

***Ecology on our  
doorstep***



*New Zealand Ecological Society Conference Auckland 2008*

**ABSTRACTS 2008**

## ABSTRACTS

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### **Hormonal Stress Responses to Capture and Confinement of Wild Birds: Implications for Translocations**

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Birds respond to environmental challenges with a non-specific stress response involving activation of the endocrine system (hypothalamus-pituitary-adrenal or HPA axis) and manifest as elevated levels of the hormone corticosterone. This stress response is considered to be adaptive and allow individuals to ameliorate the potential deleterious effects of these stressors. Despite the benefits of acute elevated levels, chronically elevated levels of corticosterone can have negative consequences. Translocation, the movement of wild animals from one site to another, has been widely employed in New Zealand and elsewhere as part of the effort to reduce extinction risk in a number of endemic birds. Such protocols are likely to be stressful. An expanding body of literature demonstrates that wild birds show considerable individual variation in corticosterone response. These are likely to reflect differences in the ability of individuals to cope with such protocols. We report here on the relationship between behaviour and plasma corticosterone concentrations and condition in wild caught blackbirds (*Turdus merula*) subject to confinement consistent with some translocation protocols. We then consider implications of these results for interpreting individual and population differences in the corticosterone responses of translocated saddlebacks (*Philesturnus rufusater*).

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### **Tree-Ring Research in Pakistan**

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Pakistan has a range of conifer species found in three out of the four main forest associations (i.e. moist temperate, dry temperate and sub-alpine zone but not subtropical). Several of the conifer species have wide ecological tolerances to different climate regimes and are consequently encountered in more than one of the forest associations (e.g. *Cedrus deodara*). The distribution pattern has the added factor of a complicated glacial history. Only a limited amount of tree-ring research has been conducted and in this paper we describe our efforts to determine the range and potential of six of the most common species (*Pinus wallichiana*, *P. gerardiana*, *Cedrus deodara*, *Juniperus excelsa*, *Picea smithiana* and *Abies pindrow*). Like many other countries in the region, there is immense pressure on the remaining timber resources and an urgency for effective conservation and alternatives.

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### **Restoring Giant Kokopu Populations and Habitat in Urban Streams, Hamilton City**

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The giant kokopu is a threatened species in gradual decline. Giant kokopu make up a small component of the whitebait run and are nocturnal and solitary. These fish naturally occur in Hamilton urban streams in low numbers. Urban streams represent highly modified degraded systems with poor water quality and storm water input. Most urban streams also have limited or no habitat available. Habitat in the form of hollow clay pipes and ponga logs were added to ten sections of stream within the city boundary to determine which habitat was preferred. Thirty tagged farm reared juvenile giant kokopu were then released into half of the restored sections and their survival and growth was monitored at monthly intervals for nine months. Fish survival and growth in the streams was better than expected with fish growing from 61 mm to 123 mm over the duration of the study period, doubling in size. Fish response to habitat was minimal with a slight preference for logs over control and pipe sections of stream.

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## **Differences in Timing of Breeding in the Grey Warbler with Latitude: Implications for its Specialist Brood Parasite, The Shining Cuckoo.**

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The Grey Warbler has one of the most widespread distribution of any native passerine species within New Zealand, making it a suitable candidate for investigating theoretical predictions and empirical effects of latitude on breeding phenology. We examined differences in the timing of breeding, including dates of egg laying, clutch completion, and incubation and nestling periods between two sites: Kowhai Bush, Kaikoura, South Island, and Tawharanui Regional Park, northern North Island. These two sites are currently the only locations where the breeding biology of the Grey Warbler has been intensively studied. As predicted, modal clutch size was larger with 4 eggs at Kowhai Bush's higher latitude and smaller with 3 at Tawharanui. However, in contrast to patterns from the Northern hemisphere, the onset of breeding occurred later and finished earlier at Tawharanui, which suggests that only one brood can be completed at lower latitudes, as opposed to two in Kaikoura. Latitudinal differences in the breeding biology of the Grey Warbler also have critical implications for its specialist migratory brood parasite, the Shining Cuckoo and its impact on host breeding success.

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## **Long-Term Studies of Population Dynamics on Tiritiri Matangi Island**

**Armstrong D**

Massey University

One of the quandaries faced by ecological researchers is whether they should continue to invest in ongoing projects or whether they should shift their attention to new species or systems that may have received less attention. While research on Tiritiri Matangi has touched on a wide range of species and topics, the long-term projects on the reintroduced robin population (16 years) and hihi population (13 years) have accounted for the bulk of the published research, with 48 papers featuring one or both of these populations. This literature has made contributions to several disciplines (wildlife management, population ecology, behavioural ecology, conservation genetics, ornithology and wildlife disease) at both the local and international level, and illustrates the benefits that can be derived from long-term studies. In this talk, I illustrate how long-term monitoring has allowed us to continually improve our understanding of the dynamics of these populations, and how this has allowed us to interpret and predict the effects of management. This management includes the 1993 poison drop, follow-up translocations to both populations, food provisioning and mite control for hihi, and most importantly, the ongoing harvesting of both populations for reintroduction to other locations. We are now getting to the stage where it will be possible to simultaneously estimate the effects of density dependence, demographic stochasticity, environmental stochasticity, inbreeding depression, and habitat maturation on population dynamics, and therefore create models that can be used to guide management of small populations around the world and also potentially guide future restoration projects.

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## **Urban Wildlife Knowledge and Awareness in Children: An Evaluation of a Local Education Program**

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The "extinction of [ecological] experience" (E. O. Wilson) is a concern for children in urban centres. Urban environments, traditionally the refuge of exotic human-commensal species, are nevertheless being increasingly planted or colonised by endemic plant and animal species. The kererū (*Hemiphaga novaeseelandiae*), is a large, easily recognisable, fruit eating pigeon that disperses the larger seeds of many native trees. Although once in nationwide decline, kererū are becoming more abundant in New Zealand's cities. Its iconic and conservation status and ecological, perhaps keystone, role make it an ideal focal species for integrating biological research and community education initiatives towards their conservation.

We tested whether incorporating biological researchers into in-class teaching and hands-on learning experiences of radio tracking wild kererū increased wildlife knowledge and environmental awareness amongst children from three schools. We conducted pre- and post- experience assessments using knowledge surveys and cognitive mapping techniques. We show increases in both knowledge and awareness across all groups, and discuss the importance of our results for blending biological and social science in conservation, particularly in urban environments.

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## **Development and Implementation of a Biodiversity Monitoring Programme on Motuihe Island**

**Baber M**

Auckland Regional Council

In New Zealand there has been a remarkable upsurge in community-based restoration initiatives in recent years. Such groups play an increasingly important role in the restoration of native biodiversity, however, monitoring programmes are rarely developed to assess the response of biodiversity to the restoration process. This is attributed to several factors, including 1) the limited availability of resources, 2) the perception by some that all aspects of ecological monitoring requires trained professionals, 3) the viewpoint that biodiversity monitoring is a non-essential component of restoration, and 4) difficulties in determining how and what to monitor. This paper discusses the benefits and challenges associated with the development and implementation of a long-term ecological monitoring programme on Motuihe Island (179 ha), in the Inner Hauraki Gulf. In line with the Motuihe Restoration Plan, the Motuihe Trust commissioned a biodiversity monitoring programme to characterise changes in biodiversity associated with the ecological restoration. To this end, forty monitoring stations were established across the island in a 200m x 200m grid. Ten monitoring stations were established in mature coastal broadleaf forest, and 30 in rank pasture. At each station, volunteers monitored birds, reptiles, and invertebrates monthly from November 2006 – May 2007. Vegetation monitoring was conducted by volunteers between June 2007 and July 2008. This data served as baseline information from which to track changes, and characterize differences between habitat types. Through this monitoring, we also detected the presence of the threatened moko skink and numerous ground-dwelling invertebrates. In conclusion, we significantly added to our understanding of the biodiversity characteristics on Motuihe through the monitoring programme, and the use of volunteers to do the monitoring was deemed a success. However, it is important to understand that success of the programme was critically dependent on resource feasibility, feasibility of volunteers to conduct the monitoring, continual training of volunteers, and the provision of feedback to volunteers.

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## **Signatures of natural selection in bellbirds *Anthornis melanura*: Perspectives from different demographic & pathogen histories.**

**Baillie S**, Brunton, D, Barraclough, R

Ecology and Conservation Group, Massey University

With a clear pathogen like avian malaria acting on bellbirds *Anthornis melanura* it may be possible to relate pathogen pressure and resistance to the MHC genotypes of hosts. MHC class I loci are of interest as signatures of natural selection because they code for the destruction pathway of intracellular antigens such as blood parasites. Recent studies have linked passerine MHC allele diversity to malaria resistance and susceptibility. Interpretation of associations between specific MHC alleles and malaria within a single host population is often problematic. A phylogeographic approach that considers geographic patterns in MHC and malaria infections in light of the phylogeny and historical demography of multiple host populations would be illuminating. Using such an approach for my doctoral research, I will present three main objectives 1) assess MHC 'allele' frequencies among various bellbird populations on the North and South Island of New Zealand, 2) make inferences about bellbird population history and demographics using MHC, mtDNA, and microsatellite markers, and 3) investigate whether or not specific MHC allele frequencies are associated with malaria. Initial results of malaria diagnostics and host body condition as well as indicators of anaemia also will be presented. This study builds upon current research in passerine MHC genes by combining population history with disease resistance and contemporary disease status. The findings of this study will contribute to conservation where the genetic viability of passerine populations is concerned.

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## Disease Screening in New Zealand Reptiles: Importance in Translocation

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The number of fauna translocations in New Zealand has been increasing, with multiple translocations to one site becoming a common undertaking as part of a restoration management plan of a protected area. This in turn raises the risk of disease transmission between populations. Therefore baseline data on the parasite prevalence in these populations is important for assessing potential risks and maximise translocation success. Currently in New Zealand little data has been published on health screening of translocated animals, including native reptiles. The translocation of two native reptile species to two islands (Tiritiri Matangi Island and Motuora Island) in the Hauraki Gulf and into captivity provided an opportunity to test the populations for *Salmonella*, *Cryptosporidia* and *Giardia*. A total of 274 cloacal swabs and 28 faecal samples were collected from resident reptile populations and translocated animals. Three individuals were tested positive for *Salmonella* subspecies IV, on both islands. This is a new host record for this serotype and is suggested to be a natural occurrence within the populations. Collated health screening data on previous avian translocations on Tiritiri Matangi Island showed no significant difference between *Salmonella* prevalence in the reptiles and birds. The study highlights the importance of recording reptile population health and potential risk of parasite transmission from human to wildlife. This information will be essential for many offshore islands, particularly in the Hauraki Gulf, which are undergoing restoration management that involves translocation.

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## Search for the Te Paki *Mecodema*: Part Three

Ball O<sup>1</sup>, Whaley P<sup>2</sup>, Booth A<sup>2</sup>

<sup>1</sup> NorthTec, <sup>2</sup> DOC

In 2006, an investigation into the distribution of the Nationally Critical Far North carabid *Mecodema* “Te Paki” was initiated within the Te Paki Ecological District. Prior to 2006, a total of nine individuals had been formally recorded in three locations in the c. 50 years since its discovery. Initially, three methods for detecting individuals were employed; kill pitfall trapping, live pitfall trapping, and active searching. Between July 2006 and July 2007, kill pitfall trapping was undertaken at nine randomly chosen sites in three different habitats (native forest, pine forest plantation and shrubland). Live pitfall trapping was undertaken between July 2006 and June 2007 at ten non-randomly chosen sites in native forest and then again between November 2007 and May 2008 at a further seven non-randomly chosen native forest sites. Active searching involved looking under woody debris and rocks when time allowed. Active searching was discontinued early in the first year of study as absence from a site was difficult to confirm with any degree of certainty. Also, the use of kill trapping was discontinued after one year, as detection rates using live trapping were considered sufficiently high and beetle mortality could be avoided. To date, a total of 39 *Mecodema* “Te Paki” individuals have been found over 30,936 trap days by live and kill trapping combined. Individuals have been detected at three locations, all in the east of the Ecological District, including one where the species has not been previously recorded. All of these locations were in native forest. Due to the fragmented nature of the landscape, each of these locations likely represents a separate subpopulation. Further trapping is required to i). survey the remaining significant stands of native forest, and ii). assess the full geographic extent of the subpopulations detected.

## POSTER

### **Spiders of Te Paki**

**Ball O**<sup>1</sup>, Fitzgerald M<sup>2</sup>, Whaley P<sup>3</sup>

<sup>1</sup> NorthTec, <sup>2</sup> Te Papa, <sup>3</sup> DOC

Clusters of pitfall traps were deployed at nine sites as part of a wider investigation into the poorly known leaf litter and soil invertebrate communities of the Te Paki Ecological District. Three habitats were sampled, native forest, pine plantation forest, and manuka/kanuka-dominant shrubland. Three replicate clusters of traps were deployed in each habitat. This paper reports on the results for spiders collected over one month on each of three occasions: winter, spring and summer. Taxonomic richness (species and families) was higher at native forest sites compared to pine forest and shrubland sites, particularly at the family level. It is widely known that taxonomic richness tends to be highest in native forest habitats, likely as a result of their more complex structure. Historically, several species of spider from Te Paki have been described from just a few specimens of one sex. In the case of *Reinga apica* and *Hypodrassodes apicus* specimens of the missing sex have been found in this study. In addition, several undescribed species have been found including a *Rinawa* species, a *Huttonia* species, a mysmenid species, a *Pahoroides* species, and a *Sidymella* species. This study supports the view that there is a distinctive endemic element in the spider fauna of the Te Paki area. Many of the species limited to the Te Paki area are replaced by other representatives of their genus further south (e.g. *Paramamoea pandora*, *Reinga apica*, *Hapona reinga*, *Hypodrassodes apicus*, *Nanocambridgea grandis* and *Pahoroides* sp.). This pattern of endemism is similar to that seen for other invertebrate groups and plants. More surveys, using pitfall trapping as well as other methods, are required to gain a clearer picture of the spider fauna of the Te Paki Ecological District.

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### **Investigating Chevron Skink (*Oligosoma Homalonotum*) Ecology, and the Impacts of Rat Control.**

**Barr B**, Brunton D, Ji W

Massey University

The chevron skink (*Oligosoma homalonotum*) is one of New Zealand's largest and rarest skinks and is known from c. 300 records from Great Barrier Island and only 2 records from Little Barrier Island. Unmet goals of the 2002 *Oligosoma* recovery plan are to ascertain the status of chevron skink, to see if they are vulnerable to introduced predators, as well as increase the basic knowledge of the species. This paucity of data, and buildup of unmet goals was largely due to poor survey techniques available for this species. However, a recently developed trapping technique has been achieving excellent capture rates of chevron skinks. Accordingly the focus of this study has been to address these unmet goals using these newly developed trapping methods in concert with radio-tracking. Specifically, the benefits of current rat control methods to chevron skinks have been quantified and basic ecological information about the species (status, population structure, home range, behaviour and habitat selection) has been built upon. Chevron skinks were trapped, measured and radio-tracked in 2 catchments in Glenfern sanctuary (rat control treatment) and 2 catchments in adjacent Port Fitzroy (control). The benefits of rat control were determined by comparing the population structure of chevron skinks, skink condition (incidence of tail loss, weight: length ratio, evidence of predator damage), and population density through the trapping programme. These measures also contribute to basic ecological information and the status of the population at each site. Home range, behaviour and habitat selection have been measured through intensive radio-tracking of adult skinks at each site to build upon knowledge of the species in addition to ascertaining possible differences between control and treatment. Rat-tracking tunnels, calibrated with rat extinction trapping will be used to determine an absolute rat density at each site, which will be used to correlate with differences observed in the skink population. Fieldwork will be completed in September 2008 and preliminary results will be presented.

## Avian Blood Parasites of Tiritiri-Matangi Island.

Barraclough R, Brunton D

Massey University

A great many aspects of Tiritiri Island's ecology have been closely examined. However, the host-parasite systems on the Island have been largely ignored. In 2006 we discovered an unsuspected high prevalence of malaria within the flourishing Tiritiri Bellbird population (infections were also detected within Tawharanui Bellbirds for the first time during this period). On average, 50% of Tiritiri Island Bellbirds were positive with *Plasmodium*. We have since surveyed an array of the Tiritiri avian forest community species and will present the native and introduced bird/parasite associations that were subsequently revealed. We will also discuss the significance of these results in terms of the health of Tiritiri Island birds as well as with regards to avian translocations to and from the Island.

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## POSTER

### Retreat Site Use and Diurnal Aggregations of Duvaucel's Geckos

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<sup>1</sup> Massey University, <sup>2</sup> University of Haifa at Oranim

Aggregation behaviour in lizards has been reported for several skink (e.g. *Egernia whitii*, *Eumeces laticeps*) and gecko species (e.g. *Coleonyx variegates*, *Nephurus milii*). But to date, the mechanisms behind group formation remain poorly understood, especially in gekkotans. This behaviour may have primarily evolved to compensate for suboptimal environmental conditions, whereby individuals gain physiological benefits, such as reducing evaporative water loss or controlling over rates of thermal exchange. Within an aggregation various social interactions are likely to take place and social factors, i.e. conspecific attraction and association may play an important role in group formation and composition. This current study investigates the diurnal aggregation behaviour of a New Zealand native lizard species, the Duvaucel's gecko (*Hoplodactylus duvaucelii*). These nocturnal lizards have been found in pairs or small groups in diurnal refuges in the wild. We collect data on group formation and shelter usage from two wild populations of *H. duvaucelii* during different seasons. Additionally, we carry out laboratory experiments under standardised conditions to test several hypotheses regarding the potential role of social influences on group-formation. These data are used to address the following aims: (1) to describe diurnal shelter preferences; (2) to determine typical group size and group composition; (3) to investigate potential social influences in group-formation; and (4) to determine the degree of genetic relatedness between group-members. Here, we present some preliminary results on grouping patterns of wild *H. duvaucelii* and retreat site choice under laboratory conditions. The findings of this study will contribute to our limited knowledge on the behavioral ecology of this endemic lizard species by elucidating the social and genetic structure within the populations. The results will also be beneficial for species conservation management decisions when determining optimal habitat sites and founder group composition or size for future translocations of *H. duvaucelii*.

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### Vespula Wasps Revisited: Experimental Evidence they can Restructure an Insect Community

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*Vespula* wasps are an invasive generalist predator that can reach extremely high densities in some South Island beech forests. Their diet includes a wide range of native invertebrates, and predation rates on some of the more vulnerable taxa are known to be severe. However, their impact on invertebrates at the population or community level has not previously been documented. We used a large-scale field experiment to assess whether *Vespula* have a negative impact on insects in New Zealand honeydew beech forests both at the community level and considering some taxa separately. Malaise traps were set at four 30-ha sites for 2 years; we treated two sites each year with toxic-bait to reduce *Vespula* abundance. Multivariate analyses showed that wasp density altered the insect community composition. We also found that fewer wasps increased the overall abundance and biomass of Lepidoptera, and the abundance of some Diptera families (Tipulidae, Tachinidae and Syrphidae). However, for many taxa tested there was no evidence of a response

to *Vespula*, while the “Floor” guild of Lepidoptera increased in abundance when *Vespula* were abundant. A high proportion of the diversity and abundance of the Lepidoptera we sampled were litter dwelling moths (Oecophoridae), suggesting that *Vespula* may have an impact on the detritovore community, with potential consequences for nutrient cycling. Similarly, if *Vespula* reduce the abundance of Tachinidae and Syrphidae this may have important consequences for pollination since New Zealand lacks many of the usual pollinating taxa. Important questions remain as to the ecological and evolutionary outcomes of *Vespula* restructuring an insect community.

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## **Selecting Street and Park Trees: What Role does Ecology Play?**

**Behrens F**, Spellerberg I, Stewart G

Lincoln University

Everyone knows about trees in urban environments - planted alongside streets, in parks or naturally occurring in old forest remnants like Riccarton Bush, Christchurch. Trees offer many not only sensible but also imperceptible benefits to humans and to the environment. Without trees our cities would be grey worlds. However, what knowledge determines tree selection? What reasons are there for choosing an oak tree over a kowhai tree? And does ecology or biogeography play a role in this selection? Much research has been carried out regarding criteria to select trees which are highly linked to the various benefits provided by trees such as reduction of air pollution. The list of criteria is long and covers a range of aspects. These aspects can be categorized into social, cultural, economic and environmental components. In my research I also propose the use of ecological and biogeographical criteria. The criteria for tree selection are well described but little is known about the process of applying these criteria. For example, are the criteria used in a hierarchical order or randomly? Or is just common sense to those who decide? As part of my PhD research these questions are being addressed to determine the human role in tree selection. In the fifteen largest cities located throughout temperate New Zealand and Australia people in charge of tree selection (e.g., arborists) were interviewed. The collected data gives insight into the selection of street and park trees. I present the results of these interviews and discuss whether ecological criteria such as biological diversity are being integrated into tree selection.

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## **Looking to the Future: A Research Strategy for New Zealand Islands**

**Bellingham P**<sup>1</sup>, Towns D<sup>2</sup>

<sup>1</sup> Landcare Research, <sup>2</sup> Department of Conservation

The New Zealand biodiversity strategy recommends the development of research strategies that address specific conservation problems. Research strategies in conservation are rare, perhaps because goals and philosophies in support are often unavailable. New Zealand has a long history of successful conservation management on islands, but until recently there has been no national framework for performance assessment. We accept the view that the primary goal of conservation management is to maintain ecological integrity and that performance assessment can be based around this goal. We use Tiritiri Matangi Island as a case study that illustrates the linkages between objectives for maintaining ecological integrity and development of a research strategy for islands in general. Specifically, we discuss where we need to improve performance in maintaining ecosystem processes, reducing exotic spread, preventing extinctions and declines, maintaining ecosystem composition, providing for sustainable use and improving community participation in island conservation.

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## **The Lichen Diversity of Motu Kaikoura**

**Blanchon D**, Ennis I, Lockett C

Unitec

Motu Kaikoura is a 535 ha island off Great Barrier Island. It was purchased in 2004 with the aim of restoring its biodiversity. The vegetation has been largely reduced to *Leptospermum* and *Kunzea* scrub by fires, farming and browsing mammals. In particular, the effects of fallow deer (*Dama dama*) have been severe, removing palatable plant species, preventing regeneration and leaving open scrub with few understory plants. Surveys of the vegetation of Motu Kaikoura in 2006 and 2007 found 259 native plant species remaining, some of them restricted to sites inaccessible to deer. The initial surveys of the vegetation were considered to provide important baseline data before the fallow deer and other mammalian pests are finally eradicated from the island. Lichens were not recorded in these surveys. Fallow deer are known to consume significant amounts of lichens, particularly species of *Usnea* in some forest types. Producing a species list of the lichens was considered to be a useful addition to studies recording the recovery of the native flora. An initial study of the lichens shows a surprisingly high number of species despite a low diversity of woody substrate tree species. Rock-dwelling lichens are well-represented as rocky substrates are common. Some foliose and fruticose genera known to be palatable to fallow deer are present within easy reach of the deer. The fact that these species have not been removed despite the decimation of many palatable vascular plant species on the island suggests that these lichens are a “last resort” food for fallow deer.

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## **Long-Tailed Bats in Plantation Forest: What are they doing there?**

**Borkin K**, Parsons S

University of Auckland

New Zealand's long-tailed bat (*Chalinolobus tuberculatus*) is considered nationally vulnerable to extinction in the medium-term if population trends continue (Hitchmough et al. 2007). It is therefore important to conserve them wherever they occur. The majority of research carried out on long-tailed bats has focussed on old growth native forest, yet this species may also be locally abundant in other habitat types, such as urban areas, agricultural land, and plantation forest. Unfortunately, little is known about their biology or ecology in these modified landscapes. Long-tailed bats were first associated with plantation forest when Daniel (1981) reported the first roost in an exotic pine tree. Further work has since shown that long-tailed bats are still present in Kinleith Forest, although the area described by Daniel has since been converted to pasture. Plantation forest is subject to radical modification on a regular basis and many of these changes represent potential risk to roosting bats. However, the cutting of plantation forest also opens potential edge habitat, which long-tailed bats preferentially use for foraging. Therefore, it is important to determine how long-tailed bat use this exotic habitat, so that companies can manage their forests in a way that minimises risk to bats. This research has investigated long-tailed bat use of Kinleith Forest, an exotic plantation forest based around Tokoroa, in the South Waikato, using automated recordings of echolocation calls and telemetry. We discuss our preliminary findings from two field seasons, focussing on how long-tailed bats use plantation forests, and discuss their roosting and foraging requirements compared to bats living in rural and native habitats.

