TABLE OF CONTENTS

Conference Organising Committee

Kate McNutt
Andrea Goodman
Carol West

Special thanks to Sue Scott from Environment Southland

IMPORTANT INFORMATION

Registration / information desk

The registration desk will open at the Ascot on Sunday 29th from 6.00pm-8.00pm, and will be open from 8.00am each day. It will shift to the Invercargill Workingmans Club on Thursday 2nd September and will be open from 8am.

If you need assistance with any conference related matters, please ask at the desk or phone: 025 821 870.

Verbal Presentations

Two concurrent sessions will be running for the majority of the conference. At the Ascot, these will be in the Aparima and Waiau rooms. In the Workingmans Club, these will be in the two rooms upstairs. All rooms will be clearly marked. The student day will take place in the Takitimu Room at the Ascot.

All sessions will have a technician on-hand to assist presenters with loading talks. All PowerPoint presentations will be using a PC (not Macintosh), so please ensure your talk is PC compatible and loaded on to a CD. We will be running Windows XP. Presenters are asked to give their talks to the technician in the room in which they are presenting by **8.00am** on the day they are presenting. Speakers wishing to use photographic slides, overhead transparencies or DVD/video presentations, should seek advice well before their session begins. Laser pointers and microphones will be provided in each room.

Poster Presentations and Wine and Cheese

The poster evening is being held on Monday 30th August, starting at 6.00pm in the foyer of the Ascot. All posters should be mounted on the display boards well before the start of the session. Poster presenters are expected to be available at their poster to answer questions. Spaces on the display boards will be allocated on a first come, first serve basis. Pins and Velcro are available from the registration / information desk.

Please present your ticket at reception for the wine and cheese evening

Food

The cost of the wine and cheese evening and morning and afternoon teas is included in your conference registration fee. All catered events at the Ascot will be held in the foyer. All catered events at the Workingmans Club will be held in the Club restaurant located downstairs.

Conference Dinner

The conference dinner is being held at Elmwood Garden, 309 Dee Street, Invercargill on Wednesday 1st September. Its location is noted on the Map of Key Locations. Please be at the restaurant by 7.00pm. Dinner is from 7.30pm, with entertainment from Neil following from 9.30pm.

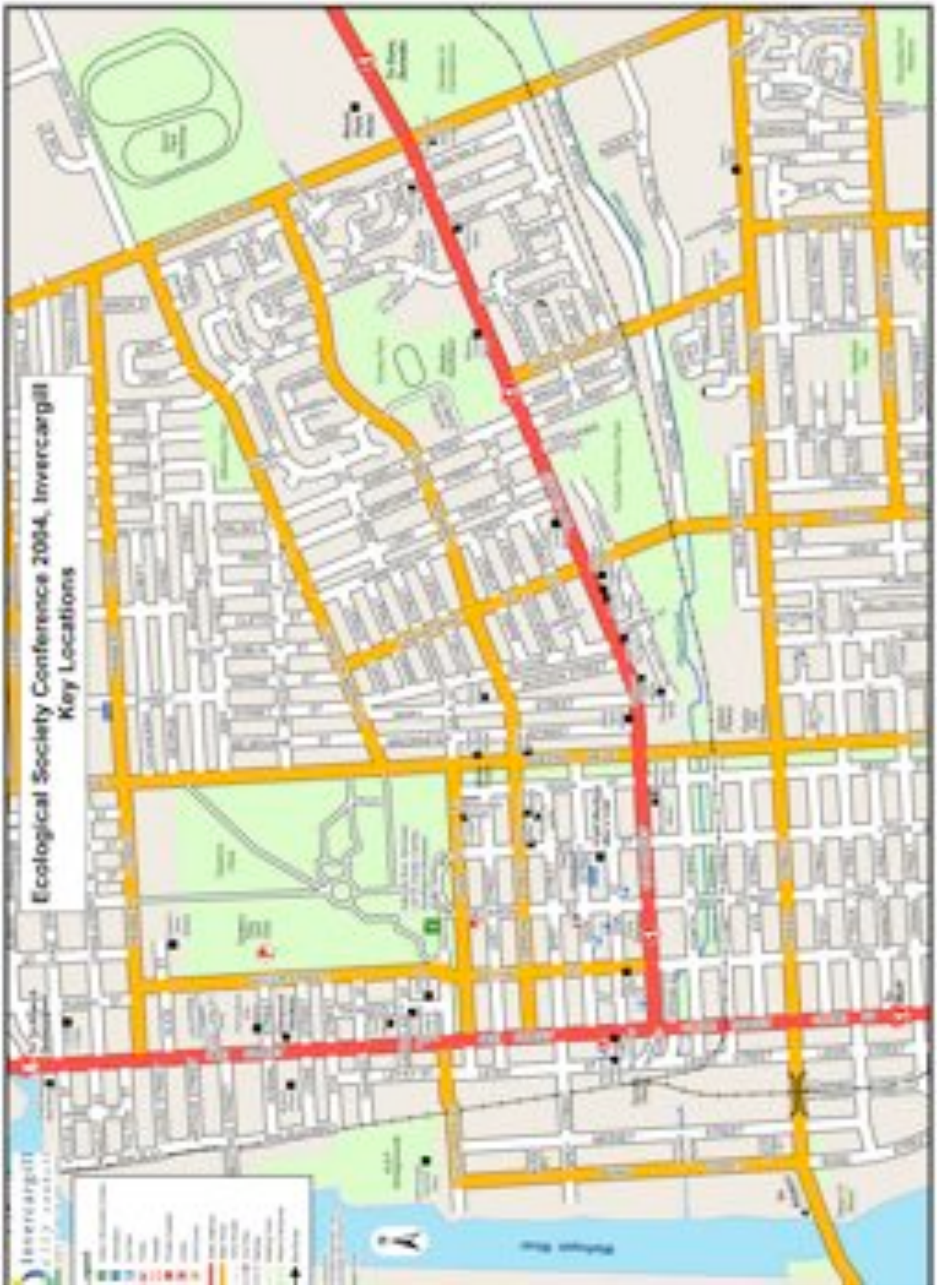
Field Trips

The day field trips will be held on Wednesday 1st September. Ulva Island day trip: please be at the Ascot by **8.10am**, for a prompt departure to catch the Bluff Ferry. For the other day trips: please be at the Ascot no later than **8.40am** for a prompt departure.

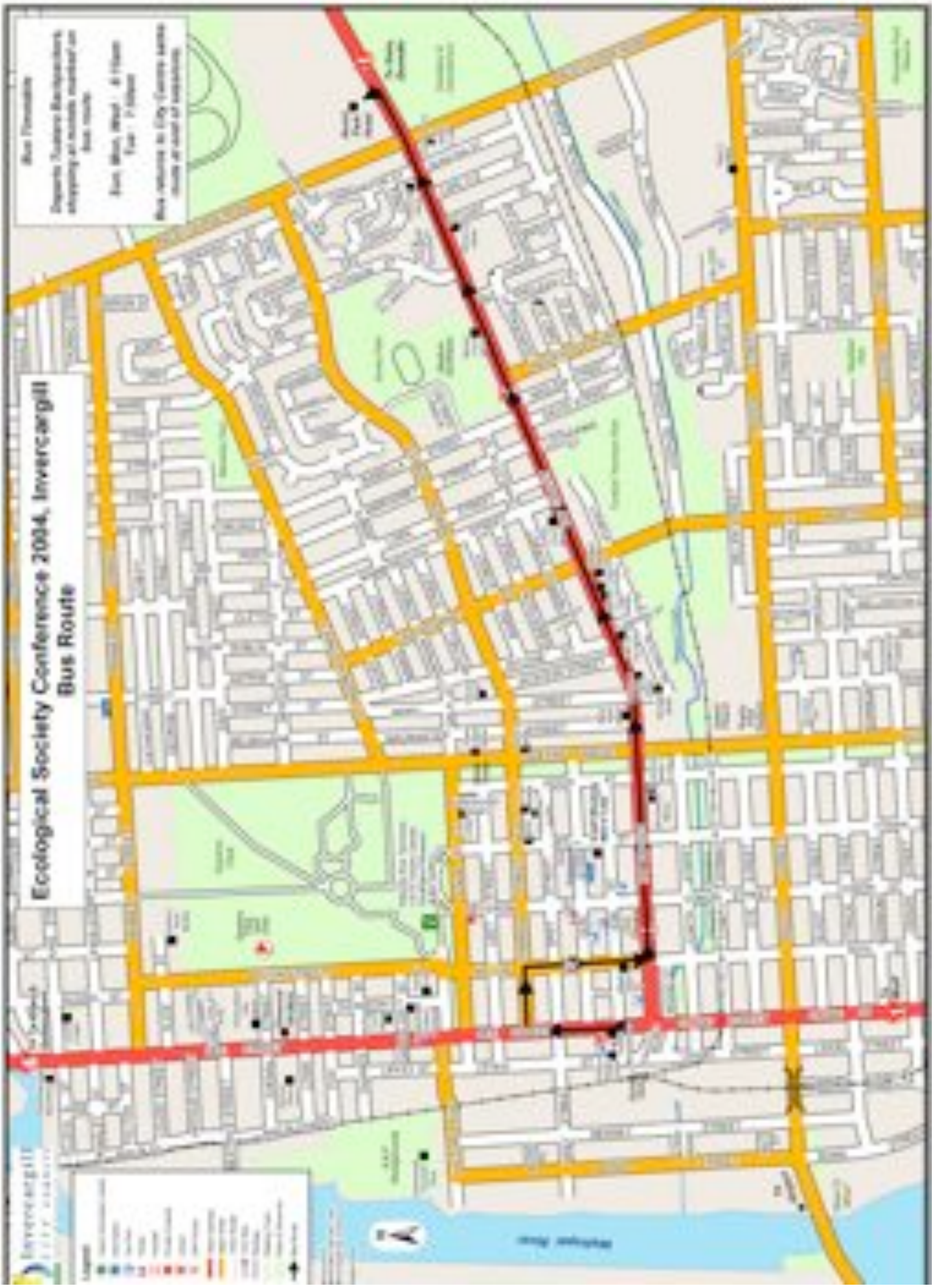
Conference T-shirts

T-shirts displaying the conference logo are available from the registration / information desk for $30.00. This year's colours are khaki and natural. Stocks are limited, so order early to avoid disappointment.

MAP OF KEY LOCATIONS



BUS TIMETABLE AND MAP



CONFERENCE TIMETABLE

Day 1	Sunday 29th August (Student Day)
8.00	Waihopai Room - Registration/Information desk opens
	Takitimu Room
9.00-9.20	Richard Clayton Introduction
9.20-9.40	**Ludwig, Karin;** Jamieson, I.; Davis, L. Department of Zoology, University of Otago, Dunedin. Do island birds use song characteristics to avoid breeding with close relatives?
9.40-10.00	**Grueber, Catherine** Department of Zoology, University of Otago, Dunedin. Investigating genetic diversity in takahe
10.00-10.40	MORNING TEA
10.40-11.20	**Jennifer M. Germano** Department of Zoology, University of Otago, Dunedin. Movements, home ranges, and interactions of the Otago skink (*Oligosoma otagense*)
11.20-11.40	**Sutton, Nicole** Biological Sciences, The University of Waikato, Hamilton Estimating site occupancy of the Mahoenui Giant weta
11.40-12.00	**Smith, Des** University of Otago, Zoology Department, Dunedin. Assessing location error from telemetry triangulation in the Fiordland Mountains, New Zealand: with implications for research into stoat (*Mustela erminea*) home range size
12.00-12.20	**Clayton, Richard** Botany Department, University of Otago, Dunedin. Effect of rats on the vegetation of islands in Paterson Inlet, Rakiura National Park.
12.20-1.40	LUNCH
1.40-2.00	**Jenny Hurst** Ecology and Entomology Group, Lincoln University Does culling of the introduced brushtail possum *Trichosurus vulpecula* result in canopy improvement of Waikato forests, New Zealand?
2.00-2.20	**Lux, Jennifer** The University of Auckland, School of Geography and Environmental Science, Auckland. Vegetation succession after prehistoric burning of kauri forest at Waipoua, Northland, New Zealand.
2.20-2.40	**Spencer, Katrina** Department of Botany,University of Otago, Dunedin. Floral development and water relations in selected alpine plants.
2.40-3.00	**Emmanuel, Yamoah[1];** Quashie-Sam[2] [1]National Centre for Advanced Bio-Protection Technologies, Lincoln University, Canterbury. [2]Institute of Renewable Natural Resources, University of Science and Technology, Ghana. Soil incorporated sawdust and *leucaena leucocephala* biomass: effects on earthworm population and soil bulk density.
3.00-3.20	**McAllum, Priscilla** University of Waikato, Hamilton. Traditional resource management of harakeke by Maori: the historical evidence
3.20-4.00	AFTERNOON TEA
4.00-5.00	Prize giving and closing

Day 2		Monday 30th August	
8.00		Waihopai Room - Registration/Information desk opens	
		Waiau Room	
9.00-9.20		**Michael Skerret**	
9.20-9.30		**John Sawyer**. Presidents welcome	
9.30-10.00		**Jon Sullivan** Ecol soc on line	
10.00-10.40		MORNING TEA	
		Waiau Room	
		DISTURBANCE	
10.40-11.20		**Leach, Helen** Anthropology Department, Otago University, Dunedin. Gardens without weeds?	
11.20-11.40		**Lloyd, Kelvin** Lee,W.G Landcare Research, Dunedin. Back country huts as foci for weed invasion in national parks	CONTRIBUTING **Aparima Room** **van Heezik, Yolanda[1]** Smyth, Amber, R[1].; Freeman, Claire[2] [1]Department of Zoology, University of Otago, [2]Department of Geography, University of Otago, Dunedin. Avian community structure within an urban matrix: factors influencing richness and diversity
11.40-12.00		**Rogers, Geoff[1]** Walker, S[2]; Lee, W.G[2]. [1]Science and Research, Department of Conservation, Dunedin. [2]Landcare Research, Dunedin. Disturbance regimes and conservation of indigenous biodiversity in dryland South Island	**Seddon, Philip J[1],** Mathieu, Renaud[2]; Shanahan, Danielle[1]; van Heezik, Yolanda M[1]. [1]Department of Zoology, University of Otago, [2]School of Surveying, University of Otago. Spatial ecology of introduced mammalian predators in New Zealand's open landscapes: What can recent advances in technology bring to applied research?
12.00-12.20		**Merrett, Merilyn** Landcare Research, Hamilton. Fragmentation effects: Consequences for some native shrubs.	***Shanahan, Danielle[1]** Seddon, Philip J[1]. Mathieu, Renaud[2] [1]Department of Zoology University of Otago, Dunedin. [2]School of Surveying, University of Otago, Dunedin. Fine-scale habitat use by hedgehogs and ferrets; a study using very-high resolution satellite imagery.
12.20-1.40		LUNCH	
		Waiau Room	**Aparima Room**
		DISTURBANCE	SUBANTARCTIC
SNA Workshop Takitimu Room	1.40-2.00	**Williams, Peter[1]** Jon J. Sullivan[2]; Susan M.Timmins[3] [1]Landcare Research, Nelson. [2]Ecology and Entomology Group, Soil, Plant and Ecological Sciences Division, Lincoln University, Canterbury; [3]Department of Conservation, Wellington. Gorse and kanuka successions are different	**Cox, Andy** Department of Conservation, Invercargill. New Zealands subantarctic islands.
	2.00-2.20	**North, Heather** Wilmshurst, J.; Burgham, S. Landcare Research, Lincoln. Monitoring vegetation succession using satellite remote sensing.	**McClelland, Pete,** Department of Conservation, Invercargill. Campbell Island rat eradication - how was it done and what does it mean for the future?

SNA Workshop Takitimu Room	2.20-2.40	***Martin, Timothy** Ogden, John School of Geography and Environmental Science, University of Auckland, Auckland. A blast from the past: a dendroecological reconstruction of forest windthrow history, North Island, New Zealand	**Childerhouse, Simon** Department of Conservation, Science and Research Unit, Wellington. Distribution, abundance and growth of New Zealand sea lion *Phocarctos hookeri* pups on Campbell Island 2003
	2.40-3.00	**Bloomberg, Mark,** Sedcole, Richard Agriculture and Life Sciences Division, Lincoln University. Modelling Germination of Radiata Pine (Pinus radiata D.Don) Seeds in Response to Environmental Temperature and Water Potential	**Williams, Murray** Science & Research, Department of Conservation, Wellington. Subantarctic waterfowl: an ecological overview
	3.00-3.20	**Smale, Mark** Neil Fitzgerald. Landcare Research, Hamilton. The McKelvey volcanic succession hypothesis 40 years on	**Childerhouse, Simon**[1] Robertson, C[2]., Hockly, W[3]. and Gibbs, N[4]. [1]Department of Conservation, Science and Research Wellington. [2]Wild Press, Wellington. [3]Stewart Island Field Centre, Department of Conservation, Stewart Island [4]Wellington Conservancy, Department of Conservation, Wellington. Status and biology of southern royal albatross (*Diomedea epomophora*) on Enderby Island, Auckland Islands
	3.20-4.00	AFTERNOON TEA	
		Waiau Room	**Aparima Room**
		DISTURBANCE	CONTRIBUTING
	4.00-4.20	**Champion, Paul**, Paula Reeves National Institute of Water and Atmospheric Research. A review of grazing impacts on wetlands	***Taylor, Sabrina S,** Jamieson, Ian G. Department of Zoology, University of Otago, Dunedin. Genetic variation in saddlebacks following population bottlenecks
	4.20-4.40	**Radford, Ian J.** Dickinson, Katherine. J.M.; Lord, Janice M. Department of Botany, University of Otago, Dunedin. Does disturbance explain site dominance by the invasive, but apparently competitively subordinate species, *Hieracium lepidulum*	**Molles, Laura E.** Waas, Joseph R. Department of Biological Sciences, University of Waikato, Hamilton. Why two heads are better than one: duetting in North Island kokako (*Callaeas cinerea wilsoni*)
4.40-5.00		**McGlone, Matt** Wilmshurst, Janet Landcare Research, Lincoln. The history of bracken and the impact of the maori fire regime in New Zealand.	**Ian Westbrooke,** Science and Research Unit, Department of Conservation, Christchurch. Minimum area for a self-sustaining kiwi population
6.00-8.00		Poster Session (wine and cheese evening)	

WINE and CHEESE POSTER EVENING 6pm – 8pm Ascot Park Hotel Foyer

Day 3	Tuesday 31st August	
8.00	Registration/Information desk opens	
	Waiau Room	
	MONITORING	
8.40- 9.20	**Watson, Ian**. Department of Agriculture, Western Australia. Design issues for large-scale monitoring systems: the Australian experience	
9.20-10.00	**McLennan, Donald** Parks Canada, Quebec. Canada K1A 0M5. Redesigning Ecological Integrity Monitoring in Canada's National Parks	
10.00-10.40	MORNING TEA	
	Waiau Room	**Aparima Room**
	MONITORING	CONTRIBUTING PAPERS
10.40-11.00	**Stephens, Theo[1] and Wright, Elaine F[2].** [1]Department of Conservation, Dunedin. [2]Department of Conservation, Christchurch. Conservation requirements from an inventory and monitoring system	**Bowie, Mike** Ecology and Entomology Group, Lincoln University. Ecological Restoration of Otamahua / Quail Island - Pests, Pitfalls and Penguins
11.00-11.20	**Lee, William G.[1]** Matt McGlone[2], Elaine Wright[3] et al. [1]Landcare Research, Dunedin. [2]Landcare Research, Lincoln; [3]Department of Conservation, Christchurch. A proposal for a national biodiversity inventory and monitoring system for conservation	**Galbraith, Mel[1]** , Ussher, G[2].; Fordham, S[3]. [1]School of Natural Sciences, Unitec New Zealand, Auckland. [2]Auckland Regional Council, Auckland; [3]Supporters of Tiritiri Matangi (Inc.), Auckland. Science and Community - a research partnership on Tiritiri Matangi Island
11.20-11.40	Froude, Victoria Pacific Eco-Logic, Porirua. National reporting of biodiversity trends	**Harper, Grant.** Zoology Department, University of Otago, Dunedin. Habitat selection and population dynamics of feral cats on Stewart Island/Rakiura: the effects of prey abundance and climate.
11.40-12.00	**Thompson,Steve**, Ministry for the Environment, Christchurch. New Zealand Land Cover Database. Applications of satellite imagery and remote sensing to create a GIS based thematic map of mainland New Zealand, nearshore islands and the Chatham Islands.	***Wood, Jamie** Geology Department, University of Otago, Dunedin. Reconstructing Holocene ecosystems at Mason Bay, Stewart Island
12.00-12.20	**Walker, Susan[1]** Stephens, R. T. Theo[2]; Lee, William G[1]. [1]Landcare Research, Dunedin. [2]Department of Conservation, Dunedin. Significance assessment to meet New Zealand Biodiversity Strategy Goal Three	***Sutton, Nicole** Biological Sciences, University of Waikato, Hamilton. Estimating site occupancy of the Mahoenui Giant weta
12.20-1.40	LUNCH	
	MONITORING	CONTRIBUTING PAPERS
1.40-2.00	**Clarkson, Beverley R.[1]** Clarkson, Bruce D [2] Sorrell, Brian K.[3]; Ward, Jonet C[4].; Reeves, Paula N[5].; Champion, Paul D[5].; Partridge, Trevor R[6]	**Kelly, Dave[1]** Poirot, Ceisha I[1].; Ladley, Jenny J[1].; Robertson, Alastair W[21]Biological Sciences, University of Canterbury, Christchurch. Biological Sciences, University of Canterbury,

