

New Zealand Ecological Society 50th Jubilee Conference
University of Canterbury, Christchurch
27-30 August 2001

Hosting department

Plant and Microbial Sciences, University of Canterbury

Conference Organiser

Hazel Chapman, Plant and Microbial Sciences, University of Canterbury

Associate Organiser

Laura Sessions, Plant and Microbial Sciences, University of Canterbury

Organising committee

Richard Duncan, Conference dinner, Ecology and Entomology Group, Soil, Plant and Ecological Sciences, Lincoln University

Raphael Didham, Evening entertainment, Department of Zoology, University of Canterbury

Rowan Emberson, Publicity, Ecology and Entomology Group, Soil, Plant and Ecological Sciences, Lincoln University

John Parks, Jubilee celebrations and written history of the Society, Landcare Research, Lincoln

Dave Kelly, Program and book of abstracts editor, Plant and Microbial Sciences, University of Canterbury

Pauline Syrett, Treasurer, Landcare Research, Lincoln

Jubilee Display

Rowan Buxton and Susan Wiser, Landcare Research, Lincoln

Field Trip Coordinators

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Technical and other assistance

Nancy Goh, Secretarial Assistance, Plant and Microbial Sciences, University of Canterbury

Matt Walters, Digital Imaging, Plant and Microbial Sciences, University of Canterbury

Anouk Wanrooy, T shirt and Program cover design, Landcare Research

Jaqueline Beggs, Student Judge organiser, Landcare Research, Nelson

Julia Barnes, Craig Barnett, Doug Brooks, Blair Brown, Yvonne Chew, Selina Davis, Erik van Eyndhoven, Rob Ewers, Gary Houliston, Sina Hustedt, Amy Leighton, Sarah McElrea, Hillary Phipps, Jon Terry, Terry Thomsen, and Janelle Webster - lecture room assistance and other conference-week jobs

Registration and records

Conference Office, University of Canterbury

The cover design was drawn for this Jubilee conference by Anouk Wanrooy. Other illustrations throughout the book are from past covers of NZJEcology, drawn by Liz Grant.

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President's welcome address

Nga mihi ki a koutou

Welcome to the 50th Jubilee Conference of the New Zealand Ecological Society. The Society was born at a Science Congress meeting in Christchurch in May 1951. Therefore, it is fitting that we celebrate the Jubilee in the same city.

Many of the inaugural members of the Society are attending this Jubilee Conference. We are privileged to welcome back K. Radway Allen, first President, and Ken Lee, first Secretary, both of whom now reside in Australia. We are also pleased to welcome former Presidents and Hugh Tyndale-Biscoe who will give keynote addresses.

I have received messages from a number of members who can't be with us to celebrate 50 years of the Society. Our thoughts will be with them wherever they are in the world.

This Society has grown with the years and has been instrumental in the policy and legislative direction that this nation has taken with regard to wise management of the environment. It is the energy and commitment of our members, particularly the Council, office holders and conference organisers, that have enabled the Society to achieve what it has, and be in the robust position that it is in today.

On behalf of the Council of the Society I wish you all an enjoyable and stimulating Jubilee Conference.

No reira, tena koutou, tena koutou, tena koutou katoa.

Dr Carol J. West
President
August 2001

History of the New Zealand Ecological Society

collated by John Parkes

The New Zealand Ecological Society began at a special meeting chaired by Prof. B.J. Marples and held during the Science Congress held in May 1951 at Christchurch, when the decision to form a professional society was mooted. Dr K.R.Allen and Prof. V.J. Chapman seconded a motion that ‘a society be formed for the promotion of the study of ecology in all its aspects’.

A provisional committee was formed in 1951 consisting of K.R. Allen, B.M. Bary, R.K. dell, V. Dellow, L.B. Moore, S.H. Saxby and K. Wodzicki. The first formal meeting was held the following year at the Society’s first conference held at Victoria University, by the end of which over 150 people had become members. The first AGM elected K. Radway Allen as President, Lucy Moore and Val Chapman as Vice-presidents, Ken Lee as Secretary/Treasurer, and G.A. Knox, B.J. Marples, R.V. Williams, G.B. Rawlings, R.V. Mirams, S.H. Saxby, and J.S. Watson as Councillors and R.M. Allen as the honorary auditor. The proceedings of this first conference were published in volume 10 of *New Zealand Science Review*, the journal of the New Zealand Association of Scientific Workers.

It is interesting to see that the issues exercising the ecologists of 1952 would not be out of place in today’s conference. Symposia were held on methods of estimating populations, the ecology of restricted areas and islands, and the ecology of western Taupo, an area about “succumb to the onward march of farming” to quote A.C.S. Wright’s summing up of the symposium.

The founding President, Radway Allen, touched on the role of ecologists in his address to the 25th Jubilee Conference in 1976 (Proceedings of the NZ Ecological Society 24: 4 - 7). He saw four roles for ecologists: (a) as investigators and scientists, (b) as assessors and advisors for decision-makers, (c) as managers and decision-makers, and (d) as advocates. An ongoing tension within the Society has been the relative strengths of these roles. Peter Bull in his Presidential address at the 25th Jubilee, reflected on this and warned the Society against equating the science of ecology (and the function of the Society) with conservation and the environmental lobby. He thought the Society was in danger of being seen by government decision-makers as “just another protest group” with a consequent perception of our views as worth no more than the form letters that inundate public consultation processes. A year later in his Presidential address, Les Batcheler also reflected on these roles and how we might get the balance right between science and advocacy. One of Les’s points was that we should not say anything as advocates unless we had something to say about the science of an issue.

The broad aims of the Society have generally meant that the focus of interest of the Society has been the sum of the interest of the members, and these interests have leant towards the ‘ecologist as scientist’ role. However, even within this role, the interests of the Society have changed. In the early days, members’ interests were probably wider than they are now, but many specialist areas of ecology have subsequently formed their own societies and the current focus of the Ecological Society is probably back to its core of conservation sciences. This is both a strength (it allows us to be more influential in some areas) and a weakness (we ignore important areas of ecology), but not really a worry providing we do not narrow the aims of the Society to exclude areas of interest or a refocus of our roles as the New Zealand Ecological Society and the society it serves evolves.

Annual Conference

The Society has held conferences and its AGM every year since 1952 (Table 1).

Table 1. Annual Conferences of the New Zealand Ecological Society 1952 - 2001.

Conference venues	Years
Wellington	1952, 1953, 1956, 1958, 1960, 1963, 1971, 1980, 1997
Christchurch	1955, 1966, 1977, 1981, 1992, 2001
Auckland	1954, 1959, 1968, 1976, 1983, 1993
Palmerston North	1957, 1965, 1972, 1978, 1985, 1995
Dunedin	1961, 1969, 1988, 1998
Lincoln	1964, 1970, 1986, 1996
Nelson	1967, 1975, 1984, 1991
Hamilton	1974, 1990, 2000
Rotorua	1962, 1982
Blenheim	1979, 1999

Upper Hutt	1989
Invercargill	1973
Turangi	1987
Hokitika	1994

Most papers presented at these early conferences were published in the *Proceedings of the New Zealand Ecological Society vol. 1 - 24*, either as full papers or as resumes. The first few pages of the first issue are reprinted on pp 10-14. Resumes of conference papers continued to be published in the *New Zealand Journal of Ecology* (which replaced the Proceedings in 1978) until 1989. However, there has been no obligation on people presenting papers at the conferences to publish in the Journal and authors may submit papers not presented at conferences resulting in a decreasing number of conference papers being published in the *NZ Journal of Ecology*.

Presidents of the Society

The Society has elected 25 Presidents, usually for a two-year term of office (Table 2).

Table 2. Presidents and terms of office of the New Zealand Ecological Society

Years	President	Years	President
1952-53	K.R. Allen	1978	J. Warham
1954-55	R.A. Falla	1979-80	M.C. Crawley
1956-57	S.H. Saxby	1981-82	T.A. Caithness
1958-59	C.M. Smith	1983-84	M.R. Rudge
1960-61	A.L. Poole	1985-86	I.A.E. Atkinson
1962-63	K.E. Lee	1987-88	M. Williams
1964-65	G.T.S. Bayliss	1989-90	J. Roper-Lindsay
1966-67	J.A. Gibb	1991-92	J.P. Parkes
1968-69	K.H. Miers	1993-94	J.M. Williams
1970-71	P. Wardle	1995-96	C. Mason
1972-73	G.R. Williams	1997-98	C. Miller
1974-75	P.C. Bull	1999-00	C. West
1976-77	C.L. Batcheler		

Life members

Members of the Society who have given significant service to the Society and ecology may be nominated by Council as Life Members. Eleven people have been made Life Members (Table 3).

Table 3. Life Members of the New Zealand Ecological Society

Member	Year honoured
K. Radway Allen	1964
Ken E. Lee	1965
Norm Elder	1971
Ruth Mason	1974
Gordon Williams	1978
Kaz Wodzicki	1984
John Gibb	1985
John Nicholls	1985
Mike Rudge	1988
John Parkes	1997
Peter Wardle	1999

New Zealand Ecological Society Award

In 1990, the Society instituted an award to recognise members who had made an outstanding contribution to the study and application of ecological science. To date, 11 members have received the honour (Table 4).

Table 4. Recipients of the New Zealand Ecological Society Awards

Recipient	Year
Henrik Moller	1990
Colin Burrows	1991
Graeme White	1992
Bill Lee	1995
Nigel Barlow	1996
John McLennan	1997
John Innes	1998
Kim King	1999
Dave Kelly	2000

The Journal

The *Proceedings of the NZ Ecological Society* was published annually from 1953 to 1977 (Volumes 1 - 24); part of the 1953 issue is reproduced on pp 10-14. Its successor, the *NZ Journal of Ecology* has been published annually between 1978 and 1989, and twice yearly since 1990.

Editors

The first proceedings appeared in the New Zealand Science Review (edited by V.J. Wilson), and the first seven volumes of the Proceedings were edited by the Council. The Society resolved at the 8th AGM that from volume 8 the Proceedings should be developed into a research journal and include suitable papers not presented at the conference. An editor has been subsequently appointed by Council (Table 5).

With the move to two issues per year in 1989, the editor's job has grown. Since 1985, the Editor has had an editorial board (currently with 11 members) to assist with the peer review process, and in 2001, a technical editor was appointed to assist the Editor.

Table 5. Editors of the Proceedings of the NZ Ecological Society and the NZ Journal of Ecology.

Proceedings Vols.	Editors	Journal Vols.	Editor
1 - 7	Council	1 - 2	M.C. Crawley
8 - 11	K.R. Allen	3 - 4	E.B. Spurr
12	J.A. Gibb	5 - 7	M.J. Williams
13 - 17	G.R. Williams	8 - 14	N.D. Barlow
18 - 21	I.G. Crook	12 (supplement)	M.R. Rudge
22 - 24	A.H.C. Christie	15 - 19(1)	J. Rapson
		20(1)	C. Veltman
		20(2)	J.P. Parkes
		21 - 23(1)	G. Lovei
		24 -	D. Wardle

Other Publications

The Society has often run special symposia at its annual conferences, and occasionally special workshops on issues of interest to members. Three conference symposia have been published as special issues of the journal. The first, published as a supplement to volume 12, was edited by Mike Rudge and published 16 of the papers given the 1986 conference in a symposium on the impact of introduced herbivores on a flora that had evolved only with avian herbivores - the biggest of which

being extinct for centuries. The second special symposium to take up an entire issue of the journal, volume 20(1) edited by Clare Veltman with 11 papers, was on the causes of the decline of native plants and animals. The third special symposium to which an issue (23(2) edited by Charlie Eason and Clare Veltman) was devoted was held at the 1998 conference. The theme was on the ecological consequences of poisons used for mammalian pest control, and published 22 of the 25 papers presented.

These special issues of the Journal have the advantage of making peer-reviewed information on a topic of moment available to a wide audience, but the disadvantage of disrupting the normal publication timetable of other contributed papers. Council has decided not to produce further such issues within the normal two-issue per year publication of the Journal, but that any future thematic special issues should be extra and so require their own funding base.

An alternative that the Society experimented with is to publish workshop proceedings in special publications. The first of these workshops, on the management of New Zealand's natural estate, was held at Dunedin in 1988. David Norton organised it and published 24 papers and the summaries of workshops in NZ Ecological Society Occasional Publication No. 1. Issues discussed included single species versus community management, how to prioritise and allocate funds for pest and weed control - all still topics exercising managers' minds as DOC grapples with optimising its biodiversity outcomes when it only has limited funds.

The second of these special workshops was organised by Caroline Mason, Grant Hunter and Chris Kerr in 1991 at Cass Field Station on the theme of vegetation change in tussock grasslands with emphasis on hawkweeds. Twenty-seven papers and some key recommendations for further research were published in NZ Ecological Society Occasional Publication No. 2. These were the days when scientists and managers were less constrained by the contestable funding regimes of later times!

A third workshop organised by Morgan Williams and Caroline Mason was held at Flock House in 1999 on the theme of the ecological impacts of intensive farming. This workshop was never published but the topic is again on the national agenda as intensive dairy farming in particular is on the increase and having impacts on the environment.

The Newsletter

The first Newsletter was produced in 1973 and has been produced quarterly since then. It started life as a stapled A4 document (No. 1 - 15), then reduced to a smaller bulletin size (No. 16 - 51), and is now in an A4 booklet format (No. 52 - 98).

Apart from the necessary Society news of conferences, AGMs, annual reports and budgets, the contents of the Newsletter have largely depended on the tastes and enthusiasms of the Newsletter Editor and on members' willingness to contribute items. Occasionally, issues have even been debated.

Submissions

The Society has a long history, going back to 1953, of identifying indigenous communities that were not represented in the formally protected estate, and advocating their reservation. This was the role of the Conservation Sub-Committee which took over the role of commenting on conservation issues from a formal sub-committee of the Royal Society in 1965. In 1958, the Society identified 36 communities that it thought would disappear with 10 years. Cases for protection were made to the Government agencies responsible for this process and a review in 1968 showed that 16 of the areas had been reserved or were about to be protected, two were in fact not in urgent need of protection, and 18 remained unprotected.

Some notable areas for which the Society successfully advocated protection during this period included Kerr Point at North Cape, the Moana Tuatua bog in Waikato, Awarua Bog Reserve and a Red Tussock Reserve in Southland, two areas of native grassland on the Canterbury plains, part of the raised beaches at Cape Turakirae, a low altitude snow tussock reserve at Lake Mahinerangi, the Lindis Pass reserve, Black Rock Reserve near Dunedin, Mana Island, part of Pitt Island, and Plimmerton swamp. Ian Atkinson, Alan Mark, David Scott, Peter Wardle, Ruth Mason, Peter Williams and many others were prominent in this process.

Major submissions

The Society has made numerous submissions to Government over the years, and published a few of the major ones (Table 6)

Table 6. Submissions made by the Society that have been published

Year	Submission	Reference
1973	Report on the utilisation of South Island beech forests	Proceedings of the NZ Ecological Society 20.
1974	An ecological approach to New Zealand's future	Proceedings of the NZ Ecological Society 21.
1978	The future of the West Coast forests and forest industries	NZ Journal of Ecology 1
1980	The National Development Bill	NZ Journal of Ecology 3
1985	The environmental consequences to NZ of nuclear warfare in the northern hemisphere	NZ Journal of Ecology 8
1991	Statement on sustainability	Supplement to the Newsletter
1994	Review of South Island high country land management issues	NZ Journal of Ecology 18
1995	Maori customary use of native birds, plants and other traditional materials. Customary management of indigenous species: a Maori perspective	NZ Journal of Ecology 19

Finally, we should not overlook the social role of a Society such as ours. The annual conference is often the only way we get to meet, and the traditional format of conferences, with dinners, teas, poster sessions and a field trip appears to have stood the test of time in meeting this role. So, welcome to the latest of these.

NZES 50th Jubilee Conference Programme

SUNDAY, 26 AUGUST

4.00-6.00 pm	Registration	C1
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MONDAY, 27 AUGUST

The presenting author is underlined if not the first author. * by the time indicates entrants for the student prize.

NZES 50th JUBILEE SESSION (MONDAY 8.30 – 12.10, C1)			
8.30	Carol West	Presidential welcome and Conference Opening	C1
8.45	Morgan Williams	Sustaining a Gondwanan remnant through the 21 st century: Some navigational challenges	C1
9.15	Peter Wardle	Regeneration of native conifers – how the largest most long-lived organisms in New Zealand maintain their niches in an inconstant environment	C1
9.45	Ian Atkinson	Successional processes on the northern offshore islands of New Zealand	C1
10.15	<i>MORNING TEA</i>		
10.45	Hugh Tyndale-Biscoe	Opossums to possums: changing perceptions of a New Zealand mammal	C1
11.15	Richard Duncan, C. Frampton, H. Gatehouse, K. Barber, J. Kemp, J. Lyall, B. McCarthy, K. Monson, C. Peters, C. Roberts, R. Smith, J. Tansell and M. Watson	Back to the future: 50 years of publishing in <i>New Zealand Journal of Ecology</i>	C1
11.35	Dave Kelly (NZES Award Address)	Do stoats harm mistletoes? - what's wrong with bird-plant mutualisms in New Zealand.	C1
12.05	LUNCH		

POSTER SESSION (MONDAY 1:10 – 1:40, FOYER)			
	Brent Booker	Can creepy crawlies contribute to bringing forests back to the future?	
*	Nichollette C. Brown, Dianne Brunton, and Bernd Würsig	Comparison of Dusky Dolphin (<i>Lagenorhynchus obscurus</i>) habitat use before and after the onset of commercial tourism	
	Isabel Castro, <u>Dianne H. Brunton</u> , Karen M. Mason, Brice Ebert and Richard Griffiths	Effect of food supplementation, female age and clutch number on egg laying and incubation in a translocated population of hihi (Aves).	
	Mel Galbraith	Tiritiri Matangi Island: 25 years as a reserve.	
	James Green, Graham Wallis & <u>Murray Williams</u>	Determining the extent of grey duck x mallard hybridisation in New Zealand.	
*	Charlotte L. Hardy, Richard A. B. Leschen & Pierre Paquin	Mycophagous beetle diversity in periurban environments	
	Clayson Howell and Pauline Penny	BioWeb: Casting the information web further	