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## **Looking Back: Reflections on John Ogden's Contribution to New Zealand Dendrochronology**

**Boswijk G**

The University of Auckland

At his university retirement function, Associate Professor John Ogden considered that one of his significant legacies to The University of Auckland was the Tree-Ring Laboratory now based at the School of Geography, Geology and Environmental Science. Dendrochronological research in New Zealand started in the 1950s with collaborations between American scientists and New Zealand based researchers, but the work was intermittent and the tree cores mostly went offshore. In the early 1980s John Ogden set up the first Auckland-based tree ring laboratory (and woodstore) at the School of Botany, U. of A. and acquired a cohort of students who were active in dendroecology and climatology (and in some cases still remain so). Some 25 years later, and in spite of quiet phases, dendrochronological research at Auckland University continues. This paper reflects on John Ogden's contribution to advancing tree ring research in New Zealand,

particularly with regard to the study of modern and Holocene kauri (*Agathis australis*), and assesses the state of dendrochronology in NZ in 2008; the year of his retirement.

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## **A Method for the Translocation and Re-Vegetation of Short Stature Coastal Turf Communities**

### **Bridge D**

University of Waikato

An experiment to develop a methodology for the translocation and re-vegetation of threatened short-stature coastal turf communities was applied to a Taranaki coastal terrace modified by erosion. The indigenous turfs, typically less than 15 millimetres in height, grow on the margins of coastal terraces in areas that are exposed to strong salt laden winds such as headlands and coastal indentations and are under threat of displacement by pasture species. These communities are dominated either by the endemic grass *Zoysia minima* (Colenso) Zotov (Poaceae) or the herb *Selliera radicans* Cav. (Goodeniaceae) and support a number species classified as rare or endangered. Three sizes of turf plugs (25, 50 and 80 mm<sup>2</sup>) were translocated from an intact community at Stent Rd to a coastal terrace margin bare of vegetation at Paritutu Scenic Reserve. Transplanted cores were randomly distributed in 42 plots at 5 or 10 percent cover, two distances from the terrace margin. A high rate of survival was recorded with all plots having a greater than 50% survival. On average, cover was either stable or declining in the first year following the translocation for each of the plug sizes. Positive net growth above initial percentage cover was observed after eighteen months and almost 50% increase in cover was recorded at two years. Associated miniature herbs have maintained survival with selected species colonising up to 11 metres from the site of translocation. It is concluded that the use of translocation as management tool will have positive implications for the survival of short-stature turf communities and the re-vegetation of eroded terrace margins.

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## **Tiritiri Matangi Island, over 30 Years as a Research Laboratory.**

**Brunton D**, Guerts J, van Rensburg M

Massey University

Over the last 30 years the potential of Tiritiri Matangi Island as a research location has been recognised by numerous scientists and students associated with Universities, DOC and CRI's. Tiri can be viewed as a natural laboratory for testing hypotheses, and understanding the behaviour, ecology and population dynamics of New Zealand's rare and endemic species. Much of this research has been conducted by Post-graduate students and includes more than 50 theses (MSc & PhD). Initial work concentrated on kiore ecology and re-vegetation of the island. One recent trend in the research conducted on the island is the focus on ecological linkages between Tiri and the surrounding habitat. One significant example of this is research on Little Blue Penguin ecology.

In this paper we will examine highlights from the Little Blue Penguin (LBP) research on Tiri and look at how our understanding of this species' ecology has grown and how the questions we ask have changed. The very first avian MSc thesis on Tiri was conducted by Graham Jones on the breeding ecology of LBP in 1978. Since then researchers have studied LBP vocalisations, breeding success and nest site preferences, survivorship and links to diet, discovered new ecto- and endo-parasites and used transmitters to monitor both nest attendance and to track birds foraging at sea. The LBP population on Tiri is large and nesting density is generally high, like other LBP populations around NZ it does experience major die-offs which are still not well understood. Given our current knowledge of this species and it's location on the door step of New Zealand's largest city it is important to continue long term research of this population.

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## **Northern Rata: Prospects for Restoration of a Once-common Strangling Hemi-epiphyte**

**Burns B**<sup>1</sup>, Knightbridge P<sup>2</sup>, Empson R<sup>3</sup>

<sup>1</sup> Landcare Research, <sup>2</sup> Department of Conservation, <sup>3</sup> Karori Wildlife Sanctuary

In 1991, John Ogden urged the study of common dominants including northern rata (*Metrosideros robusta*) that “could offer us a prospect of understanding, even restoring, the much diminished and rapidly changing lowland forest ecosystems of the North Island”. Northern rata used to be an emergent feature of many forests from which it is today rare; its decline driven by its high palatability to brushtail possums. We review evidence of the former abundance of northern rata within North Island forests and compare these to its current extent showing its dramatic decline in many areas. A survey of hemi-epiphytic northern rata host preferences indicates that where still present, it occurs most commonly on large host trees (> 50 cm diameter) and preferentially establishes on puriri, rimu, kahikatea, miro, pukatea, and rewarewa. Information on the ecology of northern rata in its epiphytic phase and the transition from this to a ground-rooted tree is the key to developing a restoration strategy. Seedlings did not show significant differences in relative growth due to three different rooting volumes, but grew faster in a substrate rich in humus. Seedling growth was sensitive to water availability. A maximum growth rate of descending aerial adventitious roots was 12 mm a day in the glasshouse but 1.2 mm a day in the field. We are currently carrying out an adaptive management experiment to further determine methods to restore hemi-epiphytic northern rata populations to existing forest. At Karori Sanctuary near Wellington, in the absence of brushtail possums, the establishment success of 200 northern rata seedlings is being assessed against 3 factors: host tree (pine versus hinau), rooting volume, and stem aspect. Significant mortality occurred over the first year due to seedlings drying out, and water availability appears again to be a key factor limiting growth and survival.

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## **Dietary Diversity in Fruit-Eating Birds: A Comparison between New Zealand and Canada**

**Burns K**

Victoria University of Wellington

I tested for convergent patterns in bird-fruit interaction webs in temperate forests located at similar latitudes in the Northern and Southern hemisphere. Observations of avian foraging were made over two fruiting seasons in Nelson Lakes National Park (South Island, New Zealand) and West Coast Regional Park (Vancouver Island, Canada). Rarefaction analyses were used to assess differences in dietary diversity between locales. Results showed that New Zealand birds interacted with a greater number of fruit species per foraging observation than did Canadian birds. Greater dietary diversity in the Southern Hemisphere likely resulted from higher species diversity in the fleshy-fruited plant community. Rarefaction analyses also showed no evidence for dietary specialization in either bird community; birds in both locales accumulated new species interactions at approximately the same rate with each foraging observation. The average size of fruits consumed by New Zealand birds was positively correlated with their body size. However, size related coupling was not observed in Canada, because the largest fruits produced in this locale could be dismembered and consumed piecemeal by smaller birds. Overall results showed little support for convergent patterns in bird-fruit interaction webs between hemispheres.

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## **Evolution of Exotic Plants in New Zealand**

**Buswell J**

Victoria University

Around 50% of New Zealand's flora is exotic, consisting of plants introduced here 100-200 years ago from all over the globe, and a wide range of different environments. In their new home, these isolated plant populations have been subject to new climatic conditions and new biotic associations. It is therefore reasonable to expect that these populations would be under selection pressure to adapt to the local environment. There are indeed many examples of rapid evolution in the introduced range, but as yet we do not know how common this response is. My research asks whether populations of exotic plants in New Zealand are adapting to the new environmental conditions they experience in their new range. It uses herbarium specimens to examine morphological change through time multiple species. I measure several plant traits, including plant height, leaf size and width, and stomatal density, in specimens collected from

around 100 years ago through to the present day. This question is important as part of a longstanding debate as to the importance of evolution in the invasion process. More importantly, it is vital to our understanding of how our flora will fare in the future. How will most plants respond to forecast global climate change? My results so far suggest that many species may not adapt to changed conditions on such short time scales. This could have severe implications for future species distributions in a disturbed landscape. If most plants do not adapt in response to environmental change, what will happen to their distributions in a warming world?

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## **Kiwis Counting Kiwis: Biodiversity Monitoring on Private Land in New Zealand**

**Byrd J**

Victoria University of Wellington

Over \$50 million dollars in contestable funds has been spent on biodiversity protection on private land in New Zealand but the latest State of the Environment report has little to say on the biodiversity gains made from this investment. Do the funding agencies know what they have achieved? Do the landowners who received the funds know? Do those who have responsibilities to write national reports on our biodiversity obligations know what's happening on the 70% of New Zealand in private ownership? I examined the conservation work and biodiversity outcome monitoring methods of 20 people undertaking 12 publicly funded conservation initiatives covering nearly 500 private properties. The results are not entirely encouraging. New Zealand has commitments under national and international laws and agreements to maintain biological diversity, including ecosystems, species and genes reliant on private land. Agencies which fund conservation on private land need to measure the success of their funding initiatives. Landowners need to measure the success of their conservation actions and to inform their land management decisions. Biodiversity data is needed to report on compliance with the laws, and to understand whether the country, funding agencies and landowners are meeting their biodiversity goals. Reports on national biodiversity must include information from the majority of New Zealand's land area which is in private hands. Monitoring of biodiversity condition, trends and outcomes on private land is a way to meet these needs. I found a lack of quantitative data does not allow us to know if funds are achieving their objectives or if the NZ Biodiversity Strategy is reaching its goals. These landowners are highly motivated, and they have to be, to establish the support systems to enable them to set up and maintain a monitoring programme on their land.

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## **An updated wild vascular flora of Tiritiri Matangi Island**

**Cameron E**

Auckland War Memorial Museum

The only previous complete survey of the flora and vegetation of Tiritiri Matangi Island was carried out in the 1970s by Alan Esler (1978). Since that time major changes have taken place on the island: stock grazing ceased (1972); 11 indigenous bird species introduced (1974-2004); 280000 native trees planted (1984-1994); kiore eradicated (1993); three indigenous reptiles introduced (2003-2006); and several environmental weed species apparently eradicated. Since 2006 we have been surveying all wild vascular plants present on the island, their abundance, main habitats, vouchering a herbarium specimen for each record, and checking previous records (published and herbarium specimens). The draft results of the post Esler flora show: a 25% increase in vascular species, of which nearly two thirds are naturalised species; and 14% of the Esler records were not located. The percentage plant group increases are: ferns 44% (14 spp.); conifers 200% (4 spp.); dicotyledons 25% (58 spp.); and monocotyledons 18% (18 spp.). Their means of dispersal to the island appears to be varied. Recommendations are made for additional naturalised species to be managed. Several regionally threatened vascular plant species occur in the open areas on: coastal slopes, track margins and wetlands – a few of these populations appear to be the regional stronghold for the species. These open herbaceous habitats have the highest floral diversity, and are well used by indigenous fauna, but appear to be under-valued.

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## **The Use of PIT Tags (Microchips) as a Remote Monitoring Tool in Free-Living Ship Rats.**

**Carter G**

Massey University

Small animal field research often relies upon the researcher being able to relocate and identify individuals on multiple occasions. Traditionally this has taken the form of capture-mark-recapture utilising visual identifiers such as ear tags, or remote monitoring techniques. Repeated recapture of animals is often not desirable and can confound the results of the research through 'trap happiness' or 'trap shyness'. Remote monitoring of small animals can be more appropriate and has been achieved through visual aids such as leg banding, and tracking aids such as toe clipping or radio transmitters. Each of these methods has relative advantages and disadvantages which will make it more or less suitable for a given research agenda. More recently, advances in micro-chipping (PIT) technology has increased the potential usefulness of this as a remote monitoring tool for small animals. The primary disadvantage of this technology is its passive nature, it has been largely viewed as an alternative to external tagging in both aquatic and terrestrial species, but requires a 'recapture' to be effective. The advantage of the technology is its relatively low cost, lifelong application, and that it does not affect the external appearance of the animal. I am utilising PIT technology in behavioural research in free-living ship rats. I hope to show how this technology can potentially offer insight into the daily activities of ship rats in terms of spatial and temporal habitat use. I hope also to demonstrate how, with the addition of visual monitoring, detailed individual specific data can be obtained. The data presented here will be derived from small scale field trials to be carried out in July - August 2008. I will attempt to offer a fair summation of the advantages and disadvantages of this technology, discussing not only my successes but also the limitations that the technology imposes.

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## **Preliminary Observation on Kiwi Olfaction: Odour Source and Composition, Scenting Behaviour and Function of Olfaction.**

**Castro I**<sup>1</sup>, **Cunningham S**<sup>2</sup>, **Jaffe K**<sup>3</sup>, **Gsell A**<sup>4</sup>, **Cabrera A**<sup>5</sup>

<sup>1</sup> Massey University, <sup>2</sup> Massey University, <sup>3</sup> Universidad Simon Bolivar, Caracas, Venezuela, <sup>4</sup> Massey University, <sup>5</sup> Universidad Simon Bolivar, Caracas, Venezuela

Birds have been shown to be capable of both producing and sensing odours. Despite this, birds generally do not seem to show any behaviours related to scent and their bright colours and showy displays, make scent appear unnecessary to social communication. Amongst birds, kiwi have a well developed olfactory system which in the past has been attributed mainly to foraging. However, conflicting results in experiments designed to test the use of scent in prey-detection, together with the recent discovery of a bill-tip organ in kiwi facilitating remote-touch foraging, suggest that kiwi may use this sense for other purposes. We video recorded 10 different wild kiwi coming out of their burrows in front of which we left objects with and without prey smell. We also recorded 6 birds while they were foraging. On three occasions kiwi were confronted with smell of other kiwi when leaving their burrow. Kiwi responded to objects, humans and other kiwi with scenting behaviour. There were no significant differences in the way kiwi responded to objects whether they had prey scent or not. However, they reacted differently to the scent of other kiwi and humans. We found that kiwi have three main behaviours related to scent: sniffing, snorting and tap-snorting. We concluded that kiwi use the sense of smell in a way similar to mammals to explore their environment, including examining objects, detecting other animals (kiwi or humans) and investigating food. We analysed the composition of the volatiles in kiwi faeces and found aromatic oils and alcohols. We suggest these substances may be produced in the uropygial gland and deposited on the faeces directly. The unusual location of the gland immediately above the cloacae would make this possible.

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## **The influence of trees on urban air quality.**

**Cavanagh J**

Landcare Research

There has been renewed interest in the use of trees to improve air quality in urban areas. There are several mechanisms by which urban vegetation can improve air quality including interception of atmospheric particles and absorption of various gaseous pollutants, lowering of air temperatures through transpiration,

which can mitigate the urban “heat island” effect and reduce ozone production. Further, appropriately located trees can reduce building energy use by shading buildings and altering air flows during hot periods, thereby indirectly reducing pollution emission from power plants. However, trees can also contribute to air pollution through the emission of volatile organic compounds (VOCs), which can react in the atmosphere to form ozone in the presence of nitrogen oxides (NO and NO<sub>2</sub>, collectively NO<sub>x</sub>). This paper provides an overview of the mechanisms by which trees can alter urban air quality and presents preliminary estimates for the influence of urban trees on air quality in Christchurch.

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## **Incorporating the Protection of New Zealand's Lizards into the RMA Process**

**Chapman S**<sup>1</sup>, **Ussher G**<sup>2</sup>, **Ruffell J**<sup>1</sup>

<sup>1</sup> Boffa Miskell, <sup>2</sup> Tonkin & Taylor

Urbanisation in the Auckland Region has intensified through infill residential development and the development of rural and semi-rural areas. The large, often overgrown, back yards of suburban Auckland are an important habitat for native lizards. The forests and regenerating shrublands to the north and south of Auckland's main conurbation are also important strongholds for native lizards. There is a risk that the ongoing intensification of urbanisation will lead to the extirpation of native lizards across much of mainland Auckland. The Wildlife Act provides all native lizards with legal protection from disturbance and killing. Most colonies of native lizards also qualify as ecologically significant under the Resource Management Act. Until recently, lizard surveys were rarely included in assessments of ecological effects and it is likely that many colonies have been destroyed without ever being detected. Improvements in lizard survey methods, together with a greater awareness of consenting authorities that lizards are an important component of urban biodiversity, have led to an increasing requirement that consent applicants accept responsibility for identifying and mitigating the effects of their activities on lizard communities. Drawing primarily on recent case studies from the Auckland Region, this paper reviews the incorporation of lizard protection into RMA processes.

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## **Morphology, Phylogeography and Drumming Behaviour in a New Zealand Ground Weta, *Hemiandrus pallitarsis*.**

**Chappell E**, **Trewick S**, **Morgan-Richards M**, **Castro I**

Massey University

Species are one of the fundamental components of biology and the accurate delimitation of species is important in evolutionary, systematic and ecological studies, yet there is still confusion over how species can be recognised. Examining different characters allows multiple lines of evidence for successful and accurate species delimitation and identification. In this study, morphological, genetic and behavioural variation is investigated within an endemic species of ground weta, *Hemiandrus pallitarsis*, in the North Island, New Zealand. Twelve morphological characters were measured, and mitochondrial cytochrome oxidase I DNA sequences were analysed from populations across the distributional range of *H. pallitarsis*. Both methods provide no evidence of a species complex within *H. pallitarsis*. Instead, the morphometric results suggest females are significantly larger than males, and ground weta in Palmerston North are significantly smaller than weta further north. Additionally, genetic analyses found substantial population structuring, large genetic distances, and an historical south to north pattern of movement in the North Island. The pattern of vibratory drumming behaviour followed that predicted by morphology and geographic proximity – drumming signals were more similar between geographically close populations and did not match the patterns of genetic isolation. Overall, this study shows that *H. pallitarsis* is morphologically, genetically and behaviourally variable across the North Island.

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## **Eradication of Mammals from Islands: History and Challenges**

**Clout M**

University of Auckland

Invasive mammals have now been eradicated from many islands in the New Zealand archipelago, with a substantial increase over the past 30 years in the number and scale of successful eradications. The most significant advance has been in the ability to eradicate invasive rodents from increasingly large islands. Ecological restoration and the recovery of threatened species have been possible as a result. Challenges for the future include understanding and managing the risks of reinvasion, and using the opportunities presented by eradications to help improve our knowledge of ecological interactions.

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## **Ecological Values and Restoration of Hamilton Urban Streams: Constraints and Opportunities**

**Collier K**<sup>1,4</sup>, Aldridge B<sup>1</sup>, Clarkson B<sup>1</sup>, Hicks B<sup>1</sup>, Kelly J<sup>2,4</sup>, MacDonald A<sup>3,5</sup>, Tonkin J<sup>3</sup>, Smith B<sup>6</sup>

<sup>1</sup> CBER, University of Waikato, Hamilton, <sup>2</sup> Alchemists Limited, Hamilton,, <sup>3</sup> Institute of Natural Resources - Ecology, Massey University, Palmerston North, <sup>4</sup> Environment, Waikato, Hamilton, <sup>5</sup> Department of Conservation, Whangarei, <sup>6</sup> NIWA, Hamilton

Urban streams globally are characterised by degraded habitat conditions and low aquatic biodiversity, attributed in large part to the effects of stormwater inputs, channel modification and maintenance works. Recent work in Hamilton City has highlighted the ability of some threatened fish species to survive in urban streams flowing through vegetated gullies with high upstream impervious area, and the presence of diverse stream invertebrate communities in small city streams and seepages that remain disconnected from the stormwater network. Macroinvertebrate community metrics reflecting ecological condition were variously correlated with habitat quality, riparian vegetation characteristics, and degree of channel alteration, and inferred a positive association between the extent and vigour of riparian buffer zones and the condition of macroinvertebrate communities in urban streams. Urban streams were also found to have lower hydraulic function than pasture and periurban streams attributed to the combined effects of channel modification and stormwater hydrology, whereas biogeochemical function was higher in urban streams reflecting the influence of intact riparian vegetation in gullies. Introduction of native galaxid fish into urban streams has demonstrated the potential use of this method as a means of population restoration to fast-track recolonisation. Shade and bank stability provided by restored riparian vegetation, coupled with remediation of passage through culverts and the introduction and stabilisation of wood to provide refugia from storm flows, should assist some native fish to persist in urban streams despite high impervious areas in upstream catchments. Furthermore, using riparian vegetation and wood as roughness elements to reduce the erosive forces of high stormwater flows may help reduce bank erosion and channel degradation, and enhance stream ecosystem function.

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## **Revegetation of Waiwhakareke Natural Heritage Park: Baseline Monitoring, Quantifying the Effects of Planting Composition and Groundcover Treatment**

**Cornes T**, Wehi P, Clarkson B

University of Waikato

Waiwhakareke Natural Heritage Park is a 60ha park on the north-west outskirts of Hamilton City where pasture is being converted back to native plant and animal communities once widespread in the Waikato region. Permanent vegetation plots have been established since 2005 in all new planting zones in the park to assess the success of different combinations of plants and site preparation. In January 2008, 18 permanent plots were established in the trial plantings. Nine plots were on the hillslope, with three ground treatments (mulch, paper plate, control). In these treatments were three planting compositions (kanuka dominant, kanuka dominant with tutu, broadleaved dominant), selected to emulate three typical Waikato successional pathways. On the semi-swamp basin, three plots were established within each of the three planting compositions (shrubs and flax, shrubs + flax and small trees, final composition), selected to determine the feasibility of foreshortening the typical successional sequence. Height and crown spread were measured on all plants. Other characteristics recorded were phenology, browse, survivorship and groundcover. Hillslope plots were re-assessed for survivorship in March 2008, to document deaths caused by the extreme summer drought in the Waikato region. Preliminary measurements showed important differences in plant survival

between treatments. On the hillslope, there was greater mortality of plants in broadleaved plots due to higher death rates of large-leaved species. In the basin plots, regions with the highest water tables had the greatest plant mortality. There were striking differences between the groundcover treatments, with mulched plots having the lowest mortality in all planting compositions on the hillslope due to their enhanced soil moisture levels. Paper plates however were ineffective, probably due to wind damage and bird interference (pukeko). To fully compare the development rates of the compositional treatments, plots will be remeasured biennially for the first six years, then every five years to detect any differences. Information gained from the trials will be used to inform future restoration planting in Hamilton City and may be applicable to similar revegetation projects elsewhere.

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### **How does Livestock Exclusion affect Leaf-litter Decomposition Rates and Invertebrate Communities in Native Lowland Forest Fragments?**

**Costall J**

Massey University

Much of New Zealand's remaining lowland forest exists as small, isolated and often highly degraded fragments on privately-owned land. In rural areas livestock access is one of the main disturbances to forest fragments, and fencing is recommended. Livestock impacts include defoliation, trampling, defecation and urination; subsequently altering vegetation, soil structure and nutrient status, food supply, shelter, and microclimate for invertebrates. However, we have little understanding of how invertebrate communities, and the ecological processes they contribute to, respond following livestock exclusion. Ten forest fragments from the Te Miro district, south-east of Hamilton, were selected as study sites. Fencing dates ranged from 1960 to the present, with one site remaining unfenced. Litter bags were used to measure leaf-litter decomposition rates at the edges and cores of fragments. Invertebrates were also extracted from the litter bags, with the intention that differences in decomposition rates might be attributable to invertebrate community composition. Preliminary results of this study will be presented. This research was conducted as part of a collaborative project examining how various management techniques affect the ecology of native forest fragments in production landscapes, involving researchers from Landcare Research, AgResearch, Canterbury University, Waikato University and Massey University.

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### **Tiritiri Matangi: a 1979 Model for Delivering Heritage to the Community**

**Craig J, Mitchell, N**

University of Auckland

The original restoration plan for Tiritiri was based on science and was constrained and assisted by value systems of the time. Research on plant regeneration, bird feeding and kiore ecology provided a justification of need and likely constraints. A wide range of people provided the support, energy and enthusiasm to ensure success. This presentation will outline some of the history including the research. It will also outline some of the omissions and constraints that led to the outcome seen by visitors today.

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## Senses Used by Probe-Foraging Kiwi - How Important is the Bill-tip Organ?