	[1]Landcare Research, Hamilton.[2] Centre for Ecology and Biodiversity Research, Department of Biological Sciences, University of Waikato, Hamilton; [3] NIWA, Christchurch; [4]Lincoln Environmental, Lincoln University, Lincoln; [5]NIWA, Hamilton; [6]Landcare Research, Lincoln. Present address: Clarendon Consulting, 53 Clarendon Terrace, Woolston, Christchurch. Wetland inventory and monitoring	Christchurch.: [2]Ecology, INR, Massey University, Palmerston North. Can we restore ecosystem interactions on the mainland?
2.00-2.20	**Wiser, Susan,** Buxton, R. Landcare Research, Lincoln Christchurch. Considerations for inventory and monitoring of plant biodiversity in rare ecosystems	**Newstrom, Linda[1]** Dr. A.W. Robertson[2], Robert Uschold[1], Ngaire Hart[3] [1]Landcare Research, Lincoln, [2]Massey University, Palmerston North, [3]University of Auckland. Progress in understanding pollination systems in New Zealand.
2.20-2.40	**Sawyer, John** Department of Conservation, Wellington. Threatened plant population monitoring in New Zealand	* **Gatehouse, Hazel [1]** Duncan, R.P[1]; Sullivan, J.J[1].; Williams, P.A[2]. [1]Ecology & Entomology Group, Lincoln University, Canterbury [2]Landcare Research, Nelson. Determinants of the naturalisation of introduced seed plants in New Zealand
2.40-3.00	**de Forest, Leah** Parks Canada, Quebec Monitoring species at risk in Canada's National Protected Heritage Areas as a measure of ecological integrity	**Sullivan, Jon J[1],** Fowler, S. V[2].; Winks, C. J[3]. [1]Ecology and Entomology Group, Lincoln University, Lincoln. [2]Landcare Research, Lincoln; [3]Landcare Research, Tamaki, Auckland Death on the edge: the role of natural enemies in structuring the geographic range limits of NZ *Senecio* species
3.00-3.20	**West, Carol J.[1]** Niiyma, Kaouru[2]; Tanaka, Hiroshi[2]; Shibata, Mitsue[2] [1]Department of Conservation, Invercargill. [2]Forestry and Forest Products Research Institute, Matsunosato 1, Tsukuba-shi, Ibaraki, 305-8687, Japan. Lessons learnt from long-term monitoring at Ogawa Forest Reserve, Japan	**Peltzer, Duane A.** Fitzjohn, R., Heenan, P, Ferriss, S., Newstrom, L.E. Landcare Research, Lincoln, Canterbury. *Brassica* distribution outside of cultivation can be used as a model system for understanding gene-flow risk.
3.20-4.00	AFTERNOON TEA	
	Room 1	**Room 2**
	MONITORING	CONTRIBUTING PAPERS
4.00-4.20	**Brown, Jennifer[1]** Overton, Jacob[2] McC. Price, Robbie[2] [1]Biomathematics Research Centre University of Canterbury Christchurch. [2]Landcare Research, Hamilton. Sampling Methods for Biodiversity Inventory and Monitoring	* **Gamage, Harshi K.[1]** Jesson,L.K[1]; Drake, D.R[2]. [1]School of Biological Sciences, Victoria Uni. of Wellington, [2]Department of Botany, Uni. of Hawaii, Honolulu. Why do plants change leaf morphology? Responses of homoblastic and heteroblastic seedlings to light
4.20-4.40	**Gillies, Craig[1]** Murphy, E[2].; Flux, I[3].; Maddigan, F[2].; Purdey, D[4]	**Roger Dungan,** Dave Kelly, Matthew Turnbull. School of Biological Sciences,

	Measuring rodent and mustelid relative abundance	University of Canterbury, Christchurch. The carbon-costs for host trees of honeydew produced by scale insects (*Ultracoelostoma* sp.) in a *Nothofagus solandri* forest
4.40-5.00	**Agnew, Warren** Connovation Research Limited, Auckland. Recent Advances in Animal and Insect Monitoring	**Burns, K.C.** Dawson, J. School of Biological Sciences, Victoria University of Wellington. Community ecology of New Zealand's vascular epiphytes and vines: Distributional patterns among host trees

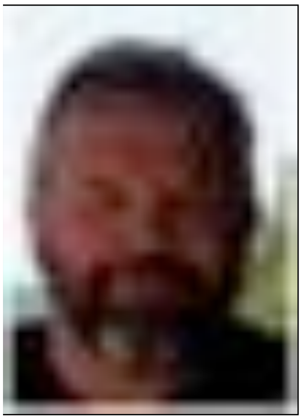
AGM: WAIAU ROOM 5.30pm – 7pm

Day 5	Thursday 2nd September	
8.00	Registration/Information desk opens	
	Room 1	
8.30-8.40	**Michael Skerret** Karakia	
8.40-9.20	**Johnson, Peter** Landcare Research, Dunedin. Southern peat	
9.20- 10.00	**Beasley, Barbara.** Clayoquot Alliance for Research, Education and Training, Ucluelet, B.C., Canada. Tales of a Conservation Biologist Among People of the Cedar, Salmon and Sea.	
10.00-10.40	MORNING TEA	
	Room 1	**Room 2**
	PEATLANDS/WETLANDS	INDIGENOUS PEOPLES
10.40-11.00	**White, Michelle**[1], McNutt, Kate[2] [1]Environment Southland, Private Bag 90116, Invercargill. [2]Department of Conservation, Invercargill. Southland peat dome restoration and monitoring	**Wijesuriya, Gamini** Department of Conservation, Northern Regional Office, Hamilton. Working with Indigenous Communities- Ethical responsibility of the Scientist
11.00-11.20	***Hodges, Tarnia,** Jill Rapson. Ecology Group, Institute of Natural Resources, Massey University. Crossing the FBT (Fen-Bog Transition zone) in the Southern Hemisphere requires the restiad, *Empodisma minus*, as engineer	**Horn, Chrys,** Margaret Kilvington Landcare Research, Canterbury. Improving Biodiversity Management Partnerships in New Zealand
11.20-11.40	***Morgan, Dai**[1] Waas, J[1]; Innes, J[2]. [1]University of Waikato, Department of Biological Sciences, Hamilton. [2]Landcare Research, Hamilton. Are magpies rural bullies? Impacts of breeding and non-breeding magpies on the distribution of rural birds	**Tipa, Gail**[1] **& Teirney, Laurel**[2] [1]Tipa and Associates, East Taieri, Otago, [2]Southern Woman Consultancy, Dunedin. Development of a Cultural Health Index for Streams
11.40-12.00	**Innes, John**[1] Morgan, D[2]; Spurr, E[3].; Waas, J[2].; Arnold, G[4]; Watts, C[1]. [1]Landcare Research, Hamilton. [2]Department of Biological Sciences, Waikato University, Hamilton. [3]Landcare Research, Lincoln. [4]Landcare Research, Palmerston North. Magpie impacts on other birds	*** McAllum, Priscilla** School of Maori and Pacific Development, University of Waikato, Hamilton. Traditional resource management of harakeke (*Phormium tenax*) by Maori: the historical evidence
12.00-12.20	**Stephen C. Urlich**, Philip J. Brady Department of Conservation, Wellington Conservancy. Managing possum impacts on tree fuchsia in the Tararua Range	**Stowe, Chris** Botany Department, University of Otago, Dunedin. Maori arboriculture - a case study on karaka (*Corynocarpus laevigatus*)
12.20-1.40	LUNCH	
	Room 2	
	INDIGENOUS PEOPLES	
1.40-2.00	**Moller, Henrik** Department of Zoology, University of Otago, Dunedin. Kia Mau Te Titi Mo Ake Tonu Atu: Progress towards assessing the sustainability of a traditional seabird harvest by Rakiura Maori.	
2.00-2.20	**Kitson, Jane** Environment Southland, Invercargill (talk on behalf Kia Mau Te Titi Mo Ake Tonu Atu (Keep the titi forever) Research programme, Department of Zoology, Otago	

	University. Research on Traditional Ecological Knowledge of the harvest of titi (sooty shearwaters) by Rakiura Maori.
2.20-2.40	**Norton, Takerei** Kaupapa Taiao, Ngäi Tahu Development Corporation, Christchurch. Kaupapa Kererü: A Ngäi Tahu initiative for community involvement in the research of kererü on Banks Peninsula
2.40-3.00	**Ogilvie, Shaun**[1] Ataria, J.M[2].; Waiwai, J[3].; Doherty, J.E[4].; Lambert, M[5].; Lambert, N[3].; King, D[6]. [1]Lincoln University, Canterbury, [2]Manaaki Whenua, Lincoln; [3]Lake Waikaremoana Hapu Restoration Trust, Tuai; [4]Tuhoe Tuawhenua Trust, Murupara; [5]Te Whare Wananga o Awanuiarangi, Whakatane; [6]Department of Conservation, Aniwaniwa. Uptake and persistence of sodium monofluoroacetate (Compound 1080) in plants of cultural importance
3.00-3.20	**Cook, Sandra** Oraka Aparima Runaka. Kaitiakitanga: Ki Uta Ki Tai: participation and partnerships - a case study
3.20-4.00	AFTERNOON TEA
4.00-5.00	Prize giving and closing

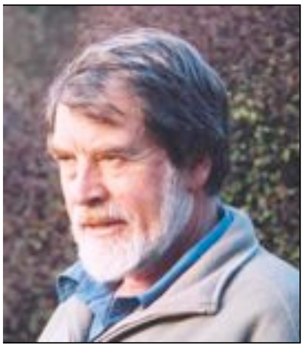
GUEST SPEAKER BIOGRAPHIES

Ian Watson has worked for the Department of Agriculture Western Australia since 1986. For his entire professional career he has worked in the rangelands, predominantly in the semi-arid shrublands. He currently manages the Western Australian Rangeland Monitoring System and was the national coordinator of the Rangeland Theme of the National Land and Water Resources Audit. His other professional interests include arid zone shrub demography and understanding the impacts of climate variability.



Donald McLennan is the National Ecological Integrity Monitoring Biologist at Parks Canada, where he is coordinating the redesign and implementation of a system-wide program of ecological integrity monitoring and reporting. Donald is a terrestrial ecologist who specializes in applied land management applications of ecosystem science, and also heads up the ecosystem inventory section of Parks Canada. Before joining Parks Canada Donald ran a consulting firm in British Columbia that specialized in terrestrial ecosystem mapping, riparian ecosystem management and restoration, ecosystem modelling, and landscape level management.

Helen Leach is a Professor in the Anthropology Department at the University of Otago and is currently Head of Department. She completed a Ph.D on the prehistory of Maori gardening in 1976 and has undertaken archaeological fieldwork in both New Zealand and American Samoa. Her primary interests and publications lie in the evolution of human diet, the nature of plant and animal (including human) domestication, the anthropology of horticulture, and the development of culinary traditions. As a keen gardener, she approaches the subject of weeds with decades of close personal experience as well as detailed academic research.



Peter Johnson is a botanist and plant ecologist with Landcare Research in Dunedin. He is the author (with Pat Brooke) of Wetland Plants in New Zealand, and with Philippe Gerbeaux of the about-to-be-published Wetland Types in New Zealand. He has also written about his love of "gumboot country" and southern lakes in Pick of the Bunch: New Zealand Wildflowers.

Barb Beasley. Senior Research Associate for the Clayoquot Alliance for Research, Education and Training, B.C, Canada. Barb is a coastal ecologist involved in forest and marine conservation within the traditional territories of the Nuu-chah-nulth First Nations on the west coast of Vancouver Island. While working for the Long Beach Model Forest in 1999, Barb designed a project that engaged First Nations youth in interviewing elders about wildlife management and conservation. She has continued to work with indigenous people as a liason between coastal community groups and academics at the University of Victoria. Barb helps coordinate community-based stewardship, research and education programs within the Clayoquot UNESCO Biosphere Reserve. She is a director for the Raincoast Education Society which delivers programs on natural and cultural history. She has taught university field courses at the Bamfield Marine Sciences Centre and the School for Field Studies. She completed a Ph.D. in Behavioural Ecology at Simon Fraser University in 1994 and has since conducted ecological research on forest birds and amphibians.

CONFERENCE ABSTRACTS-(in alphabetical order,* denotes student)

Recent advances in animal and insect monitoring

Agnew, Warren
Connovation Research Limited PO Box 58613 Greenmount Auckland Tel. (09)273-4333
warren.a@connovation.co.nz

Monitoring of species through footprint collection is a recognised and widely used technique for establishing presence or absence of mammalian species. At Connovation we have developed a long-life ink that will enable the collection of tracks over an extended period. The tracks we are able to collect are of high definition. This allows for comparisons to be made between footprint size of say rats [14mm 16mm 18mm]. We have developed tracking tunnels that can be readily placed within trees to establish the presence of rats, lizards, wetas. We are able to record the tracks of a range of insect species with such clarity it is possible to identify a given species, and the actual feet. For tracking insects we have developed an ink that is long-life, with a lower viscosity and tack that allows for insects to pass across the inked section of a card yet retain sufficient ink to establish clear high definition tracks. The inks we have developed are non-toxic. This technology has opened the way to allow for recorded tracks to be scanned with the distinct possibility those images can be recognised by a computer. To this end a team at Auckland University under Professor Klette are working with me to develop computer programmes that would allow for a database of tracks, both insect and mammalian to be established. One proposal is that tracking units would be placed within containers bound for New Zealand. On arrival the cards would be removed through a small opening, scanned and then sent to computers where tracks could be identified. This would allow for identified containers to be fumigated. This system could be developed to assist with the monitoring of food outlets. Further opportunity exists in establishing benchmarks of presence both before and after control programmes. Finally the system provides opportunity in the monitoring of rare or endangered species.

Tales of a conservation biologist among people of the cedar, salmon and sea

Beasley, Barbara
Clayoquot Alliance for Research, Education and Training, P.O. Box 927, Ucluelet, B.C., Canada, V0R 3A0.
beasley@island.net

As far as the archaeologists know, the Nuu-chah-nulth First Nations have lived on the west coast of Vancouver Island in British Columbia for 6,000 years. That's 5,778 years longer than any other people. The livelihoods of the Nuu-chah-nulth are based on the harvest of marine and terrestrial resources. They have traditional territories that fall under the jurisdiction of hereditary chiefs. Chiefs are responsible for sustaining their people and the resources within their territories. Chiefs believe in the concept of "hishuk ish ts'awalk" or "everything is one", which recognizes the sacredness of all life forms and the importance of "iisaak" or "respect". I speak in both the past and present tense because, from what I have seen in the past seven years of living among the Nuu-chah-nulth, these social constructs still exist to some extent today, as does the belief that a number of traditional philosophies and approaches may be critical for conserving our ecosystems. I will explore some of the socio-political challenges and the progress that conservationists have made by working with the Nuu-chah-nulth in three resource areas. Old growth forests, characterized by 1000 year old cedars, the "tree of life", have been protected through advocacy and activism and are now being co-managed by the Nuu-chah-nulth. Salmon, a mainstay in the diet of all coastal peoples, have plummeted in number and are the focus of stewardship efforts to restore habitat and populations. The sea holds several threatened species including sea otters and abalone. Conservation of one interferes with conservation of the other and may have serious implications for "green" economic growth in Nuu-chah-nulth communities.

Modelling germination of radiata pine (*Pinus radiata* D.Don) seeds in response to environmental temperature and water potential

Bloomberg, Mark; Sedcole, Richard
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The temperature (T) and water potential (_) of a substrate are primary environmental regulators of seed germination. In the absence of seed dormancy, time to germination of a seed population can be estimated using _ - _$_b$ and $T - T_b$. These are the actual _ and T to which the seed is subjected, minus base values for temperature and water potential below which germination will not occur (_$_b$, T_b). The parameter calculated by multiplying _ - _$_b$ and $T - T_b$ by time to germination is termed hydrothermal time, and is akin to the concept of thermal time frequently used in agronomy and horticulture. We report here on progress with estimating the time to germination of radiata pine seeds using hydrothermal time. For a commercial open-pollinated seedlot, germination rates of well-watered seeds (_ = 0 MPa) increased linearly with temperature from a T_b of 10 ºC to an optimum of 22–25 ºC. Thereafter germination rates declined to zero at a temperature of 41 ºC. For suboptimal temperatures (12.5 –22 ºC), the thermal time to germination ($T - T_b$ multiplied by time to germination) was reasonably constant for a specified percentile of the population, e.g approximately 80 ºC d for the 16th percentile. Under optimal temperature and water potentials (22 ºC, 0 MPa), full germination of seed is complete within three weeks. Under optimal temperature but with reduced water potential, germination rates decline progressively to zero at a base _$_b$ of -1.0 MPa, compared with reported _$_b$ values for *Eucalyptus delegatensis* R.T. Baker and potato (*Solanum tuberosum* L.) of -0.5 MPa and -1.54 MPa respectively. Further work on this topic is discussed, as are implications for land managers interested in natural regeneration of radiata pine in New Zealand and elsewhere.

Ecological restoration of Otamahua / Quail Island - pests, pitfalls and penguins

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The ecological communities of Otamahua (Quail Island) in Lyttelton Harbour, Banks Peninsula are being ecologically restored to a more natural condition. Eradication of pests such as hedgehogs, rats, mice and mustelids has been undertaken with some success. The invertebrate fauna on Quail Island has been surveyed as part of the island's restoration programme. Compared with other areas on Banks Peninsula, the Quail Island ground beetle (carabid) fauna was found to be depauperate. Based on this evidence, some ground beetle species were identified as candidates for introduction to the island. Wooden discs were used as substitutes for naturally occurring logs and have been assessed as a technique to restore and non-destructively sample carabids. Likewise, weta motels have been developed with the view to use them for the translocation of tree weta to Quail Island. Progress on the predator control and the invertebrate restoration on Quail Island are outlined.