	J.E. Hunt, F.M. Kelliher and T.M. McSeveny	Annual Carbon Exchange of a Tussock/Hawkweed Ecosystem	
	D. S. Jeffries and D. H. Brunton.	Attracting endangered species to 'safe' habitats: responses of fairy terns to decoys	
*	Lehnebach, C. & A. W. Robertson.	Measuring pollination success of epiphytic and terrestrial NZ orchids	
*	Paul T. Leisnham and Ian G. Jamieson	Meta-population dynamics of a New Zealand alpine weta <i>Hemideina maori</i> (Orthoptera: Anostostomatidae) on island habitat patches	
	Stephen McNeill and Stella Belliss	Modelling complex forests using radar remote sensing	
	Merilyn Merrett	Hot and steamy – habitat and sex life of two geothermal ferns	
	Merilyn Merrett, Chris Ecroyd, Paul Cashmore	Red beards in Rotorua: autecology of the rare orchid <i>Calochilus robertsonii</i>	
*	Dai Morgan, Adrian Paterson, Paul Sagar, and Donald Geddes	A comparison of the breeding biology of South Island pied oystercatchers (<i>Haematopus ostralegus finschi</i>) nesting on river terraces and surrounding farmland in mid-Canterbury	
	Judith Rhymer, <u>Murray Williams</u> & Richard Kingsford	Relationships between New Zealand, Australian and Chatham Island Grey Ducks	
	John Sawyer	A biogeographical approach to mistletoe conservation in Wellington	
	John Sawyer	The status of coastal dune vegetation in Wellington	
	Lindsay Smith, Simon Fowler, Paul Peterson, Kathy Hill, Pauline Syrett	European beetle demolishing New Zealand heather: initial success of a biological control programme	
*	Terry Thomsen, Hazel Chapman and Steve Wagstaff	Using chloroplast DNA to help explain <i>Nothofagus</i> disjunctions in the South Island	
	Corinne Watts, and Bev Clarkson	The invertebrate fauna in <i>Sporadanthus</i> wetlands on Chatham Island	
	Corinne Watts, Marie-Claude Larivière	Are urban reserves important reservoirs of invertebrate diversity?	
*	Sarah Wedde, Glenn Stewart, Richard Duncan and Matt McGlone	Few and Far between: Environmental determinants of <i>Ascarina lucida</i> distribution in south Westland, New Zealand	
	Deborah J. Wilson, Wendy A. Ruscoe, David A. Coomes, Elaine F. Wright, David A. Wardle, Charles D. Canham, David Choquenot	An Experiment to Assess Impacts of Introduced Mammals on Forest Dynamics in New Zealand	

BEECH FOREST SYMPOSIUM (MONDAY 1:40 – 3:20, C1)			
1.40	Rob Allen and David Wardle	Beech forest community dynamics: linking above- and below-ground ecosystem processes	C1
2.00	Jacqueline Beggs and Richard Toft	Restructuring of native invertebrate communities in beech forest by invasive wasps	C1
2.20	Elaine Murphy, Peter Dilks and Colin O'Donnell	Introduced predators, birds & bats - unravelling an unnatural relationship	C1
2.40	Angus R. McIntosh, Per Nystrom and Michael J. Winterbourn	Links between the terrestrial and aquatic components of beech forest ecosystems	C1

3.00	Matt Maitland and Dave Butler	Do we know enough about beech forests to manage them for the conservation of their indigenous biodiversity, or the bits we like?	C1
3.20		AFTERNOON TEA	

CONCURRENT SESSION 1A (MONDAY 3:50 – 4:50, C1)			
3.50	Nod Kay	Resource allocation in <i>Nothofagus</i> - an IRA hypothesis	C1
4.10	Alexander Wearing	Limbfalls: A cause of seedling and sapling damage and mortality in New Zealand forests	C1
4.30*	Sean Husheer and Alastair Robertson	Deer impacts on Kaimanawa beech forests	C1
CONCURRENT SESSION 1B (MONDAY 3:50 – 4:50, C2)			
3.50	Bruce Burns, Mike Dodd, Meryllyn Merrett, Ian Power, and Mark Smale	Bush in the back-paddock: does it differ from intact native forest?	C2
4.10*	Scott Davidson and Doug Armstrong	A saddleback population model with implications for reintroduction to the mainland.	C2
4.30	Colin Burrows	Weeding an island	C2

6.00 **AGM** of the NZ Ecological Society, room C2

7.00 **Wine and Cheese**, Staff Club (bar open from 6:30pm)

TUESDAY, 28 AUGUST			
AGENTS OF CHANGE SYMPOSIUM (TUESDAY 8:30 – 10:10, C1)			
8.30	John Ogden	Great Barrier Island – a microcosm for change in New Zealand biodiversity.	C1
9.10	Matt McGlone	Greenhouse climate change and the evolutionary future of the New Zealand biota	C1
9.30	Liz Wedderburn	Agriculture policy as an agent of change	C1
9.50	Carol West	Agents of change on Raoul Island, Kermadec Islands – weeds, rats and humans	C1
10.10		MORNING TEA	

CONCURRENT SESSION 2A (TUESDAY 10:40 – 12:20, C1)			
10.40*	Des Smith and Ian Jamieson	Can trapping stoats in valley floors of beech forest protect takahe nesting in alpine-tussock habitat?	C1
11.00*	Dale Williams	Wallabies vs. possums: Does size really matter?	C1
11.20*	Samantha Brown, Cheryl O'Connor, Ian Domigan and Graham Hickling	Is bigger better? Designing a stoat control tunnel.	C1
11.40	Dan C. Purdey, <u>Carolyn M. King</u> , and Barry Lawrence	Total reproductive failure in an undisturbed population of stoats	C1

12.00	Dianne Gleeson, Robyn Howitt, Andrea Byrom, and Bruce Warburton	Monitoring stoat populations using DNA profiling and mark-recapture analysis.	C1
CONCURRENT SESSION 2B (TUESDAY 10:40 – 12:20, C2)			
10.40	Glen Lauder	Update on biodiversity strategy programmes on private land	C2
11.00	Paula Warren	Ecological management within the Department of Conservation	C2
11.20	Brian Rance, Phil Knightbridge and Suzan Dopson	Mistletoe recovery planning in New Zealand.	C2
11.40	Phil Knightbridge and Fiona Bockett	Conserving beech mistletoes on the West Coast.	C2
12.00	Avibhakta Holzapfel and Chris Ecroyd	Five years of recovery of the threatened plant <i>Dactylanthus taylorii</i> - a review.	C2
12.20		LUNCH	

CONCURRENT SESSION 3A (TUESDAY 1:30 – 3:10, C1)			
1.30*	Ingrid Grüner	Herbivory by introduced mammals: A threat to native New Zealand broom?	C1
1.50	Richard Harris	Small invaders – the conservation threat posed by Argentine ant and options for its containment and eradication	C1
2.10*	Gary Houlston and Hazel Chapman	Residual sexual reproduction in facultative apomictic <i>Hieracium pilosella</i> : does the environment play a role in expression?	C1
2.30	Claire Newell	Forty-five years of change in Canterbury alpine grasslands: is <i>Hieracium</i> spreading?	C1
2.50	Pauline Syrett, Lindsay Smith, Colin Meurk and Trevor Partridge	Predicted impact of insect biological control agents on <i>Hieracium pilosella</i>	C1
CONCURRENT SESSION 3B (TUESDAY 1:30 – 3:10, C2)			
1.30	Berndt Janse van Rensburg, Stephen Chown and Kevin Gaston	Species richness, environmental correlates, and spatial scale: a test using South African birds.	C2
1.50	K. M. Lloyd, William Lee, and D.A. Orlovich	Origin, evolution and expansion of New Zealand's indigenous grasslands	C2
2.10*	D. Rutledge and Jianguo Liu	Land cover changes and wildlife habitat changes in two watersheds in Michigan, USA	C2
2.30*	Ross Thompson and Colin Townsend	When you can't see the stream for the trees: effects of riparian harvesting on stream communities.	C2
2.50*	James Russell, Mick Clout, Brian McArdle and Sam Ferreira	Island biogeography and the distribution of introduced mammals on New Zealand offshore islands.	C2
3.10		AFTERNOON TEA	

INTRODUCED SPECIES AS MODEL SYSTEMS SYMPOSIUM (TUESDAY 3:40 – 5:00, C1)			
3.40	Hazel Chapman	Every cloud has a silver lining: <i>Hieracium pilosella</i> as a model species for asking evolutionary questions	C1
4.00	Kevin Simon and Colin Townsend	The impact of freshwater invaders on nutrient cycling in streams: Can individual taxa control ecosystem processes?	C1
4.20	Helen Harman, Jane Memmott and Pauline Syrett	Weed biocontrol agents as model invaders.	C1
4.40	Richard Duncan and David Forsyth	The probability of island colonisation: using mammal introductions to test for effects of island area and latitude.	C1

6:30 for 7:00pm, **Conference Dinner** and cash bar, Ilam Function Centre, Student Union

WEDNESDAY, 29 AUGUST			
HYBRIDISATION SYMPOSIUM (WEDNESDAY 8:30 – 10:10, C1)			
8.30	Madeleine van Oppen, Luis Márquez, Bette Willis and David Miller	Hybridisation and speciation in reef corals of the genus <i>Acropora</i> : a molecular genetic approach	C1
9.10	Peter Lockhart	Phylogenetic networks for studying Late Tertiary - Quaternary plant radiations	C1
9.30	Neil Gemmell	The Trouble with Hybrids	C1
9.50	Chi-hang (Mathew) Chan, Charles Daugherty, Christine Reed, and Geoffrey Chambers	Forbes' Parakeet or a Hybrid? Development of Genetic Markers for the Study of Hybridisation in <i>Cyanoramphus forbesi</i>	C1
10.10		MORNING TEA	

HYBRIDISATION - CONCURRENT SESSION 4A (WEDNESDAY 10.40-12.20, C1)			
10.40	Geoffrey Chambers	Using molecular methods to study hybridization in New Zealand's native birds	C1
11.00	Tristan Armstrong	Habitat selection and plant speciation in the Australian Alps	C1
11.20	Mary Morgan-Richards	Inter- and intra-specific hybridization and hybrid zones in weta	C1
11.40	Toni Jenkins, Tony Conner and Chris Frampton	Interspecific hybridisation between Rape and Wild Turnip – Who acts as the go-between?	C1
12.00*	Graham Wallis	Where do we draw the lines in conserving species? A case study from galaxiids	C1
CONCURRENT SESSION 4B (WEDNESDAY 10:40 – 12:20, C2)			
10.40*	Roger Dungan	Patterns of within-canopy photoinhibition match observed leaf loss in <i>Aristotelia serrata</i>	C2

11.00	Rochelle Christian and Julian Ash.	Photoinhibition in sun and shade leaves of mangroves growing along salinity gradients in their natural habitats in south-east Australia	C2
11.20	William G. Lee, William J. Bond, Gudrun Wells, Jo Wass, Deane Harder and Joe Craine	Do we have plant structural defenses against large ratite browsers? Divarication revisited	C2
11.40*	Yanbin Deng, John Ogden, Mark Horrocks and Sandra Anderson	Palynological evidence of vegetation succession from Whangapoua estuary, Great Barrier Island, New Zealand	C2
12.00*	Angela Moles and Mark Westoby	Dispelling a myth: large seeds do not suffer higher levels of pre- or post-dispersal seed predation than small seeds	C2
12.20		LUNCH	

CONCURRENT SESSION 5A (WEDNESDAY 1:30 – 3:10, C1)			
1.30*	James Griffiths and Adrian Paterson	Effect of marram density on katipo and <i>Latrodectus atritus</i> web construction and prey capture	C1
1.50	Duane Peltzer and David Wardle.	Linking plant traits to competitive ability using structural equation modelling	C1
2.10*	Kylie Galway, Richard Duncan, Pauline Syrett, Rowan Emberson and Andy Sheppard	Using stress to our advantage: plant stress – insect performance interactions	C1
2.30	Malcolm Douglas, Nigel Perry, John van Klink, Bruce Smallfield and Rosemary Anderson.	The good oil – chemotype variability in New Zealand manuka.	C1
2.50*	Andrea Brandon and Alastair Robertson	Precocious bud pollination: maximising chances for cross pollination in the ultramafic endemic <i>Myosotis monroi</i> Cheesm. (Boraginaceae)	C1
CONCURRENT SESSION 5B (WEDNESDAY 1:30 – 3:10, C2)			
1.30	Xiao Ling Li and <u>Dianne Brunton</u>	Not just a pretty face: bellbird vocal repertoire and the role of female song	C2
1.50*	Craig Barnett	Is singing behaviour related to food availability?	C2
2.10*	Glen Newton	Behavioural changes in incubating Southern Crested Grebe (<i>Podiceps cristatus australis</i>) during periods of recreational activity	C2
2.30*	Grant Harper	Far-flung forest felines: habitat use by feral cats on Rakiura (Stewart Island)	C2
2.50*	Erik van Eyndhoven	Why did the possum cross the road? Habitat selection in a terrace beech forest	C2
3.10		AFTERNOON TEA	

CONCURRENT SESSION 6A (WEDNESDAY 3:40 – 5:00, C1)			
3.40	Linda Newstrom and Josephine Ward	Delayed self-pollination in poroporo, <i>Solanum laciniatum</i> , in New Zealand	C1
4.00	Sandra Anderson	Sticky beaks: birds and karo (<i>Pittosporum crassifolium</i>) dispersal	C1
4.20	Alastair Robertson, Jenny Ladley, and Dave Kelly	It's the quality not the quantity....Pollinator declines and inbreeding depression in tree fuchsia and kowhai	C1
4.40	Rebecca Stanley	Nowhere to run: Distribution, ecology and conservation of the forget-me-not <i>Myosotis petiolata</i> var. <i>pansa</i>	C1
CONCURRENT SESSION 6B (WEDNESDAY 3:40 – 5:00, C2)			
3.40	Bruce Waldman, John Klena, Vera Andjic and Richard Norman	Counting frogs croak: disease and mortality of wild bell frogs	C2
4.00	Weihong Ji; Mick Clout, Stephen Sarre and John Craig	Demographic responses of brushtail possums to local depopulation	C2
4.20	Isobel Castro, Richard Griffiths and <u>Rosalie Stamp</u>	Stitchbirds - a sweet management challenge	C2
4.40	Ian Jamieson, Kerry Dowsett and Graham Wallis	An unusual relationship between a colour polymorphism, body size and altitude in an alpine weta <i>Hemideina maori</i>	C2
5.00		AWARDS AND CONFERENCE CLOSING	C1

7.00pm **Bar and Bistro**, Staff Club

THURSDAY 30 AUGUST	
FIELD TRIPS 8:30am - 3.00pm	
8:30	Quail Island and Kaitorete Spit field trips depart from outside lecture theatres (east side)
3:00	Field trips return

Talk abstracts (alphabetically by author)

Beech forest community dynamics: linking above- and below-ground ecosystem processes.

Rob Allen and David Wardle

Landcare Research, Private Bag 69, Lincoln

Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, U.K.

Beech forests are subject to various perturbations that influence community dynamics at a range of temporal scales. Research has recently documented the intensive and extensive impacts of earthquakes, the nature and synchrony of periodic heavy seeding, and the importance of exotic invasions on beech forest understories. A current focus is to understand how such above-ground perturbations influence below-ground processes through detrital inputs and subsequent decomposition. Litter, coarse woody debris, and soil organic matter are major carbon and nutrient pools in beech forests and decomposition of this organic matter regulates soil nutrient availability for plant uptake. Browsing animals can influence the species composition of the leaf litter, and hence soil carbon and nitrogen storage as well as the composition of litter-dwelling faunal groups. Diverse assemblages of wood-decomposing fungi are found on beech logs, and which saprobic taxa dominate has important consequences for the rate of log decay and release of nutrients. The quantity and quality of coarse woody debris, and litter, also vary during stand development, influencing soil nutrient availability and having potential consequences for forest productivity. Interactions between above- and below-ground processes also need to be considered in relation to longer term compositional adjustments in beech forests. *-monday pm*

Sticky beaks: birds and karo (*Pittosporum crassifolium*) dispersal

Sandra Anderson

University of Auckland, Private Bag 92019, Auckland

New Zealand is unusual in having both a high percentage of native plants with fleshy fruit suited for vertebrate dispersal, and a greatly reduced native seed-dispersing fauna. The predicament of large-seeded native plants is now widely appreciated, but the situation for smaller-seeded species is less well understood. A study of the fruiting shrub karo (*Pittosporum crassifolium*) illustrates the situation for some native fruiting species. *P. crassifolium* is widespread throughout coastal forest of northern New Zealand, with fruiting capsules containing numerous xmm seeds within a sticky mucilage. The fruits are eaten infrequently by birds on the mainland, but frequently by birds on Tiritirimatangi Island. Monitoring of fruit take showed that removal was slow on the mainland, and most fruit remained at the end of the season. Closer examination showed that many fruit were also predated on the mainland. In contrast removal was rapid on Tiritiri and few fruit remained at the end of the season. Fruit predation was also 3-5 times lower. *P. crassifolium* regeneration on the mainland is probably largely via the few unpredated seeds that eventually fall from the parent plant, with probable consequences for the future distribution of this species. Such disruptions in bird-plant mutualisms are important considerations in assessing decline in native biodiversity. *-wednesday pm*

Adaptive Radiation in Australian alpine *Ranunculus*: Evolutionary Pattern and Process

Tristan Armstrong
Landcare Research

Nuclear and cpDNA sequence data support a model of recent dispersal of *Ranunculus* from alpine New Guinea to the Australian alps, with subsequent adaptive radiation during the Pleistocene. Given that the Australian alpine zone has remained relatively small in area throughout the Quaternary (currently only 120 km²) and consists of a single compact mountain block, it is likely that these interfertile lineages have coexisted in close proximity for much of their evolutionary history. *Ranunculus* hybridise extensively in the alpine region of mainland Australia. The taxa exhibit a diverse array of leaf forms, floral characteristics and plant architectures, with hybrids intermediate between parental species in all characters examined. Hybrid zones between populations of different species are characterised by narrow clines in morphological transition which correspond to narrow clines in allozyme allele frequencies. All species in the group are entirely interfertile, as revealed by artificial crossing, with F1 and F2 interspecific hybrids and backcrossed individuals viable and fully fertile.

It is hypothesised that hybridisation is restricted purely by habitat specialisation and intense selection against hybrids within parental habitats. The performance of parental and hybrid seedlings planted into parental habitats strongly supports this hypothesis. Parental species were most successful in their own habitat, with hybrid performance generally intermediate to that of the two parental species in parental habitats. These data suggest that exogenous selection, rather than any intrinsic barriers to the production of hybrids, maintains these lineages as distinct units. In light of the selection trial results, it can be hypothesised that once adaptations to exploit novel habitats arose in this monophyletic group, lineages became isolated through strong habitat selection. This study emphasises the importance of selection rather than genetic drift in speciation in insular habitats. - *wednesday am*

Successional processes on the northern offshore islands of New Zealand

I.A.E. Atkinson

Ecological Research Associates of New Zealand Inc. PO Box 48-147, Silverstream, Upper Hutt 6430

Increasing our understanding of successional processes on the northern islands, apart from its intrinsic interest, should result in more effective management of these places. In particular, it should: (i) allow us to maintain habitats capable of supporting a range of threatened plants and animals and (ii) allow us to identify and achieve realistic goals for restoring an island in cases where this is appropriate. The islands under discussion include Piercy Island near Cape Brett, the Poor Knights and Hen and Chickens groups, the lowland/coastal section of Hauturu (Little Barrier Island), Cuvier Island and islands of the Mercury, Ohinau and Aldermen groups.

Major questions likely to arise in a successional study are: what are the trends of change in plant and animal composition; at what rate is any particular change taking place; and what are the initiating factors or driving mechanisms for effecting such changes? An over-riding conclusion from this study is that, no matter how pristine some islands may appear, most have been greatly changed by human-induced fires. As a consequence, most forest successions on these islands are dominated by pohutukawa (*Metrosideros excelsa*) and, to a lesser extent, kanuka (*Kunzea ericoides*) for several centuries. Pohutukawa is a long-lived tree and, compared with other seral species, effectively retards the rate at which a more diverse community can develop.

