

The Joint Graduate School in Biodiversity and Biosecurity Student Seminar Day

Tāmaki Campus Function centre 730 220
(Population Health Building)

Wednesday, 12 June 2013



Entertaining and informative talks, whilst networking

WELCOME

Tēnā koutou,

Welcome to the fourth student seminar day for the Joint Graduate School in Biodiversity and Biosecurity. Combining academic excellence and an industry perspective, the Graduate School is jointly hosted by The University of Auckland's Faculty of Science and Landcare Research as part of the Centre for Biodiversity and Biosecurity. We offer postgraduate students the opportunity to undertake MSc or PhD research to help maintain New Zealand's terrestrial ecosystems and to enable our natural flora, fauna and fungi to flourish. Working alongside key stakeholders will ensure we equip students with the critical skills and knowledge they will need for a successful career in biodiversity and biosecurity.

This seminar day aims to showcase a diverse range of excellent student research from the Joint Graduate School

Hei konā mai



Jacqueline Beggs

Director, Joint Graduate School in Biodiversity and Biosecurity

<http://www.biodiversity-biosecurity.auckland.ac.nz/uoa/>

Photo credits for front page: Sarah Wyse and Tom Etherington



Welcome	
12:50	Beggs, J: Welcome to the Joint Graduate School Student Seminar afternoon
Session One	
1:00	Anne Tomlinson: Millipede and isopod communities in native forest fragments along a suburban-rural gradient.
1:15	Claire Warren: Promoting succession in retired pastures: can artificial bird perches increase native seed rain
1:30	Eru Nathan: Mammalian predator pest management: effectiveness and extent
1:45	Sarah Wyse: New Zealand kauri under threat: consequences for the wider forest community
2:00	Araceli Samaniego-Herrera: Invasive rodents on tropical islands: ecology and eradication confirmation
2:15 – 2:45 Afternoon Tea	
Session Two	
2:45	Varsha Mala: The ecology and impact of the broom gall mite (<i>Aceria genistae</i>) on its host plant Scotch broom (<i>Cytisus scoparius</i>)
3:00	Christine Sheppard: Potential distribution and invasiveness of new weeds under climate change
3:15	Ashleigh Robins: Modelling the movement behaviour of grey-faced petrels
3:30	Tom Etherington: Quantifying the direct transfer costs of possum dispersal using least-cost modelling
3:45	Luciana Luna Mendoza: Predator-prey interactions of feral cats and house mice on a Mexican island
4:00	Alice Baranyovits: Movements of kererū (<i>Hemiphaga novaeseelandiae</i>) within fragmented landscapes and the implications for seed dispersal of native and introduced plants
4:15 Onwards – Drinks and nibbles	

ABSTRACTS



Millipede and isopod communities in native forest fragments along a suburban-rural gradient

Anne Tomlinson
atom006@aucklanduni.ac.nz

Supervisors: Jacqueline Beggs, David Wardle

Millipedes (Diplopoda) and woodlice (Isopoda) play a key role in decomposition processes by fragmentation of litter detritus. New Zealand has a diverse millipede and isopod fauna which has been augmented by a number of naturalised introduced species. However, there is little knowledge of whether introduced species are invading native forest habitats or their impacts on endemic isopod and millipede communities. Millipedes and isopods were sampled across a size gradient of 20 native forest fragments in an Auckland suburban-rural landscape to determine firstly, whether introduced species had established in these habitats and secondly, the significance of a range of environmental and anthropogenic factors on community composition of native and exotic species. Exotic millipedes were dominant in small forest fragments, with the presence of synanthropic species such as *Cylindroiulus britannicus*, *Ophiulus pilosus* and *Oxidus gracilis* indicating biotic homogenization of these habitats. However, the high diversity of native millipedes in small fragments suggests that these habitats also play a role in maintaining native millipede populations. Reserve size and litter palatability strongly influenced exotic millipede distributions, whereas litter quantity and reserve age were important drivers of native millipede abundance. Only native isopod species were collected and litter quality was a significant influence on the abundance of all three species. The results highlight the important role of native forest reserves in anthropogenic landscapes in the preservation of native millipedes and isopods but the presence of exotic species indicates the need for further studies examining their impacts on native soil fauna and ecosystem processes.



Promoting succession in retired pastures: can artificial bird perches increase native seed rain?

Claire Warren
cwar013@aucklanduni.ac.nz

Supervisor: Margaret Stanley, Bruce Burns

Why do some retired pastures adjacent to native forest revert to native forest readily, while others don't? Given most New Zealand native forest species are fleshy-fruited and bird-dispersed, one ecological limiting factor may be that seed is not arriving into the pasture from a forest source. At three sites in the Auckland region, I am comparing seed deposition under artificial and natural perches in pastures, identifying perch visitors and determining the presence of any forest seed in the pasture prior to the study starting. Interim results suggest that without perches, bird-dispersed seed would not arrive, and that artificial and natural bird perches (trees) mediate the deposition of seed species such as *Cordyline australis*, *Meliccytus ramiflorus*, *Macropiper excelsum* and *Coprosma* spp.