Sampling methods for biodiversity inventory and monitoring

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Probability sampling methods provide an important foundation for a reliable inventory and monitoring (I+M) programme. Typical reasons for not using probability sampling in I+M include misconceptions that it is unnecessary or too expensive, and difficulties in implementing probability designs. I+M is generally interested in estimating properties about 'populations' of biodiversity components or pressures, and can be viewed as a process of buying information on these properties (by expending time and resources to gather data). Probability sampling methods allow one to describe the way in which the data represent the true population, and provide the basis for consistent, unbiased estimation of biodiversity properties. The choice of sampling design balances a number of competing characteristics, especially efficiency and generality. The efficiency of a sampling design is the amount of information gained relative to the cost. The generality of a sampling design is its ability to perform well for a number of different biodiversity properties. Results from simulated biodiversity sampling highlight the importance of probability sampling, and investigate the trade-off between efficiency and generality. Ignoring probability sampling methods can lead to false accuracy (large sample sizes and small standard errors, but unknown and often significant bias). A number of well-known techniques can be used to make a sampling design more efficient for one variable, but this makes the design less efficient for unrelated variables (thereby reducing generality). These results demonstrate that the lack of bias in probability sampling methods make them more reliable and efficient than ad hoc sampling methods, and highlight important trade-offs in the design of I+M surveys. We have developed an application that makes it easier to use probability sampling methods and allows using spatial information held in a GIS to design probability sampling schemes and choose sample locations.

Community ecology of New Zealand's vascular epiphytes and vines: distributional patterns among host trees

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Plants that rely on other plants for support (i.e. epiphytes and vines) are common in New Zealand. However, they are poorly understood relative to terrestrial plants. To help bridge this gap, we evaluated the diversity and distribution of vascular epiphytes and vines on seven common tree species in a conifer broad-leaf forest on New Zealand's North Island. Surveys of trees from the ground were compared to those from a canopy walkway to critically evaluate the accuracy of ground-based surveys. Ground-based surveys of 274 host trees were then used to test whether epiphyte and vine diversity increased with tree size, and whether relationships between diversity and tree size differed among host species. Distributional patterns of individual epiphyte and vine species were also assessed. Results showed that on average, 1 in 10 species of epiphytes and vines were unseen from the ground. However, no differences in sampling accuracy were observed among host tree species, allowing unbiased comparisons among host species. Epiphytes and vines showed strong differences in diversity and distribution. In four host species, epiphyte diversity increased sharply with host tree size. The remaining three host species showed weak relationships between diversity and tree size. Conversely, weak relationships between vine diversity and tree size were observed in all host species. The distribution of individual species of epiphytes and vines helped to explain patterns in diversity. All common epiphyte species occurred more frequently on large trees, regardless of host species. Conversely, occurrence patterns in most vine species were unrelated to tree size. Rather, they often showed strong host "preferences", or they occurred more frequently on particular host species. Overall results illustrate a rich diversity of distributional patterns in New Zealand's epiphytes and vines, and suggest a similarly diverse set of ecological and evolutionary processes are responsible for them.

A review of grazing impacts on wetlands

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The direct effects of livestock grazing on wetland vegetation includes disturbance through consumption of plant biomass and compaction of soil damaging below-ground plant parts. Additional impacts include input of nutrients and bacterial contamination from dung and urine and the introduction and dispersal of weed seeds and other propagules. The follow-on effects of these combined activities on the physical and biotic components of wetland systems vary enormously and can be difficult to predict. Grazing of wetlands in New Zealand is, in most cases, carried out to provide food for stock when this is limiting in more terrestrial habitats without, rather than for conservation benefit. However grazing, in some instances, can prevent succession to taller often woody vegetation (e.g. alien willow species)and reduce biomass of dense mats of alien weed species and may offer some conservation value. This paper provides a review of recent literature to identify the effects of livestock grazing on vegetation, fauna, soils and hydrology of estuarine, riverine, lacustrine and palustrine wetlands. The aim of this study is to provide guidelines for the use of grazing as a tool to manage wetlands, comparing this with other techniques for biomass removal and assessing their suitability in different situations.

Distribution, abundance and growth of New Zealand sea lion *Phocarctos hookeri* pups on Campbell Island 2003

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Nine weeks of field work was undertaken during two trips in January/February and March/April 2003 to investigate the distribution and abundance of New Zealand sea lion *Phocarctos hookeri* pups at Campbell Island. A total of 161 pups were tagged and a further 138 dead pups were found. A closed mark-recapture model was used to estimate the total number of live pups (e.g., tagged plus untagged pups) at Campbell Island in April as approximately 247 (SE = 28, 95% CI 192 – 302). Pup production at Campbell Island is estimated at 385, which comprises 13% of the total pup production for the species in the 2002/2003 season. The figure of 385 is considerably higher than the previous 'best' estimate of 122 reported in 1991/1992. The very high level of pup mortality (36%) at Campbell Island is higher than 17% reported for the Auckland Islands for approximately the same period in 2003 but is similar to higher than normal levels of mortality (20-30%) reported at the Auckland Islands in recent years. It was not possible to determine the cause of death of the 138 dead pups due to scavenging and decomposition. Pups were found over the whole Island, with the exception of the Northern end of the Island. Males were significantly heavier and faster growing than females over the same period. This project indicates that pup production appears to have increased at Campbell Island since 1991/1992 and that there is both colonial (e.g., Davis Point) and non colonial breeding occurring.

Status and biology of southern royal albatross (*Diomedea epomophora*) on Enderby Island, Auckland Islands

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Since 1992 there has been annual monitoring of southern royal albatross (*Diomedea epomophora*) nests on Enderby Island, in the Auckland Islands group (50°S 166°E). Annual nest counts from these and earlier surveys have documented the steady increase of nesting albatross on Enderby Island over the period 1954–1992. The population has been approximately stable over the last 10 years (1992-2001) with a mean number of nests of 51 each year (SE=3.7, range 31–69). Mean breeding success was estimated during winter surveys in 1996–1998 at 74% (SE=4.5), although this should be considered a maximum estimate of chick survival as all surveys were several months prior to fledging. Birds follow an approximate biennial breeding pattern (mean breeding frequency of 1.8 years; n=213, SE=0.03, range 1–5) with 80% of successful breeders returning after two years and 72% of failed breeders returning the following year. Most (85%) birds remained with the same partner across successive years but there was a mean annual rate of partner change of 6.9% (SE=0.30, range 0-20.0%). On average, it took 2.4 years to successfully raise a chick. Mean adult survival rate was 0.97 (SE=0.03, range 0.86-1.04). Overall, estimates of life history parameters are broadly consistent with those previously reported for royal and other albatross species.

Wetland inventory and monitoring

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A national coordinated monitoring methodology for New Zealand estuarine and palustrine wetlands was developed and trialed between 1998 and 2002, in collaboration with DOC, councils, iwi and other stakeholders. This Sustainable Management Fund project had two phases; the first focused on wetland classification and changes in extent as an environmental performance indicator; and the second on environmental performance indicators for condition and trend. Five semi-independent ecological indicators of condition, based on threats and stress factors known to degrade wetlands were selected and developed following trials in different terrestrial wetland types throughout New Zealand. Changes in hydrological regime; physicochemical parameters; ecosystem intactness; browsing, predation and harvesting pressure; and native plant dominance against an assumed natural state are used as a composite index of wetland condition. The indicators are scored at both a broad wetland scale and a more detailed plot scale to cater for a range of monitoring requirements and to underpin scores with scientific data. The monitoring methodology begins with field reconnaissance, classification and delineation using a modified Atkinson system, ground truthing, and selection of representative plots. Plots are permanently marked, and vegetation, soil and water sampled and analysed. Plot data, combined with the overall assessment of the wetland are used to finalise scoring of indicators. Information collected using this methodology can be analysed in a range of ways, including assessing overall trends in wetland condition within a region, e.g., using LENZ, DOC or council administration boundary frameworks, or for more specific projects such as monitoring of threatened species or weed invasion within a wetland. Several organisations are now using and/or adapting the methodology for their own monitoring requirements.

Effect of rats on the vegetation of islands in Paterson Inlet, Rakiura National Park

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Rats are known seed predators and consumers of seedlings and other plant parts such as flowers, fruit and bark. They also prey upon birds, invertebrates and sometimes lizards. In theory this means they can directly and indirectly affect forest regeneration and ultimately cause changes in forest composition. Assuming that this is true, there should be an apparent lack of seedlings and saplings on the forest floor when compared to a 'natural' situation. Similarly, one could predict an increase in density and diversity of seedlings and saplings if rats are removed from a system. Norway rats were eradicated from Ulva Island in Paterson Inlet, Rakiura National Park, in a project completed in 1997. Department of Conservation staff at the time initiated a small study to determine if any changes occurred in the flora following this event. Over the period December 2003 to May 2004 these plots were remeasured and a more thorough network of plots was established across the island. Environmental variables were also recorded at each site. These plots were then compared to nearby islands with similar vegetation and climates, but on which rats are still present. The three main hypotheses I tested were: 1) That there would be a greater abundance of seedlings and saplings on Ulva Island 7 years after rat eradication; 2) That there would be a greater diversity of species present in plots after eradication; and 3) That there would be both a greater abundance and diversity of species in the range 0-2m height on Ulva Island than on other islands in Paterson Inlet where rats are still present. Results will be discussed.

Kaitiakitanga: Ki Uta Ki Tai: participation and partnerships - a case study

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For the iwi who holds mana whenua within an area being active participants in utilising and managing resources within that area is not a choice, it is an obligation. Since the late 19th century the challenge for iwi has been to work out how to become, or continue to be, effective participants in the 'resource management' arena when the real power is in the hands of the dominant culture. In recent times it has become fashionable for that dominant culture to describe the iwi participation in various 'resource management' forums as a partnership between themselves and the iwi group concerned. This term is usually used to imply some form of equality as between the participants both in terms of ability to participate and outcomes. The reality of these so-called partnerships is often quite different. Oraka Aparima Runaka has a takiwa (or area) which covers thousands of hectares of land mass, several thousand kilometres of coastline and many thousands of square kilometres of the Southern Ocean. In order to fulfil their obligations as kaitiaki, the people of Oraka Aparima must work with other runaka who have a shared interest in the area or resources concerned as well as the myriad of academics, community groups, commercial operators, Territorial Local Authorities and crown agencies. The runaka has entered into a number of partnerships across the 'resource management' spectrum with mixed outcomes. The least successful of the partnerships are (in general terms) founded on an inherent disparity in the power relationship between the partners. This disparity in power usually arises out of the way in which the partnership is initiated and resourced and is often exacerbated in situations where the non-iwi partner also has 'collateral objectives'.

New Zealand's subantarctic islands

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As an introduction to the subantarctic symposium this talk will present a brief overview of the five New Zealand subantarctic island groups. All five groups are National Nature Reserves and collectively listed as a World Heritage Area. The waters around the Auckland Islands are a Marine Reserve. This talk will review the natural values these designations protect and recognise. The human history will be briefly covered including the impact that this has had on the natural values. The subantarctic island and marine reserves are managed by the Department of Conservation. From the Department's perspective management issues and our responses to them will be discussed. This will include past, present and future management programmes.

Monitoring species at risk in Canada's National Protected Heritage Areas as a measure of ecological integrity

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Canada recently passed the Species at Risk Act (SARA), federal legislation that builds on and complements other provincial, territorial, federal and international legislation to protect wildlife species. The purposes of SARA are to prevent wildlife species from being extirpated from Canada or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. Parks Canada, along with Department of Fisheries and Oceans and Environment Canada, plays a key role in the implementation of SARA. The maintenance or restoration of ecological integrity is Parks Canada's first priority when managing Canada's national parks, and the protection and recovery of species at risk within parks and other national protected heritage areas (including National Historic Sites and National Marine Conservation Areas) comprise key elements of meeting this objective. There are currently 423 species at risk in Canada, and over 50% of them occur on federal lands under Parks Canada management. Parks Canada will lead or be involved in the development and implementation of recovery strategies for these species including the identification and protection of their critical habitat (habitat necessary for the survival or recovery of species at risk). In order to effectively monitor species recovery, Parks Canada will conduct detailed assessments of the status of these species to establish an index of risk of extirpation from national protected heritage areas. Monitoring the critical habitat and population viabilities of species at risk will be integrated with other ecological integrity monitoring measures to arrive at an overall assessment of park ecological integrity. This information will be stored in Biotics 4, a biodiversity data management system that allows information to be shared across Parks Canada and other Canadian and international partners involved in biodiversity conservation.

The carbon-costs for host trees of honeydew produced by scale insects (*Ultracoelostoma* sp.) in a *Nothofagus solandri* forest

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Honeydew excreted by phloem-sap sucking scale insects (*Ultracoelostoma* sp.) living on the bark of beech (*Nothofagus solandri*) trees plays an important role in ecosystem process in native *Nothofagus* forests in the top half New Zealand's South Island. It has been estimated that the carbon contained in honeydew ranges from between 2 and >30% of the annual carbon uptake of the *Nothofagus* trees that the scale insects feed on. This wide range of values is the result of large natural variation in honeydew production, as well as the largely speculative nature of previous estimates. We have combined environmentally driven models of canopy carbon uptake and honeydew production to derive a detailed estimate of honeydew production for a *Nothofagus* forest in Canterbury, New Zealand. Our models incorporate the seasonal dynamics of processes controlling host-tree carbon uptake, as well as seasonal patterns in scale-insect honeydew production. Preliminary results point to strong links between canopy photosynthesis and honeydew production, and highlight the importance of the interaction between scale insects and their host trees for forest ecosystem processes.

Soil incorporated sawdust and *Leucana leucocephala* biomass: effects on earthworm population and soil bulk density

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Presently, the easiest way of getting rid of sawdust in many third world countries is through burning. This releases substantial amounts of carbon dioxide (CO2) into the atmosphere. Experiments were conducted in Ghana to determine the optimum amount of sawdust that can be incorporated into soil as an alternative to releasing CO_2 by burning. *Leucaena leucocephala* (a tree legume) biomass and sawdust were soil incorporated at rates of 0, 5, 10 and 20 t/ha. Earthworm population increased with sawdust application up to 10 t/ha and declined at higher rates of application. The earthworm population more than doubled at 10 t/ha of *L. leucocephala* application but it did not vary with sawdust application at the same rate in the second experiment. Plots receiving at least 10 t/ha of either sawdust or *L. leucocephala* biomass had significantly lower soil bulk density than the control plot ($P<0.05$) as a result of increased organic matter content. The optimum rate of sawdust incorporation that sustained the earthworm population was 10 t/ha. However, this amount, should be applied with adequate organic matter rich in nitrogen to obviate the effects of the high C:N of sawdust material.

National reporting of biodiversity trends

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Proposed indicators, parameters and methods have been developed for national reporting of trends for terrestrial biodiversity. This work is part of the Ministry for Environment's Environmental Reporting Programme and is designed to be policy-relevant. The indicators address changes in: the extent of vegetation cover classes; biodiversity condition; status of threatened species; extent of habitats free from alien species; distribution of environmental weed species; distribution and abundance of selected animal pest species; and the area and percentage of environments and habitats under legal protection. Where possible, use is made of existing data and programmes because this provides older first measurement "baselines". The proposed suite of indicators, parameters, methods and reporting protocols were developed after consultation with managers and scientists; as well as an evaluation of relevant literature and the implementation trials. The rationale behind the proposals will be explained. The proposals address minimum requirements for national reporting and provide guidance for local assessment of some components of biodiversity condition. Agencies may choose to add parameters and use more complex methods for their own management or research purposes. Indicators, parameters and methods for monitoring freshwater and marine biodiversity are at a much earlier stage in development. A consistent approach for all biodiversity reporting is being developed.

Science and Community – a research partnership on Tiritiri Matangi Island

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Tiritiri Matangi Island, Hauraki Gulf, Auckland, has attained an international conservation profile from public involvement in a successful ecological restoration project, and is often cited as a restoration model. Ecological restoration on the island has always involved, and been dependent on, volunteers from local communities. The initial Working Plan for the island relied heavily upon public involvement to replant the island, and recommended species reintroductions to attract and retain public interest. The success of the project is largely due to 'rewards' that the public have derived from their involvement, and illustrates how scientific and public communities can work together to achieve ecological goals. The involvement of volunteers was formalised in 1988 with the establishment of Supporters of Tiritiri Matangi (Inc.), a voluntary organization with aims to support and promote the restoration project. The contribution that the Supporters have made to the island's management has grown and diversified since their inception. Membership now exceeds 1,500 and, currently, the group contributes more than $NZ150,000 to the island annually, including funds for research and management of biodiversity. The Supporters have regularly supported post-graduate research, but only at a minor level. A 5-year strategic plan has made significant additional funding available for research on the island, with the Supporters potentially being proactive in commissioning research outcomes. This will reinforce existing links between the public and scientific communities. This paper will examine the nature of the mutual benefits for the public/scientific communities, illustrated with examples of current research.

Why do plants change leaf morphology? Responses of homoblastic and heteroblastic seedlings to light

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Plants change their leaf shape, size, and growth habit gradually from juvenile to adult stages (homoblasty). However, some plants exhibit abrupt changes (heteroblasty). We hypothesized that leaf heteroblasty is an adaptation to forest understorey and overstorey light environments between seedling and adult stages, respectively. We examined the hypothesis that foliar responses (morphology, anatomy, physiology) of heteroblastic seedlings would maximize their survival and growth relative to homoblastic congeners in shade. We grew two congeneric homoblastic (*Hoheria lyallii* and *Aristotelia serrata*) and heteroblastic (*H. sexstylosa* and *A. fruticosa*) seedling pairs for 24 months in canopy gaps and forest understorey sites. Heteroblastic seedlings that initially had lobed leaves produced entire leaf blades in the understorey, but retained their lobed leaf morphology in gaps. Contrary to expectations, all heteroblastic species survived in gaps, while all homoblastic species survived in the understorey. Heteroblastic species produced more smaller leaves and more branches than their homoblastic relatives in both gap and understorey sites. The heteroblastic species exhibited varied leaf anatomical attributes (thickness of leaf blade, cuticle, and palisade), with the exception of stomatal area index (stomatal density x stoma aperture length) which was higher for both heteroblastic species across all light environments. Photosynthetic light response curve parameters of maximum photosynthetic rate, dark respiration, and light compensation point were greater for heteroblastic species than their homoblastic relatives in the gaps, but similar in the understorey. Despite this, there were no consistent patterns of growth for homoblastic and heteroblastic species across light environments. These findings suggest that heteroblastic species from two different genera do not respond in a similar manner to gap and understorey light environments, and perhaps alternative explanations for the evolution of heteroblastic leaf morphology should be sought.

Determinants of the naturalisation of introduced seed plants in New Zealand

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Of more than 20,000 exotic plant species introduced to NZ, over 2,200 have already naturalised, of which about 500 are already causing problems by impacting on primary production and/or native biodiversity. On average, about twelve new species have naturalised regionally per year. Managing plant invasions requires that we have much greater understanding of why and when species naturalise. What determines which plants naturalise earliest? International literature suggests that several factors are important, although there is ongoing debate on the relative importance of plant biological traits, geographical features of the native range, and human effects such as the amount of effort put into introducing species. We examined the effects on dates of first naturalisation of life form (annual, biennial, etc.), native region of origin (using the 19 regions of the World Geographical Scheme for Plant Distributions), and volumes of national plant imports (as recorded by Statistics NZ). To do this, we have compiled a comprehensive list of the seed plant species naturalised here, the life modes, the region(s) of origin, and the first record of naturalisation. We also compiled a list of the value by region of origin of imports of plants and seeds since records started in NZ. Our data show that annuals and biennials on average naturalised earlier than woody species, and those species accidentally introduced naturalised earlier than those deliberately introduced. 43.5% have Europe as a region of origin, 40% have the Orient and 17% or fewer have the remaining regions as regions of origin. We analysed the entire naturalised flora, and we separated deliberately introduced from accidentally introduced species, where these species could be confidently categorised. Understanding temporal patterns of naturalisation requires knowledge of both biological traits and the timing and volume of trade from different regions of the world.

