.

<u>Contact address:</u>

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zoology.massey.ac.nz

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The Ecology Group

The Ecology Group at Massey University comprises 15 academic staff, one secretary, five technicians, and a large group of graduate students.

RESEARCH

Research interests in the group include population and community ecology, biomonitoring, restoration, systems ecology, limnology, behavioural ecology, plant ecology, biogeography, evolution, entomology, ornithology, tourism, environmental economics and natural resource management. Many staff members have a focus on conservation issues in the broadest sense, including management of ecosystems and individual species.

Staff members conduct research in a broad range of endangered New Zealand species such as kiwi, mistletoes, dolphins, penguins, falcons, land snails, hihi, saddleback, bats, kokopu, New Zealand robins, tree-daisies, dune plants, megaherbs, tuatara and weta. Research is also conducted on a wide range of endemic and introduced plants and animals, as well as whole ecosystems. Ecology staff and graduate students conduct field research throughout New Zealand, including offshore islands, and other Pacific Islands.

Another research area is environmental management. Research in this area responds to the growing awareness for the need to protect the environment and manage air, water, soil, plants and animals in a sustainable way. Students develop practical skills to assist them to incorporate environmental, social, and economic factors into holistic natural resource and environmental management strategies.

The Ecology complex has an excellent range of facilities and equipment. There are three controlled temperature rooms, four controlled temperature and light rooms, two walk-in refrigerated rooms, and access to glasshouses with associated potting sheds and shade houses. We also have a computing room together with seven research laboratories. These include labs for microscopy and image analysis, general analytical work, ancient DNA, freshwater fish and invertebrates, insect and plant ecology, animal behaviour, soil invertebrate extraction and sample sorting. We also have a field store with many of the items that you may need for your work and a workshop for any special equipment that has to be made.

If you come to study for a graduate qualification we are here to help. Talk to the staff, if you have any questions. Research should and can be fun, as well as rewarding!

COURSE REQUIREMENTS

Course requirements vary with the degree you are taking.

Most Ecology, Zoology and Conservation Biology postgraduate students will take two to four 700 level papers, one of which could be a research project. The 700

level papers offered by the Ecology Group are described in this booklet but you may also take approved papers from other subjects - consult the University Calendar for details. Most of these 700-level papers are double semester, i.e. run through both semesters 1 and 2 (March-October).

Environmental Management postgraduate students will generally take two papers (60 credits) and a dissertation (60 credits) towards their Honours degree. For a Masters in Environmental Management degree, they do an additional semester (this could be done during the Summer School semester).

Your research topic, if your postgraduate degree includes one, can be of your own choosing, but staff research profiles and some potential projects are included here to help you develop your ideas. You should discuss your possible research topics with a wide range of potential supervisors.

Other guide books / sites

This booklet contains information about postgraduate papers and research. To enrol in such studies, you need first to have completed a BSc or equivalent degree. See the Massey University calendar or web page for details if in doubt.

There is another useful guide for postgraduate Ecology Group students:

- ***A Survival Guide for Post-graduate Students in the Ecology Group***
  This detailed booklet will be invaluable to you, should you decide to undertake any form of graduate studies in the Ecology Group. It provides detailed information about a wide range of questions such as: “How do I find a supervisor?”, “How do I get keys to the building?”, “I need somewhere to work", and "How do I get space allocated?”. The answers to these and many other important questions are provided in the ‘Survival Guide’.

  You will be given a copy of the ‘Survival Guide’ at the first meeting for new postgraduate students usually held on the Monday of the first week of Semester 1.

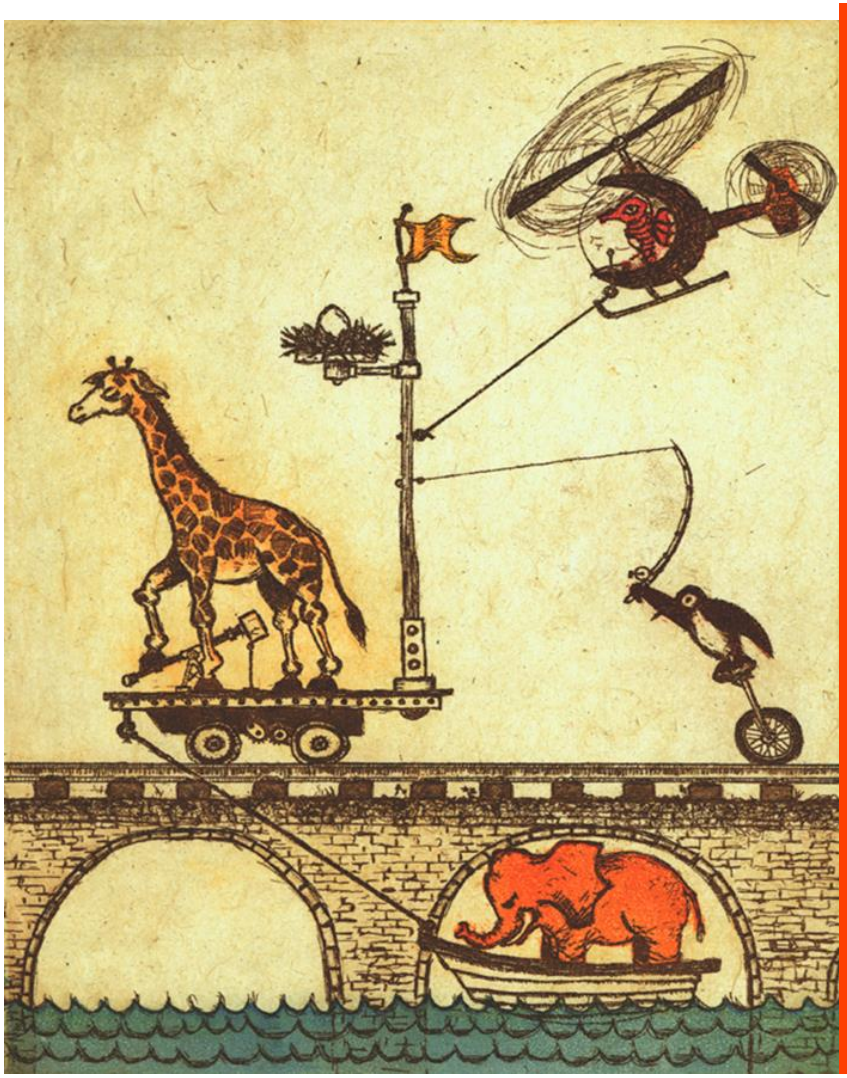
- Ecology and Zoology websites: ecology.massey.ac.nz, zoology.massey.ac.nz

- Calendar: http://www.massey.ac.nz/massey/about-massey/calendar/

GRADUATE PAPERS IN ECOLOGY, ZOOLOGY, CONSERVATION BIOLOGY & ENVIRONMENTAL MANAGEMENT

NEW ONE YEAR

ENVIRONMENTAL MANAGEMENT MASTERS DEGREE



Master of Environmental Management Degree

ENTRY: Bachelor degree
PERIOD: 1 year
CREDITS: 180

PROGRAMME DIRECTOR
John Holland

Institute of Agriculture & Environment
Massey University
j.d.holland@massey.ac.nz
(06) 356-9099

SCHEDULE OF PAPERS AVAILABLE TO ENVIRONMENTAL MANAGEMENT STUDENTS

MASTER OF ENVIRONMENTAL MANAGEMENT

THE COURSE

You need to complete a minimum of 180 credits (or 60 credits if you have an Honour's or PGDip) comprising: 60, 90 or 120 credits of reported research; the core paper 188.763 (Advanced Environmental Management) and; approved 700-level papers drawn from the five Streams listed below.

At the discretion of the Programme Director, up to 30 credits may be approved from papers chosen from other postgraduate programmes. Up to 45 credits of Special Topics may be selected.

CORE PAPER

188.763 Advanced Environmental Management
188.863 Environmental Research and Data Analysis

RESEARCH PAPERS

188.788 Research Report
188.887 Research Report
188.888 Thesis
188.889 Thesis
188.897 Thesis
188.900 PhD

1. WATER STREAM

145.705 Fluvial Geomorphology
189.758 Advanced Soil Water Management
189.755 Soil and Water Pollution
196.712 Aquatic Ecology

2. LAND STREAM

188.708 Intro to Adv. Environmental Mgmt II
119.715 Sustainable Agricultural Systems
188.752 Land Reclamation
189.753 Soil and Land Evaluation
189.757 Advanced Soil Conservation
196.713 Ecology
196.726 Plant Ecology
233.701 Advanced Pedology
233.756 Environmental Geology
284.721 Advanced Landscape Management

3. TECHNIQUES AND TOOLS STREAM

132.738 GIS Principles and Applications
132.740 Geographic Information Systems
152.752 Project Management
161.771 Analysis of Experiments for Researchers
189.761 Applied Remote Sensing
228.767 Greenhouse Gas Mitigation Analysis
228.769 Energy-Efficient Building Design
233.706 Env. Geographical Information Systems
233.707 Environmental Remote Sensing
238.700 Life Cycle Assessment - Principles
238.710 Life Cycle Assessment - Methods
238.711 Life Cycle Assessment - Case Studies
238.712 Advanced Life Cycle Assessment
238.751 Agric. Greenhouse Gas Emission Science

4. POLICY AND ENVIRONMENTAL ECONOMICS STREAM

188.707 Intro to Adv. Environmental Mgmt I
131.704 Sustainable Development
132.735 Natural Resource Planning
145.707 Economic Geography
152.704 Business and Sustainability
178.762 Nat. Res. & Env. Econ. for Non-Economists
188.705 Natural Resource Policy
228.740 Energy Policy
228.744 Case Studies of Renewable Energy Systems
228.766 Integrated Energy Resource Planning
235.701 Māori Values and Resource Management

5. ENVIRONMENT AND SOCIETY STREAM

132.751 Natural Hazards and Resilient Communities
176.718 Environmental Sociology
188.751 Advanced Zero Waste for Sustainability
218.761 Design and Mgmt of Healthy Buildings
228.750 Renewable Energy & Sustainable Dev.
228.755 Sustainable Energy Systems and Society
230.7xx Urban Ecology and Society

Look at our BEnvMgmt(Hons) degree

Environmental Management Core Paper

188.763 ADVANCED ENVIRONMENTAL MANAGEMENT

(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Associate Professor John Holland

Objective: For students to be able to demonstrate an understanding of the issues associated with the management of natural resources and apply practical skills in resource management, policy and evaluation.

Outline: The paper is made up of three parts. It develops project and programme management skills, strengthens students' knowledge of natural resources at an advanced level, and combines these two to produce integrative resource management skills.

Pre-requisites: 188.363 or permission of the Programme Director

Assessment:

Policy Analysis	10%
Integrated Environmental Management	20%
Project & Programme Management	15%
Resource Assessment Case Study	15%
Environmental Economics	15%
Seminar	5%
Field Trip	20%

Textbooks: Extensive reading is provided.

Lecturers: Associate Professor John Holland, Dr Trisia Farrelly, Professor Anton Meister, Associate Professor Bob Stewart.

188.863 ENVIRONMENTAL RESEARCH AND DATA ANALYSIS

(Semesters 1, 2 & 3, 60 credits)

Paper Co-ordinator: Associate Professor John Holland

Objective: For students to produce a robust research report based on sound research methods and data analysis.

Outline: The paper is made up of nine modules. It develops research skills and statistical analysis techniques to analyse, evaluate environment management data and write a research report.

Pre-requisites: 188.763 or permission of the Programme Director

Assessment:

Evidence Portfolio	10%
Data Analysis	15%
Research Proposal	15%
Research Report	60%

Textbooks: **Practical Statistics for the Biological Sciences**
Author: Stephen Ashcroft and Chris Pereira
ISBN: 978-0-333-96044-8
Edition: 2003
Publisher: Palgrave McMillan

Lecturers: Associate Professor John Holland

raymaseman.co

196.712 AQUATIC ECOLOGY
(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Professor Russell Death

Objective: To introduce students to the current state of research in both theoretical and applied aspects of aquatic organism ecology in standing and running waters.