Cunningham S, Castro I, Potter M, Alley M

Massey University

Nocturnal kiwi (Apterygidae) are traditionally assumed to detect their soil-dwelling invertebrate prey using their strongly developed olfactory system, but previous studies of the use of olfaction in prey-detection have provided equivocal results. We have recently found that kiwi possess a similar bill-tip organ to shorebirds, which forage using 'remote touch' (detection of prey via vibration and pressure cues in substrate). Kiwi might therefore localise prey using a similar vibrotactile sense: an example of convergent or parallel evolution across a deep taxonomic divide. We conducted foraging trials in captivity to test whether kiwi are able to use their bill-tip organ to detect prey via remote touch, and how important this sense is relative to olfaction and hearing. Trials were carried out at Kiwi Encounter/Rainbow Springs in Rotorua, NZ and San Diego Zoo and Wild Animal Park, San Diego, USA. They involved presenting kiwi with mealworm prey buried 4-8cm deep in topsoil substrate. Sensory cues produced by the mealworms and available to be detected by the birds were isolated one at a time by manipulating prey presentation. Here we present new ideas about senses involved in kiwi foraging, based on the results from these foraging trials, and our knowledge of the bill-tip organ.

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## The Temporal and Spatial Pattern of Vegetation Change in the Transition from Estuary to Freshwater Swamp: Whangapoua Estuary, Great Barrier Island

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<sup>3</sup> Microfossil Research Ltd, Mt Eden, Auckland

This study examines vegetation dynamics during the transition from salt marsh to freshwater swamp (hydrarch succession) at Whangapoua Estuary, Great Barrier Island. There are six broad vegetation communities present within Whangapoua Estuary: (A) Mangrove (*Avicennia marina*) mudflats, (B) *Juncus kraussii* sea rush beds, (C) Oioi (*Leptocarpus similis*) salt meadow, (D) *Baumea juncea* sedges, (E) Manuka (*Leptospermum scoparium*) shrubland, and (F) Raupo (*Typha orientalis*)/Cabbage tree (*Cordyline australis*) swamp forest. The pattern of estuarine wetland successional is a result of interaction between species and the physical constraints of the salinity and freshwater inundation gradients. The relationship between modern pollen and modern vegetation was used to reconstruct the past vegetation of Whangapoua. Modern pollen studies show that pollen assemblages at the seaward end of the salinity gradient are less clearly representative of the associated vegetation than those at the landward end. However, if the long-distance and over-represented pollen rains are excluded, five of six of the broad communities are represented by their pollen spectra. The exception is the *Juncus kraussii* community. The fossil pollen results indicates that three major zones can be distinguished in seven of the eleven cores. The lower zone (Pre-Impact, c. 3500-750 cal. yr B.P) is characterised by a phase of marine sedimentation. The local environment at c. 3500 cal. yr BP was a tidal flat surrounded by conifer-hardwood forest with *Cyathea* tree ferns, indicating a moist warm climate. Around 1500 cal. yr BP, the appearance of *Avicennia* pollen marks the start of the successional vegetation sequence, and coincides with charcoal fragments, probably caused by natural fire. The intermediate zone [Polynesian, c. 750 cal. yr BP (c. 1200 AD) to 110 cal. yr BP (1840 AD)] encompasses large-scale human impact in the region and a transition at the core sites from mainly marine to mainly brackish. The associated decline in tree pollen, as a result of deforestation by fire, coincides with a sharp and sustained increase in charcoal and *Pteridium* spores. Higher sedimentation rates at the same time indicate increased erosion of the surrounding hills. Around 350 cal. yr BP (c. 1600 AD), a sharp decrease in *Leptocarpus similis* pollen and an increase in *Baumea* pollen indicate the transition from salt marsh to brackish swamp in several cores. The uppermost zone (European, 1840 AD to present) is marked by the appearance of *Pinus* pollen and an increase in Poaceae pollen and greater freshwater input. The driving factor for plant succession in the Whangapoua Estuary during the late Holocene thus appears to have been siltation caused mainly by human impact, and this infilling may also have been enhanced by sea-level recession c. 700 yr BP.

## Prioritising Terrestrial Ecosystems on Hauraki, Waikato Region for Biodiversity Management

Deng Y

Environment Waikato Regional Council

The Waikato region hosts vast terrestrial ecosystems (approximately 696,000 Hectares) which provide critical habitats for indigenous flora and fauna and act as fundamental buffer zones for other ecosystems in the region. Therefore, it is imperative for Environment Waikato to establish a priority list of these ecologically valuable areas in order to manage biodiversity effectively. The prioritising process has been done in accordance with the criteria for national biodiversity assessments and under the Regional Policy Statement's framework. This work is being done on a district by district basis. The first one to be completed is Hauraki. There are two main components to the priority process. The first is a quantitative assessment including: biodiversity vegetation mapping using recent aerial maps as a baseline; an ecological survey checking the accuracy of the map, and assessing Ecologically Valuable Areas (EVAs) sites of international, national, and regional significance according to Environment Waikato's Regional Policy Statement. The second is a qualitative assessment, including an ecological ecosystem scoring process. The assessed criteria are based on ecological values, vulnerability and potential outcomes. The resulting list of high priority areas in the district has been assessed by ground truth work. The aim of the two assessment processes is to develop a number of filter strategies and to produce a priority list of EVA sites in the Hauraki District, particularly on private land as some of the region's most rare and threatened ecosystems and species are now found only on private land. In addition, most of these large areas of private land connect to Department of Conservation managed land. The results show that there are, 2 internationally significant, 6 nationally significant, 133 regionally significant, and 57 locally significant (EVA) sites in the Hauraki District and these cover about 20% of the district area, of which forest and shrubland occupy 70% of the EVA area. For management purposes EVA sites on private land have been grouped into "high biodiversity value" zones, which are located in the 4 Ecological Districts (ED) in Hauraki. The protection/management requirements for these zones have been determined. These include connecting corridor and *Agathis australis* kauri-podocarp forest restorations in the west hill county at Hapuakohe ED; fencing *Dacrycarpus dacrydioides* (kahikatea) fragments and prevention of weed invasion in the lowland Hauraki ED; preventing animal pests from continuing to degrade habitat of indigenous flora and fauna; protecting gullies by controlling possums, developing stronger laws to stop vegetation clearance, and stopping property subdivision along the coastal area south of Tairua ED and Waihi ED. Prioritising these areas helps target Environment Waikato's biosecurity and environmental restoration activities. This will protect the most threatened ecosystems, habitats and species, safeguard the remnants of rare ecosystems, and recreate ecological links from hill country to lowland then to coastal areas. These efforts therefore will maintain and enhance the biodiversity of the Hauraki District.

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## Diet of the Morepork (*Ninox novaeseelandiae*) in Relation to Prey Abundance on a New Zealand Island

Denny K<sup>1</sup>, Morgan D<sup>2</sup>, Castro I<sup>2</sup>

<sup>1</sup> Massey University, Albany, <sup>2</sup> Massey University, Palmerston North

In New Zealand, numerous studies have quantified the dietary composition of introduced mammalian predators; however, little research has been conducted on the dietary composition of common native predators, such as the morepork (*Ninox novaeseelandiae*). The morepork commonly occurs throughout much of New Zealand, and is an opportunist predator of a wide range of species, including invertebrates, small birds and rodents. This study investigated the functional response of moreporks to naturally fluctuating levels of prey availability on an island in the Hauraki Gulf, New Zealand. Regurgitated pellets were regularly collected from underneath roosting sites of 9 birds from August 2007 until April 2008 and analysed to determine the composition of morepork diet. In addition, the relative abundances of prey species known to be important to morepork (invertebrates, birds, mice (*Mus musculus*)) were also measured over the same period. The preliminary results of this study suggest that there was a positive relationship between relative abundance of certain prey groups and their frequency in the diet of the morepork. Weta (Anostomatidae and Raphidophoridae), beetles (Coleoptera) and spiders (Araneae) featured strongly in the diet throughout the study period. However, there were obvious spikes in consumption of some seasonally abundant taxa such as crickets (Gryllidae) and cicadas (Cicadidae). Results will be presented in greater detail and the importance of the morepork as a predator and potential resource competitor will be discussed.

POSTER

**Flower Visitors : please book a time!!**

**Dhami M**, Gardner-Gee, R, Beggs, J

School of Biological Sciences, University of Auckland

Mutualistic relationships are often critical in pollination systems. However, New Zealand pollination systems beg to differ; there are few specialist plant pollinators, so our systems are thought to rely on generalist insect pollinators. Furthermore, many New Zealand insects are nocturnal, so flower pollinator interactions may be more cryptic than observed in northern hemisphere diurnal based systems. We compared insect visitors to manuka at different times (0900, 1500 and 2100 hours) over a 10-day period, from 8 to 18<sup>th</sup> December 2007. The floral visitor assemblages were significantly different between each time period, which can be attributed to the varying crepuscular and nocturnal habits of the insect visitors. Cockroaches, small flies (mostly crane flies), beetles and moths dominated the assemblage during night time, whereas different groups such as native bees and drone flies featured in the morning. The afternoon shift was more similar to the morning than the evening assemblage. This study provides us with preliminary information about which insect groups are important visitors to manuka and which visitors may be important pollinators. Manuka is a valued endemic plant because of its role in producing world class manuka honey and because of its critical role in regenerating native forest. Therefore knowledge about the pollination biology of manuka will be useful for managing this species.

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POSTER

**A Research Project on Freshwater Fish Species Distribution within the Nelson City Council Area**

**Doehring K**<sup>1</sup>, McIntosh A<sup>1</sup>, Young R<sup>2</sup>

<sup>1</sup> University of Canterbury, <sup>2</sup> The Cawthron Institute

The ongoing expansion of urban land use in lower stream reaches is known to affect the ecology as well as physical and chemical characteristics of river corridors adversely, altering dependent native fish community structures. This study summarises knowledge of freshwater fish distribution, community composition and habitat association within the Nelson City Council (NCC) area.

A total of 455 survey records document the current presence of 14 native and two exotic freshwater fish species [and the crustacean (koura)] within the NCC area. Fish community composition showed clear differences between fish communities of modified, lowland stream reaches compared to more pristine, highland reaches. Longfin eel, koura, brown trout and inanga were most commonly recorded while there were only two records of giant kokopu and torrentfish. There were no records for non-migratory fish species such as dwarf galaxias or the migratory shortjaw kokopu. When put in context with the upper South Island (USI), Nelson City has a significantly higher proportion of sites with two, three and four fish species per site while the USI has a higher proportion of sites with five or more fish species per site. Nelson City has the highest fish species diversity when compared to Christchurch and Dunedin cities. The majority of the fish species in the NCC area are diadromous, requiring access to and from the sea to complete their life cycle. Therefore, to maintain and enhance fish populations in urban settings, improving fish migration is particularly important given the prospective growth of our cities.

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POSTER

**Seedling and Sapling Abundance of Canopy and Understorey Species Following Pest Control on Iona Island, Southland**

**Dutta D**<sup>1</sup>, Watchman D<sup>1</sup>, Cassie S<sup>1</sup>, Jones A<sup>1</sup>, Beaven B<sup>2</sup>

<sup>1</sup> School of Applied Science, Bay of Plenty Polytechnic, Tauranga, <sup>2</sup> Department of Conservation, Stewart Island

Seedling and sapling abundance of the main tree and shrub species on Iona Island, Southland, New Zealand, were assessed prior to eradication of possums and rats in 2004, using forty four 10m<sup>2</sup> radial plots

The survey was repeated two years later after a recent re-invasion of rats. Density of large seedlings (45-135 cm height class) remained relatively unchanged, but the densities of cotyledons and saplings were both significantly ( $P < 0.05$ ) higher than pre-control values. Cotyledon density increased more than five times, and the density of saplings more than doubled. Amongst the saplings, four *Coprosma* species (*Coprosma colensoi*, *C. foetidissima*, *C. grandifolia*, and *C. rhamnoides*) and three *Pseudopanax* species (*P. crassifolius*, *P. edgerleyi*, and *P. simplex*) comprising 39% and 30% of all saplings, respectively, appeared to benefit the most following pest eradication. Juveniles of *C. areolata*, however, showed a decrease in abundance, which is contrary to our findings from a similar study on adjacent Stewart Island. The marked increase in abundance of cotyledons and saplings was a clear indication of the severe restrictions that pests had imposed on the regeneration of native species on the island. The decrease in *C. areolata* could be possibly due to the relatively higher densities of other species which had benefited from the lack of pests, and subsequent reduced numbers due to competition.

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## The Ecology of Long-lived Perennials - A Journey with JO from ANU to GBI via GSF

### Enright N

Murdoch University

This presentation reviews 30 years of research questions and approaches concerning investigation of the population dynamics of long-lived perennials in the Australasian region (and beyond) that have their foundations in my time at ANU as John Ogden's first PhD student. Our introduction at that time to the transition matrix method for analyzing the population dynamic behaviour of plants encouraged and guided a research agenda focused on long-lived trees - in particular, members of the Araucariaceae (*Agathis* for John and *Araucaria* and *Agathis* for me) and palms (*Rhopalostylis*) – and the communities in which they occur. While we have each developed a range of other research interests since that time, some of these can also be linked to alternative ways of exploring the temporal dynamics of long-lived species where it is difficult to establish robust estimates of relevant vital rates and perturbations using field-based demographic studies.

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## Community Based Restoration - Addressing Barriers to Scale and Success

Ferkins C<sup>1</sup>, Cole C<sup>2</sup>, Bergin D<sup>3</sup>

<sup>1</sup> Waitakere City Council, <sup>2</sup> Open-Ground Indigenous Plants Incorporated, <sup>3</sup> SCION

Significant areas of riparian margins, steep hill country and connecting/buffer areas to fragmented remnants require retirement and establishment with indigenous vegetation. Such action in our largely pastoral landscapes will improve environmental outcomes, particularly for our waterways. For the growing numbers of those interested, there are two primary barriers to uptake of restoration on this scale – the cost, especially of plants, and access to clear guidance on the principles and practice of restoration. The latter is primarily a matter of awareness and skills of ecology within NZ communities. When it comes to using plants NZ has a dominant culture of gardening. This acts like a 'default' setting, and results in the increase of costs and the limiting of ecological factors that contribute to success. How many bush revegetation project plans still allow for 'secondary' or canopy species to be interplanted throughout without analysis of surrounding existing vegetation? How many call for spraying all vegetation prior to planting; use mulch; or fight weeds through the 'releasing' of plants to ground level for several years? Most revegetation programmes also involve the planting of indigenous seedlings raised in nurseries. Techniques for open-ground production of indigenous trees and shrubs were developed in the 1960s. Currently however, virtually all indigenous plants are raised in containers that can be \$3-5 or more each. Container-grown plants provide a much longer shelf life between uplift from a nursery and establishment than do open-ground plants, which are bare-rooted and subject to desiccation. This flexibility, however, is often at the cost of quality because container-housed plants readily exhibit root circling, which compromises short-term establishment and long-term viability. Open-ground production potentially could result in cheaper seedlings particularly for large-scale well-planned revegetation programmes on a catchment scale. To address the two primary barriers to uptake of restoration within communities on this scale this project aims to compare effectiveness and economics of some ecologically based restoration techniques, especially the use of toetoe (NZ *Cortaderia* species) as a nurse plant, and to compare the practicality and economics of three nursery-raising methods for large-scale production of indigenous species for revegetation programmes—PB3 planter bag containers, Hillsons Rootainers and bare-root transplants from open-ground beds.

## **Bird Species-area Relationships and Rodent Habitat use in Hawaiian Forests Naturally Fragmented by Lava Flows: Implications for Forest Restoration**

**Flaspohler D**<sup>1</sup>, Giardina C<sup>2</sup>, Asner G<sup>3</sup>, Hart P<sup>4</sup>, Ka'apu Lyons C<sup>5</sup>, Castaneda X<sup>6</sup>

<sup>1</sup> School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI, USA, <sup>2</sup> Institute of Pacific Islands Forestry, USDA Forest Service, Hilo, HI, <sup>3</sup> Department of Global Ecology, Carnegie Institution, 260 Panama Street, Stanford, CA, <sup>4</sup> Department of Biology, University of Hawaii at Hilo, Hilo, HI, <sup>5</sup> Department of Biology Northern Arizona University, Flagstaff, AZ, <sup>6</sup> Department of Biology California State University at Monterey Bay, Monterey Bay, CA

We examined patterns of native and exotic bird species use of and exotic rodent presence in remnant mid-elevation forest patches isolated by volcanic activity 150 years ago in Hawaii. The total number of bird species increased rapidly with forest patch size, with most of the native species pool found in patches  $\leq 3$  ha. Smaller forest patches were dominated by native bird species with several exotic bird species found only in the largest forests. The species-area slope rose more rapidly for exotic bird species, suggesting that many of exotic birds in this landscape show greater area sensitivity than the native birds. Track-plate surveys for rodents suggested that exotic rats were present in all forest fragments, while mice were restricted to the surrounding lava matrix; mongoose were detected only in large contiguous forest. We used airborne scanning light detection and ranging (LiDAR) to assess how well traditional measures of forest fragment quality (e.g., fragment area) correlated with newly available estimates of vegetation volume, an important predictor of bird species richness and abundance. Forest patch area was strongly correlated with vegetation volume but showed a weak correlation with mean tree height. This work demonstrates the value of conserving small remnant mid-elevation forest patches for endemic birds in Hawaii and suggests that restored forests of this type need not be enormous to provide habitat for this unique and threatened assemblage of birds.

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## **Nature in Fast-Forward; Manipulating Revegetated Habitats for Ecological Diversity**

**Forbes A**

Auckland Regional Council

Should we speed up natural succession in restored ecological environments to fit with our own ecological and social goals? The main purpose of the Tiritiri Matangi Island restoration is to create habitat where rare native birds can be viewed by the public in a natural environment. This has been achieved in part, however many areas of the east coast of the island are covered in densely planted pohutukawa monocultures where there is little plant diversity or use by birds. In this study, three different treatments of planted vegetation on Tiritiri Matangi Island were compared for ecological diversity. The treatments were dense pohutukawa monoculture plantings, areas where these had been manually thinned, and mixed species plantings. Areas of dense pohutukawa plantings were found to have significantly lower species diversity and density of vegetation regeneration and bird conspicuousness, compared to both mixed species plantings and areas where pohutukawa had been thinned. This suggests that creation of light gaps in planted monocultures encourages an increase in biodiversity, almost speeding up the natural process of canopy thinning and succession. However, deciding whether this is the best approach to restoration projects depends on the context of the project, and the ecological and social values of its stakeholders.

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## POSTER

### **Ecology and Biocontrol of the Weed *Tradescantia Fluminensis* in New Zealand**

**Fowler**<sup>1</sup>, **S.V.**, Barreto<sup>2</sup>, R.W., Kelly<sup>3</sup>, D., Lamoureux<sup>4</sup>, S., Molloy<sup>3</sup>, S., Paynter<sup>5</sup>, Q., Pedrosa-Macedo<sup>6</sup>, J.H., Smith<sup>1</sup>, L.A. Waipara<sup>7</sup>, N.W.

<sup>1</sup>Landcare Research, <sup>2</sup>Departamento de Fitopatologia, Universidade Federal de Viçosa, 36571-000, Viçosa, M.G., Brazil, <sup>3</sup>Biological Sciences, University of Canterbury, <sup>4</sup>Agresearch, <sup>5</sup>Landcare Research, <sup>6</sup>Universidade Federal do Paraná, Curitiba, Brazil, <sup>7</sup>Auckland Regional Council

*Tradescantia fluminensis* (wandering Jew, family Commelinaceae) is a serious environmental weed in New Zealand, forming dense smothering mats in indigenous forest remnants. Because chemical and mechanical

control of the weed is difficult, a biocontrol programme was initiated in 2002. Dry biomass samples of the weed in New Zealand ranged between 116-3999 g/m<sup>2</sup>, with 83% of quadrats exceeding 200 g/m<sup>2</sup>. Comparable samples from the native range in Brazil ranged between 46-296 g/m<sup>2</sup>, with only 12% exceeding 200 g/m<sup>2</sup>. In New Zealand, dry biomass levels >200 g/m<sup>2</sup> prevent forest regeneration, reduce indigenous invertebrate biodiversity, alter litter decomposition, and change soil nutrient availability. Field surveys in New Zealand found very low levels of damage to *T. fluminensis*, and yielded no specialist insect herbivores or plant pathogens with biocontrol potential. In contrast, a rich biota of insects and plant pathogens was found attacking *T. fluminensis* in Brazil. A PhD study modelling the weed's population dynamics showed that simulated herbivory of leaves or shoot tips reduced biomass production by 40-70%. These preliminary results support the short-listing of two chrysomelid beetle species that each attack the leaves or growing tips of the plant. Another promising chrysomelid has larvae that attack the mat-forming stems. Testing of the leaf-feeding species, *Neolema ogloblini*, showed it has a narrow host range and a decision on field release is expected by the Environmental Risk Management Authority in September 2008.

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## **Habitat Map of Dunedin**

**Freeman C**, Clark R, van Heezik Y

University of Otago

The quality of ecological planning is directly dependent on the quality and availability of data on which ecological decisions are made. There have been significant developments in the production of vegetation and land cover data bases. However, these data bases tend to be either too general for effective ecological planning at a localised level or are fragmented with data availability being confined to known reserves, public open space and areas with known ecological interest. As wildlife, both plant and animal does not restrict itself to these known land areas but ranges and exploits much wider landscapes a comprehensive data bases inclusive of all land areas is necessary. To address this problem in 2003 a project to develop a comprehensive habitat map for the city of Dunedin in New Zealand was successfully completed. The map and associated data base provided an extremely valuable biodiversity resource for the city, one whose value is starting to be proven as its use as a basis for subsequent urban ecological research develops. The land area inside this urban boundary represents less than 2% of the total area managed by Dunedin City Council. For local authorities planning and managing their biodiversity resource requires access to detailed data across the whole district, especially for planning relating to the functional connectivity essential to supporting the movement and dispersal of both plant and animal species across rural and urban landscapes. In 2006 the research team was fortunate enough to be provided with a small grant of \$5000. It was decided to use this money, taking advantage of the newly developed satellite imagery and object-oriented techniques to try and create complete the habitat map for the whole Dunedin district. This paper presents the final 2008 habitat map and data base created, exploring the process of creating the data base, problems encountered and overcome.

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## **Public and ecology - the role of advocacy on Tiritiri Matangi Island**

**Galbraith M**

Unitec New Zealand

Tiritiri Matangi Island has attained an international profile as a successful ecological restoration project, and is often cited as a restoration model. Ecological restoration on the island has always involved, and been dependent on, public involvement. This has shortened the restoration time frame and has allowed access to funding unavailable to government authorities. Public have always derived 'rewards' from their involvement - indeed, the initial Working Plan for the island recommended species reintroductions to attract and retain public interest. The outcome of this sustained "interest" is an understanding of ecological principles. Public (volunteer) involvement was formalised in 1988 with the establishment of Supporters of Tiritiri Matangi (Inc.), an organization with aims to support and promote the restoration project. The contribution that the Supporters have made to the island's management has grown and diversified since their inception, a contribution currently including funds for capital items, research and management of biodiversity. This reinforces existing links between the public and scientific communities, and facilitates even greater understanding of ecological concepts outside of the professional and academic worlds. This paper will examine the nature of the Supporters support for ecological research, and ecological advocacy as an outcome of public involvement in the Tiritiri Matangi restoration project.

## **Hoplodactylus Geckos Feeding on Coelostomidia zealandica Honeydew: A Threatened Island Association?**

**Gardner-Gee R, Beggs J**

University of Auckland

There is increasing evidence that island lizard populations feed extensively on sugar-rich nectars and fruits, possibly in response to reduced inter-specific competition and/or reduced food availability on islands. Honeydew feeding has received less attention, but may be another important feature of the feeding ecology of island lizards. In New Zealand, geckos in the genus *Hoplodactylus* are known to feed on nectars and have also been recorded on Korapuki Island feeding on honeydew produced by the endemic scale insect *Coelostomidia zealandica* (Coccoidea: Coelostomidiidae). This paper reports on an observational study carried out on Korapuki Island (February 2008) and on a survey of *C. zealandica* in the Auckland region (2006-2008). The observational study confirmed that ngaio (*Myoporum laetum*) and karo (*Pittosporum crassifolium*) were the most common plant hosts of *C. zealandica* on Korapuki, that heavy *C. zealandica* infestations occurred on both hosts, and that heavily infested hosts were regularly visited by geckos. These observations suggest that dense patches of *C. zealandica* honeydew are a significant food resource for *Hoplodactylus* geckos. However the survey found that dense *C. zealandica* infestations are entirely missing from the Auckland region. Ngaio was sparse at the survey sites, and while karo was locally abundant it was rarely infested by *C. zealandica* and was never heavily infested. Introduced animals and habitat loss have affected the distribution of *Hoplodactylus* geckos and may also have affected the distribution of *C. zealandica* and its host plants. As a result, this distinctive association may now be threatened.