This study identifies the major trends in forest and scrub development that follow fires by using data from permanent plots, several kinds of transects, and repeated general observations over several decades. The influence of wind-driven salt and burrowing petrels is discussed. So also are the effects of introduced goats and rabbits. Finally, a current study (by John Campbell and the author) of kiore (*Rattus exulans*) impact on these islands is summarized and related to the question of the extent to which the successional trends identified mirror what has happened on the adjacent mainland. -*monday am*

Is singing behaviour related food availability?

Craig Barnett

Department of Zoology, University of Canterbury

It is well known that a bird's behaviour may be influenced by factors such as predation pressure. An aspect that has received less attention is how behaviour may be energetically limited. I carried out supplementation experiments on two species (New Zealand robins and silvereyes) to determine if food availability affected the singing behaviour of individuals and their energetic reserves. For both species, I provided short-term supplementation (ca. 24 hr) to birds to determine if increased food availability affected both their reserves and their singing behaviour. Silvereyes increased their energetic reserves and they sang at higher rates and with greater complexity when supplementary food was available. New Zealand robins also sang more throughout the day when they received supplementary food. This increase was attributable to an increase in fat levels. These experiments show that the amount and complexity of song output may be dependent on the energetic state of birds. Hence, males that are singing at consistently higher rates than their con-specifics may be advertising their high quality to potential mates or rivals. - *wednesday pm*

Restructuring of native invertebrate communities in beech forest by invasive wasps.

Jacqueline Beggs and Richard Toft

Landcare Research, Private Bag 6, Nelson.

Invasive social wasps (*Vespula* spp.) have been intensively studied in beech forest for the last decade. They are one of the few case studies worldwide where we have an understanding of the ecological impact of an invasive invertebrate. One of their main impacts is as a predator of a wide range of native invertebrates. The supply of a plentiful carbohydrate source, honeydew, enables wasps to reach very high density. Instead of being limited by carbohydrate, as is the case in most habitats, they are limited by the supply of protein. Indeed, it is possible that the availability of native invertebrates is a key factor driving the cycling of wasp populations in these forests.

The predation rate of wasps on selected invertebrates has been experimentally determined. It is so high, that we conclude wasp populations have to be reduced by around 90% if we wish to conserve some native invertebrates species. There is limited evidence of the impact of wasps at the population or community level. - *monday pm*

Precocious bud pollination: Maximizing chances for cross pollination in the ultramafic endemic *Myosotis monroi* Cheesm. (Boraginaceae).

Andrea Brandon¹ and Alastair Robertson²

¹Department of Conservation, Waikato Conservancy, Private Bag 3072, Hamilton.

²Massey University, Private Bag 11 222, Palmerston North.

Precocious stigma presentation was investigated in the geographically restricted, serpentine endemic forget-me-not *Myosotis monroi*. Stigmas collected from precocious buds, in which the style and stigma protrude out of the bud before the petals open, showed some pollination was taking place at the precocious phase. 26.2 % of the precocious stigmas collected had received pollen, and 11.9 % had received at least 5 pollen grains. In comparison with stigmas collected from flowers at the end of the male phase, 88.1 % had received pollen, 75.81 % with at least 5 pollen grains. Hand pollinations confirmed precocious stigmas were receptive but seed set by hand-pollinated open flowers was significantly higher. Styler precocity in *M. monroi* effectively lengthens the female phase of this protogynous species. *M. monroi* also shows far greater phenological synchrony of within plant flowering than five other species of New Zealand *Myosotis* and this results in a much larger flowering display. Large floral displays while attracting pollinators, have the disadvantage of increasing chances for geitonogamous pollinations. It is hypothesized that the impact of a large floral display on levels of self pollination in *M. monroi* is alleviated to some degree by the relatively long, initial female-only phase. - *wednesday pm*

Is bigger better? Designing a stoat control tunnel

Samantha Brown¹, Cheryl O'Connor³, Ian Domigan¹ and Graham Hickling²

Environmental Management and Design Division¹, and the Department of Entomology and Animal Ecology², PO Box 84, Lincoln University, Canterbury, New Zealand.

Landcare Research³, P.O. Box 69, Lincoln University, Canterbury, New Zealand.

Stoats (*Mustela erminea*) are an introduced species to New Zealand that now pose a serious threat to many native bird species; particularly ground and hole nesting species that are ill equipped to deal with mammalian predators. Work is underway at Lincoln University to develop repeat-kill, permanent-set control devices for sustained control of stoats in indigenous forest. The aim of this study was to design a protective tunnel that would maximise the number of stoat encounters with the kill device, while minimising the risk to non-target species. We investigated the effects of diameter, length and end type on stoat entry behaviour into a variety of tunnel types. Diameter had no affect on initial entry behaviour or the furthest point reached in the tunnel. However diameter did affect repeat entry rate and subsequent behaviour in closed-ended tunnels. Longer tunnels (at 50mm diameter) appear to encourage more entries by stoats. Field trials have confirmed that wild stoats will enter 50mm diameter tunnels, regardless of end type. With no difference in initial entry behaviour, a small (50mm) closed-ended tunnel is likely to reduce non-target entries and position the stoat correctly for a humane kill with the new kill device. - *tuesday am*

Bush in the back-paddock: does it differ from intact native forest?

Bruce Burns¹, Mike Dodd², Merylyn Merrett¹, Ian Power², and Mark Smale¹,

¹Landcare Research New Zealand, Private Bag 3127, Hamilton, New Zealand

²AgResearch, Ruakura Research Centre, Private Bag 3123, Hamilton

Characteristic features of most New Zealand rural landscapes are small isolated patches of native forest surrounded by extensive pastoral grasslands. They represent an important reservoir of lowland biodiversity, and their improved management is one of the current foci of biodiversity conservation initiatives in New Zealand. We quantified the differences in plant composition and structure between forest remnants subject to >50 years of grazing and effects of adjacent pastoral management, and nearby intact forest at Whatawhata. The grazed forest remnants had significantly lower indigenous plant species richness than intact forest. Remnants had almost no indigenous palatable shrubs, terrestrial orchids, and those fern species that require consistently high humidities, e.g., *Hymenophyllum* species. The edges of the remnants differed most in composition from intact forest with pioneering species, e.g., *Kunzea ericoides*, and tree ferns dominant. Remnants also contained a large number of herbaceous adventive species. Structurally, remnants had lower canopy cover and basal area. Understories formed by shrubs and tree seedlings were almost absent from the forest remnants but attained moderate cover in the intact forest. Groundcover of the remnants was dominated by grasses, with less litter and more bare soil than intact forest. Restoration of these remnants should look to increase forest biomass, re-establish regeneration processes, and augment species diversity with those species likely to have been lost. -monday pm

Weeding an island

Colin Burrows

Department of Plant and Microbial Sciences, University of Canterbury

Since the ecological restoration project began on 85 ha Otamahua/Quail Island in 1998 a control plan for woody shrub weed species has been implemented. The first requirement is to cut off seed production by killing all adult target plants. Thereafter juveniles that develop each year from seeds stored in the soil are mopped up. Gorse and broom are sprayed with Tordon brush killer by DOC contractors. We remove the others: boneseed*, boxthorn, brier rose*, elderberry*, flowering currant*, hawthorn, by hand-pulling, or lopping/hand-sawing, with squirt bottle applications of Escort or Tordon on stumps. The only remaining adults (June 2001) are small numbers of boneseed and currant and a moderately large amount of boxthorn. The numbers of seed bank derived juveniles that appear each year are diminishing for the species marked*. The effort is by volunteer groups so it is relatively inexpensive, but very labour intensive.

Some young weedy trees that spread near our indigenous plantings: pines, cypress, ash, silver poplar, holm oak, deciduous oak, are also cleared. Herbaceous weeds: grasses, thistles and some others are removed as necessary on planting areas, mainly using Glyphosate. -monday pm

Stitchbirds - a sweet management challenge.

Isobel Castro, Richard Griffiths and Rosalie Stamp

Department of Conservation, Auckland Conservancy, Private Bag 68-908, Newton, Auckland

The stitchbird (*Notiomystis cincta*) or hihi is an endemic honeyeater of New Zealand. Dominated by tui (*Anthornis melanura*) and bellbirds (*Prosthemadera novaezeelandiae*), they feed on nectar, fruit and insects. This cavity nesting species breeds between September and March and produces up to three clutches each consisting of between three and five eggs.

Stitchbirds have monogamous and polygamous methods of mating and forced copulations have been observed. Once found throughout the North Island, stitchbirds were restricted to one population on Little Barrier Island. There are now three more translocated populations on Tiritiri Matangi, Kapiti and Mokoia Islands as well as a captive population at Mt Bruce. Techniques that have developed and behaviours that have been observed through the management of this species are described. - *wednesday pm*

Using molecular methods to study hybridization in New Zealand's native birds.

Geoffrey K. Chambers

Institute for Molecular Systematics, School of biological Sciences, Victoria University of Wellington, PO Box 600, Wellington.

Hybridization is the effective transfer of genetic material between groups or populations of organisms that would not ordinarily be expected to interbreed. The preceding definition has been made deliberately vague in order to embrace the widest range of biological circumstances. One may see at once that species concepts, their definitions and speciation processes are all important in recognizing hybridization as a set of authentic phenomena. In birds, sexual selection and volant lifestyle conspire to produce morphological variety in the advance of effective post-zygotic isolation mechanisms. This general progression of events in speciation leads to many opportunities for hybridization between otherwise well-established bird species.

Recent advances in molecular genetic analysis have provided ecologists with many tools that can be used to study the dynamics and/or consequences of hybridization among native taxa. In my presentation I will review comparative properties of these tools and their applications in two New Zealand case studies; stilts (*Himantopus* spp.) and parakeets (*Cyanoramphus* spp.) - *wednesday am*

Forbes' Parakeet or a Hybrid? Development of Genetic Markers for the Study of Hybridisation in *Cyanoramphus forbesi*

Chi-hang (Mathew) Chan¹, Charles D. Daugherty¹, Christine Reed², and Geoffrey K. Chambers¹

¹Institute for Molecular Systematics, School of Biological Sciences, Victoria University of Wellington, P.O. Box 600, Wellington, New Zealand. ²Wellington Conservancy, Department of Conservation, Bowen State Building, Bowen Street, P.O. Box 5086, Wellington, New Zealand.

Confined to Mangere and Little Mangere Islands in the Chathams group, Forbes' Parakeet (*Cyanoramphus forbesi*) numbers have declined due in part to hybridisation with the more common Chatham Island Red-Crowned Parakeet (*C. novaezealandiae chathamensis*). In recent years, a culling programme has eliminated most of the Red-Crowned Parakeets on Mangere Island, but the hybridisation process has continued. Hybrids between Forbes' Parakeet and Red-Crowned Parakeet are intermediate in physical appearance; the most noticeable difference being the pattern of red and yellow feathers on the crown. However, it is often difficult to spot a hybrid by crown colour alone. Further, we do not presently know to what extent crown morphology correlates with the genetic makeup of the birds. In our study, we are developing microsatellite markers to study population genetics of Forbes' Parakeet on

Mangere Island and for use in hybrid identification. The genetic data obtained will be of value for future management of the species. -wednesday am

***Hieracium pilosella* (mouse ear hawkweed): a national pest, an evolutionist's dream.**

Hazel Chapman.

Department of Plant and Microbial Sciences, University of Canterbury, Private Bag 4800, Christchurch

Hieracium pilosella is a successful alien invader, and is evolving in New Zealand at a rapid rate in terms of both population genetic signature, and breeding system. It is polyploid, and reproduces vegetatively and by both sexual and asexual seed.

We now know that the frequency of sexual reproduction varies among populations of *H. pilosella*, and that obligate sexuals have evolved in New Zealand. We know that most populations now comprise a mixture of ploidy levels, whereas once they were almost exclusively pentaploid. Most populations, although predominantly asexual, are highly variable.

This leads to evolutionary questions about:

- i. The maintenance value of sex
- ii. The role of hybridisation in invasion biology
- iii. Polyploid evolution and gene flow
- iv. Adaptation

We are using a combination of field and glasshouse experiments, molecular markers, herbarium specimens and flow cytometry to empirically address these questions, using *H. pilosella* as our model.

We are investigating 'why sex?' by a series of experiments testing current hypotheses, such as The Red Queen, Density Dependence and the Mutation hypothesis. The role of hybridisation in invasion biology is being tested using a combination of herbarium specimens, molecular markers and hybrid fitness experiments. -tuesday pm

Photoinhibition in sun and shade leaves of mangroves growing along salinity gradients in their natural habitats in south-east Australia.

Rochelle Christian^{1,2}, and Julian E. Ash¹.

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The extent of photoinhibition and photoprotection in sun and shade leaves of *Avicennia marina* and *Aegiceras corniculatum* were studied along an upriver salinity gradient. Reductions in the photochemical efficiency of photosystem II were evident. Depressions of F_v/F_m were greatest in sun leaves and leaves with north aspects. Midday reductions in F_{PSII} in high light environments were accompanied by reductions in q_p and F_v/F_m , and increases in nonphotochemical quenching (NPQ). Increases in the size, and decreases in the epoxidation state of the xanthophyll cycle pigment pool were associated with increases in NPQ and the occurrence of photoinhibition in high light environments. Steep leaf angles in high light environments appeared to be important in avoiding over-excitation. Diurnal patterns of depression of F_v/F_m differed for the two species: although the extent of midday photoinhibition was greater for *A. corniculatum* than *A. marina*, *A. marina* showed greater

long-term depressions than *A. corniculatum*. Greater midday reductions in F_{PSII} in *A. corniculatum* than *A. marina* were associated with lower q_p . Comparison of patterns of variation in the susceptibility to photoinhibition up and down the river with results from pot trials suggest the influence of factors other than salinity. -wednesday am

A saddleback population model with implications for reintroduction to the mainland

R. Scott Davidson¹ and Doug P. Armstrong²

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² Institute of Natural Resources (Ecology), Massey University, Private Bag 11222, Palmerston North, New Zealand.

The saddleback is an endangered endemic forest bird that only occurs on islands. In 1992 the saddleback was released on Mokoia Island to produce the only mainland population. We used the data collected from this population over its first five and a half years to construct a simulation model. We were able to estimate the population's vital rates at different densities, and the impact of an aerial brodifacoum poison drop on the population was observed. A sensitivity analysis of the population model indicated that the population was most susceptible to changes in juvenile survival.

We used the model to assess the viability of releasing saddleback onto the mainland. A mainland population of saddleback would have lower levels of survival and reproductive success than an island population as mainland reserves have not completely eradicated pest species. We looked at the effect that reducing these parameters had on the population. The population was less able sensitive to reduced reproductive success than to reduced survival. We looked at whether a saddleback population could survive an annual poisoning program where the baits were aerially distributed. This suggested that a saddleback population would not survive repeated poison drops. - monday pm

Palynological evidence of vegetation succession from Whangapoua estuary, Great Barrier Island, New Zealand.

Yanbin Deng, John Ogden, Mark Horrocks*, Sandra Anderson

School of Biological Sciences and *Centre for Archaeological Research, University of Auckland, Auckland, New Zealand

The concept of "succession" is central to ecological theory. However most long-term primary successions are inferred from spatial patterns (zonation) rather than direct observation. Whangapoua estuary provides an ideal situation in which to address whether the present spatial pattern of wetland and estuarine vegetation actually reflects the changes that have occurred through time.

Ordination results for species composition of vegetation plots sampled suggest six vegetation communities, along estuary to freshwater gradient from Mangrove (*Avicennia marina*) mudflats through *Juncus kraussii* sea rush, Oioi (*Apodasmia similis*) salt meadow, *Baumea* meadow, and Manuka (*Leptospermum scoparium*) shrubland to Raupo (*Typha orientalis*)/Cabbage tree (*Cordyline australis*) swamp forest.

Surface samples of pollen from the same plots show that the correlation between modern pollen and vegetation varied considerably between species. However, when tall wind-pollinated trees and exotic wind-pollinated grasses are excluded, five of the broad community

groupings are represented by their pollen spectra (except sea rush community). The fossil pollen and radiocarbon date results in the same area suggest the same sequence of vegetation communities, with the exception of the *Leptospermum* shrubland. Occurrence of this community in the spatial sequence is a consequence of human impact by deforestation. This widespread local burning in Whangapoua was between 600-200 yr B.P. - *wednesday am*

The good oil – Chemotype variability in New Zealand manuka

Malcolm Douglas¹, Nigel Perry², John van Klink², Bruce Smallfield¹ and Rosemary Anderson¹.

¹Crop & Food Research Institute, Private Bag 50034, Mosgiel

²Plant Extracts Research Unit, Crop & Food Research, PO Box 56, Dunedin.

A survey of the essential oil content and composition of New Zealand manuka (*Leptospermum scoparium*) included foliage from 84 sites and 252 individual plants. The average yield of steam-distilled manuka oil, based on a standard dried sample, was about 0.3% but ranged from <0.1% - 1.1%.

The levels of 48 chemical compounds were measured and wide plant to plant and/or site to site variations were found. Four major chemical types (chemotypes) can be identified:

1. monoterpene rich oils (i.e. the low molecular weight and volatile oils). This chemotype is regionally predominant in Northland, in Northwest Nelson and the West Coast.
2. sesquiterpene rich oils (i.e. higher molecular weight oils) are the predominant chemotype in most of New Zealand.
3. triketone enriched oils within the sesquiterpene rich oils. This bioactive chemotype is localized to the East Cape region, and to a lesser extent to the Marlborough Sounds.
4. monoterpene – sesquiterpene mixed oils, also present throughout New Zealand.

The reasons for these regional chemotypes are open to conjecture. The triketone enriched oils are sought for their antibiotic activity and it is important to note that these oils represent only a minor portion of the New Zealand manuka resource. - *wednesday pm*

Back to the future: 50 years of publishing in *New Zealand Journal of Ecology*

Richard Duncan, Chris Frampton, Hazel Gatehouse, Keith Barber, James Kemp, Jennie Lyall, Bede McCarthy, Keitha Monson, Conny Peters, Cynthia Roberts, Rachael Smith, Jane Tansell and Mike Watson.

Lincoln University, Lincoln.

We examine publishing trends in *New Zealand Journal of Ecology* over the last 50 years against a background of changes in the way ecological science is done in New Zealand. Broadly, changes in the way science is funded has led to greater emphasis on the applied outcomes of research, and larger teams of researchers working on bigger problems. In light of this, we examine trends in the number of authors/paper, the degree of inter-institutional collaboration, and acknowledgment of funding sources. We also examine trends in the basic design of ecological studies published in the Journal, and in the statistical techniques used to analyse those studies. We ask whether changes in the way ecological science is done in New Zealand has been associated with improvements in the way studies are designed and analysed. -*monday am*

The probability of island colonisation by mammals

Richard P. Duncan and David M. Forsyth

Ecology and Entomology Group, Lincoln University and Landcare Research, Lincoln

To identify features of islands that might influence their susceptibility to invasion, we analysed the outcome of historical introductions of six mammal species (cat, goat, pig, possum, rabbit and sheep) to 82 islands in the New Zealand archipelago. We determined how long populations had survived on islands to which they were introduced until the population became extinct naturally, was eradicated or until the last recorded visit confirming an extant population. We used failure-time analysis to identify factors predicting the length of time that populations survived on islands until natural extinction. The long-term survival of introduced populations was higher on islands at lower latitudes and islands that had been farmed, suggesting that colonisation success was enhanced in less extreme climates and in human-modified habitats. We found no evidence that island area, biotic interactions or differences among species affected the survival times of populations independent of the effects of latitude and habitat modification. - *tuesday pm*

Patterns of within-canopy photoinhibition match observed leaf loss in *Aristotelia serrata*.