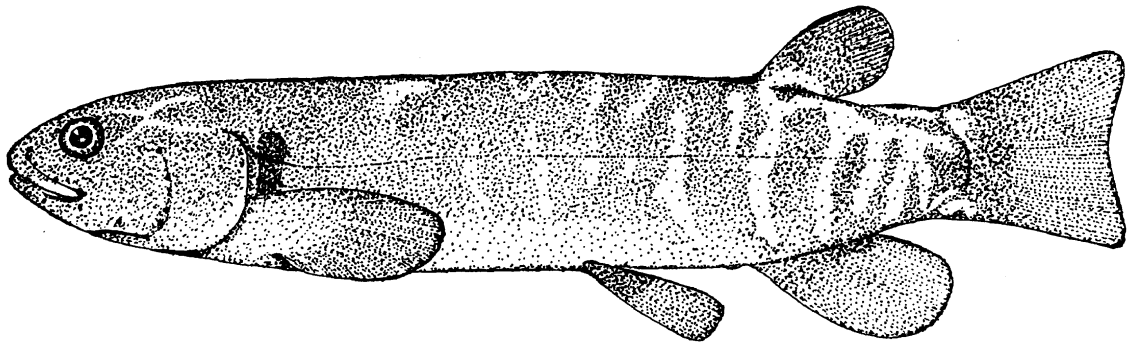
Outline: This paper presents an historical and theoretical perspective to the study of freshwaters. Topics covered include stream ecosystem structure and function, aquatic macrophytes, plankton, freshwater fish, disturbance - land use impacts - and the implications of the Resources Management Act to aquatic ecology.

Pre-requisites: BSc in any biological sciences subject.

Assessment: Three equal research assignments for Russell Death, Mike Joy and Ian Henderson. Determined each year based on student interests.

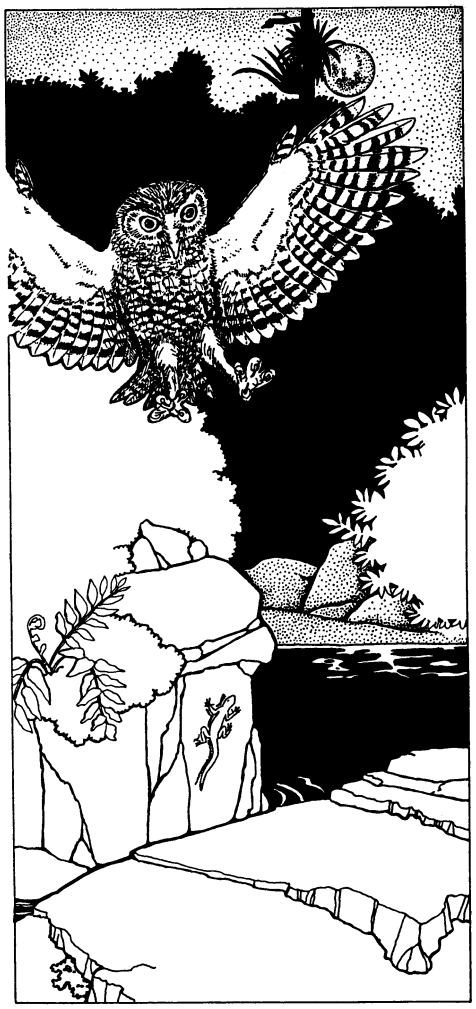
Textbooks: Extensive reading is provided.

Lecturers: Professor Russell Death, Dr Ian Henderson, Dr Mike Joy.



BANDED KOKOPU (*Galaxias fasciatus*) MJOY 1977

196.713 ECOLOGY
(Semesters 1 & 2, 30 credits)



Paper Co-ordinator: Dr Masha Minor

Objective: To explore contemporary issues in ecology.

Outline: The paper explores contemporary issues in ecology. Topics include ecological monitoring, diversity and ecosystem function, ecological methodology, patterns of species diversity, keystone species, herbivory, community structure, food web studies, etc.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided.

Lecturers: Dr Masha Minor,
Dr Mike Joy,
Associate Professor
Alastair Robertson.

196.726 PLANT ECOLOGY
(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Dr Jill Rapson

Objective: The course focuses on specific practical and theoretical topics in plant ecology which have global relevance but where a significant New Zealand contribution can be, or is being made.

Outline: Topics are chosen to reflect the interests of the students in any particular year. Recent topics have included climax communities, dune ecology, Intermediate Disturbance Hypothesis, components of urban floras, invasion ecotones, allelopathy, forest dieback, community structure and plant-animal interactions.

Usually half of the course is dedicated to a field project designed, conducted and written up by the class. Recent projects have examined the dune dynamics of Hellfire Pass, Stewart Island, and demography of beech around the Manawatu beech gap.

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Pre-requisites: BSc in any biological sciences subject.

Textbooks: Library and web resources.

Lecturers: Dr Jill Rapson and Associate Professor Alastair Robertson.

Dune at top of Hellfire Pass, Rakiura National Park. The work was published as Murphy et al. (2012) in New Zealand Journal of Botany.

Stanfield Hut as base in the West Tamaki catchment on the edge of the Manawatu beech (Fuscospora fusca) gap, March 2013.

196.793 SPECIAL TOPIC (ECOLOGY)
196.794 (Semester 1, 2 or 1 & 2, 15 credits)

Paper Co-ordinator: Case-dependent, but initial enquiries should be directed to Dr Ian Henderson.

Objective: To meet a defined and special academic need.

Outline: Special Topics normally involve papers already taught within or outside the Ecology Group, and may include extra work alongside that specified in the Massey Calendar. In extraordinary circumstances a novel special topic paper may be constructed to match the particular needs of an individual.

Pre-requisites: BSc in any biological sciences subject.

Lecturers: Specific to each case.

194.709 CONSERVATION ENDOCRINOLOGY AND REPRODUCTIVE BIOLOGY

(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Professor John Cockrem
Institute of Veterinary, Animal and Biomedical Sciences
(J.F.Cockrem@massey.ac.nz), ext 85126

Objective: In this paper students will gain an appreciation of the "state-of-the-art" in specific areas of conservation physiology, especially conservation endocrinology. There are opportunities to consider how basic principles can be applied to conservation questions. The paper also covers skills in locating information, synthesising and presenting ideas, and in analysing original scientific papers.

Outline: Students will study four topics during the year, with the topics chosen by each student. The first topic will be in reproductive endocrinology and the second topic will be in the endocrinology of stress. The third and fourth topics will be chosen by each student in consultation with the paper coordinator.

Pre-requisites: BSc in zoology or physiology

Textbooks: None

Lecturers: Professor John Cockrem

199.714 ANIMAL BEHAVIOUR
(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Dr Isabel Castro

Objective: Help students become critical and informed readers of published research on the evolution of animal behaviour.

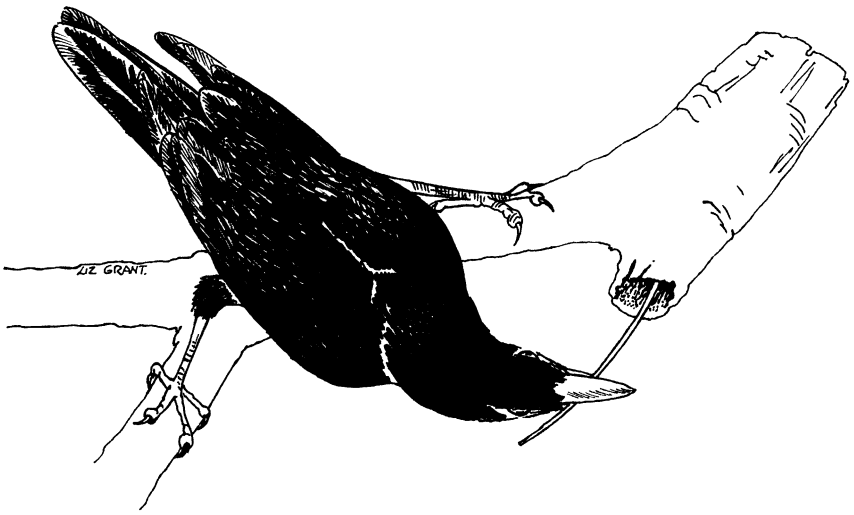
Outline: How do animals choose a mate, avoid a fight, find a meal, communicate and rear their young? These are some of the problems we investigate in detail through reading current literature and fortnightly discussions.

Topics change from year to year and according to the interests of the participants.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided.

Lecturers: Dr Isabel Castro



199.717 ENTOMOLOGY
(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Professor Murray Potter

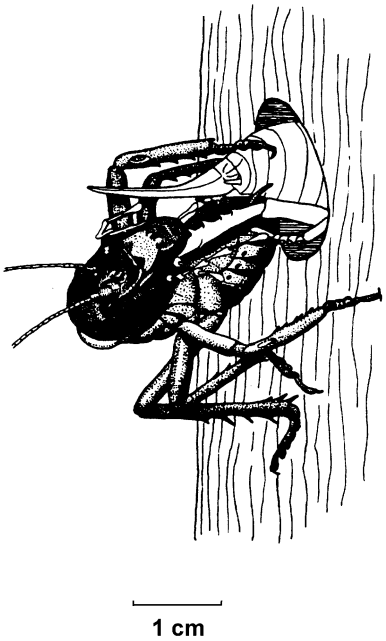
Objective: To promote an in-depth study and critical evaluation of selected advanced topics in both pure and applied entomology.

Outline: An advanced course of study involving literature reviews, tutorials and personal research on selected aspects of insect evolution, physiology, behaviour and ecology. Topics include the evolution of insect flight and sociality, pollination of native plants, courtship and mating behaviour, reproductive hormones and pheromones, human-insect interactions, and insect dispersal, pest management and post-harvest disinfestation.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided.

Lecturers: Professor Murray Potter, Associate Professor Alastair Robertson, Dr Masha Minor, Associate Professor Mary Morgan-Richards, Professor Steve Trewick.



Male and female Hemideina femorata at gallery entrance, showing copulatory position of the male (outside gallery). (From Field, L.H. & G.R. Sandlant 1983).

199.719 TOPICS IN BIODIVERSITY
(Semesters 1 & 2, 15 credits)

Paper Co-ordinator: Dr Ian Henderson

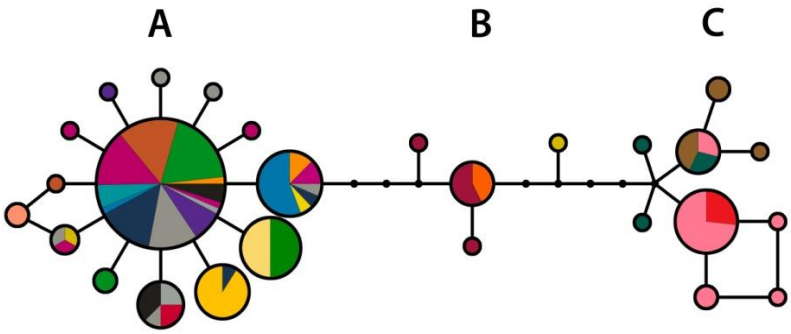
Objective: To review the theory and methods for the analysis of biodiversity patterns and processes in space and time. Learn about phylogenetic trees, phylogeography and other genetic methods for testing hypotheses in evolution, historical biogeography, and regional biodiversity.

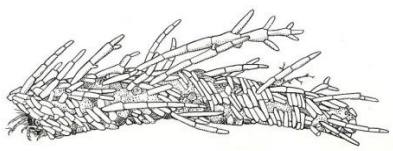
Outline: Topics covered could include the molecular clock, vicariance vs. dispersal as explanations for New Zealand biogeography, phylogeography and geological/climatic history within New Zealand, biodiversity hotspots, speciation and hybridization. A practical project involving analysis of a molecular dataset to test a biogeographic or evolutionary hypothesis will introduce a range of analytical techniques and software.

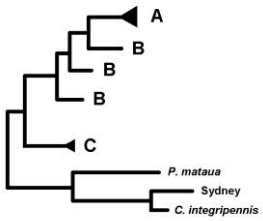
Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided.

Lecturers: Dr Ian Henderson, Associate Professor Mary Morgan-Richards and Professor Steve Trewick.