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## POSTER

### **Eating the Night Away: The Ecological Resilience of Auckland Tree Weta in Urban Forest Patches**

**Gemmill C, Wehi P, Hicks B**

University of Waikato

It is widely recognised that spatial patterns affect ecological processes. Both population and species loss can be driven by land transformations associated with urbanisation, such as habitat fragmentation. Changes in community species composition are also likely to alter ecosystem processes, and it has been proposed that niche breadth changes can be used as an indicator of species vulnerability. Recent work has postulated that resilient species are often generalists, but become susceptible to extinction in fragmented landscapes where niche breadth has been reduced, for example, through reduction in prey species richness. We have used the Auckland tree weta (*Hemideina thoracica*), a generalist omnivorous insect common throughout the northern half of the North Island, to investigate niche breadth at a range of sites. We ask whether tree weta diet, as an indicator of niche breadth, has narrowed in response to either habitat fragmentation or predation. Determination of weta diet and niche breadth is being addressed in two ways. First, frass have been collected seasonally from tree weta at all sites for molecular identification of dietary components. Molecular analysis will be conducted to simultaneously generate a profile of all plants contained in each scat and hence niche breadth, using a DNA "barcoding" approach using chloroplast DNA (cpDNA) markers. Second, comparison of natural abundances of stable isotopes  $^{13}\text{C}$  and  $^{12}\text{C}$  in weta femur tissue and suspected weta foods is being used to trace food web relations, as weta like other consumers preferentially uptake rare ( $^{13}\text{C}$  and  $^{15}\text{N}$ ) rather than common ( $^{12}\text{C}$  and  $^{14}\text{N}$ ) isotopes. Initial data suggest that tree weta appear to have a broader and perhaps more unusual diet than previously suspected. This research will contribute to understanding trophic structure, potential markers of species vulnerability and resilience, and the future role of urban forest remnants in mitigating biodiversity loss.

## **How Important is Genetic Diversity in the Equation of Eco-Sourcing in Urban Restoration Programmes?**

**Gemmill C**, Clarkson F, Cornes T, Overdyck E, Wehi P, Wilox F

University of Waikato

The use of locally eco-sourced seeds and plants is becoming common practice in a range of restoration projects. While we value this approach, we advocate that knowledge of genetic variation of natural *in situ* populations and resulting restored populations should be considered equally along with the locality of collections which is usually the primary criterion; application of population genetic theory can contribute to maximizing genetic variation in *ex situ* collections and hence the long term evolutionary potential of these plants. To learn what eco-sourcing choices are made by restoration practitioners and what they value we conducted a survey focused on: 1) what motivates practitioners to use and/or produce eco-sourced plants, 2) how these practitioners define "local", 3) what factors are most important in collecting materials for eco-sourcing and 4) the extent to which these parties understand and acknowledge the role of genetics in eco-sourcing (in terms of both genetic variation and local provenance). We also hope to gain a clear understanding of the seed collection methodologies utilised by practitioners across the Waikato. This knowledge will contribute novel data to our research programme on evaluating eco-sourcing from a genetic perspective focused at an urban restoration site, the lake at Waiwhakareke Natural Heritage. This research will culminate in a best practice model for future eco-sourcing centric restoration initiatives; from ways to maximize genetic variation during the collection of seeds, through to considerations required when selecting eco-sourced materials. Overall, our research programme will inform, from a genetic perspective, on the success of current eco-sourcing practices and provide some estimates of genetic variation over geographic distance (how local is local?) in conjunction with logistical considerations on how best to collect wild seeds for the purpose of restoration/rehabilitation and delimiting seed provinces.

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### **"The Trouble with Rats..."**

**Gilbert J**

Windy Hill Rosalie Bay Catchment Trust & GBIs Trust

John Ogden is Chairman of the Great Barrier Island Trust, a long standing trustee on the Windy Hill Rosalie Bay Catchment Trust, and the ecological advisor to the Awana Catchment Trust, all on Great Barrier Island. This ecological jewel has 28,000 hectares of mainly bush that is possum, goat, deer, mustelid and hedgehog free – one of the biggest, if not the biggest, landmass in NZ with this status. The trouble is it has abundant rats which, with few natural predators and competitors, wreak havoc on the islands ecology. John is at the forefront of the GBI Trust whose vision is make the island rat and feral cat free, to reintroduce species lost to the island, and to work towards an eco-based economy for the island. At the same time he contributes his expertise to the conservation working models at Windy Hill and Awana. 'The Trouble with Rats' details his enthusiastic and intelligent leadership, involvement, and rat expertise.

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### **Leaves, Limbs and Lagomorphs: The Influence of Microdisturbance within Forests**

**Gillman L**

AUT University

When we talk about disturbance regimes in forests, the first image that generally comes to mind is a sweep of landscape hammered by storm or fire. The second image might be that of a small scale patch dynamic involving units of one to a few tree-fall units. The importance of the interplay between these different scales of disturbance is now well established. But if we zoom right in to the forest floor where juvenile plants struggle to survive we are confronted with a stage in the life-cycle of trees where mortality is usually greatest, and where natural selection is perhaps at its most intense. Here I present evidence to suggest that the disturbance regime at this scale – microdisturbance - is also an important factor influencing the survival dynamics of trees.

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## Utility of DNA in Detecting Pest Movements and Re-invasions

Gleeson D<sup>1</sup>, Byrom A<sup>2</sup>, Howitt R<sup>1</sup>, Innes J<sup>3</sup>

<sup>1</sup> Ecological Genetics Laboratory, Landcare Research, Auckland, <sup>2</sup> Landcare Research, Lincoln, <sup>3</sup> Landcare Research, Hamilton

One of the most important components of pest management is the ability to determine the presence, number, location and origin of pests at low densities. This is particularly important when eradication from an area is required or targeting survivors post-control is the goal. However, detecting the rare survivors of pest control (or re-invading immigrants) and mapping their abundance is expensive. Managers and researchers urgently require higher levels of certainty about the presence or absence of animals than they currently possess, at much lower cost. The ability to identify individuals from DNA collected using non-invasive techniques is rapidly becoming a key tool for monitoring species at low densities. This tool has the potential to provide relatively unbiased and affordable estimates of actual densities of wild animals (as well as their location and origin), particularly where a high proportion of the population is killed and recovered as part of pest control. We have pioneered initial applications of this technology to possums (fecal pellet DNA) and stoats (hair tube sampling) and are currently expanding these methods to other pests, particularly cats and rats. We will present data from our current projects, which include determining immigrants from residents of stoats in eradication programmes (Secretary and Resolution Islands), detecting re-invaders in rats (Hauraki Gulf, Waikato Forest Fragments), and utility of DNA for estimating cat abundance (Central Otago Drylands). We will review methods required for obtaining good-quality 'field' DNA from hair follicles, scat, or tissue and how these can impact on obtaining sufficient DNA quantity and quality to avoid error rates due to factors such as allelic drop-out. Finally, we will review what techniques are currently available for each species and give estimates of costs for these.

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## Seeking Sanctuary in Mainland Islands: The Life and Times of the House Mouse in a Predator-Free Environment

Goldwater N

Removing free-living house mice (*Mus musculus*) from fenced mainland islands is becoming an increasingly difficult task. The situation is exacerbated following the eradication of other mammalian predators and competitors, which often results in a dramatic increase in mouse densities and abundance. But what other demographic and physiological changes occur in a mouse population suddenly faced with no mammal antagonists and a full larder, and how do these relate to habitat type? My study took place at the Tawharanui Open Sanctuary. It aimed to gain a greater understanding of mouse ecology in mainland islands by comparing findings with a study conducted at Tawharanui in 2001, which researched mice living in four habitat types *before* the exclusion fence was constructed and *before* rats, cats, possums and mustelids were removed. Significant changes in mouse density, body weight and fecundity were observed in my study. These differences are discussed in the context of predator/competitor release, habitat, and sanctuary management.

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## Changes in Abundance of Native Bird Species on Tiritiri Matangi Island

Graham M, Veitch C

Regular forest bird counting was started on Tiritiri Matangi in 1987 in the form of transects and five minute counts in differing forest conditions and management regimes. This paper analyses data from transects in three forested, un-managed, areas and three managed, forest re-establishment, areas. The eight native bird species that were re-introduced to the island prior to and during the study period are excluded from this analysis. Seven native bird species and eight exotic bird species were observed during all counts and are included in the analysis. The overall observation is that there has been little change in abundance of these groups in un-managed areas although some species have increased while others declined. In managed areas native birds have increased in abundance while exotic species have declined.

## Ground Invertebrate Population Changes on Tiritiri Matangi Island Following Eradication of Kiore (*Rattus exulans*)

Green C

Department of Conservation

Pitfall traps were used to monitor ground invertebrates on Tiritiri Matangi Island following the eradication of kiore, or Pacific rat (*Rattus exulans*) in 1993. Invertebrates were trapped monthly in a mature broadleaf forest remnant and in a younger regenerating forest area. During the first six years capture rates of some invertebrate groups increased and peaked immediately prior to the El Nino event of 1997-1998. Larger species (body length greater than 10 mm) including a ground weta *Hemiandrus pallitarsus* (Orthoptera: Anostomatidae) and a prowling spider *Uliodon sp* Araneae: Zoropsidae) increased four fold in this period. However, numbers declined in subsequent years with mean capture rates over the 15 year period averaging approximately double the number caught in the first season. Other species, although present elsewhere on the island, took many years to first appear in the traps. The giant centipede *Cormocephalus rubriceps* (Chilopoda: Scolopendridae) was not caught for the first 10 years but since 2003 has been encountered regularly in summer and autumn. Seasonal population changes in these and other flightless nocturnal ground dwelling invertebrates are correlated with kiore eradication.

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## Exploring the habitat potential of urban greyfield sites

Greenep H<sup>1</sup>, Wiser S<sup>2</sup>

<sup>1</sup> Lincoln University / Landcare Research, <sup>2</sup> Landcare Research

Urban greyfield sites are wasteland sites situated in the industrial, commercial and central areas of the city. In New Zealand, wasteland and greyfield sites are largely unexplored particularly with regard to habitat potential. To get an idea of greyfields as habitat the flora of Christchurch urban greyfield sites was surveyed. Two main questions are being addressed in this work: 1) do urban greyfield sites contribute to native biodiversity; 2) do they hold any potential as habitat for native biodiversity? There are many aspects of urban greyfields that on the face of it might suggest low quality habitat. One of these is their ephemeral nature, coming and going according to economic demand. On the other hand these very same aspects might make them ideal habitat for native species from naturally harsh, frequently disturbed natural habitats. Greyfield sites often present freshly cleared substrates, denuded by the process of demolition, or merely through a lapse in maintenance provide colonising plants with previously unexploited habitat. Biodiversity initiatives in urban areas often focus on remnants, river corridors, coastal areas or areas outside of the truly urban sectors of a city ignoring the highly modified environments. By exploring the habitat potential of these highly modified areas it may be possible to enhance the biodiversity value of cities and weave native biodiversity throughout the entire fabric of our cities. The data from the greyfield survey have been combined with similar data sets from braided riverbeds, shingle beaches, rocky outcrops and limestone habitats. The resulting data set was analysed using non-metric multidimensional scaling to assess how different the five habitat types are according to their floristic composition. Overlaps in species composition between the greyfield and natural habitats may indicate potential for greyfields to support a wider range of native plant species.

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## POSTER

### Innovative Ivy Control : Sharing the Experience

Griffiths K

The Conservation Company Ltd

Puahanui Bush is the largest remnant of lowland podocarp forest in the Hawke Bay. At 130 ha, it is a biodiversity gem. However, invasive weeds have been present for some time and English ivy (*Hedera helix*), in particular, has had an impact on canopy cover and regeneration. Ivy control started with herbicide applications, and more recently, the use of sheep to graze and bruise the ivy before herbicide application, resulting in a much better rate of kill. Control methods, monitoring regimes and results to date are presented.

## Investigating the Effects of Fragmentation on Forest Structure using the Forest Growth Simulation Model FORMIND

Groeneveld J<sup>1,3</sup>, Metzger J<sup>2</sup>, Perry G<sup>1</sup>, Huth A<sup>3</sup>

<sup>1</sup> University of Auckland, <sup>2</sup> University of Sao Paulo, Brazil, <sup>3</sup> UFZ Centre for Environmental Research Leipzig-Halle, Germany

Deforestation in tropical and sub tropical rain forests often results in landscape mosaics of small patches of secondary and mature forests. One example of such a network of forest remnants is the Atlantic Rain Forest in the state of São Paulo, where less than 10% of the original area is still forested. Despite this enormous habitat loss the remaining forest fragments are still considered as hot spots of biodiversity. To maintain this unique biodiversity it is essential to understand how fragmentation does alter ecological processes and the long term vegetation dynamics. Therefore we have applied the forest growth simulation model FORMIND. Firstly, we have parameterized and calibrated the model using biomass estimates of continuous forest of a nature reserve. Secondly, we have simulated the succession of small isolated fragments after clear cut. We have found that edge effects as increased mortality at the forest edge and external seed rain have been necessary to reproduce empirical biomass estimates. On the long term the simulated overall biomass is much less in fragments compared to the continuous forests, mostly due to the reduced number of large shade tolerant trees. Finally, we will discuss future application of the forest model FORMIND on questions of coexistence of gymnosperm and angiosperm species in New Zealand forests.

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## Use of Scent and Olfaction in Pest-Management

Gsell A<sup>1</sup>, Seabrook-Davison M<sup>1</sup>, Ji W<sup>1</sup>, Shanas U<sup>2</sup>, DeMonchy P<sup>3</sup>, Innes J<sup>4</sup>, Agnew W<sup>5</sup>, Brunton D<sup>1</sup>

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New Zealand's many 'pest' free offshore and mainland island refuges are the foundation of conservation management of our unique biodiversity. The success of these refuges requires the long-term maintenance of this pest free status. Rodents (Norway and Ship rats and mice) are major pests and predators of indigenous fauna. Incursions by these rodents into conservation refuges can and do occur and early detection of these rodents is crucial for appropriate control responses and eradication. The longer the rodents go unnoticed the more difficult they will be to control and the more damage they will do to the indigenous species within the refuge. Currently, the most commonly used detection device is baited tracking tunnels that record rodent footprints. However, tracking tunnels need to be serviced regularly, making them labour- and hence cost-intensive. We evaluate two different detection methods based on scent and olfaction 1) trained 'rodent' detecting dogs and 2) live decoy rats placed in cages. Dogs play an increasing role in conservation in New Zealand e.g. they are used to find kiwi and can cover large areas. The relative success of rodent-dogs in tracing and spotting rodents has though never been tested. A different approach in pest-management is also potentially plausible in attracting wild rodents by scent lures such as live animals or their derivatives (bedding, faeces and urine). The use of live rats to attract wild rodents is novel and the idea is based on the mate searching behaviour of rodents in the wild. Both methods have been highly successful and we discuss their application and benefits especially to conservation managers and community restoration projects.

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## A Review of Reptile Research on Tiritiri Matangi Island.

Habgood M<sup>1</sup>, Baling M<sup>2</sup>, van Winkel D<sup>2</sup>, Ruffell J<sup>3</sup>, Ji W<sup>2</sup>, Ussher G<sup>4</sup>

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The remnant resident herpetofauna of Tiritiri Matangi Island were thought to consist of only two skink species, moko skink (*Oligosoma moco*) and copper skink (*Cyclodina aenea*), until the 2004 discovery of the common gecko (*Hoplodactylus maculatus*). In recognition of the gaps in the island's reptile community and their importance in ecosystem function, three reptile translocations have been undertaken: tuatara

(*Sphenodon punctatus punctatus*); shore skink (*O. smithi*) and Duvaucel's gecko (*Hoplodactylus duvaucelii*). Tiritiri Matangi Island presents an ideal setting to study the somewhat under-researched native reptiles, with conservation management outcomes in mind. This review summarises research efforts on Tiritiri Matangi Island to date including post graduate studies that investigated: (1) behavioural interactions between copper and moko skinks and their implications for translocations; (2) the success of the 2003 tuatara translocation; (3) post-translocation dispersal and monitoring of the cryptic Duvaucel's gecko and effects of native predation on island lizards; (4) post-translocation dispersal patterns of shore skink; (5) distribution, population structure and genetic status of common geckos. The current research is only initiating baseline information on the ecology and biology of these species and numerous research opportunities are still available on Tiritiri Matangi Island. The need for long-term research is becoming more evident, particularly as New Zealand reptiles commonly have high longevity but low reproductive rates. Despite this, these studies will contribute to positive steps towards informed future translocations of endangered reptiles to Tiritiri Matangi Island in the ongoing effort to re-establish a fully functional ecosystem.

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## **Project Twin Streams - Working Together for Healthy Streams and Strong Communities**

**Hall K**<sup>1,2</sup>

<sup>1</sup> Thomas Civil Consultants Ltd, <sup>2</sup> Waitakere City Council

Project Twin Streams focuses on achieving long term sustainable management of the Henderson Creek and Huruhuru Creek catchments, located in Waitakere city. The project weaves together the issues of integrated stormwater management and the restoration of stream banks with a sustainable community development approach. The project is jointly funded by Waitakere City Council and Auckland Regional Holdings over a ten year period from 2002-2012. Restoration is being undertaken on 56km of urban streams, with an average width of 10-15m on each stream bank. Restoration actions are undertaken by the local community, school groups, Council employees and contractors. New Zealand conservation and restoration projects have traditionally been conducted in isolated areas or offshore islands away from people. This presentation will consider the challenges of conducting riparian restoration in an urban environment and discuss some of the successes to date. It will introduce the Project Twin Stream philosophy and discuss how restoration and community engagement is undertaken on the ground. We also introduce some questions for how restoration projects can be managed in perpetuity. For more information on Project Twin Streams, including how to become involved, please visit our website [www.projecttwinstreams.org.nz](http://www.projecttwinstreams.org.nz).

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## **Understanding the Ecology of Pests on Trade Pathways -The Tuvalu Case Study**

**Hardy C**

Ministry of Agriculture and Forestry

Global trade increases daily, which increases the likelihood of invasive species entering New Zealand's urban environments through our ports. Interception data provides evidence of relationships between commodities and pests that may not be apparent in the literature. Tuvalu's application to import coconuts into New Zealand is used as a case study of the biosecurity risk analysis process, which assesses potential risks associated with coconut production in Tuvalu and on the import pathway. Records of organisms intercepted on produce at the border from active pathways in the Pacific have highlighted interesting relationships between species. They also signpost potential pests that could cause human health impacts were they to establish in New Zealand, as well as general principles around the importance and predictability of hitchhiker organisms on the coconut pathway. Of 54 organisms in the interception data identified to species level (from other Pacific coconut imports), 39 are considered hitchhiker species with no biological association to the coconut itself. Fifteen are found to have a direct association with that plant part. The relationship between invasive ant species and honeydew producing hemipterans is looked at in detail. Nine of 17 ants in the dataset tend insects that produce honeydew where they occur. The risk factors for many hitchhikers relates to use and storage conditions of a commodity often in urban areas prior to export. Although not present in Tuvalu a mite *Androlaelaps casalis* which can cause severe puritis and dermatitis in humans and is a known transmission agent for several zoonotic diseases will also be considered. This association would not have been predicted in the absence of interception records. The coconut is intermediate in biosecurity characteristics between fresh fruit and inanimate commodities (e.g. scrap metal) based on the compliment of its intercepted pests. Implications for biosecurity risk analysis of new pathways are discussed.

## POSTER

### **Experimental Studies of the Effects of Host Plants on the Development and Survival of the Caterpillars of Monarch Butterflies (*Danaus Plexippus*) in New Zealand**

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<sup>1</sup> New Zealand Science, Mathematics and Technology Teacher Fellowship Scheme, <sup>2</sup> Monarch Butterfly NZ Trust, <sup>3</sup> School of Biological Sciences, University of Auckland

The monarch butterfly (*Danaus plexippus*) is a well studied model system for host plant use and migratory behaviour in its native and introduced ranges of North America and Australia. To date little research has been done on the effect of host plants on monarch caterpillar growth in New Zealand. We used several experimental approaches to ask three sets of questions on the foraging ecology of monarchs: what are 1: the effects of common and rare milkweed species on the growth and survival rates of the monarch caterpillars, 2: the daily and overall intakes of plant material of larvae reared on different hosts, and 3: the interactions between host plant choice and caterpillars' vulnerability to predators? We detected consistent differences between the survival, growth, food intake, and vulnerability to predators of caterpillars developing on different host plants across study areas that included both North and South Island sites, with critical differences between similar studies conducted outside New Zealand. These findings have implications for the propagation and management of monarch butterflies and suggest future work on the impacts of host species choice, toxicity, and plant architecture in influencing caterpillar foraging, survival, and predation risk.

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### **Vectoring of Seabird Nutrients into the Terrestrial Ecosystem of Motunau Island, North Canterbury**

Hawke D, Clark J

Christchurch Polytechnic Institute of Technology

Motunau Island is a 3.5 ha island lying 1 km off the North Canterbury coast. The island consists of a plateau dropping precipitously to a boulder beach, with a small flat at the eastern end. This island is unusual in that it hosts extensive penguin and petrel colonies in an environment dominated by an invasive weed (tree mallow), but free of introduced mammals. To elucidate C and N flows in this highly modified system, we carried out stable isotope ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ) analysis of the likely base and top components of island food webs. Tree mallow foliage from the 3 geographic environments on the island was highly enriched but strongly differentiated in  $\delta^{15}\text{N}$ , reflecting different levels of seabird activity. Notwithstanding an 8‰ spread in mean terrestrial vegetation  $\delta^{15}\text{N}$  from the plateau and the eastern flat, cast gecko (*Hoplodactylus pacificus*) skins from these locations were indistinguishable, showing marine levels of  $\delta^{15}\text{N}$  but terrestrial  $\delta^{13}\text{C}$ . The most biologically reasonable explanation for the overlap is that plateau geckos obtained their nutrition from a mixture of invertebrates from seabirds and tree mallow while the geckos from the beach and eastern flat obtained theirs almost solely from tree mallow; the overlap of plateau and flat geckos then being coincidence. Shore earwigs (*Anisolabis littorea*) were differentiated isotopically, with females having a higher proportion of marine C. Our study therefore showed that seabird nutrients are successfully vectored into the terrestrial ecosystem notwithstanding domination of the plant community by exotic weeds.

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## POSTER

### **Soil Mixing Processes in a Petrel Colony from the Distribution of $^{137}\text{Cs}$ and $^{210}\text{Pb}$**

Hawke D

Christchurch Polytechnic Institute of Technology

$^{137}\text{Cs}$  and  $^{210}\text{Pb}$  are environmental radionuclides often used to measure soil erosion and sediment deposition, and soil or sediment mixing. My study in a Westland petrel colony used unsupported  $^{210}\text{Pb}$  (which is deposited continuously) to model long-term mixing processes, and  $^{137}\text{Cs}$  (which came from nuclear weapons testing) to identify post-1963 soil events. Depth profiles came from two sites within the colony. The control site was on a flat section of ridgeline where petrel burrows were absent; the site on the sideslope (slope c.  $25^\circ$ ) was among petrel burrows and had topography indicative of past erosion. Control site  $^{137}\text{Cs}$  activity showed the expected small subsurface maximum, and decreased to zero by  $z = 20$  cm. The activity

of both  $^{137}\text{Cs}$  and unsupported  $^{210}\text{Pb}$  showed the expected logarithmic decrease with depth ( $^{137}\text{Cs}$ ,  $r^2 = 0.91$ ; unsupported  $^{210}\text{Pb}$ ,  $r^2 = 0.90$ ). This contrasted with the burrowed site, where neither radionuclide followed a logarithmic distribution. Both radionuclides penetrated further into the soil profile consistent with increased soil mixing, but decreased to zero just above lithic contact. A subsurface maximum centred on 12-16 cm dominated the  $^{137}\text{Cs}$  profile but was absent in the unsupported  $^{210}\text{Pb}$  profile, implying a major soil deposition event post 1963 superimposed on steady state mixing from burrowing. The study therefore demonstrated the utility of  $^{137}\text{Cs}$  and  $^{210}\text{Pb}$  for assessing mixing processes in petrel colonies.