This outcome suggests that ecological restoration projects in the Auckland region and throughout New Zealand could use artificial perches or plant trees in pasture to promote successional processes, and reduce reliance on labour-intensive plant propagation and planting strategies. Future research should investigate the effects of competition from exotic pasture grasses on the germination and survival of native forest seedlings.



Mammalian predator pest management: effectiveness and extent

Eruera Nathan
enat006@aucklanduni.ac.nz

Supervisors: Margaret Stanley, Al Glen (Landcare Research)

Introduced mammalian predators have had significant impacts on New Zealand's native flora and fauna, through both direct predation and competition for resources. As a result, management action has been undertaken in some areas of high ecological significance to reduce and control mammalian pest densities to a low level. This study aims to 1) determine the effectiveness of mammalian predator pest management in terms of biodiversity outcomes by monitoring several biodiversity indices; and 2) determine the spatial extent of these biodiversity outcomes, both across and outside the actual pest management area. These indices were measured across a 1200 m distance scale with 600 m either side of the pest management border of Ark in the Park in the Waitakere Ranges. Biodiversity indices under investigation were native bird, lizard and invertebrate abundance and diversity and seedling density. Additionally, densities of the pests themselves were measured in order to relate these factors to the biodiversity indices. Stoat and rat densities were found to decrease linearly from the point furthest outside to the point furthest inside the pest management area. Lizards were never observed. For all other biodiversity indices, at least some species or taxa were observed with increasing frequency from the point furthest outside to the point furthest inside the pest management area. These results suggest reduced levels of benefit to native biodiversity close to the edge of the pest management area and some level of spill-over benefit to the area immediately surrounding the pest management area.



New Zealand kauri under threat: consequences for the wider forest ecosystem

Sarah V. Wyse
Swys001@aucklanduni.ac.nz

Supervisors: Bruce Burns, Shane Wright

New Zealand kauri (*Agathis australis*) is known to exert a substantial influence on soil properties and nutrient cycling, modifying pH, available nutrient levels, and soil moisture regimes. Owing to these effects of kauri on microsite conditions within its stands, it could be expected that distinctive plant associations could be found with the species. However, little is known about the potential importance of kauri in shaping habitats, or its influence on its associated plant communities.

By quantifying the composition of the flora associated with mature kauri, compared to adjacent stands of broadleaved species with otherwise similar environmental conditions, I identified a significant effect by kauri on plant community composition. I identified three groups of plant species: stress tolerant species dependent on the presence of kauri within mature forest, species dependent on areas where kauri is absent, and those with distributions unaffected by the presence of kauri.

The research also explored the mechanisms that may be acting to produce the effects of kauri on its associated flora, including the limited water availability in organic soil horizons beneath kauri during periods of summer drought. In order to determine whether tolerance to water stress may be a characteristic of plants common beneath kauri, we used a dry-down experiment to examine the responses to water stress of seedlings of a number of species from the three groups of species previously identified. Comparatively high drought resistance was found to be a characteristic common to the plants able to establish within kauri stands. This finding suggests that periodic limitations in water availability beneath kauri could have a bearing on the composition of the plant communities able to establish at these sites.



Invasive rodents on tropical islands: ecology and eradication confirmation

Araceli Samaniego Herrera
asam050@aucklanduni.ac.nz

Supervisors: Mick Clout, James Russell, Dave Choquenot, Alfonso Aguirre

The eradication of invasive rodents from islands, a proven valuable tool for conservation, is now considered as “regular practice” in temperate ecosystems. However, within the tropics specific challenges need to be addressed for improving the planning, implementation and confirmation of rodent eradications. We are studying three groups of islands in the Mexican tropics where invasive rodents are present or have been recently eradicated. Field data from six rodent populations are being gathered to compare the morphological and ecological attributes of these populations. Data from the eight tropical islands being studied will also be used to identify the main impacts of invasive rodent populations on tropical fauna. Finally, “absence confirmation protocols” are being developed to estimate the probability of persistence of small mammals immediately after eradication attempts. In this talk, focus will be given to the ecology of invasive rodents and to the absence confirmation model. Preliminary results after more than two years of field work are presented: 1) rodent populations on tropical islands are up to ten times more abundant than those on temperate islands; 2) rodent abundance and fluctuations appear to be different between tropical dry and tropical wet islands; 3) four of these rodent populations were recently eradicated; rapid confirmation of success was obtained through the absence confirmation model. This information is proving to improve management projects in tropical environments, where the rate of failure is still high.