199.793 SPECIAL TOPIC (ZOOLOGY)
199.794 (Semester 1, 2 or 1 & 2, 15 credits)

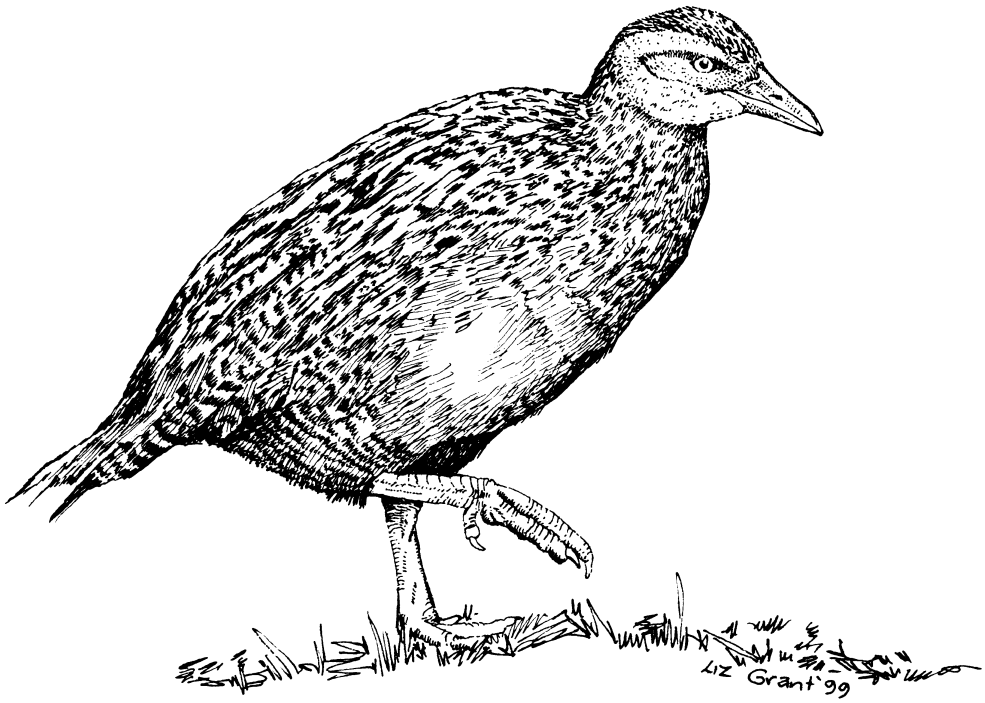
Paper Co-ordinator: Case-dependent, but initial enquiries should be directed to Professor Murray Potter.

Objective: To meet a defined and special academic need.

Outline: Special Topics normally involve papers already taught within or outside the Ecology Group, and may include extra work alongside that specified in the Massey Calendar. In extraordinary circumstances a novel special topic paper may be constructed to match the particular needs of an individual.

Pre-requisites: BSc in any biological sciences subject.

Lecturers: Specific to each case.



232.701 CONSERVATION BIOLOGY
(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Professor Doug Armstrong

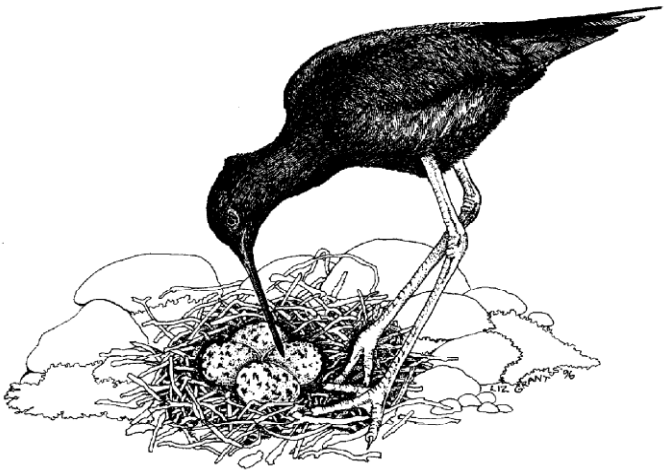
Objective: Conservation biology involves applying theory from several branches of biology to the problem of conserving biological diversity.

Outline: This paper covers a range of general issues in conservation biology, including: ethical and cultural issues, demographic and genetic issues, population viability analysis, metapopulation biology, and community-level conservation. We may also cover several specific topics in depth.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided.

Lecturers: Professor Doug Armstrong, Associate Professor Mary Morgan-Richards, Professor Murray Potter, Professor Steve Trewick.



232.703 WILDLIFE MANAGEMENT
(Semesters 1 & 2, 30 credits)

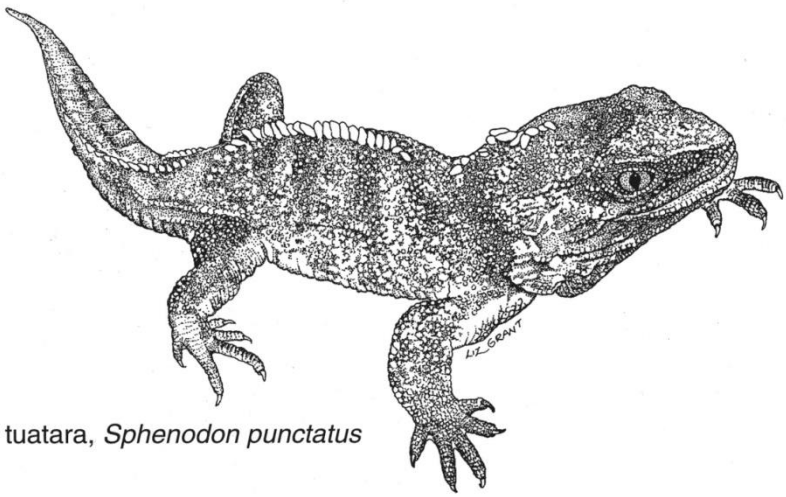
Paper Co-ordinator: Professor Doug Armstrong (Palmerston North)
Professor Dianne Brunton (Albany)

Outline: This paper provides experience managing and monitoring wildlife in the field, analysing data collected in the field, and writing reports. Fieldwork is conducted on both island and mainland systems, and includes visual surveys, capture methods, tracking tunnels, radio telemetry and predator control. Analytical techniques involve estimation of abundance, survival analysis, home range analysis, and population viability analysis. There is a strong emphasis on understanding the theory underlying the methods used.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided

Lecturers: Professor Doug Armstrong, Professor Dianne Brunton, Dr Isabel Castro, Dr Mike Joy.



tuatara, *Sphenodon punctatus*

232.705 CAPTIVE BREEDING & MANAGEMENT

(Semesters 1 & 2, 30 credits)

Paper Co-ordinator: Associate Professor Brett Gartrell
Institute of Veterinary, Animal and Biomedical Sciences
(B.Gartrell@massey.ac.nz), ext 85203

Outline: The captive breeding of New Zealand's endangered indigenous species requires a wide variety of nutritional, management and disease control programmes. This paper will explore some of the problems which may arise in some selected species and how they may be handled to ensure that healthy individuals are available for release.

Having completed this paper, a student will:

1. Have a broad understanding of the principles of captive breeding for conservation, its advantages and disadvantages.

2. Understand the principles and problems of formulating captive diets for wild species.

3. Understand problems associated with captive management in relation to genetics, behaviour and domestication.

Pre-requisites: BSc in any biological sciences subject.

Textbooks: Extensive reading is provided

Lecturer: Associate Professor Brett Gartrell

STAFF RESEARCH PROFILES

PROFESSOR DOUG ARMSTRONG *Room 1.38, AgHort Building*
Extension 84207
Email : D.P.Armstrong@massey.ac.nz

CONSERVATION BIOLOGY AND WILDLIFE MANAGEMENT

My research group focuses on conservation problems at the population, metapopulation and species level in terrestrial systems. We emphasise the interchange between theory and management in solving conservation problems. This involves developing explicit hypothesis for factors limiting populations and metapopulations, testing these using field experiments (where possible) or model selection techniques, and exploring the consequences of alternative management strategies using simulation modelling.

Recent Research Projects

Reintroductions

Our main interest over the last 20 years has been understanding factors limiting success of reintroduced populations. This has involved long-term studies of hihi (stitchbirds), toutouwai (robins), tieke (saddlebacks) and other bird species reintroduced to offshore islands and mainland sanctuaries. This has involved many postgrad students including current PhD students Kate Richardson and Liz Parlato.

Population Ecology

Our research on reintroduced population draws heavily on theory and techniques from population ecology. This involves developing models for factors affecting survival, reproduction and dispersal in populations, and using these to predict population dynamics. For example, we have developed models allowing us to determine the amount of predator control needed, the number of birds that can be harvested for further reintroductions, and to estimate effects of poison drops on populations. A major development in research years has been Bayesian modelling whereby prior information from multiple populations is used to develop pre-reintroduction models which are then updated after release. Other areas of interest include improving methods for interpreting monitoring data such as tracking tunnel data, artificial nest data, and call counts, including MSc student Emma Williams' current research on bittern monitoring.

Impact of Habitat Fragmentation

A major focus over the last 10 years has been on relative roles of metapopulation factors (chance extinction, isolation) versus habitat factors (predation, food, etc.) in declines of species from fragmented habitats. We have used a set of 24 native forest fragments near Benneydale for this research, and used toutouwai as the model species. The research has included presence-absence surveys; intensive data collection on survival, reproduction, and dispersal; experimental reintroduction to unoccupied fragments; and experimental predator control in selected fragments. This research is currently winding down, but the study system could provide a great opportunity for anybody interested in fragmentation research.

Potential Student Projects

- New reintroductions. Reintroductions are going on all the time and some of these lend themselves to good student projects. The hihi reintroduction to Bushy Park in April 2013 could be a great opportunity for a MSc student.
- Research on existing reintroduced populations. We have banded and monitored some populations for several years, and these populations are a great resource for studying a range of issues.
- Modelling existing data. One issue that desperately needs attention in New Zealand is the development of optimal population monitoring strategies. We have intensive data sets that could be modelled to develop such strategies, and this would be a great project for a MSc and PhD student with good quantitative skills. We also have 10+ years of distance data collected by 196.315 students that could modelled for a BSc honours project.
- Assessing impacts of management. We have developed quantitative techniques that can be used to assess a range of management impacts on populations, particularly if animals are individually marked. The Animal Health Board is currently looking to fund a student to investigate the biodiversity effects of 1080 applications to control bovine TB.
- Research in forest fragments. As noted above, the developed study system at Benneydale projects a great opportunity, not only to investigate effects of fragmentation but also to use the fragments as replicates in controlled experiments. One possibility we have considered is using the system to investigate competitive interactions of rats and mice.
- Skink distribution and abundance. MSc students Rowena Teal and Moniqua Nelson-Tunley have done projects on the conservation biology of small-scaled skinks in the central North Island, and there is scope for more research. I am also interested in getting a handle on the local distribution of ornate skinks, and that could also be a good student project.
- Something completely different… Some students may wish to pursue their own interests, which may not closely match the ongoing research of potential supervisors. Such projects may be quite feasible if the logistic and funding requirements can be met.

ASSOC. PROF. PHIL BATTLEY

Room 1.10, AgHort Building
Extension 84838
Email: P.Battley@massey.ac.nz

AVIAN ECOLOGY

My research focuses on the biology of long-distance migrant shorebirds (also known as waders), but I am interested in most issues related to birds. Shorebirds provide an excellent excuse to travel for research, and I am involved in research programmes that link New Zealand, Australia, eastern Asia and Alaska. Approaches involved in studying such migrants vary, but include behaviour, physiology, demographics and telemetry. Our local estuary (Manawatu River) provides an ideal study site for detailed, intimate studies on the behaviour of individual free-living shorebirds

Current research projects:

Migratory decisions and performance in bar-tailed godwits

We recently used satellite telemetry to document the longest non-stop, non-feeding migratory flights of any bird – 10,000 km from New Zealand to Asia, and over 11,500 km returning from Alaskan breeding grounds to New Zealand. These flights are immense feats of endurance exercise taking more than a week. This work was followed up by Jesse Conklin (PhD) looking at how individual godwits schedule their migrations and annual events, for which he used small light-sensitive dataloggers to track the migrants' entire journeys, as well as intensive fieldwork and digital photography at the Manawatu River Estuary. Jimmy Choi (PhD) studied the next stage of godwits' journeys, their stopover ecology at Yalu Jiang Nature Reserve in the northern Yellow Sea, China. With Angela Merino (PhD) and Dr Andrew Fidler at Cawthron Institute, we are now looking at the molecular basis for individual godwit migration timing.

Plumage colouration in shorebirds

How do migrants cope with the fact that the breeding plumage feathers they moult into on the non-breeding grounds may be months old and have been subject to the wear and tear of 17,000 km of travel by the time birds actually breed? I have been studying how feather colouration reflects investments of melanins and the amount of wear on the feather, across species and at different migration stages.

Migration and reclamation

About two million shorebirds pass through the Yellow Sea region of China and the Korean Peninsula on their way to (and in some cases from) the breeding grounds. The tidal flats they use are amongst the most threatened in the world. I was involved in a joint Australasian Wader Studies Group–Birds Korea survey programme at Saemangeum, South Korea, to evaluate the impact of a 41,000 ha reclamation project destroyed one of the most important sites for shorebirds in Asia. Now, new reclamations in Bohai Wan in China threaten New Zealand's Red Knots. I have been tracking Red Knots via geolocators to identify the sites used by knots throughout their migrations to Russia and back, revealing that the Gulf of Carpentaria in northern Australia is used extensively on both northward and southward migrations.