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## Applying the Population Indicator Species Concept to Conservation Management in New Zealand

Hoare J, O'Donnell C

Department of Conservation

Indicator species concepts are those based on the premise that measuring attributes of one or a few species can produce information applicable to a greater number of species or an ecosystem. A variety of indicator species concepts driven by different goals are in operation. Indicator species have been used to track changes in other populations, to assess environmental degradation and to identify areas with high species richness for legal protection. However, while indicators of biodiversity and ecosystem health have received significant scientific attention, others, such as indicators of population trends, remain poorly evaluated. We synthesised literature on the population indicator species concept and found that, although the assumption that trends in one species can indicate trends in other species is prevalent in conservation management, few attempts have been made to test it. Evidence for whether the concept has merit is equivocal and few recent tests exist. Nonetheless, indirect evidence can be drawn from numerous multiple-species studies to suggest that, where a shared threat is of significant magnitude and populations operate on similar spatial scales, population trends among a range of species may be correlated. We present a framework for testing the population indicator species concept and suggest that a range of New Zealand conservation management case studies should be used to reduce uncertainty about the applicability of the concept.

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## Kiwi Recovery - The Next 10 Years

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<sup>1</sup> Department of Conservation, <sup>2</sup> BNZ Save The Kiwi Trust, <sup>3</sup> Royal Forest and Bird Protection Society of New Zealand

A new 10 year recovery plan for kiwi (*Apteryx* spp.) has just been published, building on the achievements since publication of the first (1991-1996) and second (1996-2006) plan. It covers all 5 currently recognised species of kiwi as well as a number of distinct provenances within two species.

The volume and detail of submissions received during the consultation process for the new plan indicate a considerable level of engagement with kiwi recovery, with the majority of submissions coming from outside the Department of Conservation. Kiwi recovery has successfully moved from an initial focus on research to large-scale site management, and from being the domain of a small number of specialists to a broad front of active stakeholders. The new plan contains nine goals over its term, covering management, community engagement and research, and lists 91 actions to achieve these goals. The talk will present an overview of kiwi recovery today, provide context to the goals, actions and recovery principles of the plan and a summary of submissions received. While concerted management effort and new tools have allowed some kiwi populations to increase, many unmanaged populations are still declining. Kiwi recovery requires the full spectrum from continued and increased management over larger areas to close-order management of individual populations, as well as filling basic gaps in our current understanding of behaviour, biology and trends, especially for South Island species.

## POSTER

### **NVS Lite: A Data Entry System for Recce Description and Permanent 20×20 m Plot Data**

Vickers S, Hurst J, Broadbent H, Spencer N, Wiser S

Landcare Research

Data stored in the National Vegetation Survey (NVS) Databank has great potential to assist in the description and management of New Zealand's unique biodiversity. Such vegetation data can offer unique insights into vegetation distribution and dynamics, over regional and national scales. NVS Lite is a stand-alone computer package developed by Landcare Research-Manaaki Whenua, to assist with entry and validation of vegetation plot data stored within the NVS databank. NVS Lite was tailored for entry of data collected using standard forest monitoring methods (i.e. permanent 20×20 m plots) and vegetation inventory methods (i.e. the Recce method; see <http://nvs.landcareresearch.co.nz/>). Purpose-built data entry applications afford a number of benefits, facilitate data entry by the staff that undertook the data collection, and allow data to be entered in formats that are intuitive to users. Purpose-built systems ensure that sensible constraints are placed on values that may be entered and inbuilt validation facilities highlight potential errors. For example, invalid or unknown species codes can be one of the most problematic issues faced when using vegetation data. In NVS Lite, all species codes entered are checked against those currently recognised in NVS. Recent progress on the NVS databank has focussed on the ongoing development of NVS into a permanent and stable vegetation data management system. Future work will include the development of tools and applications to exchange, convert, summarise and analyse data stored within NVS. It is envisaged that such tools will be readily available, and will afford significant benefits to end-users, including DOC, regional councils, universities and others.

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### **Foraging and Breeding Ecology of the Australasian Gannet (*Morus serrator*) at Cape Kidnappers**

Ismar S

University of Auckland, School of Biological Sciences

The marine system is characterised by extreme temporal and spatial patchiness of prey distribution. Accordingly, the reproductive success of its K-selected top predators is intrinsically linked with food availability. For example, many seabirds' breeding phenology and foraging strategies are adapted to include obligate biparental care for a single offspring in social monogamy. Despite size monomorphism, behavioural dimorphism may still operate in seabirds owing to sexually selected traits or to enhance cooperation between the sexes. In a collaborative effort I employed newly adapted tracking technology, molecular sexing, and spectrophotometry in combination with extensive field observations to assess sex-specificity and seasonal patterns in the phenotype, including plumage traits and foraging and breeding behaviours of the Australasian gannet *Morus serrator* at Cape Kidnappers gannetry, New Zealand. I discovered plumage colour dimorphism in gannets, and recorded male sex-specificity for two distinct breeding behaviours: initial nestsite occupation and nesting material provisioning. Investigating the principles of this predominantly monogamous system, I discovered evidence for a reproductive advantage of mate retention across years. I also confirmed sex dimorphism in foraging and detected seasonal variability in its patterns in this New Zealand population. This study system promotes the assessment of how ecology shapes the evolution of behavioural adaptations and has implications for seabird conservation in New Zealand and beyond.

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### **The Distribution of *Hemideina Crassidens* and *Hemideina Thoracica* on Mt Taranaki: Interactions Within a Contact Zone & How Climate Change Affects Species Range.**

Jacobson M

Ecology Group, INR, Massey University, Palmerston North

Tree weta generally have a parapatric distribution (with no geographical overlap). However, on Mt Taranaki a contact zone exists, where the two species have been found occupying and sharing the same habitat (sympatry), even to the extent of sharing roost holes. Due to the continuous nature of the forest on Mt Taranaki, the contact zone between these two species was easily detected. Trewick and Morgan-Richards, (1995) estimated that the contact zone was probably not more than a few hundreds of meters wide, and

found between 650 and 900m (asl). No hybrids have been found in this sympatric zone, although a rare hybrid (probably sterile) has been identified from the Manawatu. Selection to choose the correct mate must be strong within the contact zone but absent from areas of allopatry. My study will look for evidence of reproductive character displacement in the contact zone on Mt Taranaki. What characters enable tree weta to make the correct choice of mate? The two species have definite colour differences, but being nocturnal this is an unlikely cue for mate choice, differences in stridulation rates or sounds, or perhaps pheromones are more likely. I will map more accurately, the width and centre of the contact zone of the two *Hemideina* species, on Mt Taranaki. Morphometric data (including stridulatory structures) from weta on the mountain will be compared to data from allopatric population, in order to test for reproductive character displacement. Putative hybrids will be cytogenetically examined. To facilitate ongoing data gathering, to monitor stability (or shift in response to climate change) of the contact zone, I plan to install artificial weta roosts. Preliminary results will be discussed.

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## **Social Life of Urban Possums inter and Intra-sexual Interactions, Does Kinship Play a Role?**

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<sup>1</sup> Massey University, <sup>2</sup> Landcare Research

To people, city life means pubs, restaurants, cinemas and traffic. What does it mean to wildlife? We will discuss whether urban possum populations different from that of non-urban areas. We report on the patterns of interactions between possum individuals in an urban native forest fragment revealed by proximity data loggers. Previous studies of wild populations suggested that the possums are solitary and the interactions mainly occur between males and females. Our results reveal that interactions between females occur frequently. We have also obtained the microsatellite genotypes of 43 mature and immature possums and 48 pouch young recorded over the three years in this population using 7 microsatellite loci. We will discuss whether observed pattern of interactions between possums are influenced by their genetic relatedness. The patterns and the rate of interactions between wild possums is important for both understanding the transmission of diseases and for evaluation of future self disseminated biological control methods. Consequently it is important to compare the social behaviour between different habitat types to determine whether these models can be applied uniformly.

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## **Ecology in the House: The Challenges and Imperatives of Urban Ecology**

Jones D

Centre for Innovative Conservation Strategies

Although ecology as a science was conceived to draw attention to the interconnectedness of life, in practice ecologists have consciously avoided or minimised the influences of humans. Anthropogenic environments were regarded as anti-natural where human-generated effects confounded and swamped attempts to understand 'normal' ecological processes. The result was a wilful neglect of attempts to understand the ecology of urban environments. The recent crossing of a threshold in which most humans dwell in large cities globally has been accompanied by a recognition that cities need to be understood as ecosystems, albeit atypically complex and dynamic, and that human and global wellbeing is strongly influenced by the existence of cities. Moreover, an appreciation of ecology of the city has led to an interest of ecology *in* the city, exemplified by the dramatic increase in community concerns about local wildlife and habitats, both from conservation and conflict perspectives. Such issues are well illustrated by recent work from south-east Queensland, among the most rapidly growing urban areas in the world. Up to 2000 people per week are being attracted to this region, many because of its apparent natural assets. Ecological studies in these urban environments are being used to inform planning processes with the aim of minimising the impacts of development. Inevitably, these studies have had to broaden to include social science, a traumatic but essential collaboration! The implications of this work has numerous applications for urbanising New Zealand including the changing role of mainland islands and the practice of wildlife management.

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## POSTER

### **Life in Miniature: Competitive Coexistence of Spore-Feeding Beetles in a Patchy Variable Environment**

**Kadowaki K**<sup>1</sup>, Beggs J<sup>1</sup>, Leschen R<sup>2</sup>

<sup>1</sup> School of Biological Sciences, University of Auckland <sup>2</sup> Landcare Research, Auckland

Understanding why many insect species can coexist in a patchy environment is one of the perennial challenges in ecology. Individuals of insects in different patches experience different environments and different strengths of interspecific competition at different times. Such spatial and temporal variability permeates a patchy environment and profoundly alters the conditions for local coexistence of two species that compete for a resource. This paper presents a quantitative descriptive study of the relative effects of spatial, temporal, and spatio-temporal variability of resource density on the strength of competitive interaction between three dominant beetle species on the wood-decaying bracket fungi *Ganoderma*. We first explored the most parsimonious model which explains the variability of daily spore production, accommodating several environmental variables at the patch-level. Furthermore, we tested whether the spore-feeding beetle community was simply regulated by the dynamics of spore production, or, affected by interspecific competition for limited resource or habitat. The simple fungus-insect system allows a real-time evaluation of consumer-resource dynamics and can become a useful model system for understanding competitive coexistence in patchy environments.

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## POSTER

### **Ecology, Ethnobotany, Germination, and Growth of *Eleocharis sphacelata***

**Kapa M**

Waikato University

The use of the native New Zealand wetland plant species *Eleocharis sphacelata* in restoration and creation of new wetland sites is increasingly common. While Māori have long recognised *E. sphacelata* (kuta paopao) for its thermal qualities and utilised the fibre in woven items, it is more recently prized for its ability to tolerate high nutrient loading in constructed waste water treatment situations. To aid future increased utilisation of *E. sphacelata* in restoration and commercial development, research was undertaken during 2008 identifying matauranga Māori, and practical methodologies including seed germination techniques and growth comparisons. Together this data with information collated from sources that are both published and unpublished (use and harvesting practises by Māori were recorded in the form of interviews) are revealed in a poster. Information such as this is relevant to increase the ability of wetland ecologists using this important wetland species in future restoration, enhancement and creation projects. My poster will provide important and specific methodologies investigated during my thesis research to facilitate this process.

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### **Large Fruit in the NZ Flora: The Adaptive Significance of Variance**

**Kelly D**<sup>1</sup>, Ladley J<sup>1</sup>, Robertson A<sup>2</sup>, Anderson S<sup>3</sup>, Wotton D<sup>1</sup>

<sup>1</sup> University of Canterbury, <sup>2</sup> Massey University, <sup>3</sup> University of Auckland

There has been concern in NZ and overseas about the continued dispersal of large fruits given anthropogenic reductions in the densities and ranges of large frugivorous birds such as kereru. Analysis of fruit and seed sizes for the largest-fruited NZ plants should explicitly consider the variance in fruit size, since size variability bears directly on this question. Firstly, karaka (*Corynocarpus laevigatus*) is often said to be our largest fruit, but by several measures it is not our hardest-to-disperse fruit. The answer to that question depends on whether you consider the mean, the median, the upper tail or the lower tail of fruit sizes, which have different ecological consequences. Some of the largest fruit are relatively more variable in fruit size than smaller-fruited native species, which may have adaptive significance by widening the range of potential dispersers. Much of this greater variability is driven by species (supplejack, tawapou, puriri) with varying numbers of seeds per fruit. Mean fruit size within a species varies with latitude and we explore possible reasons for this. Bird behaviour could impose directional selection on fruit size, but there is surprisingly little

evidence for this. Finally we present experiments on the relative fitness of large and small seeds in *Beilschmiedia tawa*: are the small seeds any good?

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## **Whatever Happened to the Concept of the 'Great Australian Weed'?**

**Kershaw P**

Monash University

In the late 1970's, evidence was emerging for a substantial expansion of Eucalyptus within Australia after the arrival of Indigenous people. In combination with its ecological characteristics, the possibility that the expansion was caused by human burning made it feasible to suggest that the plant should be classified as an anthropogenic weed. Although the rest of the world would have little problem with this definition, it was sacrilegious to consider 'The Universal Australian' in such terms within its homeland. A proposed paper elaborating this perspective was formulated with Ogden as we walked through the wet sclerophyll forests of Victoria, but a manuscript never materialised. This contribution considers whether the paper should have been written in light, particularly, of palaeoecological and archaeological knowledge accumulated over the subsequent 30 years. The first charcoal counts produced in 1981, associated with the long pollen records Lynch's Crater and Lake George, appeared to confirm a burning cause for the geological recent increase in abundance of Eucalyptus and that, in the absence of any notable change in global climate, human activity was the likely agent. The major uncertainty was whether the landscape change was diachronous, accommodating initial impact dates of about 130 and 40 ka, or whether the earlier date, from Lake George, was erroneous. Subsequent palaeoecological and archaeological studies have re-inforced the proposed relationship between human arrival and environmental change around 40 ka and led to a general acceptance of the human burning hypothesis. However, the 130 ka signal has not disappeared, there is no consistent response of Eucalyptus to either event or to additional suggested events, and there has been increasing recognition of the potential importance of a regional climate signal on landscape change. It is reluctantly conceded that the concept has not survived the test of time.

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## **Assessing the Benefits of Possum Control in Mixed Beech-Broadleaved Forests, South Westland.**

**Knightbridge P**, Anderson F, Anderson L, Phillips R, Elliott M, Martini M, Farrell T

West Coast Conservancy, Department of Conservation

The mixed beech-broadleaved forests of South Westland were one of the last parts of New Zealand to be invaded by brush-tailed possums. An assessment of conspicuous canopy dieback present in 1989-1990 in South Westland recommended that increases in Government funding for possum control be spent on protecting "representative forest tracts before the onset of widespread canopy dieback and associated ecosystem depletion" (Rose *et al* 1993). This presentation examines whether South Westland's current possum control programme is achieving this recommendation. A combination of increased Government funding and improved effectiveness of aerial 1080 operations has seen the area under sustained possum control increase from about 10,000 ha in 1993 to about 170,000 ha today. Since the mid 1990s the Foliar Browse Index (FBI) has been the main technique used to assess the benefits of this possum control programme. Declines in scarlet mistletoe (*Peraxilla colensoi*) and tree fuchsia (*Fuchsia excorticata*) foliage cover with increased length of possum occupation and possum abundance have been used to set possum trap-catch triggers for possum control operations. These two species have proven to be the best indicators of possum impacts in these forests as their foliage cover is sensitive to changes in possum abundance. Monitoring declines of these two species at South Westland sites with uncontrolled possum populations has demonstrated that they will disappear from forests below 600m altitude in the absence of possum control. This presentation will contrast this result with FBI data for other possum palatable species such as kamahi, mahoe and pate. In future we expect to place less emphasis on FBI monitoring as possum trap-catch triggers have been set based on the values to be protected at each site. More emphasis is likely to be placed on determining long term benefits of possum control by monitoring recruitment and mortality rates of possum-vulnerable tree species and mistletoe using permanent plots at a few key sites.

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## **The Impact of Fish Leeches (Hirudinea, Piscicolidae) on the Marine Ecosystem of Antarctica during Global Warming**

**Kolb J**<sup>1</sup>, Barraclough R<sup>1</sup>, Rainey P<sup>1</sup>, Evans C<sup>2</sup>, Brunton D<sup>1</sup>

<sup>1</sup> Massey University Auckland, <sup>2</sup> University of Auckland

In the context of global warming and to predict future impacts on an ecosystem it is important to understand the responses not just of individual species, but also of critical ecological interactions such as host-parasite relationships. The Antarctic environment provides a unique study site as human impacts are still minimal, hence making it ideal for investigating species interactions within a functioning ecosystem. The isolation of Antarctica for millions of years is rapidly declining and global warming will further increase the arrival and introduction of alien species. There is thus an urgent need for developing baseline information for monitoring impacts of climate change in Antarctica. The Notothenioidei (Perciformes) are the dominant fish taxa, mostly benthic, endemic, occupy the largest range of habitats and can be up to 100% infected with trematode parasites in the Southern Ocean. The knowledge of biology, ecology, diversity, abundance and phylogenetic relationships of Piscicolidae is still limited and their functions in marine ecosystems is poorly studied. Advancing such knowledge is important because parasites have been demonstrated to have consequences for their hosts and play key roles in ecosystems worldwide including acting as vectors for pathogens. The capacity of Piscicolidae to harbour viable fish parasites and diseases in their guts and simultaneously transmit several fish pathogens into their hosts is well known. Fish leeches generally have low host specificity and Trematoda are expected to have a wide range of primary and intermediate hosts and Piscicolidae could serve as intermediate hosts and mobile vectors. No investigation has attempted to evaluate the importance of transmission pathways at an ecosystem level. The role of marine parasites within complex ecosystems has been suggested to be highly underestimated but is a necessary component in understanding and predicting organism and community level responses to climate and environmental changes.

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### POSTER

#### **Priorities for Fish Passage Restoration in the Catchment of the Manawatu River - A Starting Point.**

**Lambie, J**

A total 31 river reaches in the catchment of the Manawatu River have been identified as Aquatic Sites of Significance on the basis of the presence of rare or threatened native fish species. The list of native fish includes five Galaxiid species which are diadromous and require unrestrained passage to and from the sea to complete their life-history. Many of the Aquatic Sites of Significance are in the headwaters and smaller tributaries of the Manawatu River where the habitat remains suitable for resident populations of adult fish and spawning. The Manawatu River is free of large dams and there are few physical barriers to fish passage in the larger tributaries. However, much of the catchment is subject to management for flood protection which includes in-stream structures such as weirs, flood-gates, and grade control structures. Culverts are common in headwater tributaries crossed by roads and farm tracks. Such in-stream structures can pose a barrier to the passage of diadromous fish and affect native fish biological diversity. This poster describes the merging of two pieces of work recently performed by or for Horizons Regional Council – the identification of Aquatic Sites of Significance and a preliminary assessment of potential barriers in the Manawatu catchment. Predictably, most of the Aquatic Sites of Significance in the Manawatu catchment do not appear to be affected by in-stream structures. However, there are some overlaps that cause a resource management conundrum that requires deeper investigation – should these barriers be mitigated, or are they somehow enhancing the habitat of rare or threatened native fish?

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#### **Biodiversity of the Dunedin Town Belt**

**Lloyd K**<sup>1</sup>, Onley D, Scott M<sup>2</sup>, Baker A

<sup>1</sup> Wildland Consultants Ltd, <sup>2</sup> University of Otago, <sup>3</sup> Golder Associates Ltd

The Dunedin Town Belt forms a more or less continuous tract of forest and amenity areas that stretches through the northern and central hill suburbs of Dunedin, occupying an area of approximately 115 ha of prime real estate. Native and exotic forests in the Town Belt are largely restricted to sites on hill slopes, while

sports fields or mown amenity grassland dominates areas of flattened topography. The Dunedin City Council commissioned an ecological survey of the Town Belt in 2005, following on from previous assessments at roughly decadal intervals. This presentation summarises information collected during the 2005 survey, which involved walk-through surveys, vegetation plots, 5-minute bird counts, and pitfall trapping of invertebrates. The Town Belt has significant indigenous biodiversity values, including elements of primary alluvial and coastal forest, 131 local native [263 exotic or non-local natives] plant species, 15 indigenous [13 exotic] birds, and 19 invertebrate orders. The distributions of plants, birds, and invertebrates are influenced by different Town Belt habitats. Ecological processes in the Town Belt illustrate contrasting relationships between indigenous and exotic flora and fauna and the effects of past management practices. Several native plants that have been displaced from forest floors by invasive ground cover weeds have found new homes in artificial habitats maintained by mowing. Invasion of the forest understorey by non-local native trees and shrubs, particularly kanono (*Coprosma grandiflora*) and rangiora (*Brachyglottis repanda*), is causing widespread regeneration failure of locally-native canopy trees. On the other hand, exotic elm trees in the Town Belt provide a key food sources for Dunedin kereru (*Hemiphaga novaeseelandiae*).

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### **Palaeoclimate Studies from Ancient Kauri (*Agathis Australis*).**

**Lorrey A**<sup>1</sup>, Palmer J<sup>2</sup>, Boswijk G<sup>3</sup>, Martin T<sup>4</sup>, Hogg A<sup>6</sup>, Turney C<sup>5</sup>, Fowler A<sup>3</sup>

<sup>1</sup> National Institute of Water and Atmospheric Research, <sup>2</sup> Gondwana Tree Ring Laboratory, <sup>3</sup> University of Auckland Tree Ring Laboratory, <sup>4</sup> Wildlands Consultants, Ltd., <sup>5</sup> University of Exeter, <sup>6</sup> University of Waikato

Pioneering work on sub-fossil bog kauri (*Agathis australis*) was undertaken by John Ogden and his students in the 1980s. His initial work revealed a wide range of radiocarbon dates on wood extracted from bog sites, which suggested that ancient tree ring chronologies of unprecedented length and age could be constructed with large enough collections. Ancient tree ring chronologies have since been constructed, building off of John's contribution to the sub-fossil kauri research, and represent some of the world's oldest annually resolved climate proxy records. These chronologies have potential to be used in ENSO reconstruction within Oxygen Isotope Stage 3 (OIS3), for which few records exist globally. Here, we describe findings to date from the Omaha and Mangawhai, two sub-fossil kauri sites north of Auckland. Comparison of the existing chronologies to available environmental proxy data suggests ancient kauri preservation closely corresponds to times when northern New Zealand was mild and wet. Increased organic sedimentation rates and anoxic conditions in bogs would have accompanied these climatic conditions. This was probably important for helping preserve buried wood through a subsequently harsh colder, dry, and windier last glacial maximum, when surficial material at many Northland sites were eroded. The direction of future palaeoclimate analyses using ancient kauri will be discussed.

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### **Podocarp Forest Dynamics in the Central North Island of New Zealand**

**Lusk C**

Dept. of Biological Sciences, Macquarie University

The regeneration dynamics of podocarp-broadleaf forests have proved an enduring challenge for generations of New Zealand foresters and ecologists. On other landmasses, direct observation of the consequences of catastrophic disturbances has afforded insights into the processes controlling population dynamics of long-lived emergent and canopy trees. A classic example is the 1960 earthquake in southern Chile. Although similar disturbance mechanisms are thought to underlie widespread discontinuities in the size and age-structures of conifer populations in central North Island (CNI) forests, the exact nature of the processes involved remains to be clarified. Here I review what is known about the regeneration requirements of the main tall podocarp species, and explore possible links of their behaviour with foliage traits. I also discuss different types of disturbance mechanisms that could have shaped existing population structures of these taxa in CNI forests, and explore the applicability of a cohort model of population dynamics, originally developed for *Agathis australis*.