Movements, home ranges, and interactions of the Otago skink (*Oligosoma otagense*)

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The Otago skink, *Oligosoma otagense*, is the largest skink on the South Island of New Zealand. Their populations have been experiencing severe decline and today their geographic range has shrunk to only 8% of their former distribution. The daily movements of these skinks were studied using radio-telemetry at Redbank Reserve near Macraes Flat, Central Otago. Thirteen adult skinks (seven females and six males) were tracked between December 2003 and April 2004 for a total of 700 fixes. Tracking periods ranged from 26 to 111 days. Mean distance moved was 12.14 metres. The farthest distance moved in one day was 82.5 metres, which was done by a male. There was no significant difference between sexes for distance traveled, although males moved significantly more often than females. Females that did not give birth during the tracking period moved significantly more often and shorter distances than females that did give birth. Intraspecific social interactions have been noted in the past for Otago skinks and during this tracking period, 20.3% of all fixes included observations of basking or interactions between the tracked skinks and other Otago skinks. Territorial behavior was only observed between Otago skinks and the sympatric grand skinks (*Oligosoma grande*) and no antagonistic behavior was observed between conspecifics. Data on home range is currently being analysed.

Measuring rodent and mustelid relative abundance

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Rodents and mustelids are usually monitored at conservation management sites in order to determine the results of pest control operations. The main technique Department of Conservation (DOC) staff use for monitoring rodents and mustelids is ink footprint tracking tunnels. These are relatively cheap and easy to use, and the index (expressed as the mean number of tracking tunnels tracked) can be related to conservation outcomes for some threatened species. In 2001, after four years of working with DOC managers from around New Zealand, we produced a set of protocols to follow when using tracking tunnels to monitor rodents and mustelids. Between 2002 and 2004 we collected tracking indices of rodent and mustelid abundance once a season from 30 sites around the country where managers were using these newly developed protocols. The results from these sites indicated that in podocarp and kauri forests, rat indices of abundance tended to be higher at those sites where stoats were controlled but the indices of mouse abundance tended to be lower. As part of the same project we calibrated the tracking tunnel indices of mustelid and rodent abundance against trapping indices of abundance and found that they correlated reasonably well.

Investigating genetic diversity in takahe

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Approximately 250 takahe (*Porphyrio hochstetteri*) remain in the wild, all derived from a single natural population in the Murchison Mountains, Fiordland. Since the mid-1980s, a total of 25 takahe have been translocated from Fiordland to the offshore islands of Mana, Kapiti, Maud and Tiritiri Matangi. A disproportionately large number of the descendant island takahe population (of around 70) is derived from relatively few of the originally released birds. Despite increased adult survival on the islands (due to a milder climate and the absence of introduced predators), fertility is reduced compared to the remaining Fiordland population, and it is thought that this reduction in reproductive success is related to the negative effects of inbreeding. As complete pedigrees are available for all the birds on the islands, my study uses microsatellite analysis techniques to measure takahe genetic diversity and identify whether there is a correlation between relatedness (based on the pedigrees) and underlying genetic diversity (based on genetic markers). The maintenance of genetic diversity in threatened populations is an important consideration for wildlife managers, as it relates to phenotypic diversity and the future survivability of the species. A correlation between genetic diversity at the pedigree and DNA levels would imply that further inbreeding depression could potentially occur and I also plan to investigate whether supplementing island populations with wild (Fiordland) individuals would be beneficial. To determine whether this is the case, I intend to investigate whether island takahe have indeed lost genetic diversity relative to the natural population in Fiordland, and whether there is a correlation between genetic diversity and reproductive success of island takahe. The results of this research will have important implications for the future management of takahe.

Habitat selection and population dynamics of feral cats on Stewart Island/Rakiura: the effects of prey abundance and climate

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Feral cats, as efficient predators of ground nesting birds, are thought to be the principal reason for the steep decline in numbers of the endangered southern New Zealand dotterel, that nest in alpine heath on the mountain tops of Stewart Island. Feral cats are being controlled to reduce predation and thus increase the numbers of dotterels. To improve the current control of cats, the habitat selection of feral cats on Stewart Island was investigated. Cats were radio-collared and radio-tracked to investigate home range sizes and habitat selection. Cats are known to select habitat depending on where their prey is located, so trapping of three rat species, which are cats' principal prey, was carried out in four forest types. Overall, rat numbers fluctuated seasonally, with a low in relative abundance occurring over the late summer and early autumn. When rat abundance was reduced cats were more likely to leave established home ranges or die, probably through starvation. As rats became less abundant cats did not apparently 'prey-switch' to birds, as secondary prey, but cats did eat proportionally more birds by weight as rat abundance declined. Rats formed 81% of cats' diet by weight and seasonal depressions in rat abundance every year were limiting cat numbers. The home ranges of cats on Stewart Island, measured using the minimum convex polygon method, were the largest recorded for females and the second largest recorded for males. The large home range sizes were probably due to the seasonal depressions in primary prey abundance. Habitat selection by cats was measured using the kernel method. Cats used podocarp-broadleaf forest more than was expected by availability, and used subalpine shrubland significantly less than podocarp-broadleaf forest. Selection of the forest types by cats was influenced by the need for shelter from wet weather.

Crossing the FBT (Fen-Bog Transition zone) in the Southern Hemisphere requires the restiad, *Empodisma minus*, as engineer

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The fen-bog transition is a well-established process for bogs, developing via either allogenic (e.g., climatic limits) or autogenic (i.e., ecosystem engineers) pathways. *Sphagnum* species are the most common Northern Hemisphere engineers, but this genus appears to have no role in crossing the FBT in the Southern Hemisphere. Instead wirerush (*Empodisma minus*), a member of the southern family Restionaceae, is the only known candidate for engineer. We review allogenic and autogenic models of bog development, and assess the evidence for *Sphagnum* and *Empodisma* as engineers. Another common species occurring around the FBT zone in New Zealand is red tussock, *Chionochloa rubra*. We present evidence of the relative competitive abilities of *Chionochloa* and *Empodisma* in experimental microcosms along parts of the FBT's nutrient and water gradients. Our results demonstrate that while conditions at the bog end of the gradient decrease productivity in both species, *Empodisma* is less affected. *Empodisma* has greater ability to pre-empt scarce nutrients supplied by aerosol to mimic nutrient input into bogs, especially at water tables which permit aerial development of its weft of negatively geotropic, nutrient-scavenging roots. *Empodisma* is a remarkably efficacious ecosystem engineer.

Improving biodiversity management partnerships in New Zealand

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The last five years has seen a growing awareness that issues of biodiversity management cross public and private lands. Consequently, they depend on the coordinated actions of land managers, communities, groups and agencies. In particular, many organisations are realising that their relationship with M_ori communities is crucial to their ongoing capacity to undertake basic biodiversity management work such as pest control, or initiate long term programmes of species management (notably for kokako, kiwi and kereru).

A number of agencies (including regional councils and the Department of Conservation) are, in effect, conducting experiments in community engagement. A few of these projects have built in the capacity to learn about and improve their success. We present examples from a range of case studies with which we have been involved, to look at the way in which agencies, researchers, community organisations and iwi organisations are learning, or could learn, to work with M_ori.

Our case studies offer insights into working with M_ori (and many of these lessons carry over into working with P_keh_ groups) They explore phases of building partnerships, the role of communication, and the potential benefits of employing those with skills in facilitation and communication to help groups work effectively together. These case studies have shown the importance of working with the issue of trust, and the value of rephrasing problems to enable alternative solutions to emerge. For instance, work on the issue of M_ori communities and 1080-based pest control illustrates that people reach agreement more quickly when they focus on a common problem (such as the need to control possum damage) rather than on a solution already decided by an agency (such as the need to drop 1080 to kill possums).

Finally, we conclude with some key ideas for the ongoing improvement of, and spread of knowledge about, successful partnerships.

This paper includes work across three different Foundation for Research Science and Technology contracts and one contract from the Ministry of Research, Science and Technology.

Does culling of the introduced brushtail possum *Trichosurus vulpecula* result in canopy improvement of Waikato forests, New Zealand?

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Annual expenditure in New Zealand on possum culling for conservation purposes alone is estimated at 12 million dollars. One assumption and rationale for a large portion of possum culling in New Zealand is that species and communities impacted by possums will recover following possum culling. Possum browse and canopy foliage cover data were collected for the majority of sites where possum control was funded by the Department of Conservation in the Waikato Region between 1993 and 2001. The accumulation of this data pre- and post-possum control has provided the opportunity to investigate trends in possum impacts and canopy recovery following possum control in the Waikato Region. The primary objectives were to determine what baseline condition and plot physiography parameters affected foliage cover trends, and to determine whether trees at different sites responded differently to possum control. Four canopy tree species, kamahi *Weinmannia racemosa*, kohekohe *Dysoxylum spectabile*, mangeao *Litsea calicaris* and mahoe *Melicytus ramiflorus* were studied. Kohekohe and mangeao showed the most recovery following possum control with large reductions in browse and improvements in foliage cover. Foliage cover for kamahi and mahoe did not increase, giving grounds to question the benefits of possum control for these species in the Waikato region.

Magpie impacts on other birds

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We monitored bird responses to a large magpie control programme undertaken by Regional Councils, and studied behavioural interactions between magpies and other birds. Counts of some common introduced birds increased after magpie control. Kereru and tui counts increased a little and variably, respectively. Literature and anecdotes report that magpies attacked 43 other bird species, but our observations showed that a) only territorial magpies attacked other birds; b) only 6% (40 of 654)of passing birds were attacked, and c) no birds were actually hit by magpies. Time-lapse video cameras showed that magpies are not important nest predators of common passerines in hedgerows and orchard trees. Most predations were by cats and harriers. We conclude that magpie attacks are actually rare, but conspicuous, and literature and public reports are biased to sensational events. The cost of magpie aggression for other birds is mostly some small (50–100m) movement, the cost of which is hard to evaluate but small. It is possible that movements of tui and kereru in a fragmented landscape can be greatly affected at particular locations by particular magpies, but we have not demonstrated this. We do not recommend large-scale magpie control to recover native birds. Control should instead focus on pest mammals in native forest remnants when native birds nest.

Southern peat

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Southern New Zealand has peat in many forms. There are wetland peats associated with bogs, fens, seepages, swamps, and estuaries. Blanket peats occur on Rakiura and across table-lands in SW Fiordland. Coastal peats occur on seabird islands where the climate is cloudy, windy, and salty. This overview will describe types of peat, their formation, and the vegetation under which they have formed. In the south we see examples of wetlands formed on plains, mountain crests, lake shores, hillsides, dunes, and moraines. Their plant cover ranges from mosses to cushion plants, sedges, restiads, flax, tussock , scrub, and forest. Stories will be told of their relationship to vegetation history, erosion, drainage, fire, nutrient enrichment, mining, and conversion to agriculture and horticulture. Southern peatlands will be related to a recent classification of wetlands (Johnson, P.N.; Gerbeaux, P.: Wetland Types in New Zealand, DOC Science Publishing; publication imminent).

Can we restore ecosystem interactions on the mainland?

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Introduced mammalian pests on the New Zealand mainland affect both the densities of particular native species, and the interactions between them, such as pollination and fruit dispersal mutualisms. Recent experiments at Craigieburn showed that stoat control over a small area boosted densities of bellbirds, but did not improve pollination of the native mistletoe *Peraxilla tetrapetala*. Here we examine whether more intensive control of a wider range of pests at the Rotoiti Nature Recovery Project (RNRP), St Arnaud, is able to restore interactions among species to something like their pre-human (or pre-pest) state. If pest control is maximally effective, bellbirds should be food-limited rather than predator-limited, and mistletoe pollination should be very efficient. We measured bellbird nest success and feeding rates, and mistletoe pollination rates, over two seasons (2002/03 and 2003/04). Bellbird nest success was only moderate, perhaps because a mast seeding event during the study meant that predators were not kept below target levels. However bellbirds did spend more time feeding during the breeding season at RNRP than at the untreated Mt Misery site, showing some evidence of food limitation. Mistletoe pollination was not especially high in the first season but quite high in the second season. Overall the RNRP does seems to be restoring at least some interactions among native species to close to their presumed pest-free conditions.

Research on Traditional Ecological Knowledge of the harvest of titi (sooty shearwater) by Rakiura Maori

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Common property resource management issues, whether environmental or wildlife based, by definition involve a human dimension. With indigenous people there can be a strong connection between social and ecological systems. Such strong linkages between the two systems allow societies to accumulate traditional ecological knowledge (TEK) that guide customary uses of wildlife. TEK embodies rules that people set up to control the use of the environment. Implementation of these rules and the associated compliance may involve an intimate belief system. As such social mechanisms can be strong instruments for sustainability. Rakiura Maori are governed primarily by TEK in a centuries old harvest of titi chicks (*Puffinus griseus*) on islands adjacent to Rakiura/Stewart Island. Rakiura Maori and Otago University are involved in collaborative research into the sustainability of this harvest. My part of this research involved examining Rakiura Maori TEK and management system practices as they relate to sustainability. Rakiura Maori harvesting practice is based on a system of rules, the most prominent being protection of habitat and adult birds and temporal restrictions of harvest. Social mechanisms to aid conservation include setting up rahui and tapu areas and including social consequences in their compliance belief systems. Such social mechanisms can be far more effective as compliance and enforcement mechanisms and are less costly than legislative mechanisms because of their self-regulatory nature. Science is often too expensive for the remote harvest sites and poorly financed customary harvest management. Also, science is not always trusted or welcomed by traditional harvesters. Therefore, science cannot be used without TEK and must be compatible with existing social institutions. By using the two types of knowledge systems together, a more complete picture of titi ecology can be obtained. In this way Rakiura Maori TEK and science can complement each other for ecological monitoring, to help keep the titi forever.

Gardens without weeds

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When Dr Monkhouse described Maori gardens seen in 1769 as "completely cleared of all weeds", did he mean that the gardeners were fastidious weeders, or were there just fewer weeds to eradicate? Did the Maori and other Polynesian peoples have a concept of weeds equivalent to that in European languages? This talk will look at indigenous plants that might have invaded Maori gardens, the inadvertent introduction of a small number of fellow-travellers with Maori cultigens, and how different groups of Polynesians might have classified the plants that we call 'weeds'.

A proposal for a national biodiversity inventory and monitoring system for conservation

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The Department of Conservation is developing a biodiversity inventory and monitoring programme to document changes in the state of indigenous biodiversity at scales from local to national. While such a programme is necessary to increase our basic understanding of how New Zealand biodiversity is changing, the primary departmental need is to inform policy and to evaluate the success or failure of conservation strategies in relation to management and resources employed. Many countries are embarking on a similar process, driven in part by the need to show compliance with international agreements (for instance, Convention on Biological Diversity). However, there is also a strong international trend to demand much higher levels of organisational accountability and better standards of strategic planning. Increasingly, organisations must demonstrate that effective outcomes are produced. The challenge is to develop a framework for structuring inventory and monitoring that links in a consistent, verifiable way, high-level governmental goals for indigenous biodiversity conservation with a range of measurements collected in the field. We have been collaborating on a project to measure biodiversity and to design a multi-scaled biodiversity inventory and monitoring programme. The framework, comprising a nested hierarchy of outcomes (national, targeted, objective) and performance assessment criteria (indicators, measures, data elements), is outlined. Our goal is to have a clear, logical, ecologically credible system in which higher-level reports of biodiversity status and policy response can be seen to be based on verifiable, accessible evidence.

Back country huts as foci for weed invasion in national parks

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The role of backcountry huts as focal points for weed establishment and spread into natural areas has received little attention. In this study we describe the pattern of weed spread around Takahe Valley Hut, in Fiordland National Park. Established in 1948, the hut is located at 900 m a.s.l., at the ecotone between forest and valley floor shrubland/grassland. We recorded the distribution of vascular plants in 110 quadrats placed by restricted randomisation around the hut, measuring relative irradiance and distance from the hut at each quadrat. Nine exotic species, mostly grasses, were recorded, the most frequent being *Agrostis capillaris* (34%). The majority of exotic occurrences were located in the immediate vicinity of the hut but two exotic species (*Agrostis capillaris*, *Dactylis glomerata*) ranged more widely. Exotic species were present in well-drained shrubland and grassland but did not extend far into *Nothofagus* forest or on infertile wetlands. The percentage of exotic species in quadrats was negatively correlated with distance from the hut, and this relationship strengthened when quadrats under forest were excluded. There was no linear relationship between the percentage of exotic species and relative irradiance. When forest quadrats were excluded, the number of native species in quadrats was negatively correlated with the number of exotics, suggesting competitive displacement of native species by exotics. The long-term persistence of most exotic species at this site appears to depend on physical disturbance and nutrient enrichment associated with human activities at the hut site. However the maintenance of this species pool has provided sufficient propagule pressure for some exotic species to springboard into the wider area. To reduce the accumulation of weeds, huts should be sited in vegetation types that are resistant to invasion.

Do island birds use song characteristics to avoid breeding with close relatives?

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Many of New Zealand's endangered birds now exist only in small, isolated island populations, where inbreeding can be common and dispersal is limited. In songbirds, females choose their mates based on their song, but what makes a particular song attractive and distinguishes it from other songs? The proposed research will investigate whether female South Island saddlebacks (*Philesturnus carunculatus carunculatus*) and New Zealand robins (*Petroica australis australis*) can use song characteristics to recognise the songs of close relatives, and potentially use this information to avoid incestuous matings. Previous research on North Island saddlebacks suggests that males match their song to their neighbour's song, which would hinder female recognition of a close relative's call. This song development pattern would not necessarily prevent inbreeding, unless the dispersal distance of males and females differs significantly. Previous research did not investigate the dispersal pattern of females, which will be taken into account in the present study. This proposed study will investigate the development of song patterns, dispersal, and mate choice of South Island saddlebacks and New Zealand robins on Ulva, Erin and Motuara Islands. The software program RAVEN 1.2 will be used to measure differences in maximum frequencies, duration of, and interval length between song units, using univariate, multivariate, and regression analyses. The results of this research will have important implications for the genetic management of island populations. Confirming the presence or absence of mechanisms that play a role in inbreeding avoidance could help interpret levels of inbreeding observed. By investigating initial song development, a minimum age for successful translocation of juveniles may be established. This study will also create a database of dialects across a geographic range, which may indicate potential breeding success problems if the dialects are too diverse, affecting translocations to and from certain areas.

Vegetation succession after prehistoric burning of kauri forest at Waipoua, Northland, New Zealand

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Omaia clearing, in the Waipoua Forest Sanctuary of western Northland, is one of several small patches of kauri forest burnt repeatedly in prehistoric times for the purpose of bird hunting, according to the oral history of Te Iwi O Te Roroa. The seral vegetation growing there today contrasts sharply with the surrounding mature forest. From December 2003 to April 2004, a detailed ecological survey describing 34 ha of the clearing (the total burnt area, plus a 100m buffer on all sides) was carried out. Data were collected on vegetation floristics/structure (including cover abundance and absolute densities of certain tree species), soil characteristics (20 cm depth) and microsite physiography. Two plots of 5x10 m were randomly located in each hectare, achieving 1% coverage of the total area. The ages and growth rates of two major initial colonising trees, kauri (*Agathis australis*) and rimu (*Dacrydium cupressinum*), were examined using the dendroecological technique of tree-coring, performed on 58 individuals along two perpendicular transects spanning the clearing. In addition, 8 manuka (*Leptospermum scoparium*) and 2 kanuka (*Kunzea ericoides*) were sectioned at the base to determine the time elapsed since the last fire. During the fieldwork it was discovered that aeolian sand deposits add significant heterogeneity to the soil pattern. Hypotheses being tested were *a)* that vegetation composition changes from centre to edge, due to time since disturbance (estimated from tree ages), *b)* that soil fertility changes from centre to edge, and *c)* that growth rates of regenerating trees are affected by soil type. Other hypotheses are generated through multivariate data exploration. Preliminary results will be presented, including a fine-scale map of vegetation classifications, an analysis of tree ages and growth rates, and possibly the outcome from a bioassay experiment in which aboveground grass biomass is used to determine the relative fertility of soils.