While my own research will continue to be on shorebirds, I am happy to supervise students working on their own subjects. I have, or recently have had, students working on Rockhopper Penguins on Campbell island, post-release survival of oiled Little Blue Penguins from the Rena spill, and the foraging ecology on non-breeding Wrybills in the Firth of Thames. If fieldwork is not your thing, talk to me about possible studies using shorebird specimens to look at feeding morphology or body composition. I also work closely with colleagues in Wildbase (IVABS) and will be co-supervising a Yellow-eyed Penguin project on Enderby Island in the subantarctic.

DR ISABEL CASTRO

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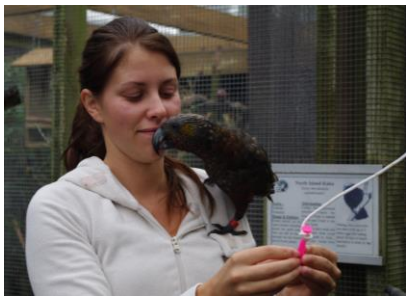
At the moment I run three main programmes:

Behavioural Ecology of New Zealand birds: I manage a big programme studying brown kiwi. Our projects in the last eight years have shed light on the use senses, reproduction and foraging. With PhD (2011) Susan Cunningham, Maurice Alley (IVABS) and Murray Potter we discovered and studied the use of the kiwi bill-tip organ. Brown kiwi had only been found breeding monogamously, but with PhD (2011) Birgit Ziesemann, Dianne Brunton and WeiHong Ji (INS), and more recently Ecology postdoc Sarah Jamieson and collaborators from San Diego Zoological Society we have found that in our population brown kiwi engages in a variety of mating systems. With MSc student Alex Wilson (2014) and Sarah Jamieson we looked at brown kiwi chick survival and dispersal at our study site, the first study of its kind. With MSc student Sian Reynolds (2013) and co-supervisors Maurice Alley and Anne Midwinter (Hopkirk Institute) we examined the uropygial gland of kiwi and hihi trying to shed some light to the long term problem of what is the gland for. Kiwi eggs suffer heavy losses for what it seems to be microbial contamination, so with MSc student Jess Hiscox (2014) and co-supervisors Anne Midwinter and Nigel French (Hopkirk Institute) we examined the microbial flora of kiwi eggs and whether and how microbes can get into the egg. MSc student Jillana Robertson is studying the time budgets of brown kiwi at Maungatautiri with Murray Potter and me. My personal research in collaboration with David Greenwood (University of Auckland) centres in finding out whether brown kiwi use the sense of smell for communication and if so, how.



Other projects include: hihi breeding biology and the effect of habitat on their reproductive output with my graduated students Matt Low (PhD, 2004) and Troy Makan (MSc, 2006) with whom I have an ongoing collaboration; morepork's diet in relation to available food and their roosting behaviour with Kirsty Denny (MSc 2009); foraging behaviour of saddlebacks with MSc student Alana Smith; behaviour, ecology and management of *Powelliphanta* snails with MSc student Rachel Turner (2011); problem solving in parrots with MSc

student Rachel Riley; and comparison between the diets of weasels and kiwi with Honours student Kathryn Strang (2013).

Parasites and Diseases of wild NZ birds: I have several projects aimed at, first finding out what parasites are affecting our forest birds and then, what is the impact of the various diseases or infections on the birds' life. With Laryssa Howe (IVABS), Dan Tompkins (Landcare Research), Kate McInnes (DoC) and Rosemary Barraclough (INS) we have recently finished a project looking at the seasonal prevalence of malaria on saddlebacks, the possible vectors of the parasite, and other bird species which could act as reservoirs. This project was followed by a study of vector borne diseases in conjunction with Daniel Tompkins and Graham MacKereth (MAF). These studies have started to make a picture of what our native parasites are like. For example, one of three *Plasmodium* isolates from our saddleback work is most likely native. Currently PhD student Ellen Schöner is investigating avian malaria transmission through historical and current reintroductions of saddlebacks. I have collaborated with Maurice Alley (IVABS) and other parasitologists in the supervision of projects involving the study of parasites and diseases: coccidia in kiwi with PhD student Kerri Morgan; protozoans in passerines with Ellen Schöner (MSc, 2010); gastric parasites influencing mortality in kaki with Louisa Robertson (MSc 2009); and diseases associated to hihi chick mortality at Zealandia (Karori) with MSc (2010) Rosemary Rippon.

Predator-prey relationships in the NZ forest. I am interested in this subject because the biggest threat of the NZ fauna is introduced predators but our knowledge of their behaviour in the NZ context is scant. Early on, Lee Shapiro (MSc 2005) examined the diet of ship rats and kiwi chicks and detected a 90% overlap demonstrating the role of ship rats as food competitors of kiwi. We have recently completed two research projects. With Gaylynne Carter (PhD 2011), Murray Potter (IAE), John Innes (Landcare Research), and Rachel Fewster (University of Auckland) we examined ship rat behaviour in the face of stoat odour at several mainland sites and in captivity at Massey. With Dai Morgan, a post-doc, we looked at the effect of rats on invertebrate density. With PhD student Kathryn Strang, Nick Cave and Murray Potter we are looking at predator/prey relationships on an Island where cats are the top predator.

DR ANDREA CLAVIJO McCORMICK *Room 1.24, AgHort Building*
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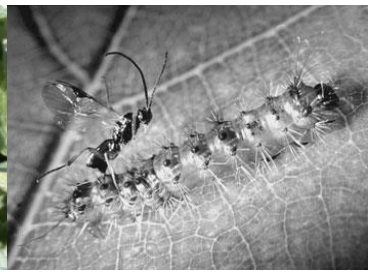
CHEMICAL ECOLOGY

My main research interest is to understand communication within and across trophic levels mediated by secondary metabolites (such as plant volatiles and pheromones), and to apply this knowledge for restoration, conservation and sustainable control purposes. I am also interested in understanding how organisms perceive and respond behaviourally to chemical cues and in the evolutionary processes underlying changes in perception and behaviour.

Previous and current research topics





Artificial bird perches as facilitators of seed dispersal in fragmented landscapes

Some human practices, such as intensive crop and livestock farming, cause severe fragmentation on natural ecosystems disrupting a number of ecological processes and endangering multiple species. The aim of this project was to understand the patterns of seed dispersal by birds across vegetation patches in a highly fragmented Andean ecosystem and to investigate the use of artificial perches as a restoration strategy to facilitate seed dispersal and regain connectivity between fragments.

Optimization and validation of field management strategies for the Guatemalan potato moth through the use of its sexual pheromone

The Guatemalan potato moth *Tecia solanivora* is one of the most devastating potato pests in the Andean regions of South America. Most potato farmers in this region have relied on the indiscriminate use of pesticides, which have negative consequences for human health and the environment. The aim of this project was to design and implement a sustainable control strategy for this pest-species using its sexual pheromone through a mating disruption technique, in order to reduce the environmental impact and noxious effects on non-target species (including humans).

Volatile mediated indirect defence of poplar trees

Herbivorous insects use plant volatiles as cues in their host selection process, but the natural enemies of the herbivores (parasitoids and predators) can also use the volatiles emitted by plants upon herbivory to obtain seemingly specific information about their prey's quality and location, in a phenomenon known as "indirect defence". The aim of this project was to explore this phenomenon in a natural stand of old-growth poplar trees in Germany and to identify the compounds responsible for natural enemy attraction, as well as the underlying mechanisms leading to their emission.

What happens when mother doesn't know best? Evolutionary diversification and changes in host-plant selection by the European gypsy moth

According to the "mother knows best" hypothesis females of herbivorous insects are expected to oviposit in plants that will maximize the performance of their offspring. However, in some cases females are flightless and thus unable to select optimal hosts. This is the case in the European Gypsy moth *Lymantria dispar dispar*. The aim of this project is to explore the adaptations in host-plant selection associated to the loss of flight by females. Some of our main research questions are: Does the lack of choice by the mothers reflect in a higher ability of the larvae to discriminate between different quality hosts? Are males somehow involved in host choice? Is lack of flight associated to a loss of olfactory ability in the females?

Potential Masters and Honours Projects

1. The impact of landscape fragmentation on plant volatile-mediated communication
2. Understanding the volatile-mediated ecology of invasive plant species
3. Exploring diversification and host-plant selection in native moth species
4. Development of sustainable control methods for pest-insects based on pheromones and/or plant volatiles
5. In general I am open to new ideas within the field of chemical ecology and willing to support students in obtaining funding to pursue their own projects

PROFESSOR RUSSELL DEATH

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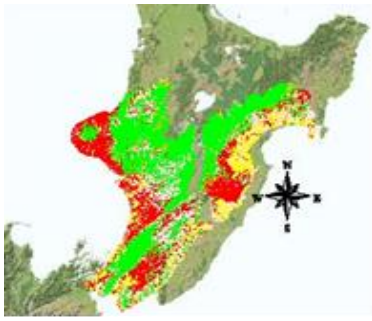
FRESHWATER SCIENCE FOR RIVERINE MANAGEMENT

My research interests are predominately in the community ecology of invertebrates in streams and rivers. I am particularly interested in the application of community ecology theory to the better management of New Zealand aquatic systems. We undertake consultancies for Regional Councils, Department of Conservation etc. to develop novel approaches to the management of freshwaters throughout New Zealand. On a more ecological front I am interested in the effects of floods on stream invertebrate community structure and resilience, particularly in relation to climate change. I have strong interests in quantitative and statistical methods, as well as modelling approaches.

Current Research Projects

Some of the projects I am involved with at the moment are:



1. Extreme floods of the future - Changes to climate patterns will alter the frequency and intensity of droughts and floods. I am currently working with researchers at the University of Birmingham to model the link between hydrology and invertebrate communities. We then hope to couple those models to future climate scenarios for UK rivers.

2. Effect of nutrient enrichment on instream biodiversity – One of the major detrimental impacts on New Zealand rivers is the addition of nutrients from fertiliser. We are attempting to quantify the relationship between nutrient inputs and biological measures of water quality and to integrate that science in to National and Regional water quality plans.

3. Global patterns of biodiversity in Springs – We are examining the invertebrate communities in springs and streams of Northern Spain, Finland, Chile, Tasmania and New Zealand to identify the similarities and differences in community ecology across the globe. We are currently applying for funding for this work to include springs in the Grand Canyon and Florida.

Potential Masters and Honours Projects

1. What is the flow frequency threshold to maintain ecological health?

2. What are the effects of global climate change on New Zealand streams?

3. Any projects linking geomorphology and ecology.

4. How do floods and nutrient enrichment interact to affect stream communities?

5. Diversity patterns in Tasmanian (or New Caledonian) springs and streams.

6. What width do you need for riparian buffers on farmland to preserve biological diversity?

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LIMNOLOGY AND BIOGEOGRAPHY

My research interests are varied; including biogeography, systematics, freshwater ecology and fisheries modelling. I have a long-standing interest in Trichoptera (caddisflies), including taxonomy, biogeography and ecology. New Zealand's diverse caddisfly fauna (and other aquatic insects) offer many interesting evolutionary puzzles at both phylogenetic and phylogeographic time-scales. A new area of research for me is in modelling recreational fisheries, particularly the impact of catch-and-release mortality on optimal harvest controls. Students I supervised have worked on a wide range of topics including: stream invertebrate communities; trout diet, blue duck; dairy farm stream water quality; endangered freshwater fish; rockpool fish communities; leaf-litter retention in streams; and the diet and movement of kereru.

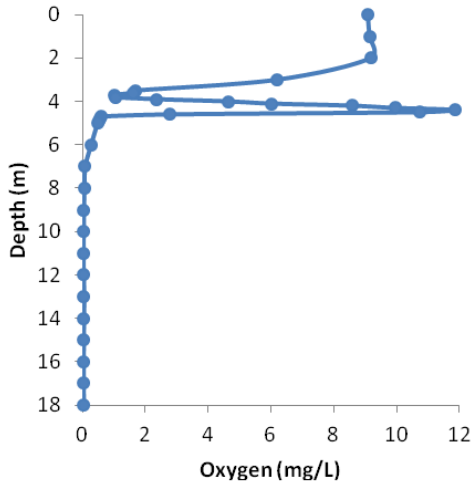
Potential thesis topics:
Lake Namunamu is a small lake near Hunterville that the 3rd year Limnology class visit and sample. We have discovered some interesting features in this lake including an unusually diverse, but highly variable, zooplankton community; a dense layer of green-sulphur bacteria below the thermocline; and a 'habitat squeeze' on the population of rainbow trout that is stocked by Fish & Game NZ.

