Empowering the Local Voice in a Graphical Representation of New Zealand's Biological Heritage (Flora & Fauna)

Miss Jodanne Aitken[1], **Mr Marcus Shadbolt**[1], Mr James Doherty[2], Docter James Ataria[1,3], Mrs Melanie Mark-Shadbolt[3]

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Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

I am in my third year of a Bachelor of Science majoring in Conservation and Ecology and an additional major in Environmental Management at Lincoln University. I aspire to be involved in an organization or group of people that work together to help research, protect, share and conserve the natural environment so that generations to come can experience its beauty.

Abstract:

The decline of iwi dialects and terms for localised fauna and flora also risks losing associated mātauranga for these species. This research project was co-created with a kaumatua (elder) from the Tuhoe-Tuawhenua region who was concerned at the loss of their own Māori names for flora and fauna in their region. The research was designed to demonstrate how we could retain and empower local bio-heritage terms via the creation of a static visual educational resource. This proof-of-concept resource is being created using the forest vegetation of the Tuhoe-Tuawhenua environs. The plants will be identified by their local Māori term and their corresponding scientific name. Depicting ecological accuracy in the artwork was a specific requirement of the kaumatua and created some unique challenges for the project team and artist. We will talk about the approaches used and will include samples of the finalised artwork. This project was funded by the New Zealand's Biological Heritage National Science Challenge.

Flammability of crown fuel mixtures is non-additive: Low flammability plants reduce fire residence time and total heat release

Mr Md Azharul Alam[1], Professor Charles Fleischmann[2], Dr Sarah Wyse[3], A/Prof Hannah Buckley[4], Mr Jake Spinks[2], Mr Patrick De La Mare[2], Dr Jon Sullivan[1], Professor George Perry[5], Dr Timothy Curran[1]

[1]Department of Pest Management and Conservation, Lincoln University, Lincoln 7646, New Zealand, [2]Civil & Natural Resources Engineering, University of Canterbury, Christchurch 8140, New Zealand, [3]Bio-protection Research Centre, Lincoln University, Lincoln 7647, New Zealand, [4]School of Science, Auckland University of Technology, Auckland 1142, New Zealand, [5]School of Environment, University of Auckland, Auckland 1010, New Zealand

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Azharul Alam is a Ph.D. student in the Department of Pest Management and Conservation at Lincoln University, New Zealand. His research focused on plant flammability and fire ecology. Mainly, he is doing research to better understand plant flammability by making relationships between plant functional traits and flammability

Quantifying the flammability of plant species is key to understanding the hazards and behavior of fire in the field, and numerous studies have been undertaken to determine the flammability of individual species. However, in nature, plants with varying flammability co-occur, and wildfires often burn through the canopy of mixed stands. Hence, experimental burning of mixed-species fuels is needed to understand fire behavior in the field where multiple species are burning in combination. In this study, we burned 70 cm shoot samples from two high-flammability and two low-flammability species, across all pairwise combinations, using oxygen depletion calorimetry. Using measurements of eight flammability parameters, we evaluated whether 1) the flammability of the two-species mixtures was different from the constituent individual species, and 2) the presence of low flammability plants influenced the flammability variables in the mixed-species burns. The overall flammability of the shoot level mixtures was non-additive, and driven by the most flammable species. While the parameters related to ignitibility and combustibility were unaffected by the presence of low flammability plants in the mixed fuel, the burning time and total heat released were significantly reduced by less flammable species. This study suggests that flammability differs in mixed-fuels than when burning their constituent species, and is usually driven by the specific flammability of a single species in the mixture. The reduction of burning time and total heat released by the presence of low flammability plants in the mixture highlights how low flammability plants could be used to reduce fire spread and impact.

How can we motivate conservation volunteering? A case study of community pest control on Herald Island

Hayley Alena[1], Associate Professor James Russell[1], Associate Professor Niki Harré[1]
[1]*The University of Auckland, Auckland, New Zealand*

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Hayley has completed undergraduate and postgraduate studies at The University of Auckland. Her master's research focused on the social and psychological aspects of involvement in community pest control projects. Hayley is currently in her first year of a Ph.D. in ecology supervised by George Perry and Janet Wilmshurst.

Along with the increasing awareness of human's impacts on the natural environment, a focus on understanding factors influencing pro-environmental behaviour to mitigate this has increased. This case study applied social science and psychological methods to an issue in the natural sciences, of how to motivate conservation behaviour.
This study focused on the inhabited Herald Island off the North Shore of Auckland. Herald Island is a 35-hectare island with a population of 700. The island's environmental group hosts regular volunteer activities such as beach clean-ups, weeding and planting days. The group had started a new project called 'Bring Back the Birds', with the ambitious goal to be the first inhabited island to eradicate mammalian pests.
Community-wide surveys showed that place attachment (the attachment an individual has to the place in which they live) predicted different levels of general involvement in the environmental group (regular volunteer, occasional volunteer, non-volunteer), but did not predict rat trapping. Rat trapping was instead predicted by owning a house and by living on the island for longer.
Interviews with 15 residents who had taken on leadership roles for the rat trapping project showed their motivations generally could be characterised as environmental, social, community-driven and for personal gain. Surprisingly, social and community related motivations were more important than environmental motivations. These leadership roles were also predicted by strong attachments to the community of Herald Island ('civic place attachment'). Recommendations for motivating community conservation and involvement in pest control will be discussed.