A blast from the past: a dendroecological reconstruction of forest windthrow history, North Island, New Zealand

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Strong winds are a major natural disturbance agent in New Zealand's indigenous forests, and a suite of native tree species is adapted to recruitment following catastrophic windthrow. Cohorts of several conifer and beech species such as kaikawaka (*Libocedrus bidwillii*) and mountain beech (*Nothofagus solandri* var. *cliffortioides*) appear to mark past storm events temporally and spatially. This paper presents the methodology and preliminary results from a research project which aims to identify windthrow initiated cohorts, and by determining their disturbance histories as accurately as possible, develop a fine resolution record of past storm events. The spatial relationship between recruitment, suppression, and release was investigated by mapping recruited, suppressed, released and fallen trees within 400 m^2 plots. A site of known storm date (Cyclone Bernie A.D. 1982) was also studied in order to assess interspecies differences between storm damage and tree ring response. The results provide a clear indication of storm events, with suppression and release events being temporally coincident with windthrow, and storm events initiating periods of recruitment.

Traditional resource management of harakeke by Maori: the historical evidence

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Traditional Maori resource use and management of weaving plants such as harakeke was investigated. Harakeke, or NZ flax, is an essential resource traditionally used by Maori to produce clothing, baskets and containers, mats, fishing nets and other items. Traditional ecological knowledge has two linked parts. Firstly, a world view that underpins the way things are done, and secondly the management practices themselves. An examination of current literature identified that only two management strategies are commonly mentioned by authors discussing traditional resource management by Maori. I hypothesized that for an important resource such as harakeke, a wide array of management practices would be used in addition to these. The historical and contemporary literature was therefore searched for evidence of other resource management practices, particularly regarding harakeke. Closer inspection of these sources, supplemented by oral interviews, provides evidence which supports this hypothesis. This 'forgotten' knowledge has thus been reconstituted and reinterpreted. Although there appear to be regional differences in traditional practice, the evidence suggests that sought after varieties of harakeke was carefully managed, for example in relation to environmental factors, and using propagation and specific harvesting methods. Harakeke remains common in the urban and rural landscape, yet traditional techniques do not appear to be frequently used by councils or other local bodies in caring for harakeke. For example, it is uncommon for councils to cut or trim harakeke according to traditional methods, in spite of the potential advantages of preventing rot, minimizing insect damage and promoting healthy growth. Hence, traditional knowledge has again become 'forgotten' knowledge by some of those currently responsible for the management of these plants. There is scope for the incorporation of traditional Maori practices into current management of harakeke and other plants. Knowledge recovered from historical sources can also be used to enhance current understandings by weavers using traditional resource management.

Campbell Island rat eradication – how was it done and what does it mean for the future?

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In 2001 the Department of Conservation undertook the largest rodent eradication worldwide to date. Three helicopters were used to spread 120 tonnes of bait over the 11300 ha island. Being 700 km away from the mainland it was logistically challenging to get all the required equipment and supplies on site. This, combined with the predictably poor weather on the island, meant that the current standard techniques i.e., two drops had to be modified to make the operation feasible. Three months were allowed to carry out the operation but unusually good weather meant that it was done in just over a month. Campbell Island was seen as another step in both New Zealand's and world-wide island eradications having built on the information gained from previous eradications and hopefully leading on to even more ambitious projects in the future. While it is still too early to be 100% sure of success a preliminary check in 2003 found no sign of rats, which was sufficient for the Subantarctic teal recovery group to go ahead with planning for the reintroduction of the flightless teal in September this year.

The history of bracken and the impact of the Maori fire regime in New Zealand

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The bracken genus *Pteridium* has been present in New Zealand since the Oligocene, but the current species, *P. esculentum* (widespread in the western Pacific) is almost certainly of recent origin. Bracken played only a minor ecological role until human settlement in the 13th century. While bracken is well equipped to survive repeated fire, this attribute was of limited use in the low fire intensity environment before settlement. However, its readily dispersed spores and tall, often lianoid, growth form permitted it to operate as an opportunistic forest edge species, capable of responding to a range of disturbances but ephemeral in the face of rapid woody plant regrowth. Only after massive rhyolitic volcanic eruptions did it briefly attain dominance. Bracken was the major beneficiary of the fire regime introduced by Maori. By the time of first European contact with New Zealand, it was prominent in the vegetation over one third of the landmass. Frequent burning maintained large areas in almost pure stands. Its rhizomes provided a major part of the starch component of the Maori diet before contact, and continued to be important until the 1860s. This level of dominance by bracken is unparalleled in other areas of the world. The Maori fire regime acted on a flora with very few woody fire specialists, and a vegetation dominated by trees with little resistance to fire. The vast forest fires that accompanied Maori settlement, in contrast to the small-scale clearances characteristic of many other countries, also favoured bracken by reducing the speed of woody recovery. Only in drier, colder regions did grasses manage to compete successfully. Under these circumstances, bracken became an honorary shrub pyrophyte, pre-empting a role that would have been occupied by a range of fire-adapted shrubs in continental regions, and therefore vastly expanding its ecological niche.

Redesigning ecological integrity monitoring in Canada's National Parks

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National Parks in Canada have recently been subject to new legislation (Canada National Parks Act 2001) that requires that …'maintenance or restoration of ecological integrity (EI)…be the first priority of the Minister when considering all aspects of the management of parks'. As a result of the requirement to manage for ecological integrity, National Park staff are mandated to report to the Canadian public every 5 years through a State of the Park (SOP) report. To meet the requirements of SOP reporting, Parks Canada is reorganising park level monitoring to be more scientifically rigorous, to develop sounder linkages between EI monitoring and the state of park EI, and to develop reporting products that more clearly communicate changes in the state of park EI. A key direction for the programme is to report changes in park health through 6–8 indices of park EI. Indices are being developed that follow an 'iceberg' model of public and scientific components, where scientific measures and models are combined to generate an easily communicated aspect of park EI.

The 41 national parks of Canada have been grouped into 6 'bioregions' where ecological conditions are relatively uniform, and where the development of park EI monitoring will be developed using a cooperative approach among parks and external partners. All parks in each of the 6 bioregions will report changes in park EI according to the 6–8 indices developed for that bioregion. Direct engagement of park managers and stakeholders in the redevelopment of park monitoring programmes is another major focus of programme development. Parks Canada is in the process of filling monitoring specialist positions to coordinate and support redesigned EI monitoring in each of the 6 bioregions. All national parks have recently conducted an assessment of their present programmes in terms of the relationship of projects to park management, their contribution to bioregional EI indices, the use of proper experimental design and sample power, identifying more precise and relevant monitoring questions, and the bioregional applicability of programme results. Based on these assessments, parks have begun to redesign their vision for park EI monitoring, and are developing new monitoring initiatives to fill identified gaps in park programmes.

Major future work will focus on developing park ecosystem conceptual models that will relate a parsimonious suite of monitoring measures to fundamental ecosystem processes, biota and stressors. Bioregional tables will consult with regional stakeholders, partners and science peers to develop a suite of monitoring measures for each park that are feasible to operationalise, and that report comprehensively on changes in park EI. Programme redesign will be carried out over the next 5 years so that designed park monitoring programmes will be implemented by 2008.

Fragmentation effects: consequences for some native shrubs

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In New Zealand, extensive destruction and fragmentation of continuous forest tracts has occurred since human occupation, and over the past 150 years since European settlement some forests that formerly occupied extensive areas have been reduced to isolated remnants. One of the features of habitat fragmentation is an increase in the amount of induced edge habitat, exposing populations to physical and ecological changes. In addition, if the viabilities of populations are reduced with a decline in population size, the so-called Allee effect, plants in smaller populations or less dense patches can be affected by reduced pollinators, and pollen may become limiting for fruit set. In this study, the breeding strategies and population structures of 16 native shrub species at 34 sites were investigated to determine whether their reproductive performances have been compromised by low population densities and the altered environments of fragmented habitats. The results show that most species produced moderate to high levels of fruit set in natural pollination experiments, although at some sites fruit set was less than 20%. Overall, self-incompatibility was relatively uncommon, and only three of the species were significantly pollen limited. Ten of the 16 species occur predominantly within 30 m of the edge, in canopy gaps, or in open habitats. Assessment of population size-classes at each site shows there was recruitment at 31 of the 34 sites. In gender dimorphic species, low numbers of male plants was the probable cause of reduced fruit set. It would appear that fragmentation and the creation of new edges 100–150 years ago has benefited some native shrub species by providing suitable habitat for colonisation and establishment. Some native species depend on disturbance for population recruitment, and in some cases, particularly for species with restricted distribution and when there is no natural disturbance, habitats may need to be actively managed, to ensure populations persist in the long term.

Kia Mau Te T_t_ Mo Ake T_nu Atu: Progress towards assessing the sustainability of a traditional seabird harvest by Rakiura Maori.

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A research partnership between Rakiura Maori and the University of Otago since 1994 will soon predict whether the traditional harvest of t_t_ (sooty shearwater, *Puffinus griseus*) chicks is sustainable. Predictions of mathematical models, comparison of chick density in harvested and unharvested sites, and long-term monitoring of population trends will be used to cross-check estimates of harvest impacts. Research has tested methodology and built preliminary models to set research priorities and identify minimum model complexity to understand the system. So far over 35,000 birds have been banded to assess survival, age at first reproduction and breeding frequency. The partnership with Rakiura Maori has greatly hastened and improved robustness of some technical aspects of the science, but also has slowed and weakened it in other ways. Analysis of a birder's harvest diary has identified climate impacts on birds. Traditional Ecological Knowledge has helped frame better hypotheses and forced attention on variation amongst islands and 'manu' (family birding territories). The research project has indirectly triggered funding for restoration by rat eradication from four T_t_ Islands. Capturing these benefits for research and management has required an enormous amount of time, flexibility, trust and mutual respect on all sides to achieve real co-management of the research.

Why two heads are better than one: duetting in North Island kokako (*Callaeas cinerea wilsoni*)

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Most of us think of bird song as something males perform to woo prospective mates: in northern temperate regions of the world, this stereotype tends to hold true. In the tropics, however, females of many species sing as well, often in striking coordination with their male partners. This style of singing, called duetting, also occurs in some familiar New Zealand natives, including the kokako *Callaeas cinerea*. Duets may serve a variety of communicative functions, including the defence of both territories and pair bonds. We are investigating duet function in kokako, and here present the results of playback experiments designed to pinpoint what it is about the duet that makes it a more effective territorial signal than a solo song. We presented kokako with one- and two-speaker playbacks to determine if kokako distinguish pairs from single birds on the basis of one versus two spatial sources of sound. Our results showed that kokako did respond differently to one- and two-speaker playbacks. Pairs perceived the simulated duet as the greater territorial threat, as shown by their faster approaches to two-speaker playback. We also examined pair proximity during playbacks to determine whether simulated duets were perceived as a stronger threat to the pair bond than solo song, and found no support for this second hypothesis. In addition to these results, we will discuss current work investigating whether kokako are able to detect the presence of two voices or two sexes based on vocal characteristics alone.

Are magpies rural bullies? Impacts of breeding and non-breeding magpies on the distribution of rural birds

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Magpies sometimes chase, attack and kill other birds in New Zealand. Here we assess if magpie aggression is generalised across species or specialised to a particular demographic. We conducted regular observations on six breeding groups and three non-breeding flocks of magpies for a year to determine (1) if other birds avoid flying or foraging close to them, (2) the proportion of passing birds that were attacked and (3) which magpies are most aggressive. Significantly fewer birds of a range of species foraged close to both breeding and non-breeding magpies. Significantly fewer birds were also recorded flying near breeding groups but not non-breeding flocks. A small proportion of birds (6%) were observed being attacked (this was more likely to occur when higher numbers of birds were counted close to magpies). Attacks consisted of the victim being swooped or chased; no physical contact was ever observed. Both adult male and female breeding magpies were seen attacking other birds; juveniles sometimes supported adults but never initiated attacks. Non-breeding magpies were not seen attacking other birds. Our results suggest that some birds avoid foraging and/or flying close to magpies because they are sometimes chased by breeding adults of both sexes. Attacks where the victim is seriously injured or killed are rare.

Progress in understanding pollination systems in New Zealand

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The concepts of pollination syndromes and blossom classes, designed to describe combinations of floral traits that are associated with particular groups of pollinators, has potential for analysing community dynamics for monitoring pollination systems in New Zealand. A "blossom class – functional group" analysis of the potential and realised pollination systems provides a method to structure information about community dynamics so that comparisons can be made among countries, habitats, sites, and over time. New Zealand has a predominance of insect pollinated plant species but the native pollination systems differ from the introduced so impact studies will be important. Bird pollination has been well studied in New Zealand but some insect systems, in particular, beetle and moth pollination have not been investigated as yet. The low diversity in native and exotic pollinator assemblages, extremely high seasonal and daily microclimate variability, and easy access to pollen and nectar in most flower types in New Zealand is thought to promote generalist and mixed pollination systems. Nevertheless, impacts of the introduction of exotic pollinators and exotic plants have the potential to change the native systems. On the other hand, in some cases native pollinators or plants may benefit from introductions. We are lacking data on pollinator frequency, effectiveness and importance for most of the habitats in New Zealand and have no base line to compare future changes to. The potential impacts of changes in pollination systems have importance for biodiversity conservation, biosecurity programs, biosafety issues, ecological restoration projects, and sustainable agriculture.

Monitoring vegetation succession using satellite remote sensing

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Large areas of the eastern South Island, New Zealand, have been subject to major ecological disturbance, with burning 600-800 years ago, and continued grazing and burning from the 1850s, as well as natural floods and landslides. This study aims to monitor the herb, tussock, shrub and tree vegetation classes that are symptomatic of various disturbance types and succession paths. Monitoring needs to cover multiple environments and vegetation communities, and be applied consistently over time to detect change. Satellite remote sensing is an obvious choice for large coverage observation of vegetation, particularly where regular updates are required. However, a clear understanding is needed of the types of vegetation that can be discriminated, and what biophysical characteristics make them distinctive. This is a two way process. From one direction, we establish a set of key successional vegetation categories and attempt to discriminate these in the satellite image. From the other, we look for patterns in the remote sensing data, and determine what these relate to in the environment. Many attributes of vegetation affect its appearance in a satellite image. These operate at the micro-scale of leaf characteristics and also at the individual plant canopy scale. However, the satellite sensor views the community scale. Each image pixel covers an area of 20 _ 20m (depending on image resolution), and thus contains information about the aggregated characteristics of all the vegetative and non-vegetative materials in this area, as well as shading between canopies. We have investigated plant functional types and structural types as suitable vegetation categorisations for operating at this scale. We have demonstrated that an ecologically useful set of structural types can be discriminated in satellite imagery, and in this paper will show what makes them distinctive. We are also able to map some plant functional types.

Kaupapa Kerer_: A Ng_i Tahu initiative for community involvement in the research of kerer_ on Banks Peninsula

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The kerer_ is New Zealand's only endemic pigeon. It plays a key role in the restoration of native forests by distributing seeds of native trees. Banks Peninsula was once known for its abundance of kerer_, a taonga (treasure) of the indigenous people, Ng_i Tahu. Today, far fewer kerer_ exist, and only in fragmented remnants of native forest. Kaupapa Kerer_ is an initiative to restore kerer_ communities in and around Banks Peninsula, and is powered by representatives of Ng_i Tahu, the Department of Conservation, Landcare Research, and Lincoln University. The initiative has a two-pronged approach, work is being done with local communities to raise awareness and support the restoration of kerer_ populations. Ecological research is also being undertaken to elucidate information as a basis for improving habitat. In this presentation we will present work on the community initiatives aspect of the Kaupapa Kerer_ programme, the Ng_i Tahu involvement in the project and the preliminary results of our research.

Uptake and persistence of sodium monofluoroacetate (Compound 1080) in plants of cultural importance

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Field research was undertaken to determine if naturally occurring plants utilised by a Maori community for food and medicine would take up the toxin sodium monofluoroacetate (Compound 1080) from baits used to control the brush-tailed possum *Trichosurus vulpecula*. Single baits were placed at the base of individual plants of two species, pikopiko (*Asplenium bulbiferum*, used for food) and karamuramu (*Coprosma robusta*, used for medicine). Plants were sampled at various time points up to 56 days, and samples analysed for 1080 content. No 1080 was detected in any of the pikopiko samples, whereas 1080 was detected in karamuramu, at a maximum concentration of 5 ppb after 7 days, and 2.5 ppb after 14 days. This concentration decreased to zero at 28 days, indicating that while karamuramu was shown to take up 1080, it was not persistent. The results of this study suggest there is negligible risk of humans being poisoned by consuming plants that have taken up 1080 from baits. To allay Maori community concerns that the presence of 1080, even in low concentrations, might influence the medicinal properties of plants, it is suggested a withholding period of 30 days after 1080 control operations could be adopted.

Brassica distribution outside of cultivation can be used as a model system for understanding gene-flow risk

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Quantifying gene-flow at a landscape scale is a major challenge for agronomists, weed scientists and ecologists, and is critical for understanding the impacts of environmental weeds or assessing risks of releasing genetically-modified plants. Here, we describe a survey to quantify wild (i.e., both crop escapes and feral) populations of *Brassica* species at a landscape scale in New Zealand. Brassicas are an excellent model system for assessing gene flow because they are widely cultivated for both seed production and forage in New Zealand, are known to hybridize in the wild, and form feral populations. We used GIS to randomly generate fifty 3 x 3 km sample plots in the Canterbury Plains region. All roadside *Brassica* populations were recorded during peak flowering in late 2003, and the identity of *Brassica* species and potential hybrids was confirmed using flow cytometry. Additional environmental information was generated for each plot using GIS. Logistic regression revealed that the presence of Brassicas was strongly, positively related to distance to the nearest town, railway, major road or *Brassica* seed storage facility. In contrast to findings from the UK, the presence of *Brassica* populations was negatively related to distance to water (both lakes and to the coast). These results point to the overwhelming importance of disturbance and human-mediated dispersal controlling the distribution of weedy *Brassica* species.

Does disturbance explain site dominance by the invasive, but apparently competitively subordinate species, _Hieracium lepidulum_

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Hieracium lepidulum is one of a number of *Hieracium* species that have become invasive in New Zealand. Despite observations that *H. lepidulum* can dominate sites in the field, performance comparisons with co-occurring species in glasshouse studies, suggests that this species should be competitively subordinate to many of its co-occurring species. Only under severe disturbance regimes, including grazing and burning, should it be possible, therefore, for *H. lepidulum* to attain site dominance. In this paper, we present performance comparisons of *H. lepidulum* and a number of co-occurring species grown alone to generate predictions about likely competitive dominance between species pairs. We then present data from a competition/interference experiment to test whether, indeed, *H. lepidulum* is competitively subordinate to these species. We also present data from a combined competition/disturbance experiment, in which we tested whether simulated grazing (clipping) could lead to dominance by *H. lepidulum*. Results of performance in isolation suggest that the co-occurring species *Agrostis stolonifera*, *Anthoxanthum odoratum* and *Kunzea ericoides* should be competitively dominant over *H. lepidulum* when grown from seedlings; *Poa colensoi* should be equal; while *H. lepidulum* should itself be dominant over *Coprosma rugosa* and *Chionochloa flavescens* var. *brevis*. Results of pair-wise competition experiments confirm our predictions, except that *K. ericoides* performed more poorly than expected and *Chionochloa flavescens* var. *brevis* performed better than expected. In addition, *H. lepidulum* was competitively subordinate, and made up only a minor component of the vegetation biomass in the competition/disturbance experiment, even under the heavy clipping treatment. Possible reasons for the discrepancy between results in glasshouse experiments, and those observed in the field, are discussed

Disturbance regimes and conservation of indigenous biodiversity in dryland South Island

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Disturbance is a relatively discrete event in space and time that alters the structure of populations, communities, and ecosystems, and causes changes in resource availability and/or the physical environment. We classify (severity, intensity, frequency, and scale) the major disturbance mechanisms of tectonic-seismic, extreme weather events, aeolian, fire, bioturbation, and herbivory in pre-settlement dryland South Island. Landslides, flooding and sedimentation, windstorm, and sand inundation were spatially restricted but relatively frequent events. Natural fires were infrequent (ca. 1500–2000 year cycle at any one place) and local, giving rise to a flora with very few fire-adapted traits and species, and relatively stable, largely woody vegetation. Large avian herbivores shaped the structure and composition of forest and scrub communities, while grazing birds maintained herb-rich, turf-communities, particularly near water-bodies and on gentle slopes. Post-settlement disturbances differed markedly in type and frequency. Polynesian burning deforested slopes and valley-floors, and facilitated grassland expansion, while European burning suppressed shrubland development and consolidated grassland dominance. Avian herbivores were displaced by introduced mammals, which have further modified the abundance of many indigenous plants. Most of the threatened indigenous plant species in dryland systems are not disturbance dependant. Issues for the conservation of dryland indigenous ecosystems including facilitating the return of woody vegetation, maintaining arrested successions (e.g. grasslands), and restoring avian dominance are discussed.