Roger Dungan

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It has been observed that there are regionally consistent patterns of leaf loss in wineberry at regional scales, with greater leaf loss from exposed than from shaded parts of tree canopies, irrespective of local air temperature. This leaf loss may be due to the deleterious interactions of cold temperatures and bright sunlight experienced on frosty mornings by over-wintering leaves. To test this possibility, the photosynthetic efficiency (the ratio of variable to maximal chlorophyll fluorescence, F_v/F_m) of shaded and exposed leaves of a wineberry tree was measured over a range of conditions, and compared with leaf temperature and received light dose. On cold sunny days F_v/F_m of exposed leaves declined markedly, whereas shaded leaves were relatively unaffected. During a severe frost event F_v/F_m values took several days to recover, whereas on milder days ratios returned to their pre-dawn values by dusk. This suggests two mechanisms of F_v/F_m decline; light induced damage of photosynthetic apparatus, or diversion of light energy to biochemical pathways other than photosynthesis (e.g. the xanthophyll cycle). The role of these mechanisms may be elucidated by investigation of diurnal changes in xanthophyll pool sizes. - *wednesday am*

Using stress to our advantage: plant stress – insect performance interactions

Kylie Galway, Richard Duncan, Pauline Syrett, Rowan Emberson and Andy Sheppard

Ecology and Entomology, PO Box 84, Lincoln University

Are environmentally stressed plants beneficial or detrimental to insect herbivores? Improved

understanding between interactions of plant stress and insect herbivory may aid weed biological control programmes, by identifying host-plant environments most suited to the insect agents. The Plant Stress Hypothesis (PSH) predicts improved insect performance on stressed plants, while the Plant Vigour Hypothesis (PVH) and the Insect Performance Hypothesis (IPH) predict insect performance is dependent on insect feeding guild. To review these hypotheses, we analysed more than 200 studies on insect performance, from five insect feeding – guilds, under 12 stress types. Sap and leaf feeders tended to perform better on stressed hosts, while miners and gall formers performed better on non-stressed hosts, supporting the PVH. Insect performance was also influenced by stress type, being higher under reduced moisture, light and CO₂, increased soil nitrogen, and on younger plants. Insect feeding guilds also varied in their response to plant stress, depending on the type of stress encountered. Our results suggest these hypotheses are too simplistic. A more detailed understanding of the interactions between insect feeding guilds and stress types are required to resolve how the performance of insect herbivores varies on stressed host-plants. -
wednesday pm

The Trouble with Hybrids

Neil Gemmell

Department of Zoology, University of Canterbury

The issue of what to do with individuals of endangered and threatened taxa that show evidence of hybridisation is a long-standing one in conservation biology. At its heart resides a general uncertainty on how we define and identify species, which ultimately impacts on decisions about what we should be conserving. In this talk I will discuss some of the philosophical, practical and legislative problems that hybrids pose for conservation science. -
wednesday am

Monitoring stoat populations using DNA profiling and mark-recapture analysis

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Monitoring the relative abundance of pests in order to determine the effectiveness of pest control operations is an essential part of pest management. Estimating abundance using standard index methods can result in biased estimates. Using traditional mark-recapture methods can be expensive. An alternative approach for estimating animal abundance is to use DNA profiling, which offers the potential of being able to identify individuals in a population without having to physically capture and/or mark animals. Recent developments with the use of hypervariable DNA markers in combination with traditional statistical methods and novel tissue capture techniques offer new possibilities for the measurement of population and behavioural parameters. In particular, these methods offer new options for accurate estimation of population abundance of species that are especially difficult to estimate due to their habitat and behaviour, such as stoats. We have optimised six microsatellite loci for estimating genetic variability within and among stoat populations, and have developed techniques that enable DNA profiling of individuals using hair samples from the field. We will present results from analyses of population structure and variability of stoats in New Zealand, along with a discussion of how genetic tags can be used to estimate population parameters in animals. We

will also discuss the applicability of these methods for examining aspects of the mating behaviour and social structure of stoats. - *tuesday am*

Effect of marram density on katipo and *Latrodectus atritus* web construction and prey capture

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Recent surveys of New Zealand's dune systems have revealed a marked decline in katipo (*Latrodectus katipo*) and *L. atritus* abundance. Survey results suggest that the decline may be related to habitat modification. Katipo and *L. atritus* appear to favour dune regions characterised by sparse vegetation with high exposure to sunlight. Sites with these characteristics have decreased as a result of human development particularly, with the invasion of marram grass (*Ammophila arenaria*). Marram is very aggressive and out-competes most native dune vegetation. When established, it forms a dense swathe over dune systems in contrast to the sparse growth habit of native dune plants.

To determine why katipo and *L. atritus* appear unable to inhabit dense marram grass, laboratory reared adult females of both species were introduced to the centre of microcosms containing sparse and dense marram grass. Illumination and warmth were provided to one side of each microcosm and one prey item was released into each microcosm every two days. Spiders inhabiting microcosms were weighed prior to release, after one week and two weeks at the cessation of the experiment. Notes were made on the size and position of catching-webs constructed, the number of prey items snared and the position of the retreat.

Results revealed that katipo or *L. atritus* inhabiting sparse microcosms constructed more extensive catching-webs than those inhabiting dense microcosms and that all catching webs were built in open spaces generally in proximity to the nearest light or heat source. Spiders inhabiting sparse microcosms snared more prey items than those inhabiting dense microcosms, although no corresponding difference in weight was found. These results suggest that dense marram may not meet the structural requirements of katipo or *L. atritus* catching-webs. - *wednesday pm*

Herbivory by introduced mammals: A threat to native New Zealand broom?

Ingrid Grüner

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Herbivory by introduced mammals has been identified as a factor likely to cause the decline of many New Zealand indigenous plant species. The study focuses on the native New Zealand broom, *Carmichaelia*. Fourteen species within this genus are currently listed as naturally rare or threatened, and browse by introduced mammals has been suggested as a possible threat to several of these.

Using enclosure trials, the effects of browse on plant growth and reproductive activity were monitored for three species over a 16 months period (incl. 2 summers). The results suggest that browse does not immediately threaten the survival of individual plants, but poses a serious threat to the long-term persistence of a population by inhibiting seed production. The effect depends on the severity of browse, and on the specific morphology of the plants. The

fact that herbivores are present at a site does not necessarily mean that the plants will be subject to browse. - *tuesday pm*

Weed biocontrol agents as model invaders

Helen Harman¹, Jane Memmott² & Pauline Syrett¹

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²University of Bristol, United Kingdom

Whether the introduction of a particular species into a new environment will result in its establishment is difficult to predict due to the stochastic nature of colonisation and the vulnerability of small populations. Both theoretical studies and retrospective analyses of deliberate introductions predict that, in general, the probability of successful establishment and persistence is an increasing function of initial propagule size, although this effect is not always consistent. However, there have been few field tests designed to test factors believed important to establishment success. Biological control programmes allow controlled and well-replicated introductions to be made into new environments. Here, we show how releases of biological control agents for weeds in New Zealand have been used to better understand the invasion process. For both broom psyllids (*Arytainilla spartiophila*) and gorse thrips (*Sericothrips staphylinus*), replicated colonies of several sizes were released and monitored to determine how the initial release size affects the probability that an introduced population establishes and persists. Data on establishment failure due to site destruction were also obtained. These results can be used to design biocontrol release strategies that maximise the chance of overall establishment success, as well as lead to an improved understanding of the invasion process. - *tuesday pm*

Far-flung forest felines: habitat use by feral cats on Rakiura (Stewart Island).

Grant Harper

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Feral cats are the top exotic predator on Rakiura (Stewart Island). Mustelids are not present. As such they have probably had a substantial effect on the native fauna. They currently still have severe impacts on threatened birds like the southern NZ dotterel and the hoiho. As part of the management of the feral cat problem by the Department of Conservation, research on the habitat use of cats was carried out over the past two years in the Rakeahua valley. Twenty-three cats were caught but only seven provided more than 30 radio-fixes required for robust analysis. Mean home range sizes, assessed using the minimum convex polygon method, were the largest recorded for female cats (1109ha, n=3) and amongst the largest recorded for males (2083ha, n=4). Density in the Rakeahua valley is 0.2 cats/km². Only one desert site in central Australia has a lower recorded density. It is suggested that these large home ranges are a result of the low prey diversity, and particularly the lack of alternative prey during periods of low prey abundance. Cats also appear to prefer podocarp forest to other forest types, which is probably due to resting site selection. - *wednesday pm*

Small invaders – the conservation threat posed by Argentine ant and options for its containment and eradication

Richard Harris

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The Argentine ant (*Linepithema humile*) is a highly invasive, introduced species, capable of invading some native habitats, displacing other ant species, and altering the composition of invertebrate communities. Its current distribution in New Zealand spans mostly urban areas from Northland to Canterbury. However, of major conservation significance is its recent discovery on Tiritiri Matangi Island, a predator-free island reserve in the Hauraki Gulf. The potential New Zealand distribution of the Argentine ant was predicted using temperature and land cover data. Much of Northland and coastal North Island are high risk of establishment, while most of central and southern New Zealand is too cold. Indigenous scrub/low stature vegetation is the native habitat most at risk. Indigenous forest is unlikely to be invaded. Many offshore islands contain suitable habitat for establishment. Spread to areas outside urban development will be slow, as unassisted dispersal is only about 150 m/yr. Management practices need to be adopted to restrict the spread of Argentine ants to native ecosystems, particularly offshore islands, and tools developed to eradicate new infestations before they become widespread. An eradication strategy is being tested at three sites in New Zealand and I report on progress thus far. -tuesday pm

Five years of recovery of the threatened plant *Dactylanthus taylorii* - a review.

Avibhakta S Holzapfel¹ and Chris E. Ecroyd²

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²: Forest Research, Private Bag 3020, Rotorua

Dactylanthus taylorii is New Zealand's only native fully parasitic flowering plant. An endemic and ancient member of the New Zealand flora, it is particularly threatened through browsing by introduced mammals preventing fruit set. In 1995, the Department of Conservation (DOC) adopted a 5-year recovery plan guiding the species' management, which is overseen by a national recovery group. Through its implementation the number of known populations has increased from 40 to 81, of which 66 are actively managed. Fruit set has increased from zero to 30% at managed sites. Standardised monitoring has allowed protection measures to be assessed and adjusted. Formal research and findings by field staff have provided crucial information on the ecology of *D. taylorii*. Advocacy within DOC and the community has raised understanding of the species' situation and support for its management on private land. A national focus of species management reflects the reality of issues across administrative boundaries and relies on strong communication between all parties. A new set of objectives can now be developed following the findings of the review. While fruit set is achieved with ongoing management, recruitment has not yet been demonstrated and a change in threat status should not be made. -tuesday am

Residual sexual reproduction in facultative apomictic *Hieracium pilosella*: does the environment play a role in expression?

Gary Houlston and Hazel Chapman

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Apomictic populations of *H. pilosella* in New Zealand are known to produce a low frequency of seed via sexual reproduction. The rate of sexual reproduction has been determined by artificially pollinating *H. pilosella* growing under field conditions with the closely related, but morphologically distinct, *H. aurantiacum*. Resulting hybrids from the crosses indicate sexual events in predominantly apomictic populations. Considerable differences in frequency exist between sites, and some obligate sexual individuals have been discovered. The differential expression of apomixis between sites can be due to two factors; genotype and environment. This work attempts to quantify the magnitude of each factor, and to determine if any predictability via environment is possible. The research to date has concentrated on environmental factors, particularly for the period directly preceding pollination. Relationships have been found between the proportion of seed produced via sex, and the mean daily temperature and rainfall. Further research will attempt to investigate the influence of genotype and nutrient regime on the expression of apomixis. This may have important implications for the control of this species by both biological and conventional methods, as well as future application of genetic material from this species to the apomixis programme for cropping. - *tuesday pm*

Deer impacts on Kaimanawa beech forests.

Sean Husheer and Alastair Robertson
Ecology Department, Massey University.

Deer impacts on mountain, red and silver beech forest vegetation in the Kaimanawa Ecological District, central North Island, have been apparent for decades. In October 1998 aerial deer control was initiated in central Kaweka Forest Park by the Department of Conservation. Deer control was aimed at reducing browse pressure on mountain beech seedlings at sites where regeneration was being inhibited.

Paired deer exclosure plots were established between 1997 and 1999 to monitoring the effectiveness of deer control in comparison to areas where control was not undertaken. Analysis of mountain beech seedling growth rates from spring 1998 to spring 2000 provide strong evidence that once deer browse is completely removed seedling growth increases. There is also some evidence that aerial deer control operations have led to an improvement in seedling growth at unfenced sites. In contrast, increased commercial and recreational hunting has had no significant benefit.

Management activity has, to some extent, overlooked impacts on red and silver beech forest vegetation. Data from 57 permanent 20x20 m monitoring plots established in northern Kaimanawa Forest Park in 1979, re-measured in 1987 and 1999 have been analysed in this study. In addition, data from two 20x20 m paired exclosure plots, established in the 1980's has been analysed. Results show compositional shifts in the forest overstorey from deer palatable to unpalatable species. There is clear evidence that deer are inducing changes in red and silver beech forest composition. This problem needs to be addressed through intensive deer control. - *monday pm*

An unusual relationship between a colour polymorphism, body size and altitude in an alpine weta *Hemideina maori*

Ian G. Jamieson, Kerry R. Dowsett and Graham P. Wallis

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Ectotherms generally increase in body size with increasing altitude or latitude, which is associated with decreasing environmental temperature. Cooler temperatures cause animals to grow slower and mature later at a larger body size than those exposed to warmer temperatures. Ectothermic species that exhibit colour polymorphisms are also differentially affected by environmental temperature; dark morphs generally warm up more rapidly and attain higher body temperatures than paler individuals and hence are thought to gain fitness advantages in colder environments. In this study of a large colour polymorphic alpine insect, *Hemideina maori* or mountain stone weta, we found that body size increased with altitude for the yellow but not the black morph, which was significantly smaller than the yellow morph at similar elevations. Furthermore, we found the opposite pattern from what is expected for the altitudinal distribution of a melanic form in an alpine area. This unusual pattern may be consistent with new theories on the role of melanism as an antimicrobial in insects living in warmer environments. -wednesday pm

Interspecific hybridisation between Rape and Wild Turnip - Who acts as the go-between?

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Wild turnip (*Brassica rapa* ssp *sylvatica*) is one of the few naturalised or native species in the New Zealand flora that is closely related to crop species. Since rape (*Brassica napus*) is a common target for transgenic technology, there is a potential risk for accidental escape of transgenes into the New Zealand flora. Rape and wild turnip are capable of producing interspecific hybrids. Although 100% hybrid progeny can be produced upon hand pollination, interspecific hybrids are rarely found in the field. As a basis for improved risk assessment of the incidence of transgene introgression from rape to wild turnip, we investigated the relative importance of wind or insects as a vector for interspecific pollination. Five New Zealand populations of wild turnip and a rapid cycling non-transgenic rape, homozygous for a single dominant mutation conferring resistance to the herbicide chlorsulfuron were used in the trial. A twin glasshouse trial was conducted using either a fan to simulate wind or bees as pollination vectors. Rape and turnip plants in individual pots were planted at a 1:1 ratio. Hybrids among the progeny from wild turnip plants were identified using in vitro screening for seedling resistance to chlorsulfuron. Bee pollinated plants produced more seed, but wind pollination produced a greater proportion of hybrids. There were no differences in the proportion of hybrids produced by the different populations. - wednesday am

Resource allocation in *Nothofagus* - an IRA hypothesis.

Nod Kay

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Species-area relationships are the most enduring patterns in ecology. A corollary of this phenomenon is that species diversity, and hence trophic web complexity, can be expected to decrease with area. Resource allocation theory assumes that trade-offs in the investment to reproduction, growth and defence, are correlated to selection pressures determining population abundance. For plants, a high risk of herbivory may result in life-history strategies that allocate considerable resources to defence. Similarly herbivores may allocate resources to counter what is interpreted as top-down (parasitism/predation etc) and/or bottom-up (resource limitation) regulatory processes.

Natural fragmentation events offer an insight into evolutionary processes operating on remnant species occupying areas of different size. The breakup of the Gondwana continent effectively fragmented the metapopulation of *Nothofagus* (Nothofagaceae:Fagales), the dominant forest endemics of the Southern Hemisphere. It was found that the growth rate of the 'unassociated' Eurasian herbivore, *Lymantria dispar* (L.) (Lepidoptera: Lymantriidae), fed *Nothofagus* species, was proportional to the geographic range of its host, and, by inference, the trophic complexity within that range. The results support the prediction (NZ Ecol. Soc. Confr. 1999) that without 'top-down' regulation of herbivores in isolated ecosystems, plants will allocate resources to a 'bottom-up' herbivore deterrence. - *monday pm*

Do stoats harm mistletoes? -what's wrong with bird-plant mutualisms in New Zealand.

Dave Kelly (NZ Ecological Society Award recipient, 2000)

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Bird-plant mutualisms can be important to plants for pollination and seed dispersal, and to birds for food. The health of such mutualisms may serve as an indicator of adequate ecosystem functioning. Recent work suggests four generalisations for the New Zealand mainland: (1) all important native pollinating birds have declined, often markedly; (2) many native bird-pollinated plants are now suffering pollen limitation; (3) dispersal limitation is less common than pollen limitation; (4) food supply is less of a limit to bird numbers than predation. In a new test of these generalisations, we conducted predator control (stoats and possums) in one 400 ha catchment at Craigieburn where the native beech mistletoe *Peraxilla tetrapetala* has been pollen limited for at least 7 years due to a shortage of bellbirds (*Anthornis melanura*). We predicted that decreased predation would increase bellbird densities and thereby reduce pollen limitation in *P. tetrapetala* - a trophic cascade, rarely seen in terrestrial systems. The results suggest how large an area needs to be treated, and for how long, to show conservation gains from predator control. Finally I list a number of things that New Zealand animal ecologists should have been measuring for years, but apparently haven't been. - *monday am*

Conserving beech mistletoes on the West Coast.

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South Westland remains a stronghold for the nationally declining beech mistletoe *Peraxilla colensoi*. Sustained possum control with the protection of mistletoe as one goal has been occurring in South Westland for ten years. Mistletoe monitoring has been established at nine South Westland sites and one North Westland site, with the first monitoring established in 1990. For the last five years monitoring has been based on the Foliar Browse Index (FBI).

The relationship between mistletoe condition (foliage cover), forest type, and length of possum occupation was explored. In most cases, *P. colensoi* condition was better at beech forest sites than mixed beech-podocarp-hardwood forest sites. No clear relationship was apparent between the length of possum occupation and *P. colensoi* condition.