The ecology and impact of the broom gall mite (*Aceria Genistae*) on its host plant Scotch broom (*Cytisus scoparius*)

Varsha Neelam Mala
varsha.mala@hotmail.com

Supervisors: Quentin Paynter, Zhi-Qiang Zhang and Bill Lee

Scotch Broom (*Cytisus scoparius*) is a deciduous shrub, with green stems, small alternate leaves and conspicuous yellow flowers. The species has been widely introduced and is a major invasive weed in New Zealand, Australia and USA. Broom has a broad environmental niche and grows in New Zealand in a wide range of conditions constrained only by an association with moderate soil phosphorus levels. This species is now affecting agriculture, plantation forestry, railway lines maintenance and conservation areas and is a priority for biological control. The broom gall mite Eriophyidae (*Aceria genistae* Nalepa) was released in 2008 as one of several biological control agents for broom. These mites cause death of the plants by forming “cancer” like stem-galls. However, there are other predatory mites on broom and bacterial and fungi appear to be associated within the galls. This species complex could potential facilitate or moderate the effect of the gall mites as a biocontrol. The major predatory mites found on broom are Phytoseiidae (*Typhlodromus caudiglan* Schuster), and Stigmaeidae (*Zetzellia māori* González-Rodríguez). Two other prominent fungivorous groups abundant on broom are Tydeidae (*Tydeus lambi* Baker) and Tarsonemidae (*Tarsonemus* sp. (Tarsonemidae)). A manipulative experiment was set up to determine the impact of the broom gall mite *Aceria genistae* on its host plant Scotch broom and to investigate the effects of manipulating relevant predators, competitors and pathogens associated with *A. genistae*. This was achieved using different pesticides and fungicides. The experiment was set up at Leslie Hills Station, North Canterbury (42°38'20.10"S, 172°46'49.62"E). Pre-treatment analysis of broom plant biomass showed no significant difference between treatments whereas post treatments results showed significant patterns over the first five months of data collection. Post treatments results showed that plants with no mites and higher natality rate whereas greater mortality was evident in plants with specific manipulations example where all predators and fungivorous were removed. Further exploration is needed to measure the success of the experiment.



Potential distribution and invasiveness of new weeds under climate change

Christine Sabine Sheppard
cjog001@aucklanduni.ac.nz

Supervisors: Margaret Stanley, Bruce Burns

Climate change and plant invasions have each been studied extensively, but few studies have considered their combined and potentially synergistic impacts. Climate change may provide opportunities for alien plants to expand into regions where they previously could not survive and reproduce. For three new weeds from warmer native ranges (*Archontophoenix cunninghamiana*, *Schefflera actinophylla* and *Psidium guajava*), potential distributions are modelled using a range of climate change scenarios. To validate the models, field trials are conducted to test whether these alien plants perform as expected in suitable, potentially suitable and unsuitable habitats (as identified by the models). Furthermore, effects of competition on closely related native species were investigated. The results of the species distribution models indicated that the alien plants are likely to expand their range by the end of the century by on average 101% (*A. cunninghamiana*), 112% (*S. actinophylla*) and 70% (*P. guajava*). Preliminary results of the field trials showed that they perform well in some of the sites identified as potentially suitable. Effects of competition from the alien species under high densities were strong compared to intraspecific competition. The combined results from the models, field trials and competition experiments provide strong evidence of the potential invasiveness of these plants. By having higher confidence in the potential risk of new weeds and where they may spread, we can aid management decisions that lead to greater cost effectiveness: resources can be prioritised and allocated effectively, to control alien plants at an earlier stage of their naturalisation.



Modelling the movement behaviour of grey-faced petrels

Ashleigh Robins
arob158@aucklanduni.ac.nz

Supervisors: Todd Dennis, Claire Postlethwaite

Much attention has been given to describing the behaviour of animals by fitting movement models to tracking data. As a result, a number of fundamentally different models of individual movement have been developed. Despite the interest, little is known about how the different approaches compare in: 1.) their ability to predict biologically relevant behavioural states; 2.) the computational effort required; and 3.) the value of information derived from given outputs. Here, we present a study in which three conceptually different inferential movement models (Markov-chain Monte Carlo; K-means clustering; and Multi-scale Straightness Index) were fit to movement trajectories of grey-faced petrels (*Pterodroma macroptera gouldi*) collected during the incubation period on Ihumoana Island (Bethell's Beach) and the chick-rearing period on Burgess Island, Mokohinau archipelago. Observed trajectories were recorded by GPS data-loggers at 30-s intervals. The movement models employed used information about the speeds and turning angles between sequential fixes to classify each observed location into distinct behavioural states. Each model provided meaningful insights regarding the movement ecology of grey-faced petrels, and advanced understanding of how the behaviour of the study species varies during foraging. However, the computational effort of the three methods varied greatly, so that there was a strong inverse relationship between ease of use and the extent of biological signals that could be extracted from the movement trajectories. Our results highlight the value of inferential movement models for studying the behaviour of animals, but also identify important issues regarding the level of training and computational effort required to use them.