Threatened plant population monitoring in New Zealand

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The Department of Conservation has undertaken a national review of threatened plant monitoring in New Zealand to inform and improve plant conservation management. The objectives of that review were to document all threatened plant monitoring projects, to determine what monitoring techniques are being used, where the data is stored and how it is analysed, and to identify gaps or inadequacies in the programme, leading to the development of a set of national plant monitoring guidelines. Threatened plant monitoring is the acquisition and analysis of quantitative data that document the condition of the population or plant community over time. It is undertaken to detect and document population recovery or decline but also provides information for determining the conservation status of species. The Department's plant monitoring database now lists 352 threatened vascular plant monitoring projects for 138 plant taxa. The most common monitoring techniques used are plant measurements (22%), number counts (21%), mapping (12%) and visual assessments (29%). The most commonly used vegetation character used in monitoring plant populations are plant 'health' (22%), size of population (22%), height or age class (15%) and phenology (9%). The five loranthaceous mistletoe species are subject to most monitoring accounting for 51 (15%) of all monitoring projects undertaken. 148 (42%) monitoring projects are for those species for which a species recovery plan has been developed (e.g., *Dactylanthus taylori*, *Pittosporum patulum*, small leaved *Olearia* and coastal *Lepidium* species). 35% of Nationally Critical plants and 13% of plant taxa included on the national list of threatened and uncommon species are subject to monitoring. Future plans include evaluation of existing techniques and collation or development of monitoring protocols into a plant monitoring toolbox. National guidelines and standards will be prepared in conjunction with other agencies involved in plant monitoring.

Spatial ecology of introduced mammalian predators in New Zealand's open landscapes: what can recent advances in technology bring to applied research?

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New Zealand has achieved success in threatened species preservation using predator-free offshore islands, but these are not sufficient to preserve all of New Zealand's unique fauna. The major challenge facing endemic fauna protection and restoration is mitigation of introduced mammalian predator impacts within mosaics of modified mainland habitats. Improved predator removal methods will provide short- and medium-term protection for "mainland islands". However, wider spatial scale and longer-term protection will require better understanding of terrestrial predator spatial ecology. Until recently, technology has been inadequate to investigate fine-scale habitat use by nocturnal cryptic species such as cats and mustelids, with only low spatial precision achievable through LANDSAT and SPOT images, and tunnel tracking and radio-tagging techniques. Recent commercial availability of high precision satellite images (IKONOS) and use of Geographical Positioning System (GPS) devices, allows fine-scale habitat selection to be quantified and analysed using Geographical Information Systems (GIS). Work on ferrets and hedgehogs has demonstrated the feasibility of using these tools. We anticipate an increase in research that applies remote sensing tools, GPS technology and GIS analyses to address mammalian predator control challenges. We've identified eight research topics relating to the spatial ecology of introduced mammalian predators that can be addressed using new technology: 1) Extent to which vegetation structural complexity influences predator movements, and ways in which manipulation of complexity could reduce encounter rates with native species; 2) Quantification of predator territory size, shape and placement and assessment of densities in different habitat types; 3) Improved placement of traps and poison-bait stations; 4) Quantification of behaviour around traps and bait stations; 5) Assessment of risks posed by incursions into conservation land from predator reservoirs; 6) Movements near artificial barriers, e.g., fences to restrict or funnel predators; 7) Reinvasion routes into trapped areas; 8) Testing the accuracy of traditional telemetry and triangulation methods.

Fine-scale habitat use by hedgehogs and ferrets; a study using very-high resolution satellite imagery

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Introduced mammalian predators have played a significant part in the decline and extinction in number of New Zealand's endemic species. Predator control programmes for conservation purposes are heavily reliant on kill-traps, however this can have limited and often variable efficacy in reducing mammalian predator populations. An understanding of the way mammalian predators use the finer features of the landscape is a necessary step in determining optimum placement of traps or poison stations, but could also open up the possibility of habitat manipulation to discourage predator access to a particular area. This study investigated fine-scale habitat use by ferrets (n = 6) and hedgehogs (n = 30) in the Mackenzie Basin, South Island; the breeding place of the critically endangered black stilt or kaki. Animals were tracked using the spool-and-thread technique, and tracks were then mapped using a GPS (Global Positioning System) device. These tracks were then matched with a detailed habitat map produced from an Ikonos satellite image of very-high resolution (4m). Using GIS (Geographic Information Systems) the data was analysed using three different methods to detect patterns in habitat use. These were; 1) a test for overall randomness where linearity and dispersal of each individual track is compared to 1000 random walk tracks; 2) compositional analysis which ranks habitat types in order of preference; 3) landscape indices, developed to provide absolute measures of landscape features within a defined area. Results showed a significant difference between the linearity and dispersal of ferrets, male hedgehogs and female hedgehogs. Compositional analysis revealed ferrets preferred high tree densities, whereas hedgehogs preferred vegetated sites over gravel and open areas. Landscape indices revealed a significant use of ecotonal boundaries by ferrets.

The McKelvey volcanic succession hypothesis 40 years on

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Long-term population data from large plots in conifer/hardwood forests that have developed since the last major eruption (AD200) in the central North Island of New Zealand was examined in relation to the centripetal volcanic succession hypothesis of McKelvey (1963). Three concentric forest zones around the eruption centre (Lake Taupo) were thought to correspond with three phases of succession towards 'climax' forest, with conifers declining progressively in importance in space and time, and hardwoods increasing. Dense conifer forest nearest the lake was regarded as the first forested phase in this primary succession, seral to more distant mixed conifer/hardwood forest, itself seral to even more distant tawa-dominant forest. Net recruitment (recruitment - mortality) rates of major species (totara < matai < rimu < miro < kamahi < hinau < tawa) agree with the predicted species replacement sequence. There is less evidence of the predicted community succession occurring. Vegetation change is not apparent in the first-phase (conifer) forest sampled, which still comprises dense mature stands. On other sites, succession appears to be stalled at second-phase (conifer-kamahi-short hardwood) forest because (1) climate or soil exclude tawa, a key species of third-phase (conifer/tawa) forest with a particularly high competitive ability with conifers; and (2) some tall hardwoods (kamahi, hinau, black maire) in second-phase forest are effective 'nurses' for conifers. Tawa populations are increasing only where they are already well established. A wider variety of successions are operating than originally envisaged by McKelvey, and some appear to be truncated, i.e., reach a 'steady state' at intermediate phases of the predicted succession.

Assessing location error from telemetry triangulation in the Fiordland Mountains, New Zealand: implications for research into stoat (*Mustela erminea*) home range size

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Stoats (*Mustela erminea*) are difficult to observe in the wild therefore radio-telemetry remains one of the few potential methods for estimating their movements. Using telemetry to study the movement of stoats in the rugged alpine grasslands of Fiordland National Park poses many logistical problems; in particular techniques such as moving close or the use of automated towers are not viable. The accuracy of triangulation using hand held yagi receivers and mirror sighting compasses was assessed using a combination of transmitters placed in test locations and from information gained from transmitters slipped by stoats later retrieved ($n = 30$). This research was undertaken in the Borland Burn in south-eastern Fiordland. Location error data was strongly right skewed and gave a median of 157 m with a range from 0 – 642 m. Distance between the transmitter location and receiving sight ($r^2 = 0.1$) and the angle or bearing intersect ($r^2 = 0.07$) were poor predictors of error, suggesting other variables may be more important. However, Cooks D statistic identified three outliers that may have had a large impact on model fit, nevertheless no a priori reasons could be found for the elimination of these outliers. Stoats have been shown to have 2–5 km range spans and an error of 157 m equates to a median of 8–3% error in home range estimation. This indicates that given the scale of stoat movement triangulation can be a useful tool for home-range estimation.

Floral development and water relations in selected alpine plants

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Future climate change scenarios for New Zealand predict a general warming and strengthening of the rain–shadow effect in response to increased El Niño events. Such changes could potentially result in a reduction of snow cover on the Eastern Otago Mountains through warmer temperatures inducing earlier melt or less snowfall. Snow cover exerts a strong influence on alpine plant distribution, phenology and survival. Therefore any changes in snow cover could have ramifications for the plant life in the alpine zone, for example early flowering and increased risk of winter desiccation from early exposure. Alpine plants are considered to be highly sensitive to environmental change and are therefore ideal candidates for monitoring changes in climate. Gaining an understanding of the ways in which alpine plants respond to their environment is critical for predicting the effects of any future of climate change. My MSc research explores some of the relations between selected alpine plants and environmental factors. A major part of this work involves investigating plant water relations of three alpine *Celmisia* species, characteristic of different alpine communities, in order to assess the potential for winter and late-summer desiccation. The importance of photoperiod and/or temperature as natural cues for inducing the development of pre-formed floral buds into flowers will be examined in growth chambers using the same three *Celmisia* species and *Psycrophila obtusa*. Previous research has indicated that 81% of New Zealand alpine plants develop primordial flower buds in the late summer–autumn of the year prior to flowering. This appears to be an adaptation to a short alpine growing season. I intend to describe the monthly changes in floral bud development from late summer 2004 to spring 2004. Preliminary findings will be presented at this conference.

Conservation requirements from an inventory and monitoring system

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The Department of Conservation (DOC) has an obligation to report on the state of biodiversity nationally. This obligation is derived from ratification of international environmental agreements such as the United Nations Convention on Biological Diversity. The Government has been seeking better information about the state of New Zealand's natural heritage and proof of performance of environmental policy and conservation management effort. In particular, the Government requires reports on progress made towards achievement of the Goals of the New Zealand Biodiversity Strategy. A systematic review of current survey and monitoring projects within DOC indicates a focus on disparate immediate and often short-tem management concerns. In addition, data collection methods are variable and data management is often poor. These factors, combined with a lack of integration of monitoring outcomes into planning and management cycles, mean that current survey and monitoring cannot be reliably used for determining biodiversity condition, achievement of management priorities or long-term trends.
The aim of the Natural Heritage Management Systems Inventory and Monitoring Programme is to develop a national biodiversity assessment framework which includes a consistent set of standards for the design, collection and handling of data. Conservation requirements from a monitoring system come from stakeholders and practitioners from all agencies. They are aimed at demonstrating to government, the public and staff at all levels, progress towards desired outcomes for protection and restoration of biodiversity from local to national scales. The challenge for the Department is to transform current approaches into a much more comprehensive and responsive system integrated across all management levels. A key component of this will be line management accountability for the quality, storage, analysis, maintenance, and implementation of monitoring and monitoring data.

Maori arboriculture - a case study on karaka (*Corynocarpus laevigatus*)

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In New Zealand, the cultivation by Maori of edible roots such as kumara, ti, taro and fern root is well documented. In comparison, the extent and importance of arboriculture utilising indigenous tree species has received little attention. This is anomalous given that fruit and seed producing tree crops have long formed an important traditional resource in Polynesian cultures. In New Zealand, however, the absence of tree crops familiar to Maori led to the utilisation of large seeded/fruited indigenous species such as hinau, tawa and karaka. Evidence for the widespread use, cultivation and translocation of karaka (*Corynocarpus laevigatus*) is particularly compelling. Evidence for this comes from historical sources such as the oral traditions of Maori and the observations of early ethnographers and travellers. A database of karaka distribution was also compiled and populations classified as 'cultural' or 'unknown' based on climate variables and spatial association with archaeological sites. Karaka appears to have a distinct cultural and natural biogeography. Prior to the arrival of Polynesians in New Zealand, it was probably restricted to the northern North Island. Its range was then extended by human translocation and cultivation to the lower North Island, South Island, Kermadec Islands and the Chatham Islands. It is concluded that the importance and extent of karaka arboriculture has previously been overlooked. This has implications for our view of certain plant communities as unmodified by humans, and provides an additional impetus to protect vegetation as an integral part of some archaeological sites.

Launching the New Zealand Journal of Ecology ONLINE

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All back issues of the *NZ Journal of Ecology* (1978-present), the *Proceedings of the NZ Ecological Society* (1953-1977), and the first proceedings of the Society, published in *NZ Science Monthly* (1952), are now available on the NZ Ecological Society website, in full-text, at http://www.nzes.org.nz/nzje/index.php. All issues more than three years old are now available for free download, by members and non-members alike. Issues less than three years old are currently restricted to institutional members (e.g., anyone working in a Department of Conservation office). The site offers directed searching (e.g., by author) and full-text keyword searching through all issues. Professionals such as conservation managers, environmental consultants, and scientists, are now able to quickly search through 50 years of research and immediately download the relevant information. We hope this service will inform environmental decision-making, aid ecological research, and help educate the NZ public about ecological science.

All NZJE articles are fully text searchable, and are tiny PDF files that can be quickly downloaded and read on any computer with the free Adobe Reader computer program (http://www.adobe.com). The Proceedings had less accurate type-setting and are therefore available as partially text searchable PDF files that include image scans of the original pages. These are larger PDF files (typically <<1 MB), still quickly downloadable on most computers.

This will be the official launch of this new web service. We will introduce the features of the site, and give a working demonstration of how to find and download articles on just about anything to do with NZ ecology.

This project was funded by the NZ Government through its Terrestrial and Freshwater Biodiversity Information System (TFBIS) Programme, formed as part of the Government's commitment to the NZ Biodiversity Strategy.

Death on the edge: the role of natural enemies in structuring the geographic range limits of NZ *Senecio* species

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Ecologists are faced with the complex task of predicting how distributions of plant species (e.g., crop plants, native plants, invasive weeds) will change in response to the forecasted rapid global climate change. Current methods use correlations between climatic variables (sometimes with other abiotic environmental variables) and the limits of species' present-day ranges to extrapolate how these limits will change when the local climate is altered. This assumes, at a first approximation, that plant ranges are typically directly limited by abiotic climate constraints on plant physiology.
Ecologists are faced with the complex task of predicting how distributions of plant species (e.g., crop plants, native plants, invasive weeds) will change in response to the forecasted rapid global climate change. Current methods use correlations between climatic variables (sometimes with other abiotic environmental variables) and the limits of species' present-day ranges to extrapolate how these limits will change when the local climate is altered. This assumes, at a first approximation, that plant ranges are typically directly limited by abiotic climate constraints on plant physiology.
At some spatial scales, plant ranges may instead be typically limited directly by biotic processes, such as competition, herbivory and pathogen infections. Numerous ecological and biological control studies have shown that herbivores and pathogens can cause large reductions in plant abundance. We are investigating whether such natural enemies can cause similarly large effects on plant ranges.
We report on preliminary results of an ongoing transplantation experiment assessing the importance of protection from insect herbivores, fungal pathogens, and competition for allowing five herbaceous *Senecio* species to grow >100 m outside of their current ranges. Five sites have been established since June 2003 in both Christchurch and Auckland, using *Senecio wairauensis* (endemic), *S. rufiglandulosus* (endemic), *S. hispidulus* (native), *S. bipinnasectus* (naturalised) and *S. jacobaea* (naturalised).
We also test whether current naturalised *Senecio* distributions in NZ are broader than the ranges predicted by the climate conditions in the species' native ranges, using the software, Climate. This hypothesis assumes some degree of natural enemy release for naturalised *Senecio* species in NZ, relative to their native ranges. However, published host records and preliminary quantitative field data are suggesting that, in general, naturalised *Senecio* species in NZ are not experiencing substantially lower amounts or diversity of enemy damage than native *Senecio* species.

Estimating site occupancy of the Mahoenui giant weta

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The Nationally endangered Mahoenui Giant weta (Orthoptera *Deinacrida mahoenui*) is an invertebrate endemic to the King Country, New Zealand. Prone to predation by a variety of small mammals, the last remaining stronghold for this species is the Mahoenui Giant Weta Scientific Reserve, a 240 hectare, gorse (*Ulex europaeus*) covered block of reverting farmland in Mahoenui. Monitoring the weta population is a crucial part of its management, which has so far relied on transect counts that assume detectability is constant between surveys. Such an assumption is probably incorrect. Site Occupancy modelling, based on Capture-Recapture models, calculates the percentage of sites occupied by a species and includes an estimate of detectability. This method uses presence or absence of the weta, consequently searching need not take as long, and is therefore less invasive than transect monitoring. Another advantage is that the plot sites are permanent; therefore site characteristics throughout the reserve, and changes over time, can be investigated. A pilot study of the Site Occupancy technique took place in autumn 2004. Seventy-two plot sites were randomly distributed throughout three areas of the reserve. They were then monitored by three people over five consecutive days. Because the weta are difficult to detect, it is possible when monitoring that they may be present but go undetected. To increase the detection probability, each plot site was monitored three to five times over the five days. Using a custom-designed software programme (PRESENCE), it was estimated that 62% of sites were occupied by Mahoenui Giant weta. Female weta occupied 44% of sites, while males occupied 40%. Weta between instars five and nine occupied 65% of sites. This figure will be compared with a second monitoring period in spring to determine if occupancy is dependant on season.

Genetic variation in saddlebacks following population bottlenecks

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Saddleback populations in NZ are not managed to maximize genetic diversity because inbreeding and reduced genetic diversity are generally considered to be characteristic of these species. However, if reduced genetic variation is the result of population bottlenecks, then greater effort could be afforded to maintain what genetic variation still exists in present-day populations. We examined the extent to which genetic variation in historical pre-bottlenecked populations (as estimated using museum skins) has changed following multiple population bottlenecks (as estimated in extant populations). Genetic variation was higher for mainland museum skins but no different between modern birds and museum skins from the last known populations of saddlebacks found on Big South Cape, Pukeweka and Solomon Islands. Low genetic variation may be characteristic of the saddleback populations used to re-establish the species, which will limit any efforts to maximize genetic variation in modern birds.

New Zealand Land Cover Database. Applications of satellite imagery and remote sensing to create a GIS based thematic map of mainland New Zealand, nearshore islands and the Chatham Islands

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NZ Land Cover Database 2 will be released 20 July 2004. This database is an update of the 1997 Land Cover Database 1. The original 16 classes in LCDB1 have been hierarchically developed to 43 target classes. The target classes are aggregatable, derived from 8 first order classes at the highest level, with an increasing number of more detailed classes at lower levels. The first order classes are based on the physiognomy of the land cover (i.e., grassland, shrubland, forest etc). Second order divisions are based on other characteristics, such as phenology (evergreen / deciduous) and floristic composition (broadleaved / needleleaved). The database maps target classes to a Minimum Mapping Unit (MMU) of 1 ha and will be released with a corrected LCDB1 to enable change analysis of target classes for the 5-year period between the two sets of data. Ministry for the Environment was the lead agency responsible for managing the project with Steering Committee oversight from the Department of Conservation and Ministry of Agriculture and Forestry. The database is designed to meet the needs of these Government agencies for national State of Environment Reporting. The database has also been translated into the UNEP / FAO Global Land Cover Classification Scheme. This paper will explore the potential of this database to inform reporting to national and international agreements and policies

Development of a cultural health index for streams

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The purpose of this study was to develop a tool to facilitate the input and participation of iwi into land and water management processes and decision making. The result is the Cultural Health Index (CHI) for streams, developed from a successful collaboration between iwi and ecologists and based on cultural knowledge about stream health. First, kaumatua and runanga members from the Ngai Tahu rohe identified a set of factors they consider fundamental to stream health. These indicators were evaluated by Otakou and Moeraki Runanga members (as representatives of the kaitiaki runanga) at 30 sites on the Taieri River. The sites spanned a range of stream orders, land uses and significance as traditional nohoanga. From the data collected, the CHI was developed. The index is made up of three components: (1) cultural significance and ability to sustain cultural usages - whether or not the site is a traditional nohoanga and whether runanga members would return to the site in future; (2) a mahinga kai component that reflects mahinga kai species traditionally present, whether these species are still present, site access (both physical and legal) and whether runanga members would return to the site; and (3) a cultural stream health component made up of five indicators, including catchment land use, use of the riparian, channel modification, flow and water quality. The CHI for streams has the potential to become an important diagnostic tool for iwi, hapu and whanau whereby stream health issues are identified and insights gained from the detail in the tool. Setting priorities and objectives for particular streams and monitoring improvements using the CHI are valuable ways the tool could be used by iwi working together with regional councils in the future. Currently the CHI is being evaluated in the Canterbury and Hawkes Bay regions on different river types and with different iwi. At this stage, the support and participation of the relevant iwi / runanga and the two regional councils is proving invaluable. Depending on the final results the tool may be implemented more widely and a process to facilitate that is being designed.