Under the standard possum control regime (5% Residual Trap Catch target) *P. colensoi* condition improved in the Landsborough Valley (pure beech forest) but continued to decline in the Windbag area (mixed beech-podocarp-hardwood forest). Mortality of tagged *P. colensoi* was 43% between 1990 and 1999 in the Windbag, and 11% between 1994 and 2000 in the Landsborough. Preliminary results are compared between a recently established 2% RTC target trial block, a site receiving the standard level of control, and a non-treatment site.
- *tuesday am*

Update on biodiversity strategy programmes on private land

Glen Lauder

Department of Conservation, Wellington

Do we have plant structural defences against large ratite browsers? Divarication revisited.

William G. Lee¹, William J. Bond², Gudrun Wells², Jo Wass², Deane Harder³ and Joe Craine¹
¹ Landcare Research, Private Bag 1930, Dunedin, New Zealand ² Botany Department, University of Cape Town, Private Bag, Rondebosch 7701, South Africa ³ Botany Department, University of Otago, Dunedin.

We provide evidence from experiments with modern ratites (emu and ostrich) that certain structural features of indigenous woody plant species reduce the impact of avian browsing, to the extent that birds are unable to meet their daily energy requirements. Feeding observations and biomechanical constraints on food handling and ingestion suggest that ratites rarely cut woody stems but feed primarily by plucking, stripping, and tugging at shoot and leaf material. Differences in food preferences amongst ratites appear to reflect variable tolerance of secondary compounds in different plant species. The main architectural defenses against large, toothless avian browsers are extensive narrow (<3mm diameter), strong (tensile strength >30Mpa) stems, small, widely spaced leaves, and structurally elastic branching patterns. These “wire plants” appear unique to New Zealand, and are broadly similar to filiramulata rather than divaricates, as traditionally defined. The defense is incompatible with mammal browsers, which can readily shear thin shoots with their teeth. However, a subset of “wire plants” which either have spines, or form dense hedge-canopies, or develop thick stems, may resist introduced mammalian browsers. Since European settlement these mammal-resistant forms have become increasingly common, but they are not distinctive to New Zealand, being widespread in countries with large indigenous mammals. - *wednesday am*

Not just a pretty face: bellbird vocal repertoire and the role of female song.

Ms Xiao Ling Li and Dr Dianne Brunton

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The bellbird (*Anthornis melanura*) is one of three extant New Zealand honeyeater species. Bellbirds are a monogamous, territorial passerine, and have evolved a sophisticated system of acoustic communication that is used in the context of both species and individual recognition. Song in passerines has traditionally been seen as an exclusively male activity, functioning in territoriality and mate attraction. During the breeding season, bellbird males perform the majority of the territorial defense. It is suggested that bellbird males sing and counter sing to space themselves in relation to one another. Female bellbirds also sing year-round at relatively high rates. Interestingly, both males and females defend independent territories during the non-breeding season. Hence, the song of female bellbirds is clearly performed independently of male song and provides a unique opportunity to test current theories of female song function. Significantly, there has been no published examination of the structure or function of female bellbird song. We present results of analysis of spectral parameters of male and female song. We found significant differences between the sexes and many variations of both male and female song within a single population on Tiritiri Matangi Island. The extent of geographic variation in bellbird song is also investigated. - *wednesday pm*

Origin, Evolution and Expansion of New Zealand's Indigenous Grasslands

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New Zealand's indigenous grasslands are globally distinctive. Among temperate grasslands they are unusual in having evolved in the absence of grazing mammals, in supporting extensive radiation of taxa, and in occurring in some bioclimatic zones normally occupied by forest. The conservation of these grasslands requires a better understanding of the evolutionary history of the dominant species, and the relation between species traits and responses to environmental change, including anthropogenic effects. Little is known about evolutionary relationships within New Zealand's indigenous grass taxa, while research examining species responses to factors such as fire and herbivory often lacks a comparative context. In this paper we introduce several hypotheses relating to the evolution of New Zealand's indigenous grasslands. We evaluate these hypotheses using the New Zealand species of two important grassland genera, one largely endemic (*Chionochloa*) and the other with a worldwide distribution (*Festuca*). We interpret the evolution and distribution of these indigenous species in the light of phylogenetic information and experimentally derived environmental response data. - *tuesday pm*

Phylogenetic networks for studying Late Tertiary - Quaternary plant radiations

Peter Lockhart

Institute of Molecular BioSciences, Massey University, Palmerston North

Species radiations, like intraspecific genealogies, can sometimes show complex patterns of phylogenetic relationship that are poorly described by bifurcating evolutionary tree models.

This appears to be particularly true when multi allelic sequence data are studied. An obvious alternative is to visualise phylogenetic relationships in terms of networks or reticulate graphs. However, a number of issues need to be addressed before networks will become a useful general tool in studies of species diversification. An introduction to network ideas and issues concerning their implementation is presented with reference to the New Zealand flora. - *wednesday am*

Do we know enough about beech forests to manage them for the conservation of their indigenous biodiversity, or the bits we like?

Matt Maitland and Dave Butler

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Beech forests in their different types make up a large proportion of New Zealand's remaining indigenous forest. They are managed through a continuum from legal protection, single-species pest management, single-species protection programmes, to intensive multi-species pest control aiming for a benefit towards the ecosystem level. The knowledge upon which this management is based stems from pure research, adaptive management, modelling, and the application of ecological principles. Using the Rotoiti Nature Recovery Project as an example, we examine what knowledge we have and how it is applied, what we know, what we do not know, and how we intend to fill some of the gaps. Positive responses at the native species population level are already very evident after just a few years of the Recovery Project. - *monday pm*

Greenhouse climate change and the evolutionary future of the New Zealand biota

Matt McGlone

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Greenhouse gas-induced climate change is now widely accepted to be underway. A great deal of effort has gone into predicting its consequences, and biodiversity implications are widely discussed. However, accurate ecological prediction of climate change impacts are well beyond our capabilities, either now or in the foreseeable future. We should instead be focussing on the wider, longer-term picture to derive stable, consensus strategies as to what actions are necessary to maintain an evolutionary future for our biota. Key climate-related considerations to be taken into account are: (1) future climates will not resemble any experienced over recent evolutionary time; (2) the likelihood of an extreme warm event lasting several hundred years; (3) the Earth is unlikely to revert to a cooler state than now for the next 50 000 years, and probably will remain in a warm state indefinitely. - *tuesday am*

Links between the terrestrial and aquatic components of beech forest ecosystems

Angus R. McIntosh, Per Nyström and Michael J. Winterbourn

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The full extent of links between aquatic and terrestrial ecosystems are only beginning to be appreciated. Allochthonous materials like leaves, wood and dissolved carbon are important energy sources for beech forest streams, particularly those where the canopy reduces light and limits autochthonous production. A few specialised consumers like the caddisfly *Zelandopsyche ingens* use beech leaves for food and case construction. More dramatic influences of the forest on streams are conceivable. For example, mice plagues may allow trout to grow particularly large in small forest streams. The flow of energy from streams to the terrestrial system is much less well studied. Birds and spiders, for example, are likely to consume large quantities of adult aquatic invertebrates. Stream invertebrate populations could also be limited by processes occurring in the terrestrial environment if the survival and dispersal of the winged adult stages are affected. For example, if adult *Z. ingens* only fly through forested areas, forest fragmentation could hinder dispersal between streams. Thus, while the flow of energy from forests to streams is well documented, there is still much to learn about energy flows in the opposite direction and other links between the terrestrial and aquatic components of beech forests. - *monday pm*

Dispelling a myth: large seeds do not suffer higher levels of pre- or post-dispersal seed predation than small seeds.

Angela Moles and Mark Westoby

Department of Biological Sciences, Macquarie University, Sydney, AUSTRALIA

Ecologists have often stated that they expect species with big seeds to suffer higher rates of seed predation than species with small seeds. In order to test this hypothesis, we gathered pre-dispersal seed predation data for 170 Australian species, and post-dispersal seed removal data for 100 Australian species. These species came from an arid environment, a sub-alpine environment and a temperate coastal environment. We also gathered data from the published literature on pre-dispersal seed predation for 140 species and on post-dispersal seed removal for 215 species. We found no relationship between seed mass and pre-dispersal seed predation using either cross-species analyses or phylogenetic regressions in any of the vegetation types, or in the compilation of data from the literature. However, there was a weak, negative correlation between post-dispersal seed removal and seed mass in the compilation of data from the literature and at two of three field sites in Australia. - *wednesday am*

Inter- and intra-specific hybridisation and hybrid zones in weta

Mary Morgan-Richards

University of Canterbury

Some hybrid zones may form barriers to the dispersal of species such as the hybridization between common and rare species (*H. femorata* and *H. ricta*). Other hybrid zones are semi-permeable allowing the introgression of alleles from one population into another such as the hybridization of chromosome races (*H. thoracica*). I will discuss the implications of different hybridisation scenarios in weta. - *wednesday am*

Introduced predators, birds & bats - unravelling an unnatural relationship

Elaine Murphy, Peter Dilks & Colin O'Donnell

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In New Zealand beech forests, huge production of seeds occurs irregularly in a phenomenon known as a mast seeding. Beech seeds are a highly nutritious food source to both introduced and native species. The introduced house mouse, normally at low densities, can become numerous during mast years, as can stoats - the most common (and sometimes the only) mammalian carnivore present. This has led to the perception that it is the increase in mouse numbers which leads to the increase in stoats, and when mouse numbers decline, stoats switch to eating birds. However, diet studies show that the number of birds eaten per stoat varies little with mouse abundance - birds are always a major prey item. The fact that mice are not the only prey of stoats to increase following a seedfall is often overlooked. It seems more likely that increases in mouse, bird and invertebrate densities all contribute to the high productivity of stoats in the year following a seedfall. The resulting increase in predation impacts on numerous taxa including kaka, kiwi, mohua, kakariki and long-tailed bats. Recently, a new player has also entered the beech forest scene. Unusual climatic conditions have led to two mast years in a row and an explosion in both rat and stoat numbers, with dire consequences for a number of native species. Just when we thought we were starting to understand the system.... - *monday pm*

Forty-five years of change in Canterbury alpine grasslands: is *Hieracium* spreading?

Claire L. Newell

Landcare Research, PO Box 69, Lincoln.

Our understanding of introduced plant invasion in eastern South Island tussock grasslands is mostly based on short-tussock grasslands. Plant invasion in alpine grasslands has largely been understudied, although these grasslands represent much of the indigenous non-woody vegetation managed as conservation land. Anecdotal evidence suggests *Hieracium*, a major short-tussock grassland invader, may threaten alpine grasslands. This study used long-term data to determine whether *Hieracium* presence, frequency, and distribution have increased over 45 years in Harper-Avoca *Chionochloa*-dominated alpine grasslands. I used data from 41 permanently-located transects, measured at 6 time-intervals (1955-2000). *Hieracium lepidulum* and *H. pilosella* were first recorded in 1965, and *H. praealtum/caespitosum* in 1980. From 1980 to 2000 the proportion of transects with *H. lepidulum* doubled (17 to 34%), while *H. pilosella* increased five-fold (5 to 27%). Over this period *H. pilosella* frequency per transect remained constant (<10% of rings/transect), whereas *H. lepidulum* increased (5 to 42% of rings in one transect). *Hieracium* altitudinal-distribution also changed with the upper-altitudinal limit rising from 1300 m (1965), to 1600 m (2000) for *H. pilosella* and from 1300 m (1965) to 1820 m (2000) for *H. lepidulum*. These results provide long-term quantitative evidence of expanding *Hieracium* presence in Harper-Avoca alpine grasslands. - *tuesday pm*

Delayed self-pollination in poroporo, *Solanum laciniatum*, in New Zealand.

Linda Newstrom and Josephine Ward

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Like many New Zealand plants, poroporo (*Solanum laciniatum* in the Solanaceae), probably arrived in New Zealand by long-distance bird dispersal from Australia. Its large purple flowers stand out among the New Zealand flowers which are mostly small, white or pale, and inconspicuous. Poroporo flowers are adapted for buzz-pollination in which specialised insects shake the pollen out of terminal pores in the anthers. No native pollinators in New Zealand are known to be capable of buzz-pollination. In spite of this, poroporo has been a successful colonising species on disturbed sites in New Zealand. Thus, the reproductive strategy of poroporo needs to accommodate (a) potentially low rates of effective pollination (no buzz-pollinators) and (b) repeated founder events (small populations or single plants). We have found evidence that a delayed self-pollination mechanism may contribute to poroporo's success. This reproductive strategy provides opportunities for pollinator-mediated outcrossing preceding pollinator-independent selfing mechanisms. We predict that such mechanisms for reproductive assurance will be common in the New Zealand flora because many plants arriving by long-distance dispersal may not have their most effective pollinators present, especially since the diversity of pollinators in New Zealand is low. In addition, these strategies are an advantage for indigenous or immigrant species of any temperate oceanic island because changeable weather frequently prevents pollinator flight in any season of the year. - *wednesday pm*

Behavioural changes in incubating Southern Crested Grebe (*Podiceps cristatus australis*) during periods of recreational activity.

Glen Newton

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Increased recreational use of Lake Pearson, an important breeding site of the rare Southern Crested Grebe (*Podiceps cristatus australis*), has raised concern that the long-term viability of the grebe population there may be at risk. Numbers of Crested Grebe in New Zealand are low (250-300), and since grebe are specialised entirely to aquatic ecosystems, they are vulnerable to changes occurring in these systems. Incubating grebe in this study showed reduced time on the nest on days with powercraft (95.9%) compared to days without powercraft (99.2%). This was the result of the grebe departing their nests more frequently and spending longer periods off their nest when disturbed. However, the increased frequency of nest departure was not enough to reduce the observed incubation spells of the grebe. Grebe that frequently departed their nest had reduced nesting success, possibly through predators being alerted to their nest-sites. Variable response among the grebe observed was potentially the result of differing environmental, recreational and learned factors. - *wednesday pm*

Changing Scenes in the Ecological Theatre - Great Barrier Island.

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Pre-human climate change caused continuous but mostly gradual shifts in geomorphology and vegetation in New Zealand. The vegetation, geomorphic and human history of Great Barrier Island will be reviewed as a microcosm of New Zealand. I will emphasise the coastal changes consequent on sea level changes. The evolution of Kaitoke swamp and the adjacent dunes indicates that the biota must adapt to continuous change as landform units of different ages are juxtaposed. By c. 6000 BP Holocene climates and sea-levels had stabilised, but ecosystem shifts continued. About 2000 years ago the pace of change may have quickened, and by 650 BP it was undoubtedly racing. Maori, largely through the use of fire, re-set the scenery, with far-reaching consequences for the biota. The rapid infilling of the Whangapoua harbour in post-Maori times will be illustrated. Europeans brought a large new cast. Continuous demographic shifts and global climate change imply new scenery in future. - *tuesday am*

Linking plant traits to competitive ability using structural equation modelling.

Duane A. Peltzer and David A. Wardle.

Landcare Research, P.O. Box 69, Lincoln New Zealand

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An unresolved issue in ecology is what characteristics or traits of plant species can be used to predict their competitive or facilitative abilities. Several authors have predicted which plant traits should be linked to success in interspecific interactions, but few studies to date have explicitly tested the predicted linkages between plant traits and success in interspecific interactions. Here, we use a path analytic approach on a species x trait matrix of 20 herbaceous species x 14 plant traits (Wardle et al. 1998) to test various predictions about which traits should confer competitive or facilitative abilities of plants. Data used for this project are drawn from a study quantifying ecophysiological characteristics of 20 herbaceous dicotyledonous plants from New Zealand grasslands. Responses of the 20 plant species to the presence of a common species of grass, *Lolium perenne*, were generally improved by increased time to reproduction and were negatively related to root length to weight ratios, suggesting that plants having fine roots were more strongly suppressed by *Lolium*. In a second experiment in which the effects of the 20 species on *Lolium* performance were examined, suppression of *Lolium* was driven by high tissue N concentrations in rosette plants, high root length to weight ratios for flowering plants, and shoot morphology for senescing plants. Allocation of nutrients to reproductive structures reduced the suppressive effects of plants on *Lolium* during flowering, but increased their effects after senescence, suggesting that different plant traits may be important in interspecific interactions throughout a plant's life history. Taken together, these results support the idea that traits related to resource capture confer the ability to suppress neighbors whereas traits relating to the persistence or longevity of plant tissues allow plants to avoid suppression by neighbours. -*wednesday pm*

Total reproductive failure in an undisturbed population of stoats

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In the Grebe and Borland Valleys, southern Fiordland, we documented a very large post-seedfall peak in mouse populations (62, 88 C/100TN) in the summer of 1999/2000, followed by a virtually complete disappearance of mice (0, <1 C/100TN) by December 2001.

Stoat traps set in the two valleys for the first time in many years over 12 days in December and 12 in January collected a total of 75 stoats, all adults. The total absence of any young stoats in this large sample suggests complete reproductive failure in a local population of stoats unaffected by any recent management, following a steep decline in density of mice over the spring, the critical period for breeding female stoats.

These results extend a previously published correlation between November mouse density and stoat productivity (King 1981), derived from cropped populations in northern Fiordland. They suggest that the density index of young stoats in a summer sample is determined more by the breeding success of the previous season than by trapping history. By contrast, trapping history is much more likely to affect the age structure of adults. -*tuesday am*

Mistletoe recovery planning in New Zealand.

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An increasing concern regarding the decline of New Zealand's loranthaceous mistletoes has highlighted the need for a focused conservation effort. A recovery group that includes managers and researchers has been formed. The recovery plan for the six species of mistletoe in the family Loranthaceae will soon be published. The long term goal of this plan is that "by 2100 populations of all extant loranthaceous mistletoes are restored and self-sustaining in the wild, throughout their known historic ranges."