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## Tawharanui Open Sanctuary Ship Rat Incursion 2008

### Maitland M

Auckland Regional Council

Tawharanui Regional Park north of Auckland was developed as an Open Sanctuary integrating conservation, recreation, and farming operations. A council and community partnership saw a 2.7km coast to coast pest proof fence completed in 2004 isolating 550 ha of the peninsula. A multi species mammalian pest eradication was undertaken in spring 2004. Seven of ten target species were eradicated and three species persist. This has allowed the recovery of many species, and the reintroduction of several others. Potential pest incursion pathways include around fence ends, transportation via visitor or park activity, and coastal landing. Detection and management of pest incursions has been successful, with isolated individuals detected and removed. In summer 2007/08 a ship rat incursion was detected which revealed an *in situ* breeding population, which was subsequently contained and eradicated. DNA analyses of rats removed indicate several unrelated founder individuals have contributed to this population. The management of this incursion is discussed.

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## Native Invertebrates in Town Tonight

### Martin N

Crop & Food Research

Today we are encouraged to plant natives and to conserve and restore indigenous ecosystems in our urban areas. A few native plant species support many species of their indigenous herbivore fauna on plants in gardens, parks and streets. Many other plant species have few of their native herbivores on plants in the urban environment while in the nearby indigenous ecosystem reserves the same plant species may have a 'normal' complement of herbivore species. These reserves may even contain very rare herbivores. Plants that have a high number of indigenous herbivores in an urban environment include *Sophora* species which can harbour two species of moth, a felted scale, a gall fly and a psyllid. *Coprosma robusta*, a common self sown native also has a wide selection of herbivores in urban areas. In contrast, *Pseudopanax lessonii*, which is widely planted as an ornamental shrub, has few native herbivores outside indigenous ecosystems. In urban areas it may have two sucking bugs, a psyllid and a diaspidid scale insect, whereas in an Auckland City indigenous forest reserve, five native herbivores were found including a leaf mining weevil only known from two other places. Further examples of these two groups of plants and their herbivores will be given and the value of urban indigenous forest ecosystems demonstrated. A question for further research is to determine the characteristics of the plant species and/or the herbivores that enable some invertebrates to survive in gardens, parks and streets and not others.

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## Windstorms in New Zealand Forests: The Ecological and Climatic Significance of Infrequent Extreme events.

### Martin T

Wildland Consultants

Strong winds are probably the most widespread disturbance agent in New Zealand forests. Studies of ex-tropical cyclones, such as the storm of 1936, and Cyclone Bernie in 1982, suggest that all North Island forests are periodically affected by extreme winds, and these play a key role in modifying forest structure and pattern. Prevailing winds also have an important role in shaping our forests, due to New Zealand's oceanic position astride the circumpolar westerly wind-belt. Changes in the frequency, the severity, and the direction of extreme winds are associated, in part, with variations of El-Nino Southern Oscillation (ENSO). Thus ENSO imposes regional patterns on our forests that are both spatial and temporal in nature. John Ogden has contributed significantly to our knowledge of windstorms in North Island forests, from lowland kauri forests in Northland to montane forests of central North Island. His research in this field, spanning 30 years, has investigated the effects of recent storms, and those in the distant past. This presentation will provide an overview of these research projects and highlight some of the key contributions that he has made.

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## POSTER

### **Protecting Forest Fragments in the Manawatu-Wanganui Region. Step One: targeting sites for survey**

**Maseyk F**

Horizons Regional Council

The Manawatu-Wanganui Region, like many areas of New Zealand, has experienced considerable loss of indigenous vegetation. Indigenous forest has been reduced to approximately 30% and wetland habitat to approximately 3% of former extent. The forest fragment project – currently in its initial stages – has two main aims. Firstly, to increase knowledge of the current condition and composition of the remaining forest fragments, and secondly to provide direction for Horizons' non-regulatory biodiversity programme and restoration funding. Horizons contracted Landcare Research (Palmerston North) to identify bush remnants (over 1 ha in size) within the Manawatu-Wanganui Region using Ecosat. Sites within 60 m of each other were clumped and considered as one site. The resulting list of sites was consequently ranked based on scores assigned for size, representativeness (using LENZ) and a measure of fragmentation. This work has provided a useful first cut and a clear regional pattern of vegetation cover. Sites identified by this analysis were combined with sites listed as a Recommended Area for Protection (RAP) in the Protected Natural Areas Programme (PNAP) to direct field surveys. Field survey commenced in the western lowland area of the Region. Over 300 forest fragments were surveyed in the summer of 2007-2008. The information gathered during the field survey will be collated with existing information. Ensuing analysis of the data will enable ecological value of the sites to be determined which will in turn determine priorities for the biodiversity. This poster presents the methodologies used to identify priority sites for survey, outcomes from the project to date, and describes the next steps for the project.

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### **The Impacts of Conservation Activities on Ecosystem Services - a Review of the Literature**

**McAlpine K, Wotton D**

Department of Conservation

Ecosystem services are the benefits people obtain from ecosystems, such as clean air, fresh water, and pollination of crops. Conservation groups, both formal and informal, protect and manage many of the ecosystems that provide these 'services' in New Zealand. We reviewed the literature to find out what is known about the links between conservation activities and the provision of ecosystem services. In particular, we looked for evidence for (and against) a) the provision of ecosystem services by natural ecosystems (such as those managed by the Department of Conservation), and b) any impacts of conservation activities on the provision of those ecosystem services. The focus was on the 'regulating' and 'supporting' ecosystem services: air, water, soil, and pest and disease regulation, pollination, natural hazard protection, and nutrient cycling. We summarise the areas that have good empirical support, and those that do not. Most studies have been done overseas, but we also report data from New Zealand. In general, the widely-held belief that healthy, intact ecosystems provide a range of ecosystem services is supported reasonably well by the literature. However, in some cases the data were limited and/or contentious, but this may simply be due to the difficulties inherent to the study of such complex, broad-scale processes. We found very few studies that examined the impacts of conservation activities on ecosystem services, but there is mounting evidence to suggest that restoring degraded ecosystems can also restore degraded ecosystem services.

## **Rat Abundance in Urban Dunedin**

**McCulloch A**, van Heezik Y, Efford M

University of Otago

Throughout the world rats are a common agricultural and horticultural pest. Rats also act as a vector for a number of virulent pathogens, making them a significant public health risk. In rural New Zealand rats are an elusive and relentless predator. Rural rat populations have been implicated with the ongoing decline and extinction of many species of endemic wildlife. The role rats have in structuring urban ecosystems, directly through predation, and indirectly through food and habitat competition is poorly understood in New Zealand. Determining the role of rats in the urban environment is impeded by a lack of information on their distribution and robust estimates of their abundance. The aim of this study was to gain an increased understanding of the distribution and abundance of rats within different urban habitats. A combination of wax tags and DNA hair-snag tubes were used in this study. Wax tagging was used to gain an indication of rat presence. DNA hair-snag tubes were used to obtain an estimate of rat abundance. Polymorphic microsatellite DNA obtained from the follicles of rat hair was used to identify individuals within a given population. Spatially explicit capture-recapture models were then applied to these data to gain an indication of rat densities in different urban habitats.

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## **A New Theory for Gender Dimorphism in New Zealand Forests**

**McGlone M**

Landcare Research

The New Zealand indigenous vascular flora has the highest level of gender dimorphism (two sexual morphs in one population) in the world. Why this should be so has been debated for many years. Globally, gender dimorphism is most prevalent on oceanic islands, in woody plants and climbers and in plants with non-showy or wind pollinated flowers. Most gender dimorphic lineages in New Zealand were gender dimorphic before arrival here. Thus New Zealand selects for this trait in immigrants, or for traits linked to gender dimorphism, but does not generally promote its autogenous development. Moreover, there is no global agreement as to why gender dimorphism arises at all, given that the vast majority of plants, and the more evolutionarily successful lineages are cosexual (one sexual morph). I will present the results of a broad survey of the incidence of gender dimorphism in New Zealand woody plants with respect to seed size, fruit dispersal, range size and plant height. The high levels of gender dimorphism in New Zealand are almost entirely due to the large number of trees and shrubs in the flora and the prevalence of fleshy fruits. This conclusion is not new. However, I have developed a new compelling ecological explanation for why this combination favours gender dimorphism.

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## POSTER

### **Monitoring change in the Awarua Wetlands using multitemporal radar and optical satellite imagery**

**McNeill S**

Landcare Research, New Zealand

Wetland ecosystems contain unique communities of plant and animal life. Their area in New Zealand has been drastically reduced by drainage, conversion to agricultural land, and fire events. Global change is likely to place further pressure on these sensitive systems, although on a long-term scale. This research aims to understand how the Awarua wetlands in Southland have responded to change in the recent past, using spatial time series information from a variety of radar and optical remote sensing satellites, over the period 2000–2008. This period of time includes seasonal variations within a year that will have continued for some decades, as well as short-term trends in regeneration in response to accidental fires prior to, and within, this time period. Using field work gathered over the 2006–2008 time period, maps of recent and historical fires, multispectral imagery from Landsat-ETM+ and SPOT-XS, radar imagery from JERS-1 and Envisat-ASAR, and low-resolution imagery from Envisat-MERIS and SPOT-Vegetation, a multivariate spatial-time series has been assembled covering the main area of the Awarua wetlands. Time series models from low-spatial-resolution optical sensors have been used to inter-calibrate optical imagery and the combination of optical

and radar images have been combined to form a set of multivariate indices. Then, using our field-gathered data, models have been developed to predict plant species-combinations as a function of the combination of remote sensing sources and their change over time. Properly-calibrated spatial time series remote sensing imagery can be used to detect seasonal vegetation changes in the wetlands. Long-term non-seasonal changes are easily detected, such as associated with regeneration following removal of dominant vegetation after a fire. The approach taken in this research is to develop models that are self-consistent (i.e. proportions of species-combinations add to 100%), temporally and spatially-consistent (i.e. smoothly describe change over time as well as change in space), with quantified error bounds. Using this approach, the models are highly sensitive to different species-class combinations (e.g. tall manuka/sphagnum vs. short manuka/grass) and their change in overall composition in space and time, but the models can be poor separating some individual species. These models predict far more than is possible from a single remote sensing image, permitting one to generate detailed, accurate maps of vegetation, and trends of vegetation over time.

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## POSTER

### **DoC's Inventory and Monitoring Toolbox: Establishing National Standards for Biodiversity Monitoring**

**McNutt K**

Department of Conservation, Research & Development Group

Biodiversity monitoring data collected by the Department of Conservation (DOC) must be collected consistently if sound and robust management decisions are to be made. The department's reporting requirements vary over temporal and spatial scales and have a range of purposes. But these reporting systems must be underpinned by monitoring data that is of a consistent and known standard. A national inventory and monitoring project aims to develop an overall framework for biodiversity assessment to identify and implement monitoring techniques to report on natural heritage outcomes. Key to this is the Inventory and Monitoring Toolbox. The Toolbox sets national standards for inventory and monitoring methodologies. The minimum standards for data collection for each methodology are described and nested within modules (e.g. birds, bats, plants, animal pests, invertebrates). The Toolbox has numerous decision supporting frameworks to assist users to select the most appropriate methods for their study objectives. Currently available through the department's Intranet, it is anticipated the Toolbox will be made available to external users in time.

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### **Bottlenose Dolphin Distribution, Habitat use and Behaviour Patterns within the Marlborough Sounds, New Zealand.**

**Merriman M**, Stockin K, Orams M

Massey University

The Marlborough Sounds, New Zealand hosts one of the largest aquaculture industries for the green-lipped mussel (*Perna canaliculus*). However, no study to date has examined the potential impact of this industry on a population of bottlenose dolphins (*Tursiops truncatus*) that utilise this region. Boat-based surveys conducted between 2003 and 2005 were used to assess spatial distribution, abundance, home range, and behaviour patterns of bottlenose dolphins. Aggregations of 3 to >170 individuals were observed, with a median group size of 12 recorded. Group size was influenced by the presence of calves, with groups predominantly larger in the presence of calves. Sightings occurred in water depths ranging from 2.1 to 80.6 m (mean = 29.2 m,  $\pm$  SE = 2.8), with sea surface temperatures ranging between 11.0 and 19.5°C (mean = 14.9,  $\pm$  SE = 0.39). Activity budgets revealed that bottlenose dolphins spent the majority of their time travelling (48%) and socialising (23%). No overall difference was detected in the activity budget of groups observed within and outside of aquaculture facilities, although feeding and milling states increased within mussel farms. Bottlenose dolphins occurred throughout all austral seasons, suggesting they utilise this region year-round. Photo-identification revealed regular movements of individuals between Queen Charlotte Sound, Pelorus Sound, Admiralty Bay and Current Basin. A total of 211.5 (C.I. = 195 – 232) individuals were found to be semi-resident in the Marlborough Sounds, exhibiting movements between the sounds throughout all seasons. Our data indicate that this region forms an important part of the home range for at least a proportion of this population. While no significant change in activity budgets appeared attributable to aquaculture facilities, further work examining the diet of individuals within and outside of the mussel farms is required.



## **Domestic cat movement behaviour in relation to threatened lizard habitat**

**Metsers L**, van Heezik Y, Mathieu R

University of Otago

While it is widely accepted that introduced mammals are responsible for the declines and extinctions of many native New Zealand fauna, less attention has been paid to the domesticated versions of those species, including domestic or house cats (*Felis catus*). As our population grows and residential development spreads further into natural areas, what impacts do the pets that accompany humans have on our native wildlife? In particular, what effects are domestic cats having on native prey species such as New Zealand's threatened lizards? I put GPS collars on 38 domestic cats living nearby threatened lizard habitat to investigate home ranges and resource selection at Macraes Flat, North Otago, Kaitorete Spit, Canterbury and on the Otago Peninsula. Home ranges (95% kernel density estimates) were largest for cats at Macraes Flat, ranging between 0.3 and 69 ha compared with 0.35 – 19 ha for cats on Kaitorete Spit and 0.2 - 9 ha for Otago Peninsula cats. Across all sites, males and females did not differ in home range size, but home ranges were significantly larger at night. Resource selection ratios indicated that cats at Macraes Flat significantly preferred trees and avoided cultivated areas (farmland) and tussock grassland, which may be beneficial for Grand and Otago skinks (*Oligosoma grande* and *Oligosoma ottagense*). Cats on Kaitorete Spit used all habitat types in proportion to their availability except for avoidance of duneland, where threatened spotted skinks (*Oligosoma aff. Lineoocellatum* 'Central Canterbury') and Canterbury geckos (*Hoplodactylus aff. maculatus* 'Canterbury') occur. There was no significant selection by Otago Peninsula cats, suggesting they do not prefer scrub habitat suitable for jewelled geckos (*Naultinus gemmeus*). Although direct effects of predation on lizards were not measured, this information could aid future management regarding the potential impacts of domestic cats as hunters in significant wildlife areas.

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## **A Review of Ecological Issues and Opportunities in Urban Environments**

**Meurk C**

Landcare Research

Urban ecology has its roots firmly anchored in Europe where inventory and description of species, biotopes (spontaneous or anthropogenic, novel plant communities) and environments dominated the discipline up until recent decades. WWII bombing of European cities sadly provided fertile ground for subsequent study of urban wastelands and plant succession. From the 1990s a new research framework was pioneered in the United States – seeking environmental causation of forest form and function along urban-rural gradients. Australia and South Africa, on the other hand, have focused on remnant grassland patterns enclosed by suburbia. Urban wildlife studies have also been carried out. New Zealand is idiosyncratic in that urban remnants and spontaneous indigenous communities are sparse. I shall highlight the few examples that do exist and then speak of the opportunities – indeed the conservation and cultural imperatives - for building indigenous seed banks, plant populations and synthetic or spontaneous, mixed plant communities in order to resurrect ecological integrity and natural character in our cultural landscapes. I shall argue for the validity of studying such anthropogenic communities within the context of niche, plant strategy, meta-population, assembly rule, intermediate predator and wildlife resource theory. Needless to say, urban ecology does not exist in isolation from the social dimension whereby community knowledge levels, values, fashion, commerce, industry, behaviour and actions moderate all ecological processes.

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## **Tiritiri Matangi Island - What If?**

**Mitchell N**

SGGES, The University of Auckland

The original (1972) proposal by the Hauraki Gulf Maritime Park Board for Tiritiri Matangi Island, was that it be allowed to regenerate naturally. However, the subsequent proposal to restore the island was accepted and today 160 of the 220ha of the island has been re-forested. When such drastic action is taken to rapidly change the ecology of a place, the lingering question always remains, "What if we had let natural processes continue, what would the place look like today?" A series of plots were set out in grasslands on the island in 1979, subsequently this area was left to see how it would develop in the absence of direct restoration.

These plots have been relocated and remeasured. The overwhelming conclusion is that the island would have changed little in appearance. There has been some shift in species, with a general reduction in introduced grasses and a spread of *Microlema stipoides* and *Muhlenbeckia complex*. At the forest margins there has been some encroachment into the grassland, but only of the order of a few metres. Perhaps more surprisingly there has been almost no recruitment of non-grassland species. This is despite there being much planting in the immediate neighbourhood, together with the original scattered kanuka (*Kunzea ericoides*) and manuka (*Leptospermum scoparium*). Profuse seeding has been observed on all the adjoining trees and shrubs, yet either seeds are not being distributed the few 10s of metres or conditions are still not suitable for seedling recruitment. The conclusion has to be drawn that the enormous conservation gains that have been achieved by the restoration programme would not have been possible without direct intervention 25 years ago.

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## **Reproductive Technologies to Source, Monitor and Secure Threatened Species for Ecological Restoration**

**Molinia F**<sup>1</sup>, Germano J<sup>2</sup>, Bell T<sup>3</sup>, Jakob-Hoff R<sup>4</sup>, Gleeson D<sup>1</sup>

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Reproductive technologies are valuable tools for understanding how different species reproduce. Contemporary techniques like non-invasive hormone monitoring, artificial insemination and sperm banking have been used to assist the breeding of threatened species in captivity, even restoring them to nature. This presentation will articulate how reproductive technologies are emerging as invaluable tools to source, monitor and secure nationally threatened New Zealand species for a range of ecological restoration projects. Two case studies will be reported where reproductive technologies are being developed to improve the conservation status and reduce the risk of extinction of native herpetofauna species. The first project involves the development of a non-invasive technique to assign sex and monitor hormones of reproduction and stress in native frogs. To date, laboratory tests have been developed to measure reproductive hormones in urine samples for the first time in frogs and there is preliminary evidence that these are different between sexes in a model, introduced species. The second project involves development of assisted breeding techniques in McCann's skink as a model for threatened native lizard species. So far in male skinks, a non-destructive technique of semen collection has been established, along with methods to assess sperm quality and specialist media developed to support short-term (liquid) storage of sperm. Female skinks have also been artificially inseminated and the success of this will be known next summer. The value of long-term (frozen) storage of sperm to safeguard species level genetic variation of threatened species will also be discussed. Collectively, these techniques are expected to substantially improve captive breeding success and will be vital tools to aid genetic management of animals bred for release to restored ecosystems and secure genetic repositories for future restoration needs.

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## **POSTER**

### **The Outstanding Native Plant Communities of Moawhitu, d'Urville Island**

**Moore S**

Department of Conservation

The property of Moawhitu (Greville Harbour) was purchased by the Nature Heritage Fund in 2005 and now forms part of d'Urville Island Scenic Reserve in the Marlborough Sounds. The complex geology, landforms and climate patterns, along with the absence of possums and feral goats on d'Urville Island, give rise to a diverse range of indigenous plant communities. These include coastal ultramafic cliff communities, wetland and dune systems, and diverse and rich forest communities. Moawhitu is one of six sites on public conservation land selected to offset the carbon footprint of a pilot group of government departments. Current management also involves the active reinstatement and revegetation of a drained wetland.

## Highlights of John O's Contribution to Ecology and Conservation in New Zealand

### Myers S

Auckland Regional Council

Associate Professor John Ogden is retiring after 29 years at Auckland University. John has been a long standing member of NZ Ecological Society, and has contributed significantly to ecological research in NZ. He has also contributed greatly to community conservation projects and to high profile conservation campaigns in the 1980s. John has inspired numerous students with his passion for ecology and his infectious personality. Highlights of John's contribution to ecology and conservation, and ways in which he has made a difference to the ecological community will be discussed.

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### Comparative Assessment of Forest Regeneration Pre- and Post Restoration on Tiritiri Matangi Island, Hauraki Gulf, New Zealand - with Particular Reference to Taraire (*Beilschmeidia tarairi* (Lauraceae) and Kohekohe (*Dysoxylum Spectabile* (Meliaceae).

Myers S<sup>1</sup>, Court A

<sup>1</sup> Auckland Regional Council

Quantitative and qualitative descriptions of a mature kohekohe-taraire dominated forest remnant undertaken over 25 years, on Tiritiri Matangi, a northern New Zealand island, are compared. Factors which may be influencing the observed regeneration patterns are discussed, including the impact of changes to the island over this time. These changes include revegetation of the island (including the remnant margins), surrounding land use, removal of kiore (*Rattus exulans*) and the introduction of various native bird species.

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### Measuring Long-term Response of Multiple Threatened Species to Predator Control in Southern Beech Forest, Eglinton Valley, New Zealand

O'Donnell C, Pryde M, Dilks P, Greene T, Sedgely J, Elliott G

Department of Conservation

Since 1990, we have been monitoring populations of a range of threatened species in beech forest in the Eglinton Valley. Initially, monitoring and research focused on identifying causes of decline in populations of mohua, kaka, long-tailed bats, and lesser short-tailed bats. Stoat numbers increased in all summers following beech mast and ship rat numbers following some mast events. Predation caused significant declines in all species monitored. Valley-wide stoat control commenced in 1998 and experimental rat control in 2006. In this presentation, we summarise the initial results from these experiments, focusing on trends in kaka, long-tailed bats and NZ robins (a convenient population indicator species). These results contribute to ongoing work focused on predicting when predator impacts are most significant, developing useful population models to help predict which management prescriptions will be most efficient at recovering these threatened species, and measuring costs and benefits of different management approaches.

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### Forty Years of Trees, Bogs and Boggers - A Personal Event Chronology.

Ogden J

University of Auckland

Long-live trees are not amenable to the usual experimental techniques of plant population ecology, but it is never the less clear that the same rules apply. To understand demography we must know ages, which, fortunately, most trees record for us in their annual rings. This record also contains other information, including some about climate, and can be extended back in time by cross-matching patterns from living to dead trees. Thus, dendrochronology links naturally to forest dynamics, and also to climatic history and palynology. These three fields, addressing respectively tree death and recruitment, tree ring patterns and the species composition of pollen preserved in bogs – deal with different but overlapping time scales. Used

in conjunction they can give insight into the past. I contend that such insights are interesting, and made more so by knowing something about the characters involved. I will illustrate this with examples from my personal chronology. Reference lists covering the research alluded to at Mount Colenso, Mount Hauhungatahi, and Great Barrier Island, and kauri ecology and dendro, can be provided to anyone who takes any of this seriously.

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## **A Four-Year Look into the Breeding Biology of a Reintroduced Population of Red-Crowned Kakariki**

**Ortiz-Catedral L, Brunton D**

Ecology and Conservation Group, Massey University

The red-crowned kakariki (*Cyanoramphus novaezelandiae*) was the first species to be reintroduced to Tiritiri Matangi Island during the 70's. Despite its extended presence on the island however, the breeding biology of this species remained fairly unknown until 2004. Since its reintroduction, wrong assumptions about the nesting preferences and productivity cycles of red-crowned kakariki have been made providing a misleading picture of the ecological role of this species on Tiritiri Matangi Island. Here I present a summary of our experiences studying the breeding biology of red-crowned kakariki during the last four years at this location. The nesting success of this population varies greatly between breeding seasons and it appears that family size and composition as well as family dynamics (i.e. previous breeding experience of parents, nestling feeding turnover between parents etc.) are relevant explanatory factors for this outcome. Finally I discuss the current state of knowledge on the distribution, genetics and diseases of this species in New Zealand and the relevance of the Tiritiri Matangi Island population in a wider conservation context.