Managing possum impacts on tree fuchsia in the Tararua Range

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The Department of Conservation established fuchsia (*Fuchsia excorticata*) monitoring in the Tararua range in 1994, to determine the effectiveness of possum control at protecting fuchsia. We present results from 10 years of monitoring tree fuchsia stands following large-scale aerial 1080 possum control in different areas of the range. Stem survival, growth, and canopy condition data was collected in upland silver beech (*Nothofagus menziesii*) forests (>600 m) from 39 permanent plots. Plots were established in four different areas where possums were controlled, and in one non-treatment area. Significant differences in fuchsia survival, growth and canopy condition were detected between the treated and non-treated areas. Our results suggest that Wellington Conservancy was successful in achieving its conservation goal of preventing 25% mortality of fuchsia between 1994 and 2004 in possum managed areas. We consider fuchsia a useful indicator of possum impacts in upland areas of the Tararua Range. From our sampling, we also identified that ungulates are inhibiting silver beech establishment in the fuchsia plots. In addition, the effectiveness of Wellington Conservancy's 1080 programme at protecting biodiversity values in the lowland forests of the Tararua range is unknown. The Conservancy is now examining these issues.

Avian community structure within an urban matrix: factors influencing richness and diversity

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Habitat loss and fragmentation, the primary cause of loss of biodiversity, is due largely to urban and agricultural development. By the year 2025 the United Nations forecasts that 60% of the world's population will be living in urban areas, compared with 29% in 1950. Urbanization results in alterations to the environment including fragmentation of natural habitat, changes in climate, soils, water, and in vegetation structure and composition, resulting in unique ecosystems. Urban bird communities in other countries are usually characterized by a paucity of species richness and diversity, with communities dominated by a few abundant species. However, bird life in urban areas can provide a rich recreational and biological resource, and may be many peoples' only experience of nature. Little is known about how New Zealand's native species respond to urbanization, and how the connectivity of parks, reserves, green spaces and well-vegetated suburbs influence animal movements, yet this information is an important part of any biodiversity strategy. Facilitating animal movements may reduce susceptibility of species in small populations to decline and local extinction. Dunedin is marketed as the wildlife capital of NZ, but there has been no systematic examination of species composition, biodiversity, and habitat use and requirements within Dunedin's urban landscape. This study aims to: (1) document avian species composition, richness, diversity and breeding activity in a representative sample of urban and peri-urban habitats in the Dunedin area; (2) using a GIS-based map, relate patterns of avian abundance and diversity to habitat quality (vegetation composition, structure), connectedness between green areas, human disturbance and degree of urbanization; and (3) evaluate the relative importance of peri-urban areas in shaping the structure of urban bird communities. Here we introduce our study and present some preliminary findings.

Significance assessment to meet New Zealand Biodiversity Strategy Goal Three

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Biodiversity protection is often contentious, and therefore explicit, objective methods are necessary to ensure places that are significant for biodiversity are consistently and defensibly identified. Achieving New Zealand Biodiversity Strategy Goal Three (Halt the decline of indigenous biodiversity) will require identification and protection of those places needed to maintain the full range of biodiversity. We describe an approach to the assessment of biodiversity significance designed to give effect to this goal. Early systems of significance assessment (e.g., developed to give effect to the Reserves Act 1977) ascribed priority for protection to the very best examples of ecosystem types. However, a primary focus on the most pristine areas cannot fulfill the goal of protecting the full range of indigenous biodiversity. In fact, the consequence of this approach is that the NZBS goal becomes a retreating option, because modified areas contain the majority of New Zealand's species and ecosystems that are at greatest risk of imminent loss. Recognising this problem, the NZBS redefines priorities for addition to public conservation lands as those habitats and ecosystems that are: (a) not represented within the existing protected area network, and (b) at significant risk of irreversible loss or decline. In other words, modern significance assessment criteria are needed that identify components of the full range of biodiversity that are under-represented, vulnerable or rare (i.e., requiring protection), regardless of quality. We propose quantitative methods, based on explicit biodiversity protection targets, to consistently assess areas of significance for biodiversity using currently available national GIS databases. The advantages of the approach are: better alignment with NZBS Goal Three, greater defensibility of significance assessment, and more efficient, targeted field survey (and so reduced costs). We demonstrate application of our approach to direct conservation effort, and to assess changes in the effectiveness of biodiversity protection.

Design issues for large-scale monitoring systems: the Australian experience

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A growing need for information about the status and trend of Australia's biodiversity has inevitably created a demand for broad-scale monitoring systems. However, the decision to embark on a monitoring system should only be made once it has been established that a monitoring system is the optimal way to inform management. Too frequently, monitoring systems become an end in themselves. Large-scale monitoring systems require considerable resources recurrently expended into the distant future, but with a limited ability to adapt to new demands. Communication and education about the system is vital, and all parties should understand that there will be a long lag between costs and benefits. It is during this period that the monitoring system is vulnerable to failure at the institutional level. A number of issues need to be addressed if the monitoring system is itself to be sustainable. These involve a mix of biophysical, social and institutional attributes - an unusual mix of requirements not often found in normal scientific activities. Investing in a planning process to determine whether a monitoring system is actually required, and if so, setting clear objectives for the system, is the single most important action. The debate about biodiversity monitoring systems in Australia has similarities to the debate within the rangeland management profession in the early 1970s. Subsequently, a large investment was made in research and development of rangeland monitoring techniques and their implementation from the mid-1970s on. In many cases these techniques were never adopted operationally, and monitoring systems themselves were discontinued before reporting on a single reassessment cycle. Few long-term ecological monitoring systems survive to the second generation of personnel. A monitoring system that depends on the charisma and enthusiasm of individuals will not meet the long-term needs of the stakeholders.

Lessons learnt from long-term monitoring at Ogawa Forest Reserve, Japan

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In April 1987, a 6 ha permanent plot was established in the center of the 98 ha Ogawa Forest Reserve. The purpose of the plot was to understand the mechanisms that maintain tree diversity in the forest (co-existence mechanisms of the tree community) and to elucidate the dynamics of this species-rich, temperate, deciduous forest community. All aspects of tree demography are studied using seed traps and small quadrats regularly established within the 6 ha plot. In addition interactions between the trees and other organisms have been studied, e.g., the role of ectomycorrhizal fungi in determining tree distribution and regeneration; the behavioural ecology of the two common forest mice species; the seasonal and annual dynamics of the bird community; and the role of mice and birds as seed dispersers and predators. One of the key outcomes sought from this research is to understand how to maintain high biodiversity at a site. After 15 years of intensive monitoring at Ogawa Forest Reserve it is possible to indicate that large scale but rare disturbances, such as fire, may be more important for effective regeneration of some species (*Quercus* and *Carpinus*), whereas smaller scale disturbances suffice for others (*Fagus* and *Acer*). The use of large-scale disturbances as a forest management tool is controversial, whereas the smaller-scale disturbances are easier to implement. More research is required on interactions between plants and other organisms and this detailed study has shown clearly that landscape-level processes should be studied with long-term perspectives.

Minimum area for a self-sustaining kiwi population

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What area of predator control is needed for kiwi population to be self sustaining? This can be analysed in terms of three main sets of parameters – kiwi survival, recruitment and dispersal. A simple two-stage matrix population model, for a treated area as source with a surrounding sink, together with a classical probability model for dispersion, allows the effect of different assumed demographic parameters to be assessed. The resulting model can be implemented and explored readily in a spreadsheet, and gives results consistent with those in a more complex model for a narrower set of parameters (Basse & McLennan, 2003, Protected areas for kiwi in mainland forests of New Zealand: how large should they be?, *NZ J Ecology, 27(2)*: 95-105).

Southland peat dome restoration and monitoring

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Raised peat domes are a distinctive feature of lowland Southland. While numerous remain in Southland, most have been considerably reduced in area and are now confined to small isolated remnants. The Dunearn peat dome is a representative example of this habitat type. The peat dome is slightly raised through peat accumulation and is dominated by a dense cover of *Empodisma minus*. Artificial drains, land development and fire have extensively modified the remnant. These modifications are reflected in a lowered water table, peat degradation, extensive *E. minus* dieback, and marginal pest plants. Despite modifications and subsequent effects, the core of the peat dome retains its natural vegetation and vital processes are still operational. In recognition of the ecological significance of this ecosystem and restoration potential, the Department of Conservation (DoC) purchased the dome in February 2003. As a result, Environment Southland in collaboration with DoC developed long term monitoring and restoration strategies. The main internal drains were plugged with sods of peat in June 2003. Indicators of ecosystem change, vegetation and groundwater, were monitored prior to and following plugging of the drains. Preliminary results indicate an increase in groundwater and peat level following plugging. Plant shoot and peat properties are similar to those reported for other New Zealand peat domes. Restoration methods and initial monitoring results will be discussed.

Working with indigenous communities – ethical responsibility of the scientist

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Human societies have developed in close interaction with natural ecosystems which in turn have shaped their cultural identity, value systems and economic well-being. Importance of the study and use of human dimensions of ecosystems have already been recognised in conservation and sustainable management of the natural ecosystems. Scientists have the task of better understanding the interaction between man and nature and the development of tools that can support conservation efforts. Within this context, study of the relationship of the indigenous communities with natural ecosystems and the associated knowledge systems has gained a worldwide recognition in the recent past. However, scientific research in these areas should be conducted within the existing cultural contexts of the indigenous communities. This requires a respect for the belief systems and practices of indigenous communities and the building of good relationships. For this purpose, ethics are being developed and the intention of this presentation is to highlight some of these from across the world.

Subantarctic waterfowl: an ecological overview

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Subantarctic islands are not just for seabirds; waterfowl have a presence on many islands of the southern ocean. To retain that presence, these waterfowl have evolved significant behavioural, physiological and ecological adaptations that now contrast with those of their parental forms. This paper will attempt to highlight those adaptations, drawing heavily but not exclusively on the examples provided by the flightless teals of Auckland and Campbell Islands.

Gorse and kanuka successions are different

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Successional communities once dominated by native manuka (*Leptospermum scoparium*) or kanuka (*Kunzea ericoides*) have been extensively replaced by the exotic gorse (*Ulex europeaus*). As gorse is considered desirable for facilitating succession to native forest, we determined whether plant biodiversity values of gorse successions were similar to those of kanuka successions at comparable successional stages. We tested three propositions; (1) kanuka stands have a different species composition and greater species richness than gorse stands, (2) kanuka and gorse scrub do not exhibit convergent successional trajectories, i.e., differences between kanuka and gorse stands are maintained over time, (3) several groups of plants are absent, or less common, in gorse than in kanuka stands. Forty-eight scrub or low forest sites in Wellington and Nelson were classified by height and composition, as viewed from within the stands, into one of four pre-defined successional stages. (1) *young gorse* with broadleaved species emergent, (2) predominantly broadleaved woody species where scattered live or dead *old gorse* stems indicated stand development through gorse, (3) where *young kanuka* dominated the canopy, with broadleaved saplings in the understorey, (4) where *old kanuka* occupied the canopy, over a sub-canopy of broadleaved species. We found the floras of kanuka scrub and gorse scrub, and their immediate successors are different, and species richness is often lower in gorse. Differences between young gorse and kanuka, and old gorse and kanuka, suggest the successional trajectories will not converge in the immediate future; gorse leads to different forest from that developed through kanuka. There are fewer small-leaved shrubs and orchids in gorse. Gorse successions do not therefore directly substitute for native successions. Efforts may be needed to assist the preservation of native secondary vegetation on landscapes where it is pre-empted by gorse or other naturalized shrubs, or indeed other land uses.

Considerations for inventory and monitoring of plant biodiversity in rare ecosystems

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Habitats that are rare in the landscape have long excited biologists and ecologists because they often harbour unusual species and ecosystems. Such habitats have high conservation value in relation to the small proportion of the landscape they occupy. The structure and composition of adjacent vegetation may have a major influence on composition of these small, island-like ecosystems, especially as a determinant of weed invasion. We focus on considerations for the inventory and monitoring of plant biodiversity in one of the least studied rare ecosystems in NZ – rock outcrops. Rock outcrops are fiendishly difficult to sample and monitor, and we have identified a number of problems and practical solutions to them. Identifying where to sample to capture the high level of variation across a region is an essential first step. Mapped data layers inadequately depict ecosystems that are near-to-vertical, so this is best achieved through reconnaissance, word of mouth and literature. Samples should be stratified across major environmental gradients (i.e. temperature and moisture), bedrock geology, and the nature of adjacent vegetation. Outcrops are also highly internally variable. We found a simple stratification dividing an outcrop into faces that differ in broad classes of slope steepness, aspect, and shading to provide an effective sampling framework. Even so, much of the area within stratification units is comprised of bare rock without plants. Random sampling using fixed area plots is thus inefficient as most plots sample bare rock. Rather, such plots should be randomly placed across the subset of the outcrop unit that is vegetated. An alternative is to use plotless methods, such as Braun-Blanquet releves. We also discuss how to quantify outcrop environments and how best to achieve comparability with inventory and monitoring systems used in other ecosystems.

Reconstructing Holocene ecosystems at Mason Bay, Stewart Island

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Dune sands and peats of Holocene age (< 10 ka) are widespread at Mason Bay on the west coast of Stewart Island, and contain subfossil remains of both plants and animals. The active Holocene dunes at Mason Bay form one of the most extensive dune systems in New Zealand. Disarticulated bird bones are moderately abundant in the dune lag deposits. The majority of the 2632 bones collected in this study are from South Georgian diving petrels (*Pelecanoides georgicus*), which formerly bred at Mason Bay but became extinct before European arrival. The colony was spread over the entire dune system, but bones are concentrated around the Great Sand Pass. Conservative estimates of colony size range from 220 to 3400 breeding pairs. It is likely that kiore (*Rattus exulans*) contributed to the extinction of the colony; however only one bone was found to show evidence of predation. Twenty-four other native bird species were represented in the dune assemblage, including New Zealand falcon (*Falco novaeseelandiae*), a species that is now very rare on Stewart Island, as well as the second subfossil record of the extinct piopio (*Turnagra capensis*) from Stewart Island. Bones of forest bird species were found a mean distance of 75m from the edge of forest, significantly closer than bones of non-forest species (X = 290m), and may be a useful palaeoecological indicator of past dune proximity to forest habitat. Three distinct peat horizons occur at Mason Bay, a coarse, sandy peat (latest Pleistocene-earliest Holocene), remnants of a drowned coastal forest (c. 7000 B.P.), and a modern flax-dominated peat. A diverse assemblage of subfossil invertebrates was found in the c. 7000 B.P. peat, including beetles from the families Carabidae, Curculionidae, Hydrophilidae, Chrysomelidae, Scirtidae, and Scarabidae. Well preserved rimu (*Dacrydium cupressinum*) shoots and miro (*Prumnopitys ferruginea*) fruits from this peat indicate forest conditions similar to present.

POSTER ABSTRACTS – (alphabetical by surname, *denotes student)

The invertebrate fauna of epiphytes in the canopy of northern rata Metrosideros robusta

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The canopies of northern rata host a micro-universe abounding with diverse and unusual epiphytic and invertebrate life that is distinct from that found on the forest floor. A study, currently carried out in the Paparoa National Park and Kahurangi National Park on the South Island West Coast, investigates mat-forming epiphyte communities and their associated invertebrate fauna. One aim of this study is to document the composition of both the epiphyte and invertebrate communities. A total of 12 samples were collected from an average canopy height of 20 m from five rata trees per site using the single rope technique. In this study, 21 orders of invertebrates, including insects from 10 orders, were found to be associated with the epiphytes. Differences in invertebrate community composition will be discussed in relation to variation in epiphyte host community composition and site characteristics. Measures of species diversity and similarity were used to compare the invertebrate communities of the canopy with those on the ground and variations between the two are discussed.

Species association of the South Taranaki Coastal Turf Communities

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Anthropogenic disturbance of Taranaki's coastal vegetation strongly influences the structure of the region's coastal turf communities. Since deforestation and the introduction of intensive grazing to the region expanding pasture boundaries are encroaching into areas of coastal turf putting rare and threatened native species at risk of being over grown. To determine the impact of pasture species on the turf species it is imperative to understand the structure of the current communities. The flat terraces of the South Taranaki coastline support a number of fragmented short-stature native plant communities dominated by turf-forming grasses and herbaceous species. The low turfs form on areas that are exposed to strong salt-laden winds such as headlands and coastal indentations. These plant communities are dominated by two species, the grass *Zoysia minima* and coastal herb *Selliera radicans* and support a small number of short-stature native plant species, nine of which are classified as rare and threatened. The study sites are classified into three main groups which can be directly represented by the ratio of *Z. minima* to *S. radicans* cover. These are grouped as follows: Group 1, high ratio *Z. minima* dominant; Group 2, low ratio *Z. minima* dominant and Group 3, *S. radicans* dominant. These three groups varied in the type and number of other native species present in them. All but one of the six abundant native turf species were present in all three groups whilst many of the native species that were not present in amounts that met statistical assumptions, including most of the rare and threatened species, were found to have group specificity. Abiotic variables and invasion of adventive pasture species were compared for each grouping.

Nutritional isolation of bog species inferred from stable isotope 15N studies

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The nitrogen isotopic signature of plants in low nutrient environments has been linked with nutrient availability and changes in plant N demand. Overseas studies have shown plant _^{15}N becomes more depleted with increasing P limitation and we tested this across a nutrient gradient at Kopuatai raised bog in the Hauraki Plains. We found foliar _^{15}N, %N and %P content in the dominant woody (*Leptospermum scoparium*, Myrtaceae) and herbaceous species (*Empodisma minus*, Restionaceae) revealed marked differences in plant _^{15}N responses to P. *Leptospermum* showed considerable isotopic variation (–2.03 to –15.55%) across the bog, with foliar _^{15}N strongly positively correlated with P concentrations in foliage and peat, and negatively correlated with foliar N:P ratios. The isotopic gradient was not related to ectomycorrhizal (ECM) fractionation as ECMs occurred only on higher nutrient marginal peat where 15N depletion was least. In strong contrast, *Empodisma* showed little isotopic variation across the same nutrient gradient with _^{15}N levels consistently around 0% (mean –0.12%). The isotopic differences between the woody and herbaceous species were linked to contrasting nutrient demands and acquisition mechanisms. *Leptospermum* shrubs on low nutrient peat were stunted, with low tissue P concentrations, and high N:P ratios, suggesting they were P-limited, which was probably exacerbated by markedly reduced mycorrhizal associations. *Empodisma*, having significantly lower concentrations of tissue N and P than co-occurring *Leptospermum*, and efficient nutrient acquiring cluster roots, is better adapted to the low nutrient conditions.

Species diversity and functional properties in North Island hill pastures

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Grazed hill country pastures in the North Island typically show the classic hump-shaped relationship between species diversity and net primary production. There are also strong relationships between diversity and site factors such as slope, aspect and fertility. Some overseas studies in grassland ecosystems have suggested positive relationships between diversity and productivity as well as between diversity and invasibility. We conducted a field experiment at two locations to examine these relationships in the context of hill country pastures without post-establishment manipulations of the swards. Eleven pasture species representing eight functional groups were oversown into plots covering a range of slope, aspect and soil fertility conditions. After ensuring the establishment of these sown species, invasion of the plots from the local species pool was allowed and observed. The strongest influences on overall net herbage accumulation were these site factors, followed by species identity effects, and lastly weak species diversity effects. However species diversity did have a more marked influence on the net herbage accumulation of sown species (ignoring unsown species invaders). In addition, there was a negative relationship between sown species diversity and the ingress of unsown species, an indicator if increased resistance to invasion conferred by species diversity.