Over the past 10 years there has been a rapid advance in our knowledge of mistletoe threats, ecology and management needs. Possum control is the main form of management currently undertaken to protect mistletoe. Predator control to protect avian pollinators and dispersers is another important form of management. Research undertaken has provided the basis for many of the mistletoe recovery plan actions proposed in the plan. Presented in this talk are the six objectives designed to achieve this goal. A focus of the plan is managing mistletoe at selected sites and monitoring to determine the effectiveness of management. Key criteria for site selection include, the presence of viable mistletoe populations, and control of possum at a site. An initial national list of 77 mistletoe management sites is analysed. A case study of mistletoe site selection in Southland demonstrates the potential to be proactive and save populations. With the application of recovery planning and appropriate management, mistletoes will continue to be represented throughout their natural range. - *tuesday am*

It's the quality not the quantity....pollinator declines and inbreeding depression in tree fuchsia and kowhai

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Recently we showed that the gynodioecious tree fuchsia (*Fuchsia excorticata*) was pollen limited at several mainland sites in both islands of New Zealand, consistent with a reduced abundance of its main pollinators the tui and the bellbird at these sites. We also showed that female plants suffered most from pollen limitation and that some hermaphrodites were able to compensate for reduced pollinator visitation by within-flower autonomous self-pollination. These observations suggest that there is likely to have been a shift within mainland fuchsia populations towards a higher proportion of selfed rather than outcrossed seeds. The inbreeding depression that may result from such a change may have important consequences for the local persistence of the species. Here we explore the possible consequences of this shift in the quality of seed by examining the fitness of selfed and outcrossed seed in a glasshouse trial with fruits from two South Island sites. We will also present some data from three South Island sites of kowhai (*Sophora* sp) – a bird-pollinated plant that also appears to be suffering from reduced pollinator availability. -wednesday pm

Island Biogeography and the Distribution of Introduced Mammals on New Zealand Offshore Islands

James Russell, Mick Clout, Brian McArdle and Sam Ferreira*

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Introduced mammals are New Zealand's youngest discrete taxa, all but one having arrived just over two centuries ago (the kiore recorded over 1000 years ago). They provide a unique opportunity to examine the colonisation of offshore islands by interacting invasive species within a whole class, over short-term (ecological) time scales. More confounding, long-term (geological) time scale effects such as species radiation can thus be considered superfluous. My research aims to investigate and explain the current distribution of introduced mammals via a suite of variables. Such *a priori* hypothesised variables include physical and environmental characteristics (geology/ geography/), ecosystem diversity measurements and anthropological historical variables. For my study over 20 variables were selected which were suspected to varying degrees of influencing the occurrence of mammal species and assemblages on New Zealand offshore islands larger than 5ha. Using statistical regression I was then able to separate out the explanatory variables which had the most influence on the response variable (presence/absence of mammal species), and also investigate interactions and correlations between such variables. Although still in progress, I shall present early findings from my work and discuss how they may affect future research and management opportunities pertaining to offshore islands. - tuesday pm

Land cover changes and wildlife habitat changes in two watersheds in Michigan, USA

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Human modification of the landscape typically reduces and fragments wildlife habitats. However, the extent of those changes is often poorly known. Therefore we quantified changes to wildlife habitats from the 1800's to the 1990's in two watersheds in Michigan (USA) that have changed markedly since European settlement. The Black River watershed underwent extensive timber harvesting from the mid-1800's to the early 1900's. Subsequently, timber harvest rates declined, and forests began to regenerate. However, forest age and composition changed dramatically. In contrast, the Huron River watershed underwent extensive conversion from mostly forest (70%) to mostly agriculture (55%) from the early 1800's to the late 1930's. From the 1930's to the 1990's, urban areas expanded due to loss of agricultural land. For wildlife habitats, results were mixed. Potential habitat area increased or decreased for different species, while mean patch size of potential habitat decreased for most species. The good news is that both watersheds retain 90% of their original species. The bad news is that population trends for most species are unknown. Assessing future viability for most species in these modified landscapes will require research to determine population trends and to relate those trends to landscape information measurable at broad scales. - *tuesday pm*

The impact of freshwater invaders on nutrient cycling in streams: can individual taxa control ecosystem processes?

Kevin Simon and Colin Townsend

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Nutrient cycling in streams is balanced between the competing forces of downstream transport in the water column and retention by organisms on the streambed. It is not clear if individual taxa can control this balance between transport and retention. We are using invasive brown trout to study the influence of individual taxa on nutrient cycling. Invading trout trigger a trophic cascade by reducing invertebrate grazing, which results in increased algal biomass on the streambed. We predicted this trophic cascade would cause increased nutrient retention in trout streams as compared to streams with native fish. To test our prediction, we used short-term nutrient and conservative tracer injections, and long-term stable isotope releases in multiple reaches of 2 tussock grassland streams: one with native fish and one with brown trout. These streams were small, had low nitrogen and phosphorus levels, and were nitrogen-limited. Results from short-term injections generally indicate nitrogen retention was greater in the trout stream than in the galaxiid stream. Preliminary results from isotope releases also show the trout stream was more nitrogen retentive than the galaxiid stream. Our results suggest that individual taxa may control nutrient cycling by determining the productivity of primary producers in streams. - *tuesday pm*

Can trapping stoats in valley floors of beech forest protect takahe nesting in alpine-tussock habitat?

Des Smith and Ian Jamieson

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Most of the ecological research on stoats (*Mustela erminea*) in New Zealand has been confined to lowland forests, with little emphasis on alpine regions. The Department of Conservation plans to implement a stoat control program in Fiordland to protect breeding takahe (*Porphyrio hochstetteri*), which nest above the treeline in the alpine/tussock zone, by trapping a network of adjacent valley floors in beech forest. The objective of this study was to determine the effectiveness of such a trapping regime. Three kilometers of valley floor in beech forest and three kilometers of adjacent alpine tussock habitat in the Ettrick Burn, Murchison Mountains were live-trapped from December 2000 to March 2001, and stoats caught were radio collared. Tracking tunnels were used as an additional measure of stoat abundance in the study area, and in two nearby sites. In all three sites, tracking tunnel indices were higher for the valley floor than the alpine habitat. Thirteen stoats were caught in the valley floor and five in the alpine zone. Fifteen radio-tagged stoats were tracked over the study period and no stoats moved between the two habitat types. Stoats are in higher numbers in beech forest valley floors compared to alpine areas, but the relatively few stoats in alpine areas appear to be resident (during the summer). Therefore, we suggest that trapping a network of valley floors is unlikely to protect nesting takahe, and other native species inhabiting the alpine zone. - *tuesday am*

Nowhere to run: Distribution, ecology and conservation of the forget-me-not *Myosotis petiolata* var. *pansa*

Rebecca Stanley

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Myosotis petiolata var. *pansa* is endemic to the western coast of the North Island of New Zealand. There are no previous studies of any kind on this species listed as threatened. This study set out to quantify the habitat requirements and autecology of *M. petiolata* var. *pansa* and potential threats to its existence. Five broad locations are identified. Habitat assessment reveals this is a species of shaded, wet and intermittently disturbed sites in coastal shrubland. Exotic plants are identified as a threat especially in open and disturbed sites. The pollination biology is investigated in the Waitakere Ranges populations and *M. petiolata* var. *pansa* is shown to be autogamous and self-compatible but favouring out-crossing. The effects of habitat fragmentation on the distribution, abundance and ecological relationships of *M. petiolata* var. *pansa* are assessed and concern is expressed that competition from exotic plants, and lack of dispersal to suitable sites, may affect the persistence of this taxon. - *wednesday pm*

Predicted impact of insect biological control agents on *Hieracium pilosella*

Pauline Syrett, Lindsay Smith, Colin Meurk and Trevor Partridge

Landcare Research, Lincoln

Two insect species have been released for biological control of *Hieracium pilosella* in New Zealand, and three more await approval for release from ERMA. A gall wasp, *Aulacidea subterminalis*, develops in stolon tips producing a cluster of galls that divert nutrients from plant growth to larval development. Larvae of the plume moth, *Oxyptilus pilosellae*, feed in the crown of the rosette plant, often destroying the growing point. The fly, *Macrolabis pilosellae*, galls the leaves of *H. pilosella* and completes several generations per year. Two

hover flies, *Cheilosia urbana*, and *C. psilophthalma*, feed in the roots and crown of the plants respectively. The impact of these five insects, which attack different parts of the target plant, and are also likely to complement each other by responding differentially to environmental conditions, is being simulated by weed removal trials in which small areas of *H. pilosella* have been suppressed with herbicide. Vegetation responses have been monitored at three sites and, after an initial expected increase in litter and bare-ground, increases in both indigenous and exotic vegetation have been recorded. -tuesday pm

When you can't see the stream for the trees: effects of riparian harvesting on stream communities.

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Effects of clear cutting of riparian plantation forests on stream communities were assessed in a study of six streams. At each stream on three occasions covering the period before and after harvest, physical and chemical characteristics were measured and food webs were described. My aim was to assess the effects of riparian clear cutting on the physical structure of the stream, the food resources that are available to the invertebrate community, and the biomass and functional organisation of the invertebrate community. There were profound effects of harvesting on all streams, but the nature of the effects depended on stream factors and the method of harvesting. The fate of organic matter left after harvesting (either submerged or suspended above the stream) had important impacts on changes in in-stream conditions. Differences in riparian characteristics and harvesting techniques had important implications for the magnitude of the change seen in the stream communities. - tuesday pm

Opossums to Possums: changing perceptions of a New Zealand Mammal

Hugh Tyndale-Biscoe

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For the first 80 years after possums were introduced to New Zealand they were perceived as a benefit to the country, by providing a source of income and enlivening the forests with an engaging species. There may also have been an unspoken assumption that a lowly marsupial species would be unlikely ever to pose a threat to the country.

The rate of reproduction of the possum is low by comparison with rabbits but their longer life span and sufficient time has changed the equation dramatically. Whereas the rabbit was perceived to be a serious pest of agriculture within a few decades of its release in New Zealand, it took much longer for anyone to recognise the potential danger of the possum. In 1951 the rabbit was the number one pest species in New Zealand and the red deer a close second. Now, 50 years later, rabbits and red deer are of minor significance and the possum is universally considered to be New Zealand's most serious pest species. Of all the mammals introduced to New Zealand it has the widest distribution, occupying almost all natural habitats from the sea coast to alpine scrub and in plantation forests, farmland and suburban gardens. By contrast, in mainland Australia the possum is becoming an endangered species, especially in the semi-arid and arid regions of the continent. Perhaps in another 50 years the possum will be perceived in New Zealand to be a useful species that attracts Australian tourists to see their iconic species in the wild.

In 1950 the only information on Australasian marsupials was anatomy, systematics and a little on development. No studies had been published on the ecology, behaviour, physiology or reproduction of any species, either in Australia or New Zealand. In the intervening years there has been a huge growth in all these fields and even the systematics of marsupials is on much firmer ground than it was then. The studies on the ecology of the possum, begun by Ralph Kean and Les Pracy, near Wellington, were contemporaneous with the first study of an American marsupial in California. The continuation of their study by others to the present day constitutes by far the most comprehensive long term study of any species of marsupial, elegantly summarised in Bob Brockie's book *A living New Zealand forest*. While New Zealand scientists led the way in large scale ecological studies on the possum, Australian research initially placed more emphasis on comparative physiology of the great variety of arboreal marsupials that inhabit the continent. One important outcome of the Australian work has been an understanding of the evolution of arboreal herbivory, especially of the leaves and other products of eucalypts. At least three separate lines of marsupials evolved to exploit the leaves of eucalypts and probably as many other lines evolved to use the exudates and saps of these dominant tree species. At the same time the eucalypts evolved an array of defence mechanisms in response to this.

The story of the possum in New Zealand forests can be viewed as the latest interaction of an arboreal marsupial and a forest ecosystem, comparable to those that occurred in Australia during the Miocene and later times as eucalypts replaced rainforest. But it is being played out so fast that it offers unique opportunities for study of an evolving arms race. While New Zealand research is pre-occupied with finding ways to reverse the effects of possums on the forest there is the larger and unique opportunity to follow evolution in action, as Frank Fenner did with rabbits and myxomatosis in Australia. There are indications in the recent book, *The Brushtail Possum*, that some New Zealand scientists are questioning the efficacy of widespread control by aerial poisoning, and others are finding the first evidence of the response of the forest to the arboreal herbivore that is now a permanent part of New Zealand's biota. - *monday am*

Why did the possum cross the road? Habitat selection in a terrace beech forest.

Erik van Eyndhoven.

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Previous possum diet studies have indicated definite selective feeding behaviour. It is postulated that their habitat utilisation patterns reflect the distribution of key palatable species. In this study, twelve radio-collared brushtail possum were telemetered over a ten-month period. The study forest could be considered as structurally heterogeneous, but spatially heterogeneous with respect to key palatable species. Radio telemetry, vegetation and habitat classification data were manipulated in a G.I.S. environment. Habitat selection, examined with compositional analysis, indicated that possums were utilising the forest in a non-random fashion. The degree to which selection was occurring is dependent on the habitat classification system used. There is strong evidence for the existence of utilisation guilds, as no firm trends for habitat preference were found. These results suggest that possum control or monitoring operations in similar forest types will need to address the forest as a whole, as opposed to only targeting areas of abundant preferred food species, in order to encapsulate all possum guilds. - *wednesday pm*

Hybridisation and speciation in reef corals of the genus *Acropora*: a molecular genetic approach

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Acropora is one of the world's most widespread genera of scleractinian coral, spanning the Indian and Pacific Oceans and the Caribbean Sea. It is also the largest extant reef-building coral genus: recent revisions of the genus recognise 113 - 180 *Acropora* species, only three of which occur in the Caribbean. Up to 70 *Acropora* species can occur sympatrically on Indo-Pacific coral reefs and most of these participate in the annual coral mass-spawning event. This creates an unparalleled opportunity for interspecific hybridisation and introgression. High levels of interspecific fertilisation in experimental breeding trials indicate that hybridisation is possible and may lead to a reticulate evolutionary history of many species in the genus. We have applied both phylogenetic and population genetic approaches to examine species boundaries and reticulate evolution in the genus *Acropora*. Our data suggest that in the Indo-Pacific interspecific hybridisation is important on an evolutionary time scale, but probably does not occur frequently enough to cause the complete merging of species. Molecular analyses on the three Caribbean species suggest that *Acropora prolifera* has arisen through hybridisation between its only other two Caribbean congeners. It is currently unknown whether reticulate speciation has occurred in the Indo-Pacific. - *wednesday am*

Species richness, environmental correlates, and spatial scale: a test using South African birds

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Energy and habitat heterogeneity play important roles in generating spatial variation in species richness, though few investigations have sought to determine simultaneously the relative influences of these variables. Here, we use the South African avifauna to examine the extent to which species richness is related to these variables, and how these relationships depend on spatial grain. Taking spatial autocorrelation and area effects into account, we find that primary productivity, precipitation, absolute minimum temperature, and, at coarser resolutions, habitat heterogeneity account for most of the variation in species richness. Species richness and productivity are positively related, whereas the relationship between potential evapotranspiration (PET) and richness is unimodal. This is due largely to the constraining effects of low rainfall on productivity in high PET areas. The increase in the importance of vegetation heterogeneity as an explanatory variable is due largely to an increase in the range of vegetation heterogeneity included at coarse resolutions, and the positive effects of environmental heterogeneity on species richness. Our findings demonstrate that biodiversity patterns are likely to be generated by several mechanisms, that spatial resolution and extent must be taken into account during investigation of the latter, and that surrogate measures for productivity should be interpreted cautiously. - *tuesday pm*

Counting frogs croak: disease and mortality of wild bell frogs.

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Populations of many amphibians around the world have undergone severe declines or have disappeared entirely since the late 1980s. Three years ago, a newly discovered chytrid fungus *Batrachochytrium dendrobatidis* was found infecting keratinised tissues of dying wild frogs in Australia and Central America. During the summer of 1999/2000, we found sick and dying southern bell frogs, *Litoria raniformis*, infected by this fungus in a wild population near Christchurch. The epizootic appeared limited in extent and duration, affecting only 16 individuals during a two-week period. Despite intensive monitoring, no additional morbidity or mortality was detected among the hundreds of adults remaining in the pond. However, as the pond began to dry up, large numbers of sick metamorphosing tadpoles were discovered. Around the pond, many dead and dying metamorphs, infected by chytrids, were found under rocks. Few frogs returned to breed during the following summer. Because the pond serves as a source of animals for the pet trade, chytrid fungus may be inadvertently being spread throughout New Zealand and possibly overseas. We now have identified incidents of chytrid infection and mortality of metamorphs at several Canterbury localities in which translocations of tadpoles are known to have occurred from the initially identified pond. - *wednesday pm*

Where do we draw the lines in conserving species? A case study from galaxiids

Graham Wallis

Zoology, University of Otago

Through our mtDNA analysis, we have now resolved at least ten distinct lineages of *Galaxias vulgaris* (*sensu lato*). Six of these have been formally described as species. We have been interested largely in how these lineages evolved in relation to intrinsic (loss of diadromy) and extrinsic (geological, paleohydrological) processes. Recognition of the existence of these lineages raises numerous issues for systematists and conservation managers alike, some of which I consider here.

I will briefly address the status of the galaxiid taxa under a few of the 24 species concepts. Next I will look at some of the suggestions that have been made in the area of conservation biology as to what it is we are trying to conserve (species, ESUs, MUs, adaptations, evolutionary potenti?). I show how we can use phylogenetic information to prioritise taxa (Vane-Wright et al., 1991) under the Moritz (1994) ESU philosophy. I then look at the debate concerning perceived problems with formal classification and taxonomic rank. One proposal (Avice & Johns 1999) has been to use temporal scaling to provide consistency; another has been to get rid of taxonomic rank altogether (Mishler 1999). Finally, I raise some issues concerning the new DoC system for classifying organisms according to their risk of extinction alone (Molloy et al., 2001). - *wednesday am*

Regeneration of native conifers - how the largest, most long-lived organisms in New Zealand maintain their niches in an inconstant environment.

Peter Wardle

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The large native conifers show slow growth and live many centuries. Studies of their population structure mainly depend on counting growth rings, which are distinct in some species, notably kaikawaka, but in others, especially rimu, they are irregular and often extremely narrow. It is generally assumed that rings are formed annually, but evidence for this is meagre. All these conifers establish vigorously beneath 'nurse' species in successional communities, but in forests where mature native conifers form an overstorey above a lower canopy of broadleaved trees, young conifers usually occur only sparsely. Cockayne (1928) considered that failure of conifer regeneration in mature stands leads ultimately to dominance by broadleaved trees with shade-tolerant seedlings, whereas Holloway (1954) explained this and other features of native forests that seem anomalous in terms of current environments by cooling and drying since the 14th century.

Wardle (1978) published data supporting the existence of an apparently synchronous 'regeneration gap' among native conifers that he considered to be broadly in keeping with Holloway's hypothesis, whereas Molloy (1969) considered that this feature could be explained by stand renewal by periodic destruction. For kaikawaka stands, Clayton-Greene (1977), Veblen & Stewart (1982) and others proposed that landslides and windthrow are agents of renewal. Using radiocarbon dates from disturbed soils, age structure of stands, and tree ring patterns, Wells et al. (1998) showed that stand initiation in kaikawaka can be attributed to earthquakes on the Alpine Fault, dated to 1717 and less precisely to 1630 and about 1460. About the same times, stands of rimu and kahikatea (Duncan 1993) and matai/totara (McSweeney 1982) on river-flats showed greatly increased cohort establishment, which was initiated by flooding and aggradation that probably had its source in landslides triggered by the earthquakes.

Even 'stands of rimu that show no independent evidence of past disturbance' consist of cohorts apparently established around these times, according to Wells et al. (1998), who proposed that they were initiated after canopies were damaged, either by windfall during episodes of increased storminess (Grant 1985) or directly by earthquakes. Either explanation credibly explains rejuvenation of dense rimu stands on glacial outwash terraces, but the less densely stocked stands on moraines, which are dominated by the oldest cohorts, are more problematical. Hill-country podocarp stands in other parts of New Zealand, for instance on inland flanks of the Longwood Range in Southland (Bathgate 1981) and Taranaki uplands (Nicholls 1956) consist almost entirely of large trees. Lusk & Ogden (1992) related the population structure of a stand in Tongariro National Park to canopy disturbances that led to release of podocarps, with peaks around 1240-50 and 1340-50 A.D.

McKelvey (1963) regarded the dense, seemingly even-aged podocarp stands on the Volcanic Plateau as the first generation after the Taupo eruption of 2000 BP, but it has since been shown that they consist of several cohorts, that form a sequence of podocarp species related to the light demands of their seedlings (Ogden & Stewart 1995). For kauri, there are stands with a unimodal structure that presumably result from single initiating events, especially fire, and others with a wide range of sizes, that on many sites fall into several distinguishable cohorts (Ahmed & Ogden 1987).