Three years of monthly monitoring of the lake has been completed which provides a good baseline for more detailed research projects and has identified more puzzles concerning this lake. Despite being surrounded by forest and having no obvious sources of excess nutrients, Namunamu has extreme concentrations of phytoplankton, at times exceeding the theoretical maximum possible level of chlorophyll. Extreme gradients of dissolved oxygen are also found at the thermocline. Super-saturation and near-zero concentrations can be found within half a metre of depth and the complex profiles have no precedent in any lake worldwide. The most recent unsolved puzzle arose after some overnight sampling. Oxygen concentrations increased at night – the opposite of that expected.

A postgraduate student with an interest in environmental chemistry could make an important contribution to understanding this puzzling lake, but a wide range of studies are possible including food-web analysis, trout population and harvest dynamics, the role of pine pollen in the nutrient budget, the role of photosynthetic

bacteria in recycling and vertical transport of nutrients, and small stratified lakes like Namunamu as sentinel indicators of climate change.

Pine pollen on the surface of Lake Namunamu, is this a critical source of phosphorous for the lake ecosystem?



Dissolved oxygen minimum and maximum in Lake Namunamu, November 2013. Such extreme oxygen gradients are unprecedented worldwide. What is causing this?

Marine caddisflies are an evolutionary oddity and are confined to New Zealand and Australian waters. Recent phylogeographic work has shown that the Australian populations are most likely the result of human-aided introductions but also identified an unexpected genetic disjunction on the east coast of North Island. There is further work to do on this fascinating animal (see the page for 199.719) to determine exactly where this break occurs, whether it involves cryptic species or a hybrid zone, what could be the cause of this pattern, and perhaps whether other shore invertebrates show a similar pattern.

Marine caddisflies and Lake Namunamu are the two areas of studies that interest me particularly at the moment but I would consider other ideas involving ecological or biogeographical questions concerning aquatic invertebrates or lakes.

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ENVIRONMENTAL MANAGEMENT

My particular interests are species management, tourism, and environmental economics. Given my background, my research interests are fairly eclectic and it's probably easier to look at some of the topics I've (co) supervised to see what I do:

PhD's

- Assessing the impacts of extreme floods on agriculture in Vietnam: Quang Nam case study.
- A Rapid Evaluation Method to Improve Project Decision-Making Associated with Natural Resources.
- Sustainable ecological systems and urban development in New Zealand: a freshwater case study.
- An application of satellite tracking technologies to conserve wildlife: A case study approach.
- The Application of Multiple Criteria Analysis to Reduce Institutional Inefficiencies in National Park Funding.
- The Effectiveness of Multi-layer Governance and the Management of New Zealand's Natural Environment – a Case Study.
- The Ecological requirements of the New Zealand bush falcon in plantation forestry.
- Ecological and Economic Benefits of Satellite Tracking Endangered Species.
- United Nations Organisation and the Freshwater Crisis in Developing Countries.
- The Use of GIS and Remote Sensing to Identify Areas at Risk from Erosion: a Case Study in Central Java.
- The Provision of Alternative Energy Systems to Community-Based Rural Communities in New Zealand.

Masters

- Endangered species management planning in New Zealand.
- The Breeding Behaviour and Development of the New Zealand Falcon (Falco novaeseelandiae) in a Plantation Forest,
- A Resource Inventory for the Ruamahanga Catchment, Wairarapa, New Zealand
- Best Practice guidelines for the sustainable construction and management of large hydropower projects: a New Zealand study,
- Ecological Footprint of Japanese Tourists in New Zealand, MSc,
- Energy Saving Potential in the New Zealand Agricultural Sector with Emphasis on the Vegetable Greenhouse Industry,
- Environmental Regulation and Pollution Management in the New Zealand Motor Vehicle Industry,
- A Critical Assessment of Watershed Management in Indonesia
- Constraints to Sustainable Forestry Management in Indonesia,
- The impact of urban development and habitat fragmentation on aquatic invertebrate communities in remnant wetlands: A Christchurch case study.
- Incorporating economic, social and environmental factors into a decision model for sustainable management of natural resources: A case study of the Ningaloo Coast, Western Australia.
- A policy design for solving land conflicts between forestry companies and indigenous people in Chile.

- An analysis of resource development in the oil and gas industry in Papua New Guinea – to identify factors that directly contribute to landowner-related conflicts.
- Environmental Performance Indicators for Energy Sector Industry,
- The Recreational Value of the Ruahine Forest Park: Demands and Concerns of the Users of the Ruahine Forest Park,
- Genetic Engineering and Organic Agriculture: Perceptions of Organic Exporters, Producers, and Consumers,
- Community Owned and Operated Renewable Energy Schemes in Rural New Zealand,
- The status of Guanaco in the Timaukel Area, Tierra del Fuego, Chile

Honours

- The use of alternative indicators to GDP in a steady state economy
- Effectiveness of Vocalisation Recordings in Locxating New Zealand Bush Falcon (Falco novaeseelandiae),
- Observations of the Brooding Phase of the New Zealand Falcon (Falco novaeseelandiae),
- Mitigating Biodiversity impacts in the Environmental Impact Assessment process, case study and genetic biodiversity analysis on an open cast mining site on the Southern West Coast of New Zealand.
- The protection of natural character from the effects, including cumulative effects, associated with coastal subdivision in New Zealand: a case study
- Enhancing Indigenous Ecosystem Biodiversity on Private Land: A case study analysis of the effectiveness of current policy,
- The Adoption of Pine Plantations by New Zealand Falcon (Falco novaeseelandiae) in the Hawke's Bay, New Zealand,
- Satellite Tracking the Movement of an Adult Female New Zealand Bush Falcon (Falco novaeseelandiae),
- An assessment of nature tourism, conservation hotspots and farm stays in New Zealand, Kate Leydon, 2003 (ch)
- Implications of dune stabilisation for natural resource managers along the Manawatu coast, Anna Wilson (PGDipApplSc), 2003 (co)
- The effect of gravel extraction on the recolonisation of stream invertebrates in the Waikanae River.
- The relationship between land use, hydrological processes and the incidence of river water contamination in the Oroua River.
- An assessment of water demands in the Ohau River Catchment, Horowhenua.
- Implementing a captive management plan as a tool for conserving the New Zealand falcon (Falco novaeseelandiae).
- Coastal Hazard Assessment: Investigating the Impacts of Future Sea Level Rise on the Manawatu-Wanganui Coast,
- Community Involvement in Urban Park Management in New Zealand and the Philippines.

- Policy Evaluation for Sustainable Mangrove Management: The Case of Western Visayas, Philippines.
- Use of policy instruments in land management and dairy farm effluent treatment: Survey of Regional Councils and dairy farmers
- An Investigation of the Viability of Lyall Bay, Wellington, as a Suitable Location for an Artificial Surfing Reef.

DR KAREN HYTTEN

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ENVIRONMENTAL MANAGEMENT

My research focuses on social responses to environmental issues. In particular, I have a strong interest in social responses to climate change, social dimensions of wildlife management, and the potential for national parks to promote transformative behaviour change. I am currently supervising students researching diverse topics, ranging from community based adaptation to climate change in Cambodia to e-waste management in Tanzania.

Current Research Interests

Social Responses to Climate Change

Climate change is arguably the most complex and urgent challenge facing contemporary society. However, despite the overwhelming scientific evidence supporting the need for action, social responses to climate change continue to be largely inadequate. In this context, there is a need for research into what shapes these responses and how more effective responses can be achieved.

I have been investigating the social construction of climate change and how it frames and constrains responses to climate change. I am also interested in analysing New Zealand's climate change policy and how it compares to climate change policy in other parts of the world. Finally, I am looking at drivers and barriers to the increased uptake of renewable energy and other options to reduce greenhouse gas emissions.

Social Dimensions of Wildlife Management

Wildlife management seeks to mediate the relationship between humans and wildlife. Conflict between people and wildlife is ubiquitous, both where wildlife negatively impact upon human activities such as growing crops or raising livestock, and where wildlife are perceived to jeopardise human safety. There is an increasing recognition of the importance of the human aspect of negative human-wildlife interactions. However, there is often a continuing lack of understanding about the social dimensions of wildlife management.

I am interested in research that contributes to improving this understanding. I am currently investigating dingo management on Fraser Island, Australia and approaches to managing human-wildlife interactions in the Canadian Rocky Mountain Parks.

The Potential for National Parks to Promote Transformative Behaviour Change

Since the first national parks were created in the 1870s, national parks around the world have come to play a critical role in promoting public awareness about the environment. Today, many national parks offer a wide range of interpretive signs and public education materials. However, for the most part these are focused exclusively on explaining natural phenomena within the park.

I have recently become interested in the potential for national parks to expand upon these messages to raise greater awareness about current environmental problems, highlight the impacts that visitors' day-to-day activities are having on the natural phenomena they have come to see, and promote transformative behaviour change to reduce these impacts.

Current Student Projects

I am currently supervising and co-supervising Masters and PhD students investigating a range of topics including:

- Socio-ecological relationships and livelihood strategies in Northern Thailand national parks.
- Key factors influencing the effectiveness of community-based adaptation to climate change in Trapaing Sangke community fishery, Cambodia.
- Sustainable e-waste management in Dar es Salaam City, Tanzania.
- The potential for non-government organisations to contribute to biodiversity conservation, sustainable livelihood improvement and climate change mitigation in degraded tropical forests in Ghana, Kenya and Uganda.
- Climate change adaptation and mitigation within the tourism sector in Mauritius.
- Integrating wildlife conservation into multi-use production landscapes in New Zealand.

Current Teaching

I currently co-ordinate and teach two undergraduate and two postgraduate papers:

- 188.263 Environmental Science I
- 188.363 Environmental Science II
- 188.705 Natural Resource Policy
- 188.707 Introduction to Advanced Environmental Management

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PREDICTING STREAM FISH AND INVERTEBRATE SPATIAL OCCURRENCE: APPLICATIONS FOR BIOASSESSMENT

My research interests are based around the application of predictive modelling to freshwater environmental impact assessment and general environmental science investigation. Environmental degradation is denied by many in positions of power, and unknown by most New Zealanders although this is gradually changing. One of the many reasons why the true state of New Zealand's environment is not made public is the economic imperative related to our perceived image to both overseas consumers of our produce and potential tourists. Regardless of this denial, accurate assessment of environmental degradation is imperative to sustainable development and this is the goal of much of my research. Accurate biological assessment of environmental condition relies on knowledge of the conditions expected in the absence of impact. These unimpacted conditions are referred to as reference conditions and are assessed using reference sites. The reference site approach underlies many of the predictive bioassessment models I have produced for a number of New Zealand regions. The statistical tools used to produce predictive bioassessment models are many and range from simple univariate indices to complex multivariate software packages. Geographic information systems (GIS) have opened up a huge new field of possibilities for predicting spatial occurrence. We are in a unique situation in New Zealand in that large remotely sensed datasets are available at low or no cost because of government involvement in their production. This is in stark contrast to many other developed countries where these datasets are held by large corporations and not available for research because of high costs. The use of artificial intelligence (AI) to model biological systems is another exciting new development. The ability to predict whole assemblages and model nonlinear relationships offer amazing new possibilities for understanding complex systems.

Research projects - Wellington Region

We have developed an Artificial Neural Network (ANN) to predict the spatial occurrence of freshwater fish in the Wellington Region. The predictions are made using GIS data from the River Environment Classification (REC). The model has been incorporated into a GIS package available to resource management staff at the regional council. This allows any of the staff to assess the likelihood of the presence of 18 species of fish at any site in 32 the region. Ecological information for the species predicted has been prepared by post-grad students in the department and has been added to this system. This enables non-expert biologist staff at the regional council to click on any stream in the region and get all the necessary information on the expected fish fauna and critical habitat requirement information. This has

recently been put online so is available for anyone to use. I have also developed an Index of Biotic Integrity (IBI) for the Wellington Regions.

Auckland Regional Council
We have developed an Index of biotic integrity using fish for the Auckland Regional Council and predictive models using artificial intelligence. This model is made available as software for council staff and consultants to use.

Hawkes Bay Regional Council
We have developed a number of biomonitoring tools for this council including point-click- fish predictive models.

Environment Waikato
We have developed a fish index of biotic integrity (IBI) and predictive GIS based predictive fish model (point click fish) for this Council. Recently the two model were combined into a predictive IBI model which is a world first and this enables the Modelling of different land use change scenarios and measure the effect on stream health. These predictive IBI models for future scenario models of land use changes have been used to predict the effects on stream communities

Modeling Insect invasions
I am a research fellow with the National Centre for Advanced Bioprotection Technologies Lincoln University involved in modeling the probability of invasion of a number of terrestrial invertebrate species in New Zealand.