Ecology of the orange-fronted kakariki

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The orange-fronted kakariki (*Cyanoramphus malherbi*) is currently classified as Nationally Critical which means it has a high risk of extinction. With only about 100-200 birds left in the wild, it is the rarest parakeet in New Zealand. Recent research reveals it is a distinct species and not a colour morph of the more common yellow-crowned kakariki (*C. auriceps*) (Boon and Kearvell 2000). The distribution of orange-fronted kakariki has been reduced dramatically since the 1800s through predation and habitat loss. Once South Island wide, they are now restricted to three valleys in Canterbury, all within a 30 km radius in upland beech forests. They feed on a range of invertebrates and plant material including buds, shoots, flowers, leaves, sprouts, ferns and grasses. Beech seeds (*Nothofagus* spp.) form a large part of their diet, especially during a mast event when breeding activity is also extended. Orange-fronted kakariki roost and nest in tree cavities which makes them vulnerable to predation by rats and stoats, both very successful arboreal predators whose numbers often reach plague proportions during a masting event. To ensure the survival of orange-fronted kakariki, the Department of Conservation closely monitors all known populations and undertakes intensive predator control and monitoring in two of the three locations where the kakariki remain. Currently the top management priority is to establish a population of orange-fronted kakariki on predator-free Chalky Island in Fiordland. Eggs or chicks are removed from the wild and transferred into captivity where they are raised by foster parakeet parents or hand reared if necessary. Six nests have so far been monitored. Three of these were in red beech (*Nothofagus fusca*), one in mountain beech (*Nothofagus solandri* var. *cliffortioides*) and two in dead beech trees. Clutch sizes vary from five to ten eggs, which take 21–26 days to hatch and the chicks fledge when they are about 40 days old.

Assessing eco-sourcing: an analysis of the geographic variation of *Metrosideros umbellata* Cav. and the implications for restoration using nearest-provenance-based sourced plant material

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The importance of plant provenance for restoration efforts is now at the forefront of conservation policy. The use of eco-sourced or nearest-provenance-based sourced plant material is supported by various conservation authorities in response to the risk of genetic pollution. However, a problem for advocates of eco-sourcing is the lack of published scientific evidence supporting its application. The degree to which eco-sourcing has an important role in conservation is reflected in the genetic variation evident in the geographic range of a species. I investigate the geographic variation in morphology, isozymes and DNA apparent in populations of southern rata (*Metrosideros umbellata*). Populations of southern rata have been sampled randomly to identify five trees within each; to provide some understanding of the geographic variation within and across the selected populations. From each tree three stems were collected using a standardised system: an attempt to broadly but objectively represent the leaf morphological variation within single trees. Sites throughout the South Island and Stewart Island have been sampled, but because of the often localised and inaccessible occurrence of southern rata, and the economics of student science; herbarium specimens have been used to bolster the fresh collections and represent North Island populations. The variation evident in this species is being analysed using leaf morphological analysis: length/width ratios, tip shapes, stomatal and oil gland densities. Isozyme variation is being analysed through a number of enzymes, and molecular variation is being assessed using inter-simple sequence repeats (ISSR). In addition, the above analyses are being performed on restored specimens, provenance unknown, and on commercial cultivars and garden specimens to ascertain some understanding of what genetic threat they may represent. Consideration is finally given to the potential role that non eco-sourced plant material has in facilitating genetic transfer, an attribute possibly restricted by the historical removal of large tracts of forest.

Do heteroblastic plants give up plasticity within a life stage? Plasticity of homoblastic and heteroblastic seedlings to changes in light environment

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Heteroblastic plants have fixed ontogenetic changes in leaf morphology between juvenile and adult stages relative to homoblastic plants. Within a life stage, heteroblastic plants may be less plastic in their foliar responses (morphology, anatomy, physiology) and growth to changes in light environment relative to their homoblastic congeners. We studied how congeneric homoblastic and heteroblastic species would vary in foliar plasticity and growth at seedling stage. We compared variation in foliar responses and growth of homoblastic (*Hoheria lyallii*, *Aristotelia serrata*, *Pseudopanax arboreus*, and *Melicope ternata*) and heteroblastic (*H. sexstylosa*, *A. fruticosa*, *P. crassifolius*, and *M. simplex*) species in sun and shade light environments both in a glasshouse and in the field. We found that heteroblastic species exhibited greater variation in net photosynthesis, stomatal conductance, palisade mesophyll layer thickness, and stomatal density but not in leaf size, specific leaf area, daytime dark respiration, and light compensation point. However, both homoblastic and heteroblastic had similar variation in growth attributes (height, root collar diameter, and total biomass) to changes in the light environment. These results suggest that increased variation between life stages in heteroblastic species does not result in reduced variation within a life stage.

Physiological acclimation to changing light environments: scaling the shade-tolerance of Syzygium tree seedlings

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This study aimed to identify: (i) leaf physiological differences (photosynthesis, stomatal conductance and nutrients) among closely related *Syzygium* species; and (ii) to correlate those differences with *Syzygium* spp. shade-tolerance. Seedlings of four *Syzygium* species (*S. firmum*, *S. makul*, *S. operculatum*, *S. rubicundum*) in the family Myrtaceae, were selected for the study, that, when taken together represented a wide range of shade-tolerance. Seedlings were grown for two years under six different shade treatments (95%, 82%, 50%, 0% of shade, long periods of full sun=6h d^{-1}, short periods of full sun=2h d^{-1}) at the research station of the Sinharja World Heritage Site, Sri Lanka. All species increased their rate of photosynthesis with decreasing shade. However, stomatal conductance and leaf nutrient content (N, P, K, Ca, and Mg) were greatest in the 95% shade treatment. Comparison across species revealed that the shade-intolerant *Syzygium rubicundum* and *S. operculatum* were highest in their photosynthesis rates in full sun treatment while *S. makul*, an intermediate species in shade-tolerance was highest in the 50% shade treatment. The very shade-tolerant species, *S. firmum*, had the highest photosynthesis rates in 85% shade treatment. *Syzygium operculatum* exhibited the greatest stomatal conductance and leaf nutrient content followed in decreasing order by *S. rubicundum*, *S. makul*, and *S. firmum*. Findings support the notion that measures of photosynthesis and stomatal conductance rates are good indicators of differences in shade-tolerance among *Syzygium* species.

Monitoring a native New Zealand insect using its sex pheromone – an attractant for the kowhai moth *Uresiphita polygonalis maorialis*

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Relatively few sex pheromones for native moths have been identified, primarily because only a few indigenous moth species are considered to be pests in our agricultural ecosystems. The pheromones of several moth pests are routinely used to monitor male flight phenology for targeted insecticide application and to disrupt mating for reduced crop damage in horticultural crops such as apples and berryfuit. Pheromones are also contributing to biosecurity, through delimitation surveys for several invasive species (e.g. gum leaf skeletoniser). In addition pheromones are ideal tools for determining the presence and abundance of moth populations, and consequently may have a role in conservation of iconic species or as indicators of ecosystem health. The kowhai moth *Uresiphita polygonalis maorialis* is a native crambid that is well known for outbreaks on *Sophora* spp. and *Lupinus arboreus*. As part of a capability building strategy in chemical ecology, we have used coupled gas chromatography-electroantennogram detection (GC-EAD) to identify five antennally-active compounds in female pheromone gland extracts of the kowhai moth. Trapping trials in the DOC-administered Lyttelton Reserve, from December 2002 to June 2003 and from November 2003 to March 2004, indicated that a three-component blend was the most effective for trapping male kowhai moths. During the 2003–2004 trial, males were first caught in baited delta traps at the end of November 2003 and catches continued until the end of February 2004, with peak numbers trapped over the Xmas period. Trapping data so far suggest a univoltine population in Canterbury. Work is continuing to further refine the lure.

Evaluation of Plumage and Morphological Characteristics as a Means of Determining Age and Gender of Brown Teal/Pateke (*Anas chlorotis*) at Summer Flock Sites

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The brown teal or pateke (*Anas chlorotis*) is a Nationally Endangered New Zealand duck, which only occurs in significant numbers on Great Barrier Island, The Coromandel Peninsula, and Mimiwhangata, Northland. Intensive predator control is carried out within these areas and the demographic responses of pateke are monitored by radio telemetry. However, radio telemetry will not be sustainable in the long term due to cost. An alternative to monitor demographic changes may be to use plumage and morphological characteristics enabling the relative numbers of adult and juvenile pateke to be established. A study was therefore carried out to investigate if any of these characteristics could be used to determine age and gender of pateke at flock sites during early and late summer. Previously documented and suggested characteristics, in addition to characteristics observed during preliminary observations of captive and wild birds were used. Traits exhibited by banded birds (of known age and gender) observed at two flock sites within Mimiwhangata Coastal Park over the summer of 2003-04 were recorded using a scoring system. Chi-square tests were used to determine which of the characteristics were useful in determining age and gender during the two periods. Basian Analysis was then carried out to determine which of the age/gender cohorts (adult and juvenile males and females) were most highly associated with each of the scores of the useful characteristics. Breast plumage, dark iridescent head, neck ring, eye ring, primaries length, dark 'chocolate' colour, white flank patch, vermiculations, and body size were useful in determining age and gender during the January/February period, while only breast plumage was useful during the November/December period. Results of the study therefore indicated that the most effective sampling period was in late summer. Further investigation is needed to determine if the technique used could eventually provide effective replacement of radio telemetry.

Marram grass and the loss of New Zealand's coastal dunes

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The dune systems of the exposed coasts of New Zealand are the product of sand movement. Various environments are associated with active dune systems, including complex and often chaotic inland dunes, wetlands, forested dunes, vegetated foredunes and stonefields. A unique set of native plants and animals, adapted to burial, drought and wind, are associated with these habitats. Marram grass (*Ammophila arenaria*) was widely planted during the 20th century, in part because moving dunes posed a threat to agriculture, road and rail links, at a few locations, and marram grass is better at trapping sand than native dune plant species. More fundamentally, coastal dunes were considered to be unproductive wastelands through most of the 20th century. As a result, marram grass is now the primary foredune species in most regions of New Zealand. Once established, marram grass foredunes are more resistant to disturbance by erosion. Active (moving) dunes are unlikely to form and landscape (and habitat) diversity declines. Sand accretion caused by marram grass invasion results in the burial of most native dune plants. Dunes stabilised by marram grass are commonly invaded by other exotic species, such as gorse (*Ulex europeus*), hieracium (*Hieracium pilosella*) and lupin (*Lupinus arboreus*).A massive foredune developed between Duck Creek and Martin's Creek at Mason Bay, Stewart Island, following marram grass invasion (c. 1950). Since 1958, pingao (*Desmoshoenus spiralis*) and other species have been lost from the foredune in Mason Bay. Marram grass also provides cover for introduced predators such as wild cats (*Felis domesticus*), which prey on native shore birds, including the New Zealand dotterel (*Charadrius obscurus*).

New Zealand still possesses dunes of high natural character, particularly in the far south and far north of the country. Marram grass does not appear to be as invasive along the northeast coastline of the North Island. The survival of dune systems elsewhere requires active management of marram grass. The Department of Conservation is leading this work and has saved key dune systems in Fiordland and on Stewart Island. However, marram grass is still spreading in some dune systems recognized as being of national conservation significance.

The impact of marram grass (*Ammophila arenaria*) invasion and eradication, Doughboy Bay, Stewart Island

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The programme to eradicate marram grass from Doughboy Bay, Rakiura National Park, Stewart Island, is the largest of its type attempted in New Zealand. The present paper examines the impact of marram grass invasion and eradication on dune form, dune process and vegetation, with a particular focus on the southern dunes in Doughboy Bay. Marram grass invasion of the southern dunes occurred not long before a major storm event, probably in the early 1950s. Subsequent barrier progradation facilitated rapid marram grass invasion. At the same time barrier morphology was transformed from a transgressive dune to prograded foredune type. Marram grass colonised the formerly unvegetated northern margins of the southern dunes, forcing northward barrier growth, diversion of the Doughboy River and destruction of one of the remaining colonies of the threatened plant *Gunnera hamiltonii*. Initial applications of the herbicide Gallant® by helicopter resulted in approximately 70 percent necrosis of leaf material in year 1 (1999). Helicopter operations in year 2 and ground operations in years 3 and 4 (ARGO) virtually eradicated marram grass from the southern dunes. Ideal conditions for marram regrowth from surviving rhizomes occurred in years 2 and 3 of the program. To avoid regrowth herbicide operations must be sustained. The gross morphology of the southern barrier did not change rapidly during the eradication operations. Sedimentation has been retarded by in situ rhizome, leaf material and stolons, which are resilient to decay and abrasion. The foredune-ridge topography associated with marram grass is now being transformed, as minor blowouts develop between incipient pingao (*Desmoschoenus spiralis*) shadow dunes. The northern third of the barrier, which did not exist prior to the arrival of marram grass, is eroding rapidly. The vegetation cover of the southern dunes is returning to its pre-marram state. Vegetation cover and species diversity were both high prior to the commencement of the eradication operations. Marram grass greatly reduced sedimentation and allowed the establishment of a range of opportunistic exotic and native plant species not usually associated with dune systems on Stewart Island. Marram grass necrosis resulted in higher rates of sedimentation, re-establishment of specialist dune species and a decline in species diversity.

The effects of landscape structure on weed invasion into native forest fragments, West Coast, New Zealand

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Habitat fragmentation is a major cause of biodiversity loss throughout the world, as it results in reductions in population sizes leading to extinction. Forest fragments are vulnerable to processes occurring in the surrounding landscape matrix, particularly if external disturbances such as grazing or fire act synergistically with the effects of fragmentation. Recent research has shown that there may be a landscape threshold at 10-30% habitat cover in the landscape, below which connectivity decreases abruptly and edge-mediated processes and species interactions become disproportionately more severe. Despite its importance, relatively little research has been conducted on forest fragmentation or edge effects in New Zealand, and very little is known about the synergistic effects of landscape structure on weed invasion processes, or the interactions between introduced weeds and native species. I will investigate the effects of landscape structure on weed invasion into native forest fragments on the West Coast of the South Island. Interactions between native plants, introduced weeds and insects will be studied along edge gradients in fragments in landscapes with varying amounts of forest loss. Fragments will be sampled from the adjacent matrix habitat through the forest edge and up to 200 m into the forest interior. Native and introduced vascular plant species and microclimatic variables (e.g., air and soil temperature, relative humidity, light intensity) will be measured at various distances from the edge. Relationships between these variables and patch and landscape attributes will be examined. The ecology of several weed species and mechanisms of invasion will be studied in detail with field observations and experiments, and herbivorous insects associated with those weeds will be identified. Geographic information systems will be used to analyse national weed distribution patterns and investigate their relationship with environmental characteristics (e.g. forest cover, soil type, human population density), thus revealing possible landscape drivers of weed invasion.

Weed Invasion: *Eupatorium cannabinum* at Ihupuku Swamp

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This research was undertaken at the request of the Department of Conservation to produce a report on Hemp agrimony (*Eupatorium cannabinum*) at Ihupuku Swamp. The aims of this research were to clarify: (1) How much of a threat *E. cannabinum* poses to the swamp (2) Whether control of *E. cannabinum* is justified (3) Why some sites are more susceptible to invasion than others. Ihupuku Swamp, located near Waverley, South Taranaki, is an area of conservation importance to the Wanganui Conservancy, containing a number of plants that are rare in the Conservancy, including the threatened orchid *Pterostylis micromega*. Ihupuku Swamp contains a number of weed species, including Hemp agrimony (*Eupatorium cannabinum*). Through vegetation sampling analysis, *E. cannabinum* was found to be spreading throughout the swamp into all vegetation types, including areas relatively untouched by other invasive species and areas with an expansive coverage of natives. The only factors limiting the invasion of *E. cannabinum* are the dryness of the soil and intense grazing pressure. While *E. cannabinum* has not yet altered species diversity where it has invaded, it has the ability to form monospecific stands which could reduce species diversity in the future.

A laser scanning technique for estimating vegetation structure in forested environment and its application in ecological monitoring

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In the study of habitat use by animals, it is important to sample vegetation structure or degree of cover at different heights or vegetation stratum. Commonly-used techniques to estimate vegetation cover (e.g. point height intercept and RECCE methods) are time consuming and quantitatively limited in tall forest environment. We investigated the application of the I-SITE Laser Scanner in quantifying forest structure variation for the study of nest site preferences of translocated populations of South Island saddlebacks and robins on Ulva Island, Stewart Island. We further combine structural and compositional data to estimate the importance of vegetation components on the establishment and reproductive output of these populations. We expect the results from this study will highlight the efficiency of this new technique in estimating vegetation density at different heights and will encourage its application in ecological or forestry research.

Propagation of *Syzygium maire* from seed

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This research is being undertaken as part of the Royal Society of New Zealand Teacher Fellowship Programme, studying biodiversity of Hamilton gullies. The Hamilton Ecological District is one of the most modified areas of New Zealand, with approximately 1.6% of original vegetation remaining. Within the city area, 8% (750 hectares) is formed by four major gully systems. With less than 20 hectares of indigenous habitat left, these extensive gully networks are vital for the future restoration of indigenous ecosystems. The vegetation remnants in gullies retain the unique characteristics and heritage of the region. It is therefore important that these remnants provide the parentage for restoration projects. The aims of this research are to 1) determine factors that effect the germination of three locally rare species; 2) identify seed storage conditions that affect seed germination rates and percentages. Preliminary results have shown that *Syzygium maire* seed cannot withstand a relatively short drying out period in storage. Seeds stored in water at room temperature have a higher germination percentage than other storage techniques and these results are similar to findings on other *Syzygium* species. In addition, this study has also shown that the digestive process of birds positively influences germination.

Northern Te Urewera Ecosystem Restoration Project

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The Northern Te Urewera Ecosystem Restoration Project is a large ‘Mainland Island’ project initiated in 1996. The project encompasses 50,000 hectares within Te Urewera National Park. Intensive multi pest control is undertaken to protect and enhance the high biodiversity values of this site. The benefits of this approach have been monitored using a wide range of monitoring techniques to assess conservation outcomes. Significant conservation achievements have been recorded within the project, most notably an increase in the number of kokako pairs within one study site from a low of eight pairs to 92 pairs. The project has also been an important site for trialling and developing new techniques.

Are large seeds still being dispersed in New Zealand?

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Following the arrival of humans in New Zealand, a number of large frugivorous birds were driven to extinction. At least six large-fruited species now depend almost entirely on kereru (*Hemiphaga novaeseelandiae*) for seed dispersal. Kereru populations, however, are threatened by illegal hunting, habitat loss, and introduced predators. The consequences of any loss of disperser service for plant populations and communities are uncertain. Some species may be buffered from extinction by traits including vegetative reproduction, persistent seed banks, or storage structures. In addition, the effects of dispersal disruptions may not become evident for a long time, especially in long-lived trees. The aim of this research is to determine the effects of declining kereru numbers on population and community dynamics of large-fruited trees. We will investigate the following key questions: 1) How effective are kereru as seed dispersers? 2) Do large-fruited species need to pass through a disperser to germinate? 3) Are dispersed seeds more likely to be recruited than non-dispersed seeds? 4) Are low kereru numbers sufficient to maintain large-seeded tree species? 5) Are large-seeded species buffered against reduced regeneration from seed? We will determine spatial patterns of kereru seed deposition and compare the germination success of consumed and whole fruits. Post-dispersal seed predation, germination, and seedling survival will be compared for seeds under and away from adult conspecifics. Data collected will be used to develop a spatially explicit seed dispersal model to predict the long-term effect of declining kereru on large-seeded trees.

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AUTHOR INDEX

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