Kauri, rimu, matai and miro survive and grow slowly under low light intensities, whereas kahikatea and totara require more light (Ebbett & Ogden 1998). Seedlings establish on sites ranging from elevated to flat according to species and soil conditions, but not under shrubs or ferns (June 1982; Duncan 1991). Regeneration cycles have been described in which podocarp seedlings are associated with kamahi trees (Beveridge 1973; Norton 1991). Evidence for recruitment of podocarp seedlings into gaps formed through windfall is clear for kauri (Ogden et al. 1987) but ambiguous for podocarps (Ogden et al 1991; Adams & Norton 1991).

Native conifers establish best on soil with only a thin cover of litter and raw humus, under a canopy of tall shrubs or small trees that is dense enough to suppress competing understorey plants. The window of opportunity for successful establishment in successions and gaps in mature forest possibly amounts to only a few decades, which seems at variance with postulated recruitment periods of 150-300 years for cohorts following flood disturbance

(Duncan 1993). That extinct herbivores may have widened these windows of opportunity is suggested by analogy with the facilitation of podocarp regeneration by introduced herbivores. Areas affected by catastrophic natural disturbances since European settlement should be examined for direct evidence as to whether, where and how conifer regeneration has been enhanced. - *monday am*

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Ecological Management within the Department of Conservation

Paula Warren

Principal Policy Analyst, Department of Conservation

This paper will provide an update on work within the Department of Conservation to develop a framework to guide ecological management. Key conceptual approaches will be outlined. Key assumptions in areas of low knowledge will also be explained. The implications for the scientific community will be highlighted. - *tuesday am*

Limbfalls: A Cause of Seedling and Sapling Damage and Mortality in New Zealand Forests

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This paper reports on the extent of damage and mortality caused by limbfalls to free-standing seedlings and saplings of canopy-forming tree species. The study sites were located in modified conifer-broadleaved and conifer-kamahai forests in the Catlins, south-east Otago, New Zealand. All seedlings and saplings of canopy-forming species were counted in 25 m x 25 m plots. Both edge and interior sites were sampled. Damage or death was attributed to limbfall if a fallen branch was lying on the plant. For plants damaged by past limbfalls information was collected on the type of damage and the outcome for the plant in terms of

plant form and condition. The data from this study suggest that damage and mortality caused by limbfalls is spatially variable. Damage occurs more frequently around gaps, in stands with permeable edges, under trees with laterally spreading crowns, and where there are numerous emergent trees. More studies are needed to determine the frequency of deaths caused by limbfalls. - *monday pm*

Impacts of Agricultural Policy on Biodiversity

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This paper examines the impact agricultural policy has had on Biodiversity focussing on New Zealand and its economic and social development. Use is made of the OECD framework that links drivers with the state of the resource and the actions being taken to change the resource state. The NZ state has played a large role in the management of resources giving the rationale that development of resources is essential for improving economic growth and social welfare. When economic growth was the driver retention of indigenous forest was based on the functions that it performed i.e. flood and erosion control rather than for its intrinsic value. Agricultural expansion has been the major contributor to the loss of biodiversity in New Zealand and worldwide. Two case studies are reviewed south island tussock and north island sheep and beef. The drivers now are changing and worldwide biodiversity is being sought for its intrinsic value. The role of agricultural policy within the EU to achieve biodiversity goals and the role of the market is explored. - *tuesday am*

Demographic responses of brushtail possums to local depopulation

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Possoms were live-trapped for two years prior to and after depopulation experiments in two 6 ha areas of native forest. The populations recovered to about half of the original densities two years after the depopulation. The immigration rate during the initial influx in two months after depopulation was significantly higher than that of pre-removal populations. Body sizes of recolonising possums did not differ significantly from that of the original populations. These suggest that the initial re-colonisation was mainly a result of surrounding animals moved into the depopulated area. The recovering populations responded to reduced density with a higher proportion of females breeding, higher survival rate of young and less fluctuation in seasonal body condition. The natal dispersal pattern in recovering populations did not differ significantly from that in the original populations. This apparent density independence of dispersal suggests that conventional removal control is unlikely to adversely affect the spread of biological control agents between possum populations. - *wednesday pm*

Agents of change on Raoul Island, Kermadec Islands - weeds, rats and humans

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In order to protect the endemic ecosystem of Raoul Island a programme to eradicate weeds commenced in 1972. Almost 30 years on it is possible that seven species have been eradicated, none of which was widespread but some of which were difficult to control. There are another 22 species on the eradication list, most of which are barely present. Seven species represent the greatest threat at present and also are the most difficult to control. These are *Senna septemtrionalis*, *Caesalpinia decapetala*, *Anredera cordifolia*, *Psidium cattleianum*, *P. guajava*, *Olea europaea* subsp. *cuspidata* and *Passiflora edulis*. Difficulties of the programme include the rugged terrain, resistance of some species to herbicide, cryptic species and long lived seed bank of some species. Each year an area equivalent to one quarter of Raoul Island is grid searched twice; this is the area where weeds are known to be present. The remainder of the island is checked during the recreational time of staff and volunteers and occasionally by air. The weed eradication programme has been successful to date but still has many years to run. Changes in abundance or distribution of some weed species are expected as a result of the planned rat eradication in 2002 and, in anticipation of the changes, a number of species have been eradicated. Maintaining search efficiency and staff morale at low weed densities and determining the end point of the programme will be a challenge. - *tuesday am*

Wallabies vs. possums - does size really matter? An evaluation of bait stations for maintenance control of dama wallabies (*Macropus eugenii*)

Dale Williams

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Dama wallabies were liberated in the Bay of Plenty around 1912. Their feral range is currently expanding by c.16 km²/yr. Wallabies severely deplete the understorey of indigenous forests. Despite large reductions in wallaby numbers (following aerial 1080 poisoning), regeneration remains suppressed. Wallabies (and other introduced browsers) need to be maintained at very low levels for regeneration to occur. Reliance upon a single control method (aerial poisoning with 1080) is unlikely to be sustainable or socially acceptable in the long term. A pilot study was designed to investigate the potential of bait feeder stations as a control technique. Results indicate; bait station design and interactions between wallabies and possums will limit the effectiveness of this technique. Wallabies are reluctant to feed from some types of station. Despite their size advantage, dama wallabies will 'give way' to possums during interactions. If possums are present in moderate numbers they will dominate access to bait stations. Modifications to bait stations and alternative baiting strategies may provide solutions. Major impediments to managing the impacts of wallabies include; the lack of research on control and monitoring methods, and the limited number of registered baits and pesticides for use on wallabies. - *tuesday am*

Sustaining a Gondwanan remnant through the 21st Century: Some navigational challenges.

Dr J Morgan Williams

Parliamentary Commissioner for the Environment

New Zealand, since 1984, has been a hot house of institutional, economic and social reform. Successive governments of the “left” and “right” have impacted on most elements of family and business life. We now have one of the most open and unregulated economies in the world. The overall goal has been to improve productivity through emphasis on growth, increased competition, reduced market rigidity and lower inflation. The reforms began in the financial sector, the labour and goods markets (i.e. tariff removals) and then moved to the public sector commencing with environmental administration. The focus has been predominantly on economic efficiency and mitigation of any resultant environmental and social effects. The long term consequences for our Gondwanan remnant, and its distinctive ecologies are far from certain.

Against this backdrop, my paper reviews the progress New Zealand is making towards becoming a more ecologically sustainable nation. The focus is on how we organise ourselves which is indicative of the way we think about the challenges. My working definition of sustainability is the anthropogenic Bruntland model – “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.

It is a snapshot that is built around an eclectic mix of what I consider to be sustainability indicators. They span resource, social and economic measures with particular emphasis on those that indicate institutional (including research) and societal capacity to advance ecological sustainability. I conclude with some “navigational lessons”. These revolve around the limitations of legislation, the importance of education and the necessity for meaningful sustainability indicators (as distinct from environmental). There is a need for vision, leadership and strategic planning that better integrates the social, environmental and economic realms of a more ecologically sustainable New Zealand. - *monday am*

Poster abstracts (alphabetically by author)

Can creepy crawlies contribute to bringing forests back to the future?

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A 'mainland island' in the Waitakere Ranges west of Auckland titled, 'Ark in the Park' has restoration of the forest as one of its main aims. A Teacher Fellowship for 2001 has enabled research on ground invertebrates using pitfall traps to be carried out within this forest. The research aims to provide a baseline survey of invertebrate populations in the area. It also aims to investigate the impacts of rodents on invertebrate populations by comparing this area, which has low levels of pest control, with a nearby reserve that has had intensive pest control over the last two and a half years. Some preliminary findings from this research suggest ground weta may be sensitive to the number of rats present in an area, whereas cave weta numbers do not appear to be related to the presence of rats. The poster will outline the aims of the Ark in the Park mainland island which is a community run project located about 20 minutes from downtown Auckland. It will look at the role ground invertebrates could play as indicator species for forest restoration projects and detail some preliminary findings from the research being carried out this year.

Comparison of Dusky Dolphin (*Lagenorhynchus obscurus*) habitat use before and after the onset of commercial tourism

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Marine tourism is becoming increasingly popular in New Zealand (currently >70 permits). The short-term physical effects of such tourism on target species have been investigated, although to date no comparisons with pre-tourism periods have been made. The aim of this is to accomplish such a comparison for the dusky dolphins of Kaikoura and enable identification of any changes in the long-term spatial distribution and behaviour of the dolphins since the beginning of commercial dolphin watching and swimming. A study conducted by Cipriano (1984-1988) investigated the behaviour and activity patterns of the dusky dolphin, *Lagenorhynchus obscurus*, in Kaikoura. Cipriano's study was conducted prior to the first commercial dolphin watching operation, which began in Kaikoura in 1989 and provides baseline data for the current comparison. A theodolite was used to collect information on dolphin group locations and movements. Comparisons were then made with similar data collected fifteen years earlier. A total of c262 hours of theodolite data were collected over six months, detailing the movement patterns of 274 dolphin groups. Analysis indicates that since the onset of tourism there has been a change in habitat use. This is discussed in relation to present tourism practices and management, and other local contributing factors.

Effect of food supplementation, female age and clutch number on egg laying and incubation in a translocated population of hihi (Aves).

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Food abundance, temperature, and day length in combination with life history traits such as age, and biotic factors like predation are known to affect the incubation behaviour of females. We studied the effect of food supplementation, age and clutch number on laying and incubation parameters of female hihi. The hihi is an endangered bird for which the main conservation action has been translocation. We found that food supplementation and female age were significant in shaping female laying and incubation behaviours. Food supplementation significantly increased clutch size from a mean of 3.8 to 4.1 eggs per nesting attempt. Females at fed sites had an 18% shorter clutch interval, and started a second clutch 72% sooner after fledging first clutch chicks, than unfed females. Females at fed nests had shorter incubation (-3.7 minutes) and foraging bouts (-2.2 minutes). Older females laid larger clutches (4.2 vs. 3.8 eggs), incubated for shorter lengths of time (15.6 vs. 16.4 days), had greater hatching success (77.0 vs. 66.5 %), and incubated for longer intervals (16%). The successful establishment of hihi populations on islands with poor natural food supplies, e.g. Mokoia Island, may be dependent on the provision of supplemental food at the nest site of each breeding female.

Tiritiri Matangi Island: 25 years as a reserve.

Mel Galbraith

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Tiritiri Matangi Island in the Hauraki Gulf was gazetted as a reserve progressively from 1976. Natural regeneration and an ecological restoration programme initiated in 1984 have resulted in a reserve that has both national and international recognition for conservation success. The habitat enhancement following the revegetation and eradication of kiore has allowed translocation of 10 bird species to the island, with invertebrate and reptile species recognised as potential future introductions. The island has provided an opportunity for trialing conservation management options, and is seen as a model for other restoration projects. Post-graduate research is an integral part of the restoration monitoring. Tiritiri Matangi is renown for public involvement, ranging from a replanting programme using volunteers from conservation groups to participation of a wider cross-section of the community contributing to management and advocacy activities. Visitor numbers now approach 30,000 per year, generating an annual income for the island of around \$100,000 through the Supporters of Tiritiri Matangi (Inc).

Determining the extent of grey duck x mallard hybridisation in New Zealand.

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Hybridisation between native grey duck *Anas superciliosa* and introduced mallard *Anas platyrhynchos* is widespread. Grey ducks are becoming rarer and their distribution restricted. Recent mtDNA studies have confirmed extensive mitochondrial gene exchange between the 2 species and in both directions. It has proved difficult to identify hybrids by phenotype because of the variability in plumage of the game-farm mallards originally introduced. Using measurement and plumage scores of approx. 300 hybrids bred in captivity, a discriminant function was derived that allowed both grey duck and 3 hybrid categories each to be distinguished with >85% confidence. This function was then applied to a sample of 2300 ducks obtained from hunters throughout New Zealand to indicate the present extent of

phenotypically-detectable hybridisation. The long-term integrity of both *superciliosa* and *platyrhynchos* as separate species in New Zealand is doubtful all hail the “grallard” !

Mycophagous beetle diversity in periurban environments

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Mycophagous beetles play an important role in ecosystem function within forest remnants. However little data exist comparing fungus beetle habitats in urban, periurban and rural environments in New Zealand. This study determined whether species diversity and composition of fungus-feeding beetles varied among forest and pasture habitats and differing forest patch sizes. The model groups Leiodidae (saprophagous and mycophagous) and Scaphidiinae Staphylinidae (mycophagous) were studied.

Twelve sites in a periurban environment were chosen, including nine forest and three pasture sites within the Rodney district in northern New Zealand. Fifteen species were identified, six in pasture and twelve in forests, with one (introduced) species unique to pasture. No patch size effect was discerned for mycophagous beetles, contrasting with more ambulatory Carabidae species studied concurrently. A clear correlation in diversity among forest and pasture sites was detected. Decreasing species diversity of fungus beetles in pasture is probably due to a lack of fungal hosts and suitable microclimate conditions, but indicates native species migration between habitats. Comparing other habitat studies and beetle diversity shows changes in the ratio of native to exotic species in pasture sites in different environments. We predict increasing exotic species diversity in pastures if all families of mycophagous beetles are sampled.

BioWeb: Casting the information web further

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DoC has developed a series of databases that seek to capture and deliver a wide range of biological information to staff throughout New Zealand using Web Browsers. The Weeds database is the most advanced of these applications and is a good example of how an application specifically built to support DOC's business, can provide a wealth of information to interested parties outside DoC. The databases that we have developed solve many of the problems associated with discrete databases and are fully relational and spatially enabled. We strongly support the governments position of making information available, unless there is good reason to withhold it, and would like to continue to make the ecological community aware of what we are able to offer.

Annual Carbon Exchange of a Tussock/Hawkweed Ecosystem

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The sustainability of any ecosystem is dependent on its ability, over time, to gain carbon or at least stay carbon neutral. We use eddy covariance over a period of two years to directly

measure the carbon exchange of a seasonally dry short-tussock/hawkweed ecosystem near Twizel, Mackenzie Basin, New Zealand. We found that these ecosystems have a limited ability to absorb and store carbon due to a low leaf area index and low productivity. During a wet year the annual total carbon gain was only 40 g C m⁻² a⁻¹, while during a year with a moderate drought, the ecosystem was carbon neutral and at times a strong carbon source. The sustainability of these ecosystems is finely balanced and will vary from year to year depending on rainfall magnitude and frequency.

Attracting endangered species to 'safe' habitats: responses of fairy terns to decoys.

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The New Zealand fairy tern (*Sterna nereis davisae*) is considered an endangered subspecies. The aims of this study were to quantify fairy tern responses to decoys and sound recordings and determine the viability of decoys as a technique for re-establishment of this species in protected habitat. Sixteen decoy trials were conducted in an area suitable for nesting from 9 September to 2 October 1999 at Papakanui Spit, New Zealand. The decoy models were effective in attracting fairy terns to a specific area. There was a significant effect due to decoys with >80% of landing episodes occurring in the decoy plots. A planned contrast between decoys with and without recordings showed no significant difference. The behaviour of the fairy terns towards the decoys included erect postures, one aggressive response, and a possible courtship feeding. Despite low numbers, the response to the decoys was highly significant. We suggest that decoy techniques could be used as a simple and effective management tool for a wide range of group-living species. Such techniques will become particularly important as the availability of suitable habitat declines due to anthropogenic effects. Finally, regardless of whether the attraction of fairy terns towards these decoys encourages residence and nesting in this area, the effectiveness of attracting terns to a specific location results in a safe and efficient means of trapping adults away from the nest and/or outside the breeding season.

Measuring pollination success of epiphytic and terrestrial NZ Orchids

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A large diversity of floral morphology and specialised pollination syndromes are well known features in the Orchidaceae. In the orchids, pollen grains are joined into a compact structure (the pollinia), which is generally removed or deposited as a single unit. This feature makes orchids ideal for studies of pollination success and pollinator effectiveness as visitation history and success are recorded in the removals and depositions. Despite the simplicity of these observations, reports on pollinia removal and deposition ratios in orchids are rather scarce in the literature. In this work we assessed the pollination status of four epiphytic orchids (*Earina autumnalis*, *E. mucronata*, *E. aestivalis* and *Winika cunninghamii*) and one terrestrial species (*Pterostylis alobula*) occurring in the south of the North Island. Pollen deposition was low in all the species studied, ranging from 2.39% (*P. alobula*) to 11.86% (*E. autumnalis*). On the other hand, pollinia removal was rather high in all epiphytic species (25.38-91.52%), except for *P. alobula* (2.39%). The ratio of deposition to removal (a measure of pollinator efficiency) varied considerably among species, from 1 (as many pollinia deposited as removed) in *P. alobula* to 0.03 in *E. mucronata* and *E. aestivalis*.

Meta-population dynamics of a New Zealand alpine weta *Hemideina maori* (Orthoptera: Anostomatidae) on island habitat patches

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Many species living in a fragmented habitat are thought to act as 'meta-populations', i.e. a collection of discrete local populations connected by dispersal. Despite widespread acceptance of the meta-population paradigm empirical issues that require further study remain, such as the effects that inter-patch dispersal and variability in patch size have on population dynamics. Mountain stone weta (*H. maori*) on the Rock and Pillar Range, Central Otago, live on 'island' rock outcrops called tors. We marked and recorded the location of 480 adults and 789 juveniles on four large and 14 small tors to assess the effects of habitat fragmentation on the population dynamics of *H. maori*. Only twelve marked adults (2.5%) and 2 marked juveniles (0.3%) dispersed between tors. The mean dispersal distance was 361 ± 54 m (range=36–672 m). Larger tors supported larger populations, which contributed a higher absolute number of dispersers, however, smaller tors had proportionally higher immigration and emigration rates. Four extinction and three colonisation events occurred over the study period, all on small tors. These results reveal that *H. maori* can move over long distances for a flightless insect and since they live in sufficiently high numbers on large tors, their dispersal rate can still generate enough migrants to colonise empty tors.