Future research I am planning research into freshwater fish behaviour using electronic tagging. Questions will include temporal spatial movements and home range assessment. I am also planning further development of GIS and Artificial Intelligence models including collaboration with colleagues in Italy and Colorado USA.

With Russell Death and Ian Henderson we have set up the **Massey University Centre for Freshwater Ecosystem Modeling and Management (CFEM)**. The centre concentrates on improving the quality of freshwater research in New Zealand using new computer based techniques such as ANNs and GIS.

DR MARIA (MASHA) MINOR

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INVERTEBRATE ZOOLOGY & APPLIED ENTOMOLOGY

My research involves terrestrial invertebrates and insects. Research topics include: native invertebrate biodiversity; soil invertebrate communities and ecosystem function; ecology of native and adventive species; impacts of land management on invertebrate biodiversity; ecology of threatened NZ invertebrates; discovery and description of new species; diversity patterns in relation to abiotic gradients.

Applied entomology projects are on ecology of insect biocontrol agents, beneficial insects, and insect pests in agricultural and forest ecosystems.

SOIL & SYSTEMS ECOLOGY

I'm also interested in research which explores the interactions between ecosystems and our economic activities, usually in agricultural context. Emphasis here is placed on an interdisciplinary approach and quantitative techniques, we use several modelling tools. Examples of projects include: sustainability assessment at the farm and catchment level; energy and carbon accounting; soil biodiversity and soil ecosystem services.

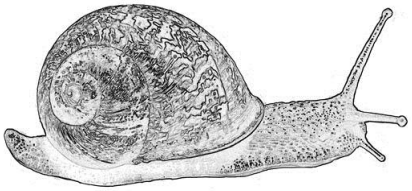
Examples of Postgraduate Student's Projects:

- Native and adventive detritivores in Manawatu forest fragments (MSc)
- Ecology of a lace bug (Hemiptera), and implications for it success as a biocontrol agent in NZ (PhD)
- Soil invertebrates in pastures, their response to pasture management, and links to soil services (PhD).
- Impacts of forest fragmentation on invertebrate community composition and ecological functioning (PhD).
- Ecology and reproductive biology of the bronze beetle, *Eucolaspis* sp. (Coleoptera) (PhD).
- Reproductive behaviour and fitness trade-offs in aphid parasitoid *Diaeretiella rapae* (Hymenoptera) (PhD).
- Effect of translocations on dispersal and foraging behaviour of giant *Powelliphanta* snails (MSc).
- Choosing best traps for collecting invertebrates for biodiversity assessment and monitoring in agroecosystems (BSc Honours).
- Sustainability analysis of organic fruit production systems in New Zealand (PhD).
- Catchment-scale sustainability: trends in carbon emissions during catchment-scale land use management (MSc).

Potential research topics

Because of their high biodiversity, short generation times, easy sampling methods, and a variety of ecological roles, terrestrial invertebrates provide great research subjects. These projects can be large or small, and suitable for a BSc (Hons), MSc or PhD. Some interesting topics are:

- Diversity and distribution of native soil invertebrates. Many native NZ invertebrates – centipedes, millipedes, slaters, and many others – remain poorly studied, and the range of possible projects is huge.
- Adventive invertebrate species and ecosystem function. A number of invertebrate species have been introduced to New Zealand. How invasive are they? How deeply do they penetrate in NZ forests? Do they displace native species? Many native and invasive species of terrestrial invertebrates appear to co-exist in NZ forests; examining their niche differentiation may provide some interesting answers.
- Community structuring in soils. The number of co-existing species in soil and litter communities is very high, and species appear to co-exist without extensive niche differentiation. The study of mechanisms contributing to the structure of species assemblages would provide valuable information.
- Soil biodiversity and ecosystem services in agricultural and urban soils. Soils provide a range of important ecosystem services; invertebrates contribute to some of these services such as decomposition, nutrient cycling, soil structure and drainage, nutrients turnover, etc. Quantifying these services is important for soil management.
- Or you may wish to pursue your own interests – you are welcome to discuss them with me.



"If we knew what it was we were doing, it would not be called research, would it?" - Albert Einstein

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Gene flow, adaptation and the process of speciation is my main research focus. I use the theory of population genetics, and data obtained from cytogenetics, and molecular genetics to address evolutionary questions about how new species are formed and what limits their distribution.

Hybrid zones are regions where distinct populations meet and mate and produce hybrids. There is the potential for hybrid zones to lead to the evolution of reproductive barriers (biological species) and there is the potential for hybrid zones to lead to homogenising of populations. If there is selective pressure against hybrids the zone where the two populations (or species) meet will be narrow (and controlled by the distance individuals disperse). By studying the behaviour and flow of genes and by comparing hybrid zones one can understand more about the evolution of species and the barriers that prevent (or limit) gene flow. There are a number of weta hybrid zones that could be characterized as part of a BSc (Hons), MSc or PhD.

Management Units and the conservation of invertebrates

Conservation requires some understanding of the current biodiversity we have and the use of genetics and evolutionary theory allows informed management of species and conservation units. I have been involved in the study and conservation of tree and giant weta for many years by describing new species, and showing how hybridization could be protecting the threatened Banks Peninsula tree weta (*Hemideina ricta*) from competitive exclusion by the Canterbury weta (*H. femorata*). Many other rare New Zealand invertebrates would benefit from similar studies that could be done in collaboration with the Department of Conservation for a BSc (Hons) or MSc project.

I also have projects working on a range of topics using New Zealand invertebrates such as: “sex without males” in the parthenogenetic stick insect genus *Acanthoxyla*, chromosome evolution in weta, and phylogenetics of marine molluscs.

Current student projects:

Ecology of tree weta
Genetic diversity and the species gradient
Taxonomy of Cave Weta
Conservation genetics of skinks
Evolution of reproductive isolation in ground weta
Phylogeography

New projects available:

Conservation genetics of New Zealand geckos
Taupo eruptions and genetic diversity
Comparison of hybrid zones
Rocky shore communities and population divergence

PROFESSOR MURRAY POTTER

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ECOLOGY, PHYSIOLOGY AND CONSERVATION

My research interests and expertise are broad, encompassing entomology, ornithology, avian reproductive and stress endocrinology, vertebrate and invertebrate conservation biology, nutrition and digestive physiology, predator/prey population dynamics, reproductive strategies, sensory physiology and behaviour, and migration biology. I am especially interested in the interplay between physiology, ecology and natural history of whole organisms within their natural settings, and the application of this knowledge to species conservation. I have helped develop species recovery plans for kokako (*Callaeas cinerea wilsoni*) and kiwi (*Apteryx* spp.) in New Zealand, for *Placostylus* snails in New Caledonia, and for ma'oma'o (*Gymnomyza samoensis*) and manumea tooth-billed pigeon (*Didunculus strigirostris*) in Samoa, and I am involved in research that is of relevance to the conservation of trans-hemispheric migratory birds.

Major foci of my current research include: i) assessment of the endogenous and exogenous regulation of timing of long-distance migration; ii) the physiological stress responses of animals to environmental change and human disturbance; iii) the sensory detection and selection of dietary items; and iv) the relevance of gut physiology and nutrition to animal ecology and conservation. A major thread that runs through my research is identification of the repeatability of responses by individuals that points to adaptive personalities within species, and the application of my research to conservation outcomes.

I am a strong advocate for collaborative research and have co-supervised students with many colleagues including Dr Phil Battley, Dr David Butler, Dr Isabel Castro, Prof. John Cockrem, Assoc. Prof. Brett Gartrell, Professor Roger Lentle, Assoc. Prof. Alastair Robertson, and Dr Dave Thomas.

I have conducted research and supervised students in diverse locations throughout New Zealand and around the world including Alaska, Antarctica, the sub-Antarctic Islands, China, Indonesia, Thailand, New Caledonia, and Samoa.

I have supervised nearly 70 postgraduate students in a diverse range of topics. My current and recent post-graduate students include:

PhD

Current	Przybylski, Charlotte	The welfare impact of ecotourism on wildlife.
	Strang, Kathryn	Population dynamics of feral cats
	Merino, Angela	Genetic structure in migratory waders.
	Stirnemann, Rebecca	The conservation ecology and breeding biology of the ma'oma'o (*Gymnomyza samoensis*) in Samoa.
2015	Tantikamton, Khwanta	Beach quality assessment using benthic macrofauna along the southern Andaman Sea coast of Thailand.
	Choi, Mo (Jimmy)	Foraging behaviour of great knots in the Yellow Sea.
2013	Krainara, Pornuma	Analysis of marine water quality in South-West Thailand following a devastating tsunami.
	Minson, Charlotte	Gut functioning and development of an artificial maintenance diet for captive-held kiwi.
	Dathong, Waewdao	Variables influencing epiphytic macrolichen diversity on *Mangifera indica* in the Northeast of Thailand.
2012	Carter, Gaylynne	Rat/stoat interactions in a New Zealand forest.
2011	Conklin, Jesse	Individual strategies of migration among bar-tailed godwits (*Limosa lapponica*). *Awarded 'Dean's List of Exceptional Theses'.*
	Brescia, Fabrice	Ecology and population trends in the New Caledonian *Placostylus* snail population.
2010	McCartney, Jay	Factors that affect mating behaviour in the bush-crickets (Genus *Poecilimon*).
	Cunningham, Susan	Foraging behaviour and the olfactory and tactile senses in kiwi.

MSc

Current	Challand, Ty	The welfare cost of breed conformation: Perception versus reality.
	Guinee, Geneva	The stress responses of trout to confinement and elevated temperatures.
	Gamarra Landa, Abel	The effects of habitat structure on a predator's efficiency
	Kim, Anne	Physiological responses of starfish to environmental stressors
	Andrews, Chris	Is activity an accurate indicator of oestrus in cats?
	Brighten, Alex	Vocalisation behaviour of the New Zealand morepork (*Ninox novaeseelandiae*).
2013	Lowe, Lydia	Stereotypical behaviour in zoo animals.
2012	Curtin, Emma	Diet and dispersal in the Cromwell chaffer beetle.
	Martin, Ross	Activity patterns of wild stoats in Tongariro Forest.
2010	Jones, Erica	Characterisation of limb development and locomotion in brown kiwi (*Apteryx australis*).
	Cottam, Yvette	Characteristics of green rimu fruit that might trigger breeding in kakapo.

BSc(Hons)

2013	Przybylski, Charlotte	Hunting behaviour in salticid jumping spiders.
2011	Powell, Michelle	Seasonal and spatial variation on *Nikon aestuariensis* (Polychaeta: Nereidae) at the Manawatu Estuary, New Zealand.

DR JILL RAPSON

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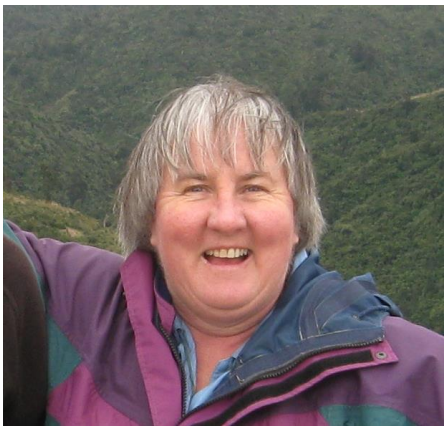
PLANT ECOLOGY



New Zealand has a high proportion of endemic plants, unique to the country, and making up a huge range of vegetation types, which have few similarities with other parts of the world. As well as studying the ecological nature and consequences of this isolated flora, we are interested in its response to the increasing flora of invading plants, which requires a broader approach than just NZ!

My research focusses on these issues, i.e. of both rare and over-abundant (weedy) species, using a range of techniques such as field surveying and monitoring, experimental, modelling, ecophysiological, eco-genetic, and data-base investigations. I tend to focus on habitats of short stature (grasslands, dunes, alpine, desert and wetlands). Other areas of interest include impacts of disturbance impacts on vegetation, urban flora patterns, beech forest dynamics around treeline, and tree-daisy ecology.

Pimelea actea - found in only 3 sites, Fox-Tangi coast

Current research topics

Coastal wetland and dune ecology

Digging an ephemeral dune wetland as habitat for tiny rare turf plants.

Rare wetland turf species - Selliera rotundifolia, Eleocharis neozelandica, Lilaeopsis orbicularis, Isolepis cernua *and* Triglochin striata.

New Zealand has a huge coastline for its size, but relatively few fragments of native duneland vegetation survive, about which relatively little is known. Locally we focus on dune dynamics at several coastal locations, dune forest remnants, and estuarine vegetation of the Manawatu River, often with a conservation focus. Recently we completed surveys of ephemeral wetlands along the Manawatu coast, hosting two locally endemic plants. The Department of Conservation and regional councils are increasingly interested in supporting work along coasts.