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## **Seed Dispersal Modes and the Successful Restoration of Urban Native Forest Patches**

**Overdyck E, Clarkson B, Gemmill C**

Waikato University

This research investigates the influence of native and exotic seed availability on vegetation composition and succession within urban forest restoration patches in Hamilton City. We hypothesise that the increased relative availability of non-native seed sources and seed dispersers in urban environments has altered the rate and trajectory of native forest recovery succession. Isolation from native forest seed sources and a reduction in key native seed vectors (e.g. kereru, the native woodpigeon) suggests that it may not be possible for urban forest patches to become sustainable indigenous communities without relying heavily on management intervention such as planting enrichment and removal of invasive exotic species. Vegetation composition, seasonal seed rain and soil seed banks have been quantified within urban restoration plantings of varying age and are contrasted with naturally regenerating lowland forest in both urban and non-urban environments. Plant growth form, seed characteristics and propagule dispersal modes (both spatial and temporal) are used to investigate whether and to what degree seed availability is driving the formation of alternative plant species compositions and creating novel successional pathways. By identifying propagule dispersal barriers or limitations which may exclude key native species from regenerating in urban forest patches we can make recommendations to enhance natural succession in urban native forest restoration projects.

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## **Avian Translocations to and from Tiritiri Matangi 1973-2008: Providing Outcomes for Wildlife, Resource Managers, Scientists and the Human Community.**

**Parker K**

Massey University

I review avian translocations conducted to and from Tiritiri Matangi between 1973 and 2008, and the diverse conservation outcomes associated with these translocations. Eleven species of birds have been translocated to Tiritiri Matangi, ten of which have successfully established breeding populations on the island. These translocations have provided vital conservation management outcomes for species such as hihi (*Notiomystis cincta*), highly informative research outputs from species such as North Island robins

(*Petroica australis longipes*) and invaluable advocacy opportunities from species including North Island kokako (*Callaeas cinerea wilsoni*), takahe (*Porphyrio mantelli mantelli*) and whiteheads (*Mohoua albicilla*). Many of these translocated populations have thrived and they now provide opportunities to harvest birds for translocation to other island and mainland sites. To date there have been approximately 17 translocations of six species of birds from the island and Tiritiri Matangi has become the primary source of translocated birds for ecological restoration projects in the Auckland region. Critics have often dubbed Tiritiri Matangi a zoo. However, avian translocations to and from Tiritiri Matangi have provided diverse outcomes for the three major groups involved in conservation – managers, scientists and the community – and provide a valuable case study for ecological restoration practise in New Zealand.

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## **Comparison of North Island Tomtit (*Petroica macrocephala toitoi*) Foraging Behaviours, Hunua Ranges, New Zealand**

**Peace J**<sup>1</sup>, Brunton D<sup>2</sup>

<sup>1</sup> Massey University, <sup>2</sup> Massey University

The North Island tomtit (*Petroica macrocephala toitoi*) is a small, insectivorous, native bird of New Zealand. Tomtits utilise a variety of forest habitats including native and plantation forests and forage primarily on ground and plant-dwelling invertebrates. Focal animal observations were conducted during 2006-08 in the Hunua Ranges, New Zealand, an area with both native forest and exotic pine plantation with continuous behavioural data recorded. Over 300 observations made during this time contained foraging events, with more than 600 foraging events quantified. Initial research found that the majority of tomtit foraging events occur on the ground with the birds gleaning prey items. Preliminary results comparing tomtit foraging in breeding and non-breeding seasons showed differences in the predominant foraging station used. During the breeding season the birds mostly utilised vegetation over 3 m in height, but most foraged on the ground during the non-breeding season. However, regardless of where the tomtits foraged the majority of them still utilised gleaning as a foraging strategy. The foraging behaviour of tomtits is described in general with a focus on substrate, height, and foraging strategy and final results on similarities and differences in tomtit foraging depending on sex and year presented. This research is both timely and imperative considering the large areas currently planted for commercial forestry in New Zealand and it will assist in clarifying the depth of effects these areas have on native insectivorous birds.

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## **Seed Dispersal and Seedling Recruitment in Miro (*Podocarpus Ferrugineus*, Podocarpaceae) & Puriri (*Vitex lucens*, Verbenaceae) in New Zealand**

**Pegman A**

University of Auckland

Because community structure and species diversity are, in part, believed to be determined by patterns of dispersal, there is currently great interest in seed dispersal and the potential value of quantitative models (mechanistic or phenomenological) for describing and predicting these processes and patterns. The research presented here explores the influences of seed dispersal on long-term forest community structure and dynamics using two significant New Zealand forest canopy tree species, chosen because of their similar-sized seeds and method of dispersal, one being a dioecious conifer (Miro) and the other a monoecious angiosperm (Puriri). The following theoretical questions are investigated:

1. What are the seed dispersal distributions (passive and bird-mediated) and seedling distributions of isolated Puriri and Miro trees, are these distributions concordant, and how are they affected by different demographic and ecological factors?
2. What are the effects of decline or loss in disperser (Kereru) numbers on the seed dispersal processes and community structure of the systems where these tree species occur?
3. How do these factors influence long-term forest demographics and the maintenance of these plant populations? This will include simulation of population expansion and spatial patterns using field-estimated dispersal distributions.
4. What is the distribution of Kereru-dispersed seeds (such as Miro, Puriri, Tarairi, Karaka, and Tawa) under adult examples of these same species? Seedling patterns will reveal whether these species are in fact being dispersed and processes of dispersal.
5. What is the probability of long-distance seed dispersal in these species?

This project will help to explain the implications of declining numbers of dispersers and the isolation of tree species on long term forest dynamics and spatial patterning. There is a paucity of knowledge of such links between seed dispersal and its demographic consequences and very little is known about how seed dispersal is affected by the addition or loss of the disperser(s), the consequences of changes in disperser abundance for the maintenance of plant populations, and whether there will be dispersal failure without the vector. This could become the case in New Zealand where a suite of large-seeded tree species are dispersed solely by the Kereru, due to its ability to swallow and void large seeds, and which is believed to be in national decline.

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## **Pattern and Process in New Zealand's *Nothofagus* Forests: Models as Tools for Synthesis**

**Perry G**

School of Geography, Geology & Environmental Science, University of Auckland

"Thus I present a picture of long-lived species populations which wait or migrate in space and time in the variable environment... Such species exceed the time scales of 'normal' ecology and force us to retrospective techniques such as palynology and dendrochronology. I suggest that by combining such techniques with predictive modelling a more complete understanding of their dynamics may be reached" (Ogden, 1985a). *Nothofagus* (beech) forests, whether pure or mixed, are the most widespread indigenous forest type in New Zealand, and much empirical work has focussed on their dynamics. One issue of long-standing interest in beech forests has been how species differing in their life-histories - such as the gap colonising and light-demanding red beech (*Nothofagus fusca*) and the slightly longer-lived and more shade-tolerant silver beech (*Nothofagus menziesii*) - manage to persist alongside each other. Ogden (1985b) termed this "the dilemma of survival in heterogeneous environments" - this issue is at the heart of contemporary plant community ecology. Attempting to resolve this dilemma requires the integration of processes operating from the instantaneous (e.g. photosynthesis) to the generational (e.g. tree longevities and stand-level disturbance events). While field-based investigations are extremely important for exploring such issues, the scales over which forests change inevitably limit the temporal and spatial scope that field studies can take. Simulation modelling is one way to develop and test hypotheses about forest dynamics. Such models do not just represent tools for prediction; they are also powerful tools for learning and for synthesising understanding and data. Here I will present a simple spatially explicit individual-based model of the interactions between red and silver beech. The outcomes of this model illustrate the potential of the approach for (i) *in silico* experimentation and (ii) making quantitative predictions about forest dynamics that are amenable to testing with field data.

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## POSTER

### **The Vocal Repertoire of Common Dolphins (*Delphinus* sp.) in the Hauraki Gulf, New Zealand**

**Petrella V**<sup>1,2</sup>, Stockin K<sup>1</sup>, Brunton D<sup>2</sup>

<sup>1</sup> Coastal-Marine Research Group, Massey University, <sup>2</sup> Ecology and Conservation Group, Massey University

Quantifying the vocal repertoire of a species is critical for subsequent analysis of signal functionality, geographical variation and social relevance. While vocal repertoires have been documented for several fauna, detailed descriptions for cetaceans (whale, dolphins, porpoises) are rare. For the first time, we present the vocalisations of free-ranging common dolphins (genus *Delphinus*) recorded in New Zealand waters. Data presented here represent preliminary results of a doctorate study examining the vocal repertoire of common dolphins in the Hauraki Gulf, Auckland. Vocalisations of focal dolphin groups were made using a hydrophone PZ-1A and Sony minidisk. Recordings were subsequently analysed using Raven Pro 3.0 and compared with published data available for common dolphins examined in UK waters. Our initial findings offer valuable insight into both the whistle characteristics and vocal repertoire of the Hauraki Gulf common dolphin population.

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## POSTER

### **Hygrochastic Capsules in Alpine Areas in New Zealand – A Tool to Restrict Dispersal?**

**Pufal G**

Victoria University

Alpine areas are habitats with extreme conditions and a very confined range. Plants living in those areas are usually highly adapted to those conditions and would be quickly out-competed in lower elevations. Therefore, it is necessary to restrict their dispersal range to the small habitats they are well adapted to. Some alpine taxa in New Zealand exhibit a rather uncommon capsule opening mechanism, which responds to rain and might ensure short-distance dispersal of seeds through raindrops. Here, we will present the first results of dispersal experiments conducted with selected alpine *Veronica* (Plantaginaceae), showing the tight relationship between rain –operated capsule opening, short-distance dispersal and its role for the plant's survival.

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### **What's Significant?**

**Sawyer J**

Department of Conservation

Despite enormous efforts by government agencies, landowners, scientists and community based restoration groups, New Zealand's biological diversity is still undergoing serious, some would say catastrophic, decline. There are many causes of the recent biodiversity declines from the prolific spread of exotic species to habitat destruction. Territorial local authorities (TLAs) play an important role especially regarding vegetation clearance and rules included in their plans. Section 6(c) of the RMA requires TLAs to provide for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna and must therefore consider indigenous biodiversity on private land. In the absence of guidance on this, it has been a challenge for TLAs to balance development with the protection mandate of 6 (c) and this has led to often vigorous debate and litigation. Walker et al. (2008) in a soon to be published paper describe the ambiguity of the statute mostly relating to the word 'significant'. While a new Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land (SNP) has now been published, it will be some time before the effects of this, on biodiversity related planning processes at a local and district level, can be gauged. There remains no other legislation to protect threatened indigenous plant life on non-Crown land. TLAs are left to prevent further losses of 'significant' vegetation despite on-going and often important development needs. Many TLAs find themselves adopting significance criteria that may be insufficient to slow further biodiversity declines. Few TLAs have the resources to invest heavily in capacity to tackle resource management issues relating to protection of significant vegetation and habitats. Finally, few players involved in biodiversity protection at a local level take land owners or managers to task for inadequate maintenance of significant natural areas on their properties. This situation can be improved through development of adequate criteria for identification of significant sites and programmes for their ultimate protection and restoration. It can also be improved through supporting TLAs to develop and work towards biodiversity protection goals to conserve their indigenous biota. Using information from the Wellington region as a case study this paper will examine the various tools for significance assessment from precautionary approaches to the policies in the SNP to higher crème de la crème tests of significance. This case study will be used to identify core attributes of significance that will be required to halt biodiversity decline. These should be regarded as minimum standards by TLAs when developing plans and rules under the RMA.

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### **Ecologists in Action Working with Communities: The Better Way to Skin a Cat?**

**Schmechel F**

Environment Canterbury

Working with communities, or putting 'ecology into action', can be very effective for achieving positive ecological outcomes. Ecologists may see working with communities as unnecessary, not part of their job, or inefficient, but there are often unexpected positive outcomes, and it may be the only way to achieve certain gains, particularly given that the areas of priority for biodiversity protection and enhancement in NZ occur

predominantly on private land. Ecologists can add to and inform community efforts; in turn communities can provide an important reality check for ecologists or suggest more effective approaches. On Banks Peninsula, community involvement in ecological projects with the input and support of ecologists, has resulted in additional support, funding, capacity, and led to new projects. It has also brought about better inter-agency coordination. The Banks Peninsula Conservation Trust has been instrumental in initiating and supporting a number of activities such as a feral goat eradication programme, convening a conservation forum, covenanting private land, setting up vegetation and bird monitoring programmes, and leading or collaborating in animal and plant pest control. Other community environment groups in Canterbury have achieved similar or other outcomes. Communities can also be a source of knowledge that informs scientific discovery through their detailed local knowledge, and provide partners to environmental endeavours (e.g. Kaupapa Kereru).

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## **Protozoan Diseases in Native New Zealand Passerines**

**Schoener E**, Castro I, Alley M, Howe L

Massey University

Disease screening and management are becoming an important part of wildlife management worldwide and particularly in New Zealand. However, knowledge of diseases affecting individual species is lacking and hinders management decisions. In New Zealand, animals are expected to undergo a disease screening programme and a quarantine period prior to translocation. Currently, there is no knowledge of the prevalence and epidemiology of diseases caused by protozoan parasites such as malaria or coccidiosis. Both genera of parasites possess the ability to inflict major damage to their avian hosts and limit their chances for reproduction and survival. In addition, it is thought that many of these parasites, especially malarial parasites, were introduced to New Zealand. However, a recent study on Mokoia Island found that Saddleback (*Philesturnus carunculatus rufusater*) and Tui (*Prothemadera novaeseelandiae*) were infected with native malarial parasites of the genus *Plasmodium* and *Haemoproteus* respectively (Castro and Howe, manuscript in preparation). This research focuses on identifying and investigating the prevalence of coccidial parasites in Tui and Saddlebacks on Mokoia Island. These studies will examine the epidemiology of these malarial parasites, identify the different strains and species of parasites involved, and create an overview of how the birds are affected by their parasite load throughout the year. The results of three of the five trips planned to Mokoia Island will be presented. PCR and faecal flotation slides of blood and faecal samples were examined for the presence of coccidial parasites. To date, at least three different species of coccidial parasites of the genus *Isospora* have been found. These studies will be extended by examining dead birds of these species and thus gain further information on the prevalence, pathology and pathogenicity of these protozoan parasites throughout New Zealand. These results will be valuable in guiding future management options for these passerine species and also provide useful baseline data for health monitoring in the future.

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## POSTER

### **The Challenge of Efficiently Controlling Rats**

**Seabrook-Davison M**, Gsell A, Ji W, Shanas U, Brunton D

Massey University

A three stage experiment was conducted to understand aspects of the behaviour of rats and to explore a novel approach to their detection and control. The first stage involved a 12 month tracking experiment to ascertain seasonal differences in occurrence within a variety of habitat types. The second experiment was a test to see whether the scent of caged laboratory reared rats (*Rattus norvegicus*) and their urine soaked bedding would attract wild rats. The third experiment involved a tracking and trapping experiment to give an indication of the number of rats in the study area. The study site was a 5 hectare mixture of regenerating native vegetation, wetland and mixed pasture and exotic trees. Rats were recorded throughout the year from all sites especially in areas of native vegetation, wetland and streams. Wild rats were attracted to both female and male caged laboratory rats in these wet and vegetated areas but it is unclear whether their behaviour differed according to the sex of the caged rats. The combined tracking and trapping experiment indicates that the rats have defined territories, especially in area of favoured habitat. These results indicate that with a greater understanding of the behaviour of rats it will be possible to improve the efficiency and cost effectiveness of rat control. It is proposed to use these results to develop a lure or rat scented bait to more efficiently attract wild rats.

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## POSTER

### **New Approaches to Developing Humane Toxins**

**Shapiro L**<sup>1</sup>, Eason C<sup>2</sup>, Murphy E<sup>2</sup>, Hix S<sup>2</sup>, MacMorran D<sup>2</sup>

<sup>1</sup> Connovation Ltd, <sup>2</sup> Department of Conservation

1080 use is under pressure and the use of alternatives such as brodifacoum has resulted in extensive wildlife contamination and non-target deaths. Culling of vertebrate pests still relies on the use of unpopular poisons, or poisons that are linked with secondary poisoning or are inhumane. Hence our focus on safer humane poisons. For example, in 1997 Feratox® was approved for possum control in NZ. It is a cyanide pellet which combines improved safety for handlers, with low secondary poisoning risk and proven humaneness. As Feratox® has proven humaneness for possum control, we are now increasing the intensity of our efforts to complete the development of cyanide pellets for new species. We are focusing on the development of Feratox® for wallabies and ferrets – exploring the potential of cyanide for humane culling of species other than possums. Para aminopropiophenone (PAPP) is a new substance undergoing trials for humane control of stoats and feral cats in NZ and cats and foxes in Australia. PAPP's mode of action, whilst different from cyanide makes it a particularly humane toxin for vertebrate pests. By reducing oxygen supply to the brain stoats and feral cats become lethargic, sleepy and unconscious prior to death in 1 to 2 hours. PAPP could potentially be the most significant advance in this field since the 1970's and PAPP will be the only vertebrate toxic agent other than the new cyanide pellets (Feratox) which clearly outstrips 1080, anticoagulants and other conventional poisons from a welfare perspective. It is noteworthy that both cyanide and PAPP cause central nervous system anoxia, lethargy and death albeit through different mechanisms of toxicity. PAPP has potential for peri-urban control of stoats and feral cats as well as broader field use for conservation and protection of biodiversity.

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### **Conservation in the Sky: the Role of Greenroofs in Urban Biodiversity**

**Simcock R**, Toft R, Smale M

Landcare Research

In London and Switzerland flat roofs of new large buildings must be covered in a thin (50 to 200 mm) layer of substrate and vegetation established to create habitat for birds, lizards and invertebrates, as mitigation for development of brown fields such as railway yards and abandoned industrial land. These 'living roofs' or 'extensive greenroofs' have no public access, low disturbance, low fertilization and low maintenance. Ground-dwelling animals can be excluded, or encouraged using structures that link roofs to the ground. The

potential for greenroofs to support mammal-free New Zealand ecosystems has begun to be investigated by monitoring vegetation and invertebrate communities on c.200m<sup>2</sup> roofs established in 2006 on commercial buildings in downtown Auckland and Waitakere City. In the absence of irrigation the survival and growth of native plants, exotic sedums and adventive plants is strongly influenced by substrate depth, water supply and shading, with sedums significantly more vigorous than native species trialed to date in substrates depths <75mm. A variety of native herbaceous and woody groundcovers have persisted where substrates are c.100 mm depth, including *Pyrossia*, *Festuca*, *Disphyma*, *Coprosma* and *Crassula* species. Successful species are drought tolerant or able to rapidly recolonise areas from underground roots/rhizomes or new seedlings. The youthful invertebrate communities are currently strongly biased towards adventive species, with most of the natives present being ubiquitous species that are common in anthropogenic habitats. Many of the species currently resident in the plots were introduced with the plants, including 5 adventive molluscs: a salient lesson in the need for nursery hygiene and biosecurity measures when moving plants to new locations. The placement of wooden rounds created refuges for spiders and species prone to desiccation (e.g. molluscs, earthworms) and habitat for species associated with rotting wood (some Coleoptera and Lepidoptera).

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### **Northern Gumlands: Barren Wasteland or Biological Treasure?**

**Smale M**<sup>1</sup>, Clarkson B, Williams P, Wiser S, Hoare R, Forgie S, Buxton R, Hall G

Landcare Research

As part of a nationwide study of historically rare (i.e., originally comprised <1% of New Zealand's land area) ecosystems, we recently sampled vegetation structure, composition and age, soil morphology and chemistry, and invertebrate communities at the 15 substantial remaining Gumlands from Auckland to the Far North. The overall aim was to typify the biota and controlling processes, determine major threats, and eventually develop a framework to ensure effective conservation management. Most Gumlands have been lost to agricultural and urban development, both of which are continuing, and remaining sites are vulnerable to a suite of woody weeds. Gumlands encompass a range of heath shrub-covered flat to rolling lands in northern New Zealand that contained deposits of 'kauri gum', the subfossil remains of *Agathis australis*, and supported a major export industry from 1870-1940. Doubts remain about the 'naturalness' of many of them; they have undoubtedly become more widespread since human settlement as a result of repeated fires, and gumdiggers often burnt them to provide access to the substrate. Soils are mostly extremely infertile podzols, often seasonally waterlogged. They are home to at least two dozen rare plants and some unique invertebrates. We identified 10 vegetation types, containing 53 native and 20 adventive vascular species. Only nine species contributed significantly (>5%) to vegetative cover, and combinations of just four (manuka, *Schoenus brevifolius*, tangle fern, pakihī rush) dominated. Four widespread vegetation types, three shrubland and one fernland, together accounted for over 80% of the 154 plots sampled, with two of these, Manuka shrubland and Tangle fern fernland, accounting for over 60% of plots. Vegetation structure and composition is related to time since fire, with *Schoenus brevifolius* apparently dominating early and manuka later. Drainage is also important, with tangle fern and pakihī rush prominent on poorly drained sites, and manuka preferring better drained ones. Multivariate analysis indicates the relative importance of age and drainage, as well as soil chemistry, aspect and slope on the composition of Gumlands.

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## **The Case for Developing Public Participatory GIS to make use of Community Data for NZ Conservation Management**

**Smith E**

T.E.E.

Engaging the community in biodiversity protection and promoting the concept of whole-of-landscape planning is especially pertinent in the areas of rural New Zealand with fragmented remnant vegetation. Public Participatory GIS offers tools to not only engage and advise the community, but to solicit and categorise valuable information which is likely to be otherwise lost by generational amnesia. This research investigates the trend to manage natural features and organisms as assets, with values and costs, and the development of tools such as Geographic Information Systems (GIS) and web portals which present data for resource management applications by conservation managers. Developments in the systems that will improve the quality of information and accessibility to data will also allow more accurate Assessment of Environmental Effects as required under the Resource Management Act. Better connectivity between national databases, and an awareness of the existence of certain information, or even classes of information, would result in better biodiversity outcomes. Databases are not shared at a community planning level, nor is there a system of PPGIS available to assist the legislative requirement of sustainable development. This paper explores methods to gather and verify community-held data, providing small scale detail which may be invaluable when devising national standards. The NZ 'Community Partnership Fund' under the Digital Strategy is supporting a pilot project of community data entry to a GIS, the "Taranaki Educational Resource: Research, Analysis and Information Network" (T.E.R.R.A.I.N.). The preliminary work has identified sources of community-held data and is demonstrating how a PPGIS may provide information for environmental management. This portal model may assist the national strategy of increasing information sharing and open access. The aim is to forward relevant information to national and international biodiversity datasets, involving the community in environmental care and management.

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## **New Zealand Lizard Pollination**

**Smith J**

School of Biological Sciences, University of Auckland

The visitation of lizards to flowers has generally been considered as nectar robbing. Observations of New Zealand lizard-plant interactions are limited and their importance as pollinators remains unknown. On Otata Island, the hypothesis that the endemic gecko, *Hoplodactylus maculatus* is a pollinator of pohutukawa, (*Metrosideros excelsa*; Myrtaceae) was tested. This was assessed by measuring the frequency of flower visitation and the pollinators' effect on nectar levels and seed set. *Hoplodactylus maculatus* was found to be the main flower visitor. The nectar levels decreased during the night which correlated with the lizards' visitation time. Preliminary results suggest that even at low densities these lizards increased pohutukawa seed set. These findings improve our understanding of the role of lizards in the New Zealand pollination system.

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## **What did the 2007 and 2008 Garden Bird Surveys Tell us About Birds in Urban Gardens?**

**Spurr E**

Landcare Research

Urban gardens are an important habitat for several species of native birds, including kereru, tui and bellbird. However, there are few studies on the composition of bird populations in gardens in New Zealand and fewer on annual trends in these populations. The first nationwide garden bird survey took place in July 2007. The second was scheduled for July 2008. The methodology used is based on the RSPB Big Garden Birdwatch in the UK. Volunteers spend one hour watching birds and recording the highest number of individuals of each species seen at one time. In 2007, 2064 survey forms were completed (1954 from home gardens, 78 from local parks, and 32 from school grounds). In total, 89 species of birds were recorded (average 7.6 species per home garden, 8.9 species per park, and 6.5 species per school ground). Blackbirds were recorded in 90%, house sparrows 86%, silvereyes 81%, starlings 61%, song thrushes 52%, and other species less than 50% of home gardens. Silvereyes were recorded in the greatest numbers (average 10.2 per garden). House

sparrows averaged 9.4, starlings 3.1, blackbirds 2.7, greenfinches 1.2, and other species less than 1.0 per garden. Only two natives (silveryeye 1<sup>st</sup> and fantail 9<sup>th</sup>) featured in the 10 most common species. The tui was 11<sup>th</sup>, bellbird 15<sup>th</sup>, kereru 18<sup>th</sup>, and grey warbler 21<sup>st</sup>. The relative abundance of some species differed between habitats, regions, and whether or not people fed birds. Results from the 2008 survey will be compared with those from 2007. The value of garden bird surveys as a tool for monitoring urban bird population trends over time will become apparent only after several more years' data have been collected.