Modelling Complex Forests using Radar Remote Sensing

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Synthetic aperture radar (SAR) remote sensing is a candidate technology for biomass estimation of complex forests, either alone, or in conjunction with other remote sensing technologies. Essentially, this is an inverse modelling problem, made particularly difficult in the New Zealand landscape by terrain-slope and species-composition variation. It is therefore necessary to make some well-founded assumptions concerning the structure of a complex forest, and the interaction between forest components (canopy, trunk, understorey). This paper investigates some of the basic assumptions required by SAR remote sensing to model New Zealand forests of varying degrees of species complexity and age classes, over a variety of different terrains across the country. The results show that although single-species, single age-class forests can be easily modelled, increasingly complex forest types require much more sophisticated analytical models to describe them.

Hot and steamy – habitat and sex life of two geothermal ferns

Merilyn Merrett

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Two uncommon fern species, *Christella* aff. *dentata* (b) and *Cyclosorus interruptus*, have specific habitat requirements associated with geothermal activity that allow them to occur in regions that would normally be too cold. However, they differ in their reproductive strategies and habitat requirements. *Christella* aff. *dentata* (b) habitat is associated with hot springs discharge where the surrounding atmosphere is modified by warm steam. This species is early successional; rapidly colonising disturbed ground and bare surfaces after perturbation, such as caused by erosion of stream banks after high water flows and flooding. Immature sporangia are present on fiddleheads and uncurling fronds, leading to rapid spore maturation

and dispersal. Spore appears to be produced in great abundance and, when suitable habitat is available, germinate readily. In contrast, *Cyclosorus interruptus* is more reliant on unmodified and more stable environments. In the Taupo area, it requires a geothermally modified habitat, often provided by warmed, swampy soil, in addition to atmospheric modification. *Cyclosorus interruptus* has relatively poor sexual reproduction; rather, it expands its range by rhizome extension, albeit slowly. It has a low rate of frond fertility and poor spore germination, indicators of species of stable habitats. Unfortunately, this reproductive strategy can lead to decline and local extinction in highly modified environments.

Red beards in Rotorua: autecology of the rare orchid *Calochilus robertsonii*

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Calochilus robertsonii (red bearded orchid) is found in New Zealand at only a small number of sites, mostly in geothermal areas in the North Island, but also in other habitats including one site in the South Island. It is currently classified as 'naturally uncommon'. The largest known population occurs at Rotorua in mown grassland. Since 1988, the orchid area has been managed by not mowing it during the flowering season, facilitating flowering and seed set. Flowering occurs from October to the end of January. The number of flowers and height of flowering stems varied significantly between 2 years of monitoring. Annual census records since 1985 show that the number of visible plants has fluctuated from less than 1,000 to more than 3,000, the last census recording the highest number of plants. The management regime has so far been successful in maintaining this population. However, *C. robertsonii* competes poorly with pasture grasses and although it has migrated onto bare areas over the last 15 years, these are gradually diminishing and the population is expected to decline in the long term.

A comparison of the breeding biology of South Island pied oystercatchers (*Haematopus ostralegus finschi*) nesting on river terraces and surrounding farmland in mid-Canterbury

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The South Island pied oystercatcher (SIPO) has historically bred on braided river terraces in the South Island, New Zealand. Since the 1950s, increasing numbers of SIPO have foraged and nested on surrounding farmland. We investigated the relative breeding success of river nesting SIPO and farmland nesting SIPO. Two populations of birds were studied in mid-Canterbury, New Zealand, during 1999 and 2000. One population nested on a river terrace on the South Branch of the Ashburton River and the other on adjacent farmland. To determine the more productive habitat, information on several breeding parameters, e.g. initiation of egg laying, clutch size, egg volume, egg survival rate, chick survival rate, chick rearing time, and number of chicks fledged per pair and per hectare was collected and compared between each population. SIPO nesting on farmland initiated laying earlier and laid more eggs per clutch that were larger in volume than SIPO pairs nesting on river terraces. Chicks raised on farmland also had a higher survival rate and fledged 7 days earlier than did chicks raised on river terraces. Although SIPO nesting on farmland produced significantly more chicks per

breeding pair, more chicks were produced per hectare on river terrace habitat. There were no differences in egg survival or hatching rates between the two habitats.

Relationships between New Zealand, Australian and Chatham Island Grey Ducks

Judith Rhymer¹, Murray Williams² & Richard Kingsford³

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Extensive hybridisation with introduced mallard *Anas platyrhynchos*, a shrinking range and a declining population have resulted in New Zealand's grey duck *A. s. superciliosa* being assigned a conservation status of "endangered" (IUCN criteria A1bce, A2bce). Crucial to acceptance of this conservation ranking is evidence that New Zealand grey ducks are sufficiently different from those in Australia (*A.s. rogersi*) to warrant the present sub-specific taxonomic distinction and that there is no evidence of periodic gene flow between the 2 populations. Analyses of mtDNA sequences from specimens from Queensland, S.Australia, NSW, Tasmania, NZ North Is., NZ South Is. and Chatham Is. identified 25 haplotypes, some of which were population specific while others were common among all or most populations. The haplotypes fell into 2 structural groupings with genetic distances ranging 3.2% - 7.3% between groups. There was evidence of historical colonisations as well as ongoing geneflow across the Tasman.

A biogeographical approach to mistletoe conservation in Wellington

John Sawyer

Department of Conservation, Wellington Conservancy, P.O. Box 5086, Wellington, New Zealand (email: jsawyer@doc.govt.nz).

Over the past 8 years information about the distribution of mistletoes in Wellington has been collated onto a regional plant database. The objective was to understand the biogeography of mistletoes and to apply that information to their conservation and protection. Eight mistletoe species have been recorded in Wellington (5 Loranthaceae and 3 from the Viscaceae). Information about mistletoe distribution was collated from a variety of sources and is now being applied in various ways. For example, distribution information is being used: to determine the conservation status of mistletoes more accurately; to monitor the changing status of mistletoe over time; to provide ecological explanations for mistletoe distribution patterns; and in gap analysis to identify species poorly represented in the protected natural area network. Case studies (for *Korthalsella salicornioides*, *Peraxilla tetrapetala* and *Ileostylus micranthus*) are described that demonstrate how biogeography is being applied to mistletoe conservation in Wellington.

The status of coastal dune vegetation in Wellington

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The state of coastal dunes in Wellington was assessed as a basis for prioritising dune conservation efforts. Native coastal dune vegetation occupies the drier raised coastal sand and gravel substrates and is dominated by low growing grasses and sedges. Native dunes have been extensively modified and many threats still exist including colonisation by pests, urban

encroachment and use of vehicles in dunes. Information about coastal dune species has been compiled onto a regional plant database since 1993. Information was used from a variety of sources including: herbaria; plant checklists; and the Coastal Resource Inventory. Using that information ten key dune systems were identified in Wellington. Those sites are: Pahoa Scientific Reserve, Pencarrow Lakes coast, Castlepoint Scenic Reserve, Flat Point, Uruti Point, Ocean Beach, Owhiro Bay to Karori Stream, Hokio South Dune, Te Humenga Point, and the Turakirae coast. Only 2 of these sites are fully protected. Over the past 100 years a significant decline in native coastal plant distributions has occurred. Species most seriously affected are: *Coprosma acerosa* (sand coprosma) *Pimelea arenaria* (sand daphne) and *Desmoschoenus spiralis* (pingao). Case studies are used to demonstrate the state of coastal dune vegetation in Wellington Conservancy.

European beetle demolishing New Zealand heather: initial success of a biological control programme

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European heather *Calluna vulgaris* (Ericaceae) was introduced to the Central North Island in the early 1900s to provide habitat and food for grouse but the birds failed to establish and now heather occupies > 10 000 km² and continues to invade new areas.

Biological control may be a long-term, cost effective solution to reducing the dominance of heather. Heather beetle, *Lochmaea suturalis* (Chrysomelidae), was tested to ensure its host specificity, and intensively line reared to eliminate parasitoids and disease prior to its release in January 1996. More than 6100 beetles and 4300 larvae have since been released at over 40 sites with beetle establishment confirmed at one location. We are monitoring 14 release sites for beetle impact.

Using chloroplast DNA to help explain *Nothofagus* disjunctions in the South Island

Terry Thomsen, Hazel Chapman and Steve Wagstaff

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In common with a number of indigenous plant species, *Nothofagus fusca* (red beech), has a disjunct distribution, being absent from the central part of the South Island. The absence may be explained by one of two broad hypotheses: (1) fragmentation via vicariance factors, in particular the Pleistocene glaciations and / or intense tectonic activity since the Pliocene. (2) long distance dispersal occurring across a large area of habitat unsuitable for *N. fusca* establishment. In this study, we are using PCR-RFLP analysis on non-coding regions of chloroplast DNA. DNA amplification using PCR is being carried out using a combination of universal chloroplast primers (as developed by Taberlet and Demesure) and our own designed primers. RFLPs are being used to evaluate the degree of genetic variation within and among populations of *fs24 N. fusca*, north and south of the disjunction. High variation among populations will indicate genetic isolation over a long period, and would support vicariance hypotheses. Early results, from RFLPs and DNA sequencing, suggest a very low degree of variation in chloroplast DNA among *N. fusca* populations.

The invertebrate fauna in *Sporadanthus* wetlands on Chatham Island

Corinne Watts, and Bev Clarkson
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Diversity and abundance of invertebrates were studied in three *Sporadanthus* wetland systems on Chatham Island. During 21 days of pitfall trapping, 3880 invertebrates from 18 Orders were caught. More than twice as many individuals were collected at Tuku than either of the other sites. Amphipoda was the dominant Order caught at Ocean Mail and Lake Rotokawau. At Tuku, Collembola were dominant. More beetles were collected at Tuku than at the other sites. This can probably be attributed to higher rainfall, predator control and/or a less disturbed habitat. The invertebrate fauna of Chatham Island *Sporadanthus* wetlands is depauperate compared to similar wetlands sampled in the Waikato. It is unclear whether this is a characteristic solely of these wetlands, or of Chatham's biodiversity values and/or sampling on an island, or whether there is an effect of predators and habitat disturbance.

Are urban reserves important reservoirs of invertebrate diversity?

Corinne Watts¹, Marie-Claude Larivière
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The present study examined the invertebrate communities in four different sized habitat patches (Moire Reserve, Shona Reserve, Sharps Bush and Waitakere Ranges) in Auckland. Each had varying degrees of connectivity, time since isolation, and degree of disturbance. The main question posed was 'do urban reserves provide suitable habitat for invertebrate diversity?' During two months of pitfall trapping (20 November 2000–18 January 2001), 22967 invertebrates from 25 Orders were caught at the four sites. Collembola (40%) and Acarina (23%) were the dominant Orders caught over the sampling period. The Waitakere Ranges site recorded the highest total number of invertebrates (7174). Sharps Bush (5702), Moire Reserve (5490) and Shona Reserve (4601) recorded similar total number of invertebrates. The number of Orders collected at each site was similar. Although correlations between invertebrate abundance and the environmental variables were quite low, results demonstrate the existence of relationships and shows that they were still important predictors of invertebrate abundance. The majority of Orders (85%) found in the Waitakere Ranges site were also collected in the small urban reserves (Moire and Shona Reserve). Therefore, even though these reserves may be isolated from a 'larger', more continuous forest they still support invertebrate communities. Therefore, this study showed that small urban reserves provide suitable habitat for a sizeable proportion of the invertebrate Orders presently occurring in larger forest remnants.

Few and Far between: Environmental determinants of *Ascarina lucida* distribution in south Westland, New Zealand.

Sarah Wedde, Glenn Stewart, Richard Duncan and Matt McGlone*
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Ascarina lucida, an indigenous small tree, was abundant throughout humid northern and western districts of New Zealand from 9000 to 5000 years ago, but currently has a highly restricted distribution, and is only common in the superhumid climates of south Westland. We identified environmental factors associated with *Ascarina lucida* presence or absence at three scales in south Westland. At the individual scale, *Ascarina lucida* were associated with raised

microsites, decreased canopy cover, and increased litter cover. Across Saltwater Forest, *Ascarina lucida* were more abundant on sloping ground and sites with increased litter cover. Over the south Westland region, *Ascarina lucida* abundance was greatest on steeper plots located on hillslopes, within tall forest. Species associated with *Ascarina lucida* were also found to be good predictors of its distribution at the regional scale. These results suggest that three environmental factors limit *Ascarina lucida* distribution: light, drainage and exposure.

An Experiment to Assess Impacts of Introduced Mammals on Forest Dynamics in New Zealand

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¹ Landcare Research, Private Bag 1930, Dunedin; ² Landcare Research, Lincoln; ³ Department of Plant Sciences, Cambridge University, Cambridge, U.K.; ⁴ Department of Conservation, Christchurch; ⁵ Department of Animal and Plant Sciences, University of Sheffield, Sheffield, U.K.; ⁶ Institute for Ecosystem Studies, Millbrook, New York, U.S.A.; ⁷ Arthur Rylah Institute for Environmental Research, Natural Resources and Environment, Victoria, Australia

Introduced mammalian herbivores are widespread in the forests of New Zealand. Browsing by deer alters forest species composition; impacts of mice, rats and pigs remain poorly known. At present, we cannot predict eventual consequences to forest structure and composition of ongoing governmental management expenditures. A large-scale, long-term project was begun in late 2000, to characterise processes driving forest ecosystem change. Field research is based in the Waitutu Forest in southern Fiordland. As part of the project, we are constructing replicated, nested exclosures to protect forest plots from ungulates and rodents. Exclosures are located on alluvial flats and marine terraces, in order to assess impacts of herbivory under different nutrient regimes. We will compare predation on seeds and seedlings, and growth and mortality of saplings, among experimental treatments, and test hypotheses relating these factors to soil fertility. In other components of the project, recruitment, growth and mortality functions estimated from forest measurements and experiments will be used to parameterise process-based, spatially-explicit models of forest dynamics (based on SORTIE, a model developed for North American forests). The exclosure experiments will provide estimates of new parameters, quantifying how herbivores modify forest demographics. These models will enable prediction of long-term effects on forests of ungulate and rodent management.

Field trip information

The two field trips on Thursday 30 August are to Kaitorete Spit, on the south edge of Banks Peninsula, and to Quail Island in Lyttelton Harbour. Trips depart from outside the lecture theatre at 8:30am. Leaflets explaining background to each site follow.

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Notes

Practical information

Please refer to the maps inside the back cover for the location of places mentioned here.

Registration desk and helpers

The registration desk will be set up in the Central Lecture Block and general enquiries can be answered there. Also, watch out for the conference helpers (wearing yellow Jubilee Conference T shirts), they can help at any time. The hosting department, Plant and Microbial Sciences, is in the 4 storey building immediately west of the lecture block.

Venues for conference talks and social events

All spoken talks and posters will be in the Central Lecture Block. The social events are mostly either in the Student Association Building, or in the Staff Club, which is across Ilam road to the southeast (see map). Refer to Conference Programme (pp 15-21) for details of the particular events.

Phone, internet, email, modem access, faxes

There are four computers with web access for checking Webmail set up in the central lecture block for your use. There are also phones which can be used for free local calls (or for modem access) in this block. The phones are toll barred but you can make toll calls using a calling card or a collect call to bill the call elsewhere. If you need to send or receive a fax, contact one of the local organisers to arrange use of the PAMS fax machine.

Conference T shirts

There is a special Jubilee T shirt featuring the conference logo, which is available from the registration desk in a choice of colours. Orders placed by Monday evening will be printed to your specifications and can be collected on Wednesday. The cost is \$20 per T shirt.

Information for presenters of talks

Those giving powerpoint talks should already have sent their files to Matt Walters, who will have loaded the necessary files on the computers in the relevant lecture rooms. If not, see Matt as soon as possible on arrival. We recommend you use the installed computer rather than using your own laptop as the latter would slow down changeovers and may introduce technical problems. If you are using slides, please go to C3 to put your slides in a carousel in the break before your session. Also please familiarise yourself with the control panels in the lecture rooms before your session. We will have lecture room C3 available for previewing slides and powerpoint talks, learning the controls (which are the same in all three lecture rooms), etc throughout the conference.

Information for presenters of posters

Posters will be displayed in the foyer of the lecture block. Boards and pins are supplied. Please have your poster up as soon as possible and in any event before lunchtime Monday. Those presenting posters are expected to be next to their poster during the Poster session, after lunch on the first day (Monday). Posters should then remain up for as long as possible, depending on when you leave.

Field trip departures

The field trips to Quail Island and Kaitorete Spit are leaving from outside the Lecture block (near Café 101) at 8:30 am on Thursday. They will return to there by 3pm to allow time for you to get to evening flights home etc. If you have not signed up for the field trips but now want to go, see the Registration desk. There is information on the field trip destinations in this book (pp 69-73).

Banks, bookshops, chemist, and other shops on campus

There is a BNZ with a money machine in the Bookshop building south of the library. This building also houses the UBS bookshop which has a wide range of books, magazines and sweets. There is a Westpac money machine on the south side exterior of the Student Association building facing the car park. The Student Association building also has a chemist, dairy, computer shop, and so forth.

Lunch, cafes, food shops etc

There are 3 cafes on campus. The best and closest is Café 101 in the Commerce building (under the copper roof) just east of the lecture theatres. Other cafes are under the library building and in the Student Association. Lunches are also available in the Staff Club (you are technically meant to have a local member to sign you in as a guest). The nearest dairy (apart from the small one in the student association) and nearest restaurant (a good Chinese restaurant) are both on Ilam Road about 200 m south of the Student Association car parks. The nearest supermarket is at the Fendalton shopping centre about 15 minutes walk away on Memorial Avenue (walk along Creyke to Clyde, north on Clyde one block to the BP petrol station, then northwest 100 m along Memorial Avenue). This shopping centre also has a chemist, post office, hardware shop etc. There are also supermarkets and other shops at Upper Riccarton (corner of Riccarton Road and Waimairi Road) but this would be a slightly longer walk.

Transport to town and airport

Buses to town run on two routes, one leaving from University Drive near the Students Association, and the other route leaving from Creyke Rd near Forestry Rd (several different buses ply this route, all go to town). More details on routes, timetables and fares are on display in the lecture block. Fares are \$1 or \$2 depending on distance. Buses to the airport run along Memorial Avenue (about 15 minutes walk, see above for directions to the Fendalton shopping centre) every 30-60 minutes depending on time of day. You can get exact timetable information at any time on any route by calling Businfo (366 88 55).

You can walk to town from the University along Riccarton Road and through Hagley Park but it's about 6 km so would take an hour.

If you want to go to town for a meal or evening entertainment, the best place to start is on Oxford Terrace at the end of City Mall. Taxis will know it well; or the buses will take you to the Bus Exchange which opens onto City Mall, then head west along the mall.

Shuttle buses to the airport will cost about \$10 for the first passenger, and \$2 for each additional person on the same trip. One company is Super Shuttle ph 0800 748885. There are many taxi companies in Christchurch including Gold Band (3795 795) and Blue Star (3799 799). A taxi to the airport should be about \$17.50.

There are good cycle shops on Riccarton Road (Bikeline, 109 Riccarton Rd and Chain Reaction, 114B Riccarton) if you need to hire a bike or repair your own (go greenies!!). Go south from the University on Clyde Rd and turn left (east) when you hit Riccarton Rd, it's about 2 km from there.

If you've read this far you have done very well, but I'm going to stop now as I can't think of anything more to say. Have a nice conference.