Research topics are:

- Ecology of rare native dune sand binders or ephemeral wetland species.
- Re-evaluation of the nationally distributed group of dunelands first surveyed a decade or more ago.
- Impacts of interventionist habitat management in dunelands.
- Nature and regeneration strategies of duneland forest.

Invasion ecology of plants

New Zealand is unusually vulnerable to invasion by exotic plant species. One of the first places in which invasive species take hold is the urban environment. With colleagues from around the world we have been studying the invasion of urban areas, to examine both their floras, and their phylogenetic diversity. Urban floras are all closely related to each other, and species adapted to anthropogenic habitats dominate. More locally, a preliminary study of North Island urban by sabbatical visitor Ulle Asmus of Germany, discovered species previously unrecorded in this country, and we are writing a paper on urban invasion determinants here.

Future research topics might include:

- The occurrence of invading species in New Zealand urban areas, and identification of their functional trait characteristics.
- Relationship between urbanisation and floristic diversity.
- A congeneric comparison of natives and exotics in terms of their ecological amplitude and relative naïvete to competitors.

The urban flora of Bath, England, with waste areas, old factories and long-boats on canals.

Vegetation dynamics

The way in which vegetation changes over time is a constant interest, accessible via a range of techniques, including monitoring over short and longer terms. Current interest is on disturbed and stressed vegetation types, on the responses to climate change of decomposition rates and carbon sequestration in tussock grasslands, and on making restoration techniques more successful. Future research topics:

- Structure and function in restoration plantings of differing composition.
- Habitat and ecologies of wetland species, and their response to water quality.

Also I retain interests in more general areas of plant ecology related to plant taxonomy and ecotypic adaptation, and I like to accommodate student's own research plans where possible. Feel free to come along and discuss your own ideas.

ASSOC. PROF. ALASTAIR ROBERTSON

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PLANT-ANIMAL INTERACTIONS

Plant-animal interactions are an extremely important part of ecology and the study of ecosystem function. I am involved in three main areas of research - the study of vegetation as habitat for animals, the study of herbivory and seed predation, and the study of pollination and seed dispersal. New Zealand has a number of unique interactions of this kind but lacks detailed descriptive ecology or an experimental approach to determine the strength or importance of these links.

Potential Thesis Research Topics:

Manuka Honey
Massey currently is undertaking a large multidisciplinary study of the environmental and genetic determinants of the quality of medicinal manuka honey. Field trials are underway planting selected varieties of manuka that are hoped to be high yielding. But what factors determine nectar yield in the field, and will bees like these new varieties?

Crop pollination
Kiwifruit and avocado are two of New Zealand's most valuable horticultural crops but surprisingly there are some important pollination questions that haven't been properly answered. In avocado, what is the relative attractiveness of different cultivars to honeybees, the effects of temperature and humidity on flower opening, and is pollination at night important? Kiwifruit have separate male and female plants so orchardists need to grow both genders or bring pollen into the orchard. Surprisingly, honeybees much prefer to visit female flowers to the point where insufficient pollen is moved from male to female flowers. Can we make male flowers more attractive or would dusting bees with pollen as they leave the hive work?

Ecosystem services of New Zealand birds
Recent work in New Zealand has highlighted problems with the pollination and dispersal of trees and shrubs caused by the decline in bird populations. Fewer seed is being made and spread around as a result and much of it may be of lesser quality due to selfing and inbreeding depression. Is this decline sufficient to cause demographic declines in tree Fuchsia, kowhai, and tawa or is there enough recruitment to replace adults as they die?

Alpine pollination ecology
The pollination of New Zealand alpine plants has been little studied. New Zealand has a potentially very important role of play internationally as our pollinating fauna consists largely of flies and moths rather than long-tongued bees as is usual in the

alpine habitats elsewhere. Demonstrating the effect this has on the selection imposed on our flora would be a fascinating study for someone interested in botany, entomology and alpine environments.

New Zealand's longest flower tube
The flowers of *Euphrasia disperma* possess what is almost certainly New Zealand's longest flower tube at up to 60mm. Ordinarily, tubes like these are probed by insects with long tongues that reach to the base of the tube to access nectar. However, we are unaware of any native insect with a tongue this long. This challenge of this study would be to reveal the secret of this long flower tube.

The use of flowers by native short-tongued bees
Members of two families of bees (Halictidae and Colletidae) are the dominant bees visiting most native New Zealand plants. The taxonomy of the bees has now largely been worked out but plant-bee relationships are largely unknown. These bees provision their nests with pollen collected from the wild. This provides an opportunity to combine observations in the field with an investigation of pollen from bee nests to determine the identification and importance of native plants for the bees, to look at the habitat requirements of the bees, and to look for examples of plant-bee mutualisms.

Current or Recent Post-Graduate Students:

PhD:	
Amir Sultan	*Biosystematics and ecology of NZ pygmy mistletoes (Korthalsella)*
Merilyn Merrett	*The pollination ecology of forest shrubs*
Tran Hop	*Integrated weed management – broom in NZ pine forests*
Sean Husheer	*The impact of sika deer on beech forest vegetation*
MSc:	
Rob Silberbauer	*The interacting effects of seed dispersal failure and seed predation on seedling recruitment in tawa*
Sarah Jackman	*The potential for leaf-eating beetles to suppress the competitiveness of Tradescantia*
Troy Makan	*The stitchbird (hihi) and its habitat: effects on nesting behaviour and reproductive success*
Michael Perry	*The impacts of hares on sub-alpine vegetation*
BSc(Hons):	
Ngaire Larsen	*Designing insect traps for assessing biodiversity in orchards*
Alana Lawrence	*Do introduced bees facilitate the invasion of lupins?*

PROFESSOR STEVE TREWICK

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BIODIVERSITY, SPECIATION, & BIOGEOGRAPHY

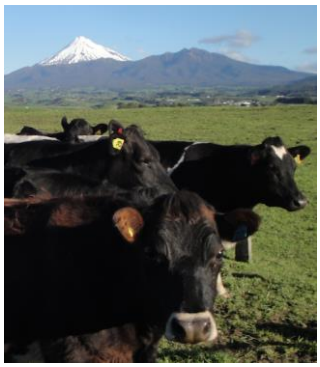
I am interested in how, why and when species form. Why do assemblages have the species they do? To what extent is this a product of historical events such as dispersal, vicariance and extinction, vs ecological adaptation, species interactions and competition? How do species evolve as they interact with one another?

The NZ archipelago has ancient geological links with other (Gondwanan) landmasses, and harbours some organisms of ancient pedigree, but many taxa appear to be the products of recent colonisation or radiation. A mixture of ecological, morphological, physiological, behavioural and molecular approaches to help understand the process that lead to the distributions and interactions of species. I am particularly interested in endemic invertebrates including peripatus, weta, carabid beetles and stick insects, and also birds and reptiles. Studies of these taxa involve comparison with relatives in neighbouring regions such as Australia, South America and New Caledonia.

Molecular tools have contributed much to our understanding of ecology and the testing of questions about adaptation, but an interest and understanding of whole organism biology is essential. Good research requires good questions and these come from observing the natural world, hence a focus on natural history. Molecular tools provide a way to look at nature in both a space (geography) and time, by inferring relatedness through phylogenetics and gene flow (dispersal, migration) using population genetics. Often it is possible to test ideas about the behaviour and ecology of animals using genetic markers that cannot (or not easily) be viewed directly, and as such can be a useful addition to field studies. Similarly, population genetic methods can help research on conservation, and explore the interactions between individuals, populations and related species where they meet and interact ecologically and reproductively.

NATURAL HISTORY

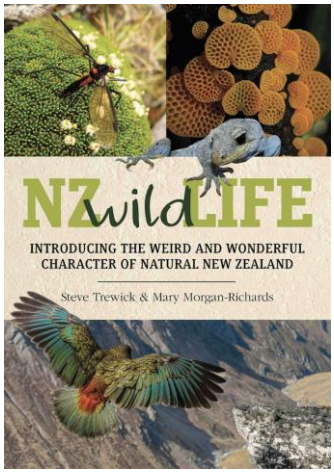
Natural history provides the essential life-history and ecological information needed to understand what makes a particular species successful. It also allows us to test why some species are sensitive to climate change, habitat modification and introduced predators. The same types of information help us understand why some species become pests and biosecurity risks, and how to manage them. Often, simple questions about the biology of an animal lead to novel and exciting discoveries that have implications for fundamental theory, conservation, captive management, species diversity, plant-animal interactions, disease spread and much more.



ENVIRONMENTAL SUSTAINABILITY

Our environment can be classified in many different ways, but escalating human population and climate change are making it impossible to treat the "natural" environment and human environment as different things. In New Zealand, despite our "Clean Green" image, it is very easy to see that human exploitation of the terrestrial, marine and freshwater systems has damaged biodiversity and ultimately sustainability of the very things that make New Zealand distinctive. Coupled with media and economic globalisation our environment is becoming homogenous as well as diminished. Understanding how ecosystems operate, whether they be native rimu forest or farm paddocks, is an essential step toward being able exist in a sustainable way in our landscape. Combinations of ecological, GIS, niche modelling and bio-inventory methods provide the opportunity to contribute to the future of life on Earth.

Read about the evolutionary ecology and environment of New Zealand in: *NZ Wild Life*. Penguin New Zealand.



Some recent/current projects include:

- Niche modelling alpine diversity.
- Global phylogeography of pukeko (*Porphyrio*).
- Mapping Turitea environments.
- Microendemism of micorsnails.
- Seed predation by tawa moth.
- Patagonia and Chilean red crickets.
- New Zealand microparasites- *Wolbachia*
- Evolutionary ecology of brush-tailed possum.
- Mate location and mate choice in stick insects.
- Diet and ecophysiology of tree weta
- Sexual selection and diversity in the ground weta.
- Systematics and population genetics of cave weta.
- Deep time diversification of rails.
- Skink conservation genetics.
- Ecology and behaviour of weka (*Gallirallus australis*).
- Evolutionary rates in New Zealand marine molluscs (fossils and DNA).
- Conservation genetics of *Powelliphanta* land snails.
- Behaviour and phylogeny of Fijian honeyeaters.
- Southern hemisphere biogeography of weta.
- Speciation and evolution of flightless rails (Rallidae).
- Conservation of Philippine crocodile.
- Reproductive and ecological interactions at tree weta contact zones.
- Tui foraging behaviour.
- Seed predation and plant/insect mutualisms.
- Host-parasite interactions in cabbage aphid.

You can find more about the Phoenix research group at: evolves.massey.ac.nz

STRUCTURE OF POSTGRADUATE DEGREES

POSTGRADUATE DEGREE OPTIONS IN ENVIRONMENTAL MANAGEMENT

DEGREE	STUDY MODE	NO. of SEMESTERS	YEARS	CREDITS REQUIRED	PART A			PART B		
					CORE PAPER (CREDIT)	PAPER STREAMS (CREDITS)		CORE THESIS (CREDITS)	CORE RESEARCH REPORT	SCHEDULED PAPER STREAMS
PhD in Env,Mgmt. (entry by Hons. or Masters degree)	Full time / mixed mode	-	3	-	-	-		120	-	-
MEnvMgmt if GPA ≥ B	Full time / distance / mixed mode	3 to 9	1	180	188.763 (30)	➡ 2 papers from selected from 2 Streams (60) ➡	if PART A GPA ≥ B+	188.888 Thesis (90)	-	-
							if PART A GPA < B+	-	188.863 Environmental Research and Data Analysis (60)	1 paper selected from a Stream (30)
Upgrade existing Hons or PGDip to MEnvMgmt	Full time / distance / mixed mode	1 to 2	0.5	60	-	-	if GPA ≥ B	-	188.863 Environmental Research and Data Analysis (60)	-
BEnvMgmt(Hons) if GPA ≥ A-	Full time / Distance / mixed mode	2 to 6	1	120	188.763 (30)	1 paper selected from a Stream (30)		188.787 Dissertation (60)	-	-
PGDipEnvMgmt	Full time / distance / mixed mode	2 to 6	1	120	188.763 (30)	3 papers from selected from 3 Streams (90)		-	-	-

Master of Environmental Management
Bachelor of Environmental Management with Honours
Postgraduate Diploma in Environmental Management

The Degrees

The Masters degree programme has been shortened to align with international trends and also to make postgraduate studies cheaper and more accessible without compromising their integrity. Effectively, if full use is made of the third semester (summer school) a Masters degree can be completed within a one-year period. This means that both undergraduate and Masters level studies are now able to fall within the four-year government funding time catchment.

Traditionally, students taking this programme have first degrees in geography, environmental economics, environmental planning, zoology, and ecology.