Quantifying the direct transfer costs of possum dispersal using least-cost modelling

Thomas Etherington
teth001@aucklanduni.ac.nz

Supervisors: George Perry, Mick Clout, Phil Cowan

The brushtail possum (*Trichosurus vulpecula*) is a notorious invasive species within New Zealand. Management of the species needs to consider dispersal, however the current dispersal model models the transfer component of dispersal between geographic locations upon a kernel that is purely a function of distance. This approach ignores any landscape barriers to dispersal that impose transfer costs through factors such as energetic expenditure, behavioural aversion, or mortality risk. We estimated the transfer costs associated with brushtail possum dispersal by quantifying the transfer costs associated with landscape barriers, and by describing the likely transfer costs accumulated by dispersing brushtail possums. Assuming that landscape connectedness between pairs of locations can be represented by the genetic relatedness in possums at those locations, a landscape genetics approach based upon least-cost modelling was used to create a geographic information system cost-surface for the North Island of New Zealand that quantified the transfer costs associated with various landscape barriers. Least-cost paths between the start and end points of dispersal movements from radio-collared brushtail possums from several studies were then used to define a dispersal kernel in terms of accumulated-cost units. By using the cost-surface in combination with the accumulated-cost dispersal kernel, existing dispersal models could be refined to include transfer costs as part of the dispersal process in order to better represent dispersal for management of brushtail possums.



Prey-predator dynamics of cats and mice on Guadalupe Island, Mexico

Luciana Luna Mendoza
llun008@aucklanduni.ac.nz

Supervisors: Mick Clout, James Russell, David Choquenot, Alfonso Aguirre

In consumer-resource systems, populations fluctuate according to the dependence of one level (consumer) to the other (resource). The study of these interactions through the functional and numerical responses is used to understand the relationship between the different trophic levels and to make predictions about population changes over time. For species considered as pests, the modelling of the population rate of increase becomes critical for management purposes. Feral cats and house mice have been introduced to islands all over the world. Both species can have negative impacts on native species causing an alteration of the natural ecological processes. On Guadalupe Island (24,171 ha), feral cats and house mice are both present. Through this research, the numerical response of mice to seed availability, and the numerical and functional responses of cats to mice availability were estimated. The numerical and functional responses of both species were incorporated in a simulation model linking rainfall, seed availability, mice and cats. For the numerical response of mice, the rates of increase were related to estimates of seed density and to a density-dependent factor. The functional response of cats was estimated from scats collected on the island across different seasons, being the house mouse the main prey. The main driver of the rate of increase for mice and cats are food resources. Preliminary results show that cats are not capable of regulating mouse numbers. The study of the ecological relationship between both invasive mammals on Guadalupe will inform management decisions (e.g. feasibility of eradication) for feral cats.



Movements of kererū (*Hemiphaga novaeseelandiae*) within fragmented landscapes and the implications for seed dispersal of native and introduced plants

Alice Baranyovits
abar939@aucklanduni.ac.nz

Supervisors: Mick Clout, Jacqueline Beggs & George Perry

In terms of native vegetation, urban and peri-urban areas are often highly fragmented, comprising of small remnants surrounded by a range of human modified environments. Long distance seed dispersal is essential to maintain connectivity between plant populations within these fragmented landscapes. The amount of gene flow between fragments is determined by the frequency of dispersal events; low frequency can lead to a reduction in genetic diversity and increase the risk of inbreeding. Seed dispersal also largely determines the extent of range expansion so can have important implications for the management of introduced plant species. Many fleshy fruited plants rely on vertebrate frugivores to disperse their seeds. In these cases, it is necessary to understand the movement patterns of the frugivore in order to accurately estimate the extent of dispersal.

In New Zealand, the kererū (*Hemiphaga novaeseelandiae*), a large (c.650g) endemic fruit pigeon is a key disperser. Kererū are mobile, widespread and known to consume the fruits of over 70 plant species. Although primarily forest birds, kererū do occur in urban areas and other fragmented landscapes. The movements of kererū can be fairly limited, although they are capable of making longer distance flights of several kilometres. Movement patterns of kererū tend to be site-specific and are often linked with changing seasons and the availability of food resources. However, little is known about the frequency and extent of longer distance flights or how movement patterns might differ in the urban environment. This project will use various tracking technologies to develop a detailed understanding of kererū movements at different spatial and temporal scales within the urban environment.

NOTES

NOTES