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## **That's a Rare Plant? Protecting Auckland's Threatened Flora**

**Stanley R**

Auckland Regional Council

Auckland is New Zealand's largest city and is home to over a million people and some 700 native plant taxa. Almost half of the flora is regarded as regionally threatened. Because the city is actively expanding in both urban spread as well as population numbers this continues to increase pressure on what remains of our native and threatened flora. This poses many challenges, two of which will be discussed: the value of knowing just what taxa are threatened and the importance of advocating threatened plant protection in an urban context.

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## **Spontaneous Urban Wall Vegetation in Christchurch and Dunedin, New Zealand**

**Stewart G**<sup>1,3</sup>, de Neef D<sup>1,2</sup>, Meurk C<sup>4</sup>, Ignatieva M<sup>1,3</sup>

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The vegetation of urban walls in New Zealand's cities has been little studied. We investigated the occurrence and patterns of wall vegetation in Christchurch and Dunedin cities. This is a contribution to the urban ecological knowledge base that enables the development of management tools aimed at preserving and enhancing urban biodiversity. Walls were randomly selected with the only requirement being wall vegetation present. In addition to plant species presence and abundance at different wall heights, wall characteristics including substrate type, aspect, orientation, and colour were also recorded. Due to high species diversity and low abundance, data analysis was generally carried out at the taxonomic level of orders. The majority of species on urban walls were non-native; 89.6% (102 of 117) and 92.9% (63 of 70) of exotic species in Christchurch and Dunedin respectively. Species diversity is high, but repeat occurrence low; 76.5% and 50% of the species occur in less than 5% of the samples for Christchurch and Dunedin respectively. In both cities the orders Asterales, Brassicales, Caryophyllales, and Poales were predominant, along with lichens and mosses. High incidence of species in the crack between base of wall and pavement indicated more favourable conditions or enhanced accessibility compared to other parts of the wall habitat. Lichens, and to some extent bryophytes, seemed to prefer the higher and better lit areas of the wall; lichens the rock surfaces and bryophytes often preferring the joints. In Christchurch, lichens were rare in the urban-industrial centre of the city. Overall the observed wall vegetation is relatively similar between the two cities despite the differences in humidity.

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## Is the Dumping of Garden Waste a Significant Addition to the Weeds Problem?

James A<sup>1</sup>, Stover J<sup>1</sup>, Plank M<sup>1</sup>, Timmins S<sup>2</sup>

<sup>1</sup> University of Canterbury, <sup>2</sup> Department of Conservation

It is commonly suspected that dumping garden waste at road ends and carparks contributes to the spread of weeds. However, there is very little evidence, other than anecdotal, to back this up. Data collection is a tricky problem with so much area to watch so we have turned to mathematical modelling to try and provide some answers. By developing a very simple mathematical model of weed spread we aim to confirm whether garden dumping contributes to the spread of weeds. We can then ask how important this is compared to the biological factors inherent to the weed, or the environmental factors associated with the site being invaded. This information will be used to focus and prioritise management efforts, and perhaps weed awareness campaigns, where they will be most effective.

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## How Stable are Island Ecosystems? - A 20 Year Case Study of Two Small Islands near Auckland

Taylor G<sup>1</sup>, Cameron E<sup>2</sup>

<sup>1</sup> Department of Conservation, <sup>2</sup> Auckland War Memorial Museum

Offshore islands are often considered by ecologists as stable ecosystems that serve as controls to compare with the more unstable human-impacted ecosystems on the mainland. This view is often based on small islands appearing to have simple ecosystems that appear to be in equilibrium. However, the processes that lead to changes on the mainland are still relevant to many offshore islands. In this talk I will use a detailed examination of two small (<1.5 ha) islands off the west coast of Auckland (Kauwahaia and Ihumoana Islands) to demonstrate that small islands are in a state of constant change. Over a 20 year period the two study islands have been monitored intensively up to 5 times annually. Vegetation communities on both islands were documented in early 1990s and annual changes in vegetation composition and structure have been recorded up to 2008. New plant species colonising the islands have been recorded, including all new native and adventive species. Pest animal species (rats, mice and possums) were initially removed on Kauwahaia in 1989 and Ihumoana Island in 1992. The patterns of reinvasion of new mammal species have been monitored annually, and the effects on the vegetation after removing mammals were recorded. The annual breeding populations of grey-faced petrels, sooty and flesh-footed shearwaters have also been monitored in detail. Over 20 years, the number of breeding burrows has doubled on Ihumoana and increased by 50% on Kauwahaia Island. In addition, diving petrels have established as a new breeding species on Kauwahaia Island since 2004. The role of seabird disturbance of vegetation communities will be discussed. Climate fluctuations and extreme weather events have proven to be decisive factors influencing the ecosystems on these islands. This talk will examine both the biotic and abiotic effects on the plant communities to demonstrate that long-term stability on offshore islands may be a myth.

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## Behaviour and Development of New Zealand Falcons (*Falco novaeseelandiae*) Nesting in Plantation Forests

Thomas A

Massey University, Palmerston North

The breeding behaviour and development of New Zealand falcon (*Falco novaeseelandiae*) were observed at two nests in Kaingaroa Forest by direct observations from a hide. Both nests were observed for the later part of the incubation, the entire nestling and early post-fledging period. Nest observations were made over a four month period between the 5th of November 2006, and the 2nd of March 2007. The duties of incubation were shared between both parents, the male providing about 30% of the total time on the eggs. Incubation remained very constant from the laying of the last egg in the clutch, even when a stoat (*Mustela erminea*) attempted to predate the eggs. During incubation the male provided only occasional prey for the female. Brooding was also shared between the parents, however, the male contributed only about 10% of the total brooding time, almost all of which was in the first seven days of the nestling period. The mean prey delivery rate was 1 prey item per hour and 13 minutes and the mean feeding rate was only slightly lower with 1 feeding event every hour and 8 minutes. The assisted feeding of the chicks was always completed by the female. The male, however, is capable of undertaking self-feeding of the young in the event of the female

parents' death. The male's primary role during the nestling period was prey delivery. During the early nestling period the female spent the majority of the day brooding chicks. Later in the nestling period this role shifts primarily to hunting for the young.

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### **1995 - 2008: A 13 Year History of Ecological Research on Tiritiri Matangi Island's Hihi.**

**Thorogood R**<sup>2</sup>, Armstrong D<sup>4</sup>, Low M<sup>3</sup>, Brekke P<sup>1</sup>, Brown R<sup>1</sup>, Walker L<sup>1</sup>, Ewen J<sup>1</sup>

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In August 1995, a release of 40 hihi onto Tiritiri Matangi Island (Tiri) (wild caught on Little Barrier Island) marked the start of an ongoing success story in terms of ecological restoration and research. Previously termed "the acid test for ecological restoration" the successful establishment of a hihi population anywhere in New Zealand has proven very difficult. The lessons learned in partnership with directed research on Tiri have helped identify the required management for sustaining this and other hihi populations. The population of hihi on Tiri has also been important in maintaining one of New Zealand's more detailed case study species, attractive for studying questions in ecology and evolution. Hihi lend themselves to research by being a conservation challenge and through having a unique and often extreme life history. The significance of research involving hihi from Tiri is evidenced by the growing number of research publications both in New Zealand and internationally. Here we review the major ecological research contributions from 13 years of ongoing study on this dynamic species and spectacular study location.

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### **Evaluating Invertebrate Biodiversity in Kiwifruit Ecosystems**

**Todd J**

HortResearch

A significant proportion of New Zealand's landscape is devoted to non-native ecosystems. These ecosystems are often subjected to manipulation, such as the introduction of new plant cultivars or biological control agents. Risk assessments of the impact of these introductions on the invertebrate species present in these ecosystems are required under the HSNO Act, 1996. As a result, a determination of which species are present and how these might interact with the new organism is required. As a first step to achieving this requirement, a survey of the invertebrates present in kiwifruit orchards (*Actinidia deliciosa* (A. Chev.) C. F. Liang et A. R. Ferguson 'Hayward') in the Bay of Plenty region of New Zealand has been conducted. A variety of trapping techniques were used to capture invertebrates in 20 kiwifruit orchards over the 2007 to 2008 season. Ten of the orchards were managed using the certified organic programme (ZESPRI Green Organic™) and the other ten were part of the KiwiGreen integrated management programme (ZESPRI Green™). The orchards were located in pairs (one Green Organic and one KiwiGreen) between Katikati and Pongakawa. Approximately 1000 species, or morphotypes, have been identified from the survey, and an analysis of species composition within the two orchard types is being undertaken. A Microsoft® Access database has been built to contain the taxonomic, biological and ecological information that is available for each species found in the survey. This information will be invaluable for assessing the risk to these species from the introduction of new organisms, such as entomophagous biological control agents, to the kiwifruit ecosystem.

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## The Success of the Tiritiri Matangi Island Tuatara Translocation

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Translocation has been identified as an essential element of tuatara conservation. This presentation describes the translocation and post-release monitoring of 60 adult northern tuatara (*Sphenodon punctatus punctatus*) from Middle Island, Mercury Group, to Tiritiri Matangi Island, Hauraki Gulf, in October 2003. The primary objective of the study was to describe the success of the translocation, which was assessed on the basis of survivorship; changes in body condition and snout – vent length (SVL); dispersion (indicative of reproductive cohesion); and breeding behaviour. Tuatara were located during nocturnal searches of varying intensities from the time of the translocation to March 2005; and between March 2007 and February 2008. At least 23 (38.3%) of founders survived for 150 days after release, and 13 (21.7%) founders were sited between March 2007 and February 2008. Body condition and SVL typically increased over time. During the 2004 and 2005 breeding seasons 50% (n=4) and 40% (n=5), respectively, of females whose locations could be assumed were located within 20m of a potential mate. Two nests and a hatchling tuatara have also been discovered. As with previous tuatara translocations, results suggest that the translocation has been successful in terms of individual survival and growth, and that reproduction is occurring. However, whether population size and reproductive cohesion is sufficient for long term persistence is not known.

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## Urban wildlife studies in Dunedin

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University of Otago

There is growing recognition of the important role that urban landscapes may play in supporting biodiversity, and providing an increasingly urban-based human population with opportunities to encounter wildlife and natural areas. While urban ecology is a developing field of interest internationally it is still in its early stages in New Zealand. In Dunedin several urban-based projects are contributing to our understanding of factors influencing the spatial distribution and abundance of populations of native species and introduced predators. Dunedin appears to support a reasonably diverse community of native birds, but it is not clear whether urban populations are self-sustaining or sink populations supported through landscape connectivity with more productive per-urban areas. Empirical and modelling studies have/are being conducted to determine: impacts of domestic cats on native wildlife, factors influencing bird community composition and skink distribution in different urban habitats; nest survival of native and exotic species; and the role of rats as potential meso-predators. An overview of these studies will be presented, and future directions identified.

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## Cultural Evolution of Song in Kokako (*Callaeas Cinerea Wilsoni*) at Pukaha Mount Bruce

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<sup>1</sup> Massey University, <sup>2</sup> Massey University, <sup>3</sup> Lincoln University

The kokako, *Callaeas cinerea wilsoni*, is an endangered species which only exists in small isolated populations often recovered from low numbers of individuals. Currently there is little to no gene flow between these populations without human intervention. Translocations between populations are often used to increase genetic diversity. However, the integration of kokako from different populations is made difficult by the fact that each population has a different song dialect, and birds will generally not mate with birds whose dialects differ from their own. This assortative breeding coupled to small population sizes can lead to inbreeding and inbreeding depression. My Masters thesis aims to look at how kokako song evolves in areas where multiple dialects are present. At Pukaha Mount Bruce kokako come from two different areas, Northern Mapara and Mangatutu. These birds exhibit different song dialects and were translocated to Pukaha separately. Three years on from the translocations they have not bred with each other; all breeding to date has been from birds that mated within their original dialect. I want to determine if the song of the birds born at Pukaha is a new dialect for Pukaha which will potentially unify all kokako and allow interbreeding. I have been recording song from three groups; birds at the original translocation sites, those translocated to Pukaha, and their offspring. To compare these three groups I have been analysing the syllables, phrases and song themes, examining the way coexisting at Pukaha may have influenced the songs of the

translocated and Pukaha born birds. Preliminary results will be presented looking at dialects of Northern Mapara birds at Mount Bruce.

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### **Monitoring Post-translocation Responses of Cryptic Geckos (*Hoplodactylus duvaucelii*) and Investigation of Avian Predation on Island Lizards.**

van Winkel D , Ji W , Brunton D

Massey University

New Zealand's native herpetofauna has suffered severe range contractions as a result of habitat fragmentation and introduced mammalian predators. Translocating threatened species to islands, free of introduced predators, may prove a successful tool for conservation management. However, the success of such procedures is often difficult to measure due to the low reproductive rates and poor detectability of native reptiles. Increasing detection may involve intensive post-release monitoring. This study focuses on the translocation of Duvaucel's geckos (*Hoplodactylus duvaucelii*) to two island sanctuaries, within the Hauraki Gulf (Auckland, NZ), as part of the islands' ecosystem restoration. *H. duvaucelii* are nocturnal, semi-arboreal geckos that have become extinct on mainland New Zealand. We aimed to monitor the initial establishment of *H. duvaucelii*, evaluate the efficiency of existing monitoring techniques for cryptic lizards, and quantify the rate of avian predation on island lizard populations. Post-release movements and habitat selection were recorded, via radio-telemetry. Three standard reptile monitoring techniques were employed: night spotlighting, artificial refuge use, and ink tracking tunnels. A comparison of these methods may warrant the development of best practice protocols for surveying cryptic species of lizards. Results on initial dispersal movements, habitat selection, success of monitoring techniques, and predation rates will be presented. This study provides invaluable information and recommendations for the future management of Duvaucel's geckos. Additionally, it may aid managers in conserving more threatened reptile species, such as the rarer *Cyclodina* skinks.

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### POSTER

#### **Cape Kidnappers and Ocean Beach Wildlife Preserve**

Ward-Smith T

Cape Kidnappers and Ocean Beach Wildlife Preserve

The Cape Kidnappers and Ocean Beach Wildlife Preserve is a significant *ecological* mainland restoration project, situated on privately owned land on the iconic peninsula of Cape Kidnappers, Hawke's Bay. The project started in 2006, with the aim of increasing levels of endemism, species diversity and species abundance on the peninsula. Restoration is being achieved with conventional tools – intensive pest control, species reintroductions, exclusion of domestic stock from forest patches, and re-planting of selected habitats. In 2007 the landowners completed building a 9.6 km long pest-proof fence across the base of the peninsula, from coast to coast, and have now spent more than a year removing pests from the 2200 hectares of coastal dunes, cliffs, and farmland behind the fence. Robin, tomtit, rifleman, whitehead and pateke have been liberated into the Preserve, and releases of brown kiwi are about to begin. If all goes well, these will be followed by re-introductions of species that are even more predation-sensitive, such as burrowing seabirds, tuatara and saddleback. This poster outlines the regionally and nationally significant features of the project and describes the techniques used to remove and maintain close to zero pest numbers, the involvement of local and wider community volunteers, and the progress made through the first two years.

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## Kauri Dynamics: Forest Gaps and the Cohort Regeneration Model

Wardle G

The University of Sydney

Progress in ecology, like much of science, occasionally requires major shifts in our thinking. Despite mounting evidence that relevant empirical information does not fit into existing models we cling to simple or traditional views and resist the inconvenience of a complex and variable world. The regeneration of the long-lived forest tree kauri (*Agathis australis*) is used to examine how two paradigm shifts were needed to overturn the entrenched position in the New Zealand literature that viewed kauri as a successional forest type. The first required a shift from an ecological framework that focused on a climax vegetation state in equilibrium with site and climatic variables, to one that embraced disturbance processes and forest dynamics. A second paradigm shift was needed to incorporate the heterogeneity of multiple spatial and temporal scales into one framework, the “cohort regeneration model”. Observations of seedling recruitment on decaying timber within forest gaps provided a mechanism for replacement of kauri populations through a periodic gap-filling process within a site. At the other end of the temporal and spatial continuum, abundant recruitment of kauri beneath a shrub layer of *Leptospermum* occurs after widespread disturbance from clearing or fire. These high-density stands experience self-thinning during periods of low seedling recruitment, but eventually as the forest matures, tree falls create gaps and a second wave of recruitment follows. Some of the evidence was available 50 years prior to the development of the cohort regeneration model but awaited a new synthesis and a shift in ecological thinking. Today we acknowledge a distinguished ecologist who worked on important problems in ecology and contributed new ideas that have stood the test of time. Disturbance, gap-phase recruitment and a focus on multi-scale dynamics are still common in many ecological systems but what are the next challenges requiring large shifts in our thinking?

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## Not-So-Sweet Release: How Native Insect Herbivores Took to Invasive Weeds

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<sup>1</sup> Lincoln University, <sup>2</sup> Landcare Research

The enemy release hypothesis (ERH) – sometimes referred to as the “natural enemy hypothesis” – is based on the principle that invasive species spread rapidly because they are “liberated” from some (or all) of their co-evolved natural enemies. Hypothetically, this reduction in predation/parasitism/pathogen pressure allows the invader to channel all of its energy to growth and reproduction thereby attaining a much higher level of fitness. While this seems an intuitive explanation and is generally accepted by ecologists, recent research invalidates its blanket application (Agrawal *et al.* 2005, Mitchell and Power 2006, Liu and Stiling 2006). This consideration was determined to be especially true for invasions involving congeneric species with shared natural enemies. New Zealand is home to a unique and amazingly diverse array of plants, including many endemic species. The diverse genus *Senecio* is part of the Asteraceae and is well represented throughout the world. Aotearoa is home to 19 native species – 13 of which are endemic – as well as a host of specialist insect herbivores. Since the beginning of European settlement, 18 more species of exotic *Senecio* have made their way here and established. The data I am presenting reflect interesting trends in herbivory on native and exotic *Senecio* by native insect herbivores. In particular, I will talk about literature and insectaria samples that imply native *Senecio* specialist insects were using exotic hosts soon after their establishment. In combination with this evidence, field data collected shows that this pressure was (and is) significant. Implications in terms of the ERH will be discussed.

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## Secondary Succession on Tiritiri Matangi Island

West C

Department of Conservation

Tiritiri Matangi was cleared and grazed from the mid 1800s to 1972. The island’s vegetation variously supported sheep, cattle, pigs, rabbits and kiore. After 1972 only kiore remained, and these were eradicated in 1993. From October 1978 to September 1979 seed rain was recorded monthly on a ridge toward the northern end of the island. In the same period vegetation composition on this ridge was documented. The purpose of the study was to investigate the likely mechanisms and rates for succession back to forest in the

absence of browsing mammals. Based on the results it was suggested that *Pteridium esculentum* (bracken) would continue to colonise the grasslands to be followed, in its degenerate phase, by broad-leaved forest species. Although most of the island had been replanted from 1984, largely with *Metrosideros excelsa* (pohutukawa), the study ridge was left to regenerate naturally (as the control for the “experimental” planting). Twenty seven years later, in 2006, the vegetation on the study ridge was resampled to record the changes in grassland composition. Casual observations over the years had revealed the establishment of *Phormium tenax* (NZ flax), scattered across the ridge. Fleshy-fruited shrubs were colonising around these plants. Resampling of the grassland vegetation revealed a shift from grassland dominated by exotic species to one dominated by natives. The “fast-track” route to forest via *P. tenax* was unforeseen – it is a mast-seeding species and within a 25 year period there had been one seeding event coupled with the opportunity for establishment.

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## POSTER

### **Population Recovery of Species with Relict Distributions: Maximising Returns from Whio Conservation Efforts**

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University of Canterbury

Traditional assumptions that population densities are correlated with habitat quality may be inappropriate for threatened species, which are often restricted to small, fragmented areas of habitat due to the presence of introduced predators or changes in habitat. Significant changes may result in relict distributions, where the current range is not representative of historical habitat. Such areas may contain low quality habitat that results in poor survival rates and low productivity, further reducing their ability to maintain self-sustaining populations. These issues can make the large-scale management of threatened species problematic because it is not always apparent where conservation efforts should be concentrated to maximise returns and ensure long-term persistence. The blue duck (whio - *Hymenolaimus malacorhynchos*) is an endangered species of riverine duck that has undergone a serious decline due to predation by introduced mammals and loss of forested riverine habitat. Whio conservation is currently dominated by *in situ* predator control in small isolated populations across New Zealand. We evaluate the management options available for whio conservation and suggest ways to increase the effectiveness of conservation efforts. The use of carefully structured management plans that assess both the suitability of habitat and the effectiveness of management techniques is vital for successful conservation management.

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## Auckland's Remarkable Urban Forest

### Wilcox M

Auckland Botanical Society Inc.

Auckland has a diverse assemblage of native and introduced trees, both wild and planted, which constitute a remarkable urban forest. The forest includes remnants of native bush (e.g. Smith's Bush), wild areas of naturalised trees (e.g. Jagers Bush), native restoration and landscaping projects (e.g. Watercare, Mangere), public parks and gardens (e.g. Auckland Zoo, Cornwall Park, Pt Erin Park), street trees, and the trees planted in private gardens, school grounds, motel and hotel sites, church yards, cemeteries, residential development sites, parking lots, and on industrial estates.

The species composition of the trees and shrubs in the urban forest has been catalogued into eight regional groups: (1) New Zealand natives, (2) Australia, (3) Southern Africa, (4) Central & South America (5) North America, (6) UK & Europe, (7) Asia, and (8) the Pacific. Examples from each group will be illustrated in the presentation and a summary given of the number of species and family representation. Several species of outstanding merit in the urban environment will be highlighted with regard to their attractive form and shape, good growth and health, and ecological benefits. The composition and structure of Auckland's planted urban forest varies according to the suburb. Old parts of Auckland like Mt Eden and Remuera generally have the biggest trees and the greatest diversity of species. The species composition of trees and shrubs in front gardens will be recorded and analysed for some streets in different parts of the city. The conservation and management of the urban forest is complex, and subject to the rules and bylaws for tree protection in the individual cities (Auckland, Manukau, Waitakere, North Shore). Public parks and street trees are under the management of council arborists. Several introduced tree species that grow well in Auckland have become abundantly naturalised, forming forests or infiltrating native bush margins. Examples are woolly nightshade (*Solanum mauritianum*), tree privet (*Ligustrum lucidum*), monkey apple (*Syzygium smithii*) and maritime pine (*Pinus pinaster*). These weedy species are controversial as they have both desirable and undesirable ecological effects.

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## From tree mortality processes to ENSO reconstruction - how virtual ecologists can help real ecologists

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Tree growth and mortality are key elements of forest dynamics, and thus are of great concern for forest managers. It is widely accepted that tree mortality can be predicted using tree growth data. Several approaches have been proposed for modeling the growth-mortality relationship, differing in terms of data sources and model flexibility. However, little is known about their ability to reliably reconstruct the shape of the real growth-mortality relationship due to a lack of long-term data. We adopted a 'virtual ecology' approach to this problem, simulating forests with either of two *a priori* specified growth-mortality relationships. Different sampling regimes in these virtual forests resulted in virtual tree-ring data, forest inventory data, or a combination of both. We used eight existing or newly developed models of different structural flexibility to analyse the growth-mortality relationship. The accuracy of the different model outputs, i.e. the deviation from the *a priori* specified growth-mortality relationships, was quantified with the Kullback-Leibler distance. For all data sources, reliable growth-mortality models could be identified. The highest accuracies were found for tree-ring based models, which require only a small sample size (60 dead trees). High model accuracies were also found for forest inventory based models, starting at sample sizes of 500 trees. Flexible statistical approaches turned out to be superior to less flexible models only for large sample sizes (totally 2000 trees). The additional use of Bayesian statistics, specifically designed for small sample sizes, led to high model accuracies only when model flexibility was constrained. Our study shows that simulated experiments are a powerful tool for selecting reliable approaches to analyse ecological processes such as tree mortality. Reliable models are fundamental for gaining novel ecological insights into the growth-mortality relationship of tree species. The use of more accurate growth-mortality relationships in forest succession models would allow for strongly improved projections of past and future forest dynamics. Our study provides the theoretical basis for a sound estimation of such growth-mortality models, and it also provides guidelines for efficient sampling schemes in real forests.