The pictogram is self-explanatory and shows that the degree may be undertaken either full time, in distance mode, or a combination of the two and the study modes are reflected in the length of time allowed to complete the degrees.

Entry into the Honours program requires an A- aggregate and is especially suitable for those candidates who want to undertake a PhD.

Contact Details

Contact Persons for the Proposal: Associate Professor John Holland
Associate Professor Bob Stewart

To gauge market demand for Environmental Management postgraduates, I monitor employer organisations and survey past graduates who are in the workforce and use the feedback to modify our courses to meet employer needs. Some of the results are presented below:

Workplaces

- Private consultancies and businesses (17%)
- Research/University/district/city councils (28%)
- Central government departments (11%)
- International organisations e.g. UN, FAO (4%)
- Multinational organisations (15%)
- Overseas governments (15%)
- Other (11%)

Income

- The average annual salary of graduates is approximately NZ$83,250

Life skill benefits

(1=strongly disagree, 3= neither disagree nor agree 5= strongly agree)	MEAN	SD
My degree provided an essential platform for my career	4. 3	0. 9
My degree increased my ability to think laterally	4.3	0.7
My degree challenged me from a philosophical perspective	4.2	0.8
Markedly increased my self-confidence	3.8	0.9
My degree contributed significantly to me being where I am today	4.2	1.0
My degree taught me to view situations from many angles	4.2	0.9

Most valued courses

Looking back on your career development, rate the usefulness of the following subjects you studied. (1=low, 5=high)

	MEAN	SD
Report Writing	4.4	0.8
Oral Presentations	4.1	1.0
Computer Skills	4.2	0.8
Cost-Benefit Analysis	3.7	0.9
Environmental Policy	4.1	0.9
Environmental Impact Assessment	4.0	0.9
Group Work	3.9	0.9
Quantitative/Qualitative Analysis	3.8	1.0
RMA	3.8	1.0
Environmental Economics	3.7	0.9
Facilitating Meetings	3.6	1.1
GIS	3.5	1.1

Other graduate degrees that are offered by the Ecology Group and the basic requirements for each degree

See the Massey University Calendar for details of degrees available, and for regulations governing these. Below are the normal degrees undertaken, and the usual requirements to commence them. Note, though, that field-based studies may take longer than laboratory studies, because of the relative brevity and infrequence of the field season; plan for this in organising your studies. Note also that the regulations are extremely flexible. If you have special needs please discuss these with the Head of the Institute, your supervisors and/or your Graduate Subject Advisor.

Full course regulations can be found at:

http://calendar.massey.ac.nz/

Degree	General Prerequisites	Duration time*
PGDipSc	BSc with B- average in 300 level papers	9 months
BSc(Hons)	BSc with B+ average in 300 level papers	1 year
MSc with honours	BSc with B average or BSc (Hons), PGDipSc conversion	18 months - 2 years
MSc by thesis alone	PGDipSc. or BSc(Hons) with a B average in 700 level papers	1 year
M.Phil	First degree	Variable
PhD	BSc(Hons), BEnvMgt(Hons), MSc, MEnvMgt or M.Phil	3 – 4 years

***Part-time enrolment is also available**

Postgraduate Diploma in Science
The PGDipSc is a one year degree consisting of 120 credits of 700-level papers, one of which could be a research project. This degree is available for students who wish to gain a postgraduate qualification within one year but do not meet the entry requirements for BSc (Hons). The PGDipSc can also be converted to the first year of an MSc (Hons) if you perform well.

Bachelor of Science (Honours)
The BSc(Hons) is a one year degree that combines consisting of 90 credits of 700-level papers and a 30-credit research project. The best reason for pursuing BSc(Hons) is as a fast track to doing a PhD. You might also decide to do an Honours year because you are stimulated by the idea of a challenging year that will help you to define your next career move. Your class of honours (First Class, Second Class Division I, Second Class Division II) is determined by how well you perform in your papers (75%) and research project (25%).

Master of Science
The MSc is currently undergoing changes to allow options similar to those already available in the Masters of Environmental Management (page 48). The MSc (Hons) has traditionally been a two year program combining 120 credits of 700-level papers with 120 credits of thesis. It is also possible to complete a one year, 120 credit Masters “by thesis alone” following successful completion of a PGDipSc. or BSc(Hons). Those options are still available but a 180 credit MSc, completed over 18 months, is also now available. During this transition period some variations on the 180 credit MSc may not be available in certain subjects because of the availability and timing of 700-level papers.

For Zoology and Ecology it will be possible in 2016 to commence a 180 credit MSc (Hons) comprising two 30 credit 700-level papers and a 120 credit thesis. The two papers will be from the 199.7xx or 196.7xx offerings for Zoology and Ecology respectively. The availability of some 15 credit papers will allow a combination of a 90 credit thesis and 90 credits of papers. In Conservation Biology three 30 credit 700-level papers and a 90 credit thesis will be available.

Note that a 180 credit MSc is expected to be completed in 18 months, not 12 months.

PhD
The Doctor of Philosophy degree is a three to four year research degree which can be undertaken only by students with suitable Honours or Masters degrees.

Your papers can be selected from the appropriate schedules in the calendar, though particular subjects may be negotiable with relevant staff or particular combinations of specialist papers acceptable as "Special Topics". See your Graduate Subject Advisor for approval.

COMMONLY ASKED QUESTIONS ABOUT POSTGRADUATE STUDY

When do the Ecology and Zoology 4th year papers meet?

Most courses meet as regular tutorials. For most papers, there are 12 "on-weeks"; all other weeks are "off-weeks" when you should prepare for the next tutorial or work on your research project. This provides students who have a distant study site the opportunity to do a reasonable amount of fieldwork. Some papers meet more regularly, timetabled to suit the students. Plant Ecology usually has a substantial field trip component. Other papers may also have substantial practical components.

Are there certain papers that I must take?

Firstly, you must take those papers that are required for your degree as stated in the Massey University Calendar. This means that you will take at least 30 credits of Zoology papers if you are doing a Zoology degree, and at least 30 credits of Ecology papers if doing a degree in Ecology. For Conservation Biology, you are required to take 232.701, at least one of 237.702 and 232.703, and to choose your other papers from an approved list. Secondly, you may be advised or required to take certain papers to augment your undergraduate degree. Normally, this will be sorted out at the time you confirm your enrolment in the week before classes begin. However, your research supervisor may suggest that you take certain papers related to your intended research topic.

May I take papers from other Institutes or Groups as part of my postgraduate degree?

Yes, you may take papers from another related or relevant subject area. This must be approved by the relevant Graduate Subject Advisor (see below). Ecology or Zoology majors may wish to take a paper in fields such as data analysis or physiology to help you with research. For Conservation Biology, you are encouraged to create an interdisciplinary programme by selecting among the approved papers in Natural Resource Management, Resource & Environmental Planning, and Environmental Education.

What is “course approval”? Isn’t it enough just to enrol?

If you are doing a PGDipSc, MSc or BSc (Hons) then your papers will be approved by the Graduate Subject Advisor for your majoring subject (Professor Potter for Zoology, Dr Ian Henderson for Ecology, Professor Armstrong for Conservation Biology), or Associate Professor Holland (Environmental Management) before classes begin. However, your particular combination of papers and research project needs to be approved by the Director of Graduate Studies. This is a committee within the College of Sciences, which oversees all post-graduate study, except for the PhD. The Committee serves to protect the interests of students by ensuring that their programme of study and research meets the regulations and standards set by the University.

PGDipSc, MSc and BSc (Hons) students need to enrol at the beginning of the year. This is because most papers span semesters 1 & 2 (March-October). For Masterate students you may wish to spend your first semester discussing and finalising your research plans. You will need, though, to register a provisional, albeit temporary, title for your research in order to secure course approval.

Can I change my mind and take another paper or switch to another degree programme?

Course changes must occur by dates specified annually in the Massey University Calendar.

The usual deadline for adding another first semester or double semester paper to your course is the Wednesday of the second week of Semester 1. To withdraw from a paper and still get a refund of fees you must withdraw before 10% of your course has elapsed. You can change or withdraw from programmes, majors, endorsements and papers online via MyEnrolment on the Massey University website.

To change to another degree programme in Ecology or Zoology, for example from a PGDipSc to MSc, you will need to get permission from your Graduate Subject Advisor. These changes are normally done at the beginning or the end of the academic year.

Am I just another number? Does anybody know who I am?

Whether you are new to the Ecology Group or not, it is nice to feel that you belong. The best way to get known is to go around knocking on doors and introducing yourself. This is guaranteed to work. Just leave your inhibitions behind.

A more formal way of introducing yourself is with the photo board near the office. All staff and postgraduate students appear here. You will need to provide a suitable “head and shoulder” photograph of yourself. The photo will be displayed on the photo board. By providing a photo you signify that you are willing to have the photo displayed on the photo board.

Who are the staff in the Ecology Group, where can I find them and how do I contact them?

The guide to field identification of staff members is the photo board in the foyer just outside the Ecology Office. You can read a bit about the academic staff in this booklet. The best thing, however, is to talk with them in the staff room, or just knock on their door. If they’re not free immediately, they will be pleased to make an appointment. There is a staff list near the end of this booklet.

ECOLOGY STAFF DIRECTORY

RM	NAME	E-MAIL	EXTN NO.	DIRECT DIAL
1.38	Doug **ARMSTRONG**	D.P.Armstrong@massey.ac.nz	**84207**	**9517207**
1.12	Paul **BARRETT**	D.P.Barrett@massey.ac.nz	**84826**	**9517826**
1.10	Phil **BATTLEY**	P.Battley@massey.ac.nz	**84838**	**9517838**
1.24	Andrea **CLAVIJO MCCORMICK**		**85687**	**9518687**
1.23	Isabel **CASTRO**	I.C.Castro@massey.ac.nz	**84830**	**9517830**
1.21	Russell **DEATH**	R.G.Death@massey.ac.nz	**84839**	**9517839**
1.14	Tracy **HARRIS**	T.A.Harris@massey.ac.nz	**84843**	**9517843**
1.19	Ian **HENDERSON**	I.Henderson@massey.ac.nz	**83542**	**9516542**
3.42	John **HOLLAND**	J.D.Holland@massey.ac.nz	**84832**	**9517832**
3.41a	Karen **HYTTEN**	K.Hytten@massey.ac.nz	**83089**	**9516089**
1.22	Mike **JOY**	M.K.Joy@massey.ac.nz	**84834**	**9517834**
1.16	Masha **MINOR**	M.A.Minor@massey.ac.nz	**84833**	**9517833**
1.17	Mary **MORGAN-RICHARDS**	M.Morgan-Richards@massey.ac.nz	**84835**	**9517835**
1.37	Shaun **NIELSEN**	S.R.Nielsen@massey.ac.nz	**84840**	**9517840**
1.11	Murray **POTTER**	M.Potter@massey.ac.nz	**84836**	**9517836**
1.25	Jill **RAPSON**	G.Rapson@massey.ac.nz	**84889**	**9517889**
1.08	Alastair **ROBERTSON**	A.W.Robertson@massey.ac.nz	**84823**	**9517823**
1.18	Steve **TREWICK**	S.Trewick@massey.ac.nz	**84842**	**9517842**
1.36	Lesley **VAN ESSEN**	L.P.vanEssen@massey.ac.nz	**84884**	**9517884**
1.37	Cleland **WALLACE**	C.D.Wallace@massey.ac.nz	**84824**	**9517824**
1.09	Sharon **WRIGHT**	S.R.Wright@massey.ac.nz	**84841**	**9517841**

	Student Vacation (undergraduate)
	Study & Field Trip break
	Examinations (undergraduate)
	Easter

2016 Calendar

Semester One

Week No	*1*	*2*	*3*	*4*	*Break*	5	6	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*Exams*	*Student Vacation*			
Month			**March**			**April**				**May**				**June**			**July**		
M	29	7	14	21	28	4	11	18	25♣	2	9	16	23	30	6*	13	20	27	4	11
T	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12
W	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13
T	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14
F	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15
S	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16
S	6	13	20	27	3	10	17	24	1	8	15	22	19	5	12	19	26	3	10	17

Semester Two

Week No	*1*	*2*	*3*	*4*	*5*	*6*	*Break*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*Exams*	*Student Vacation*			
Month	**July**			**August**				**September**				**October**				**November**			
M	18	25	1	8	15	22	29	5	12	19	26	3	10	17	24♦	31	7	14	21	28
T	19	26	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29
W	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30
T	21	28	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	
F	22	29	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	
S	23	30	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	
S	24	31	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27	

*♣Anzac Day * Queen's Birthday holiday ♦ Labour Day holiday. Note: this is the undergraduate time-table.*