Experimental mesocosm communities reveal no support for enemy release

Dr. Warwick Allen[1,2], Dr. Lauren Waller[1,2], Dr. Jason Tylianakis[1], Dr. Barbara Barratt[3], Dr. Ian Dickie[1]
[1]University of Canterbury, , , [2]Lincoln University, , , [3]AgResearch, ,

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:
Warwick Allen is based at the University of Canterbury and is a postdoctoral fellow in the Bio-Protection Research Centre. He is interested in biological invasions, multitrophic species interactions, and biogeography. His postdoctoral research investigates how the structure of multitrophic species interaction networks can influence the success of invasive plants and arthropods, and how native communities respond to these invasions.

The enemy release hypothesis is commonly invoked to explain the success of invasive exotic species, positing that invaders suffer less damage from enemies in their introduced range relative to co-occurring native species. However, support for this prediction has been mixed, with empirical tests mostly comprising pairwise native-invasive comparisons using a single enemy, and with little consideration given to indirect interactions (e.g., apparent competition). To address these limitations, we manipulated plant-herbivore interactions in 180 experimental mesocosm communities, designed from a pool of 39 plant and 20 arthropod herbivore species, that varied in provenance, phylogeny, and traits. We measured plant and herbivore biomass and quantified plant-herbivore interaction networks, that were then used to calculate each species' potential to exert or suffer from apparent competition based on shared herbivores. We used these data to ask whether exotic and native plants differed in direct herbivory as well as their potential for apparent competition. Across all plant and herbivore species, we found no support for the enemy release hypothesis: compared to native plants, exotic species interacted with a greater diversity of herbivores, accumulated more herbivore biomass, suffered greater leaf chewing damage, and had a larger reduction in biomass due to herbivores. Moreover, exotic plants had higher potential to both exert and receive apparent competition effects than native species, driven by their higher herbivore loads and sharing of interaction partners. Our findings suggest that the enemy release hypothesis breaks down at the community level, with important implications for understanding the causes and consequences of biological invasions.

Impacts of ungulate exclusion on forest C stocks in NZ

Kara Allen[1], Mark G. St. John[2], Peter J. Bellingham[1], Sarah J. Richardson[1], Duane A. Peltzer[1]
[1]Manaaki Whenua--Landcare Research, Lincoln, New Zealand, [2]MSJ Consulting, Ottawa, Canada

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Kara is a recent transplant to NZ. She moved to Manaaki Whenua this year from a postdoc at West Virginia University, where she was using empirical data to develop and refine a coupled plant-microbial decomposition model. Her main research interests are biogeochemistry, plant-microbial interactions, and ecological modelling. She is looking forward to learning more about NZ ecology and landscapes!

Forests store large amounts of carbon (C) and through their biomass have the potential to mitigate the effects of climate change. However, the introduction of new species, such as ungulates, can alter forest structure and composition, subsequently reducing biomass and forest C stocks. To determine the impact of ungulate exclusion on forest C storage, we assessed forest structure and composition, and above- and belowground (30 cm depth) forest C pools using a multidecadal network of paired deer exclosure experiments (n=26). Ungulate exclusion increased numbers and diversity, of browse level vegetation (e.g., saplings and small trees (DBH > 2.5 cm < 10cm)) in exclusion sites, leading to the only significant increases in C pools between treatments. However, the sum of C bound in saplings and small trees represented only ~5% of total ecosystem C. Whereas, C stored in the largest trees (DBH > 30 cm) accounted for ~38% of total ecosystem C across treatments. Biomass of the largest tree (mean DBH: 91 cm) in each plot explained ~50% of the variation in total ecosystem biomass. These large trees not only store most of the ecosystem C, but likely exert dominance on ecosystem nutrient cycling, potentially reducing the effects of exclusion on nutrient stocks at our sites. Our results illustrate a snapshot of forest dynamics under ungulate exclusion. Over time, the establishment and growth of the more diverse browse level vegetation found in our exclusion sites could alter ecosystem functioning in these systems and their ability to cycle and store nutrients.

Plant functional traits associated with drought tolerance in the Lewis Pass, New Zealand

Grace Allison[1], Tim Curran[1], Breanna Hill[1]
[1]*Lincoln University, Christchurch, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Drought is a key determinant of species' distributions across the planet. Climate change is altering the frequency and intensity of drought periods, which is predicted to alter current vegetation distributions and ecosystems. Therefore, it is necessary to determine the drought tolerance of species; this can be measured using a plant functional trait approach. This study estimates the drought tolerance of 29 species in the Lewis Pass, New Zealand, by measuring 5 morpho-anatomical traits and assessing them against midday leaf water potential, a physiological trait directly related to drought tolerance. The traits most related to drought tolerance in the study species were leaf area, wood density and leaf dry matter content. We found no correlation between either leaf thickness or specific leaf area and water potential. This suggests that leaf area, wood density and leaf dry matter content can be used as surrogates in place of the measurement of water potential for estimating the drought tolerance of species. It was found that small-leaved, high wood density plants with high leaf dry matter contents will possess greater drought tolerance. This study provides a useful starting point for the development of models to predict the impacts that drought will have on species' distributions in the future.

Assessing subspecies status of leopards (Panthera pardus) of northern Pakistan using mitochondrial DNA.

Mr Muhammad Asad[1], Mr Francesco Martoni[2], Dr James Ross[1], Mr Muhammad Waseem[3], Mr Fakhar-i-Abbas[4], Dr Adrian Paterson[1]

[1]Lincoln University, Selwyn, New Zealand, [2]AgriBio Centre for AgriBioscience, Melbourne, Australia, [3]World Wide Fund for Nature, Islamabad, Pakistan, [4]Bioresource Research Centre, Islamabad, Pakistan

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Muhammad Asad is currently a Ph.D. candidate examining the conservation behaviour of leopard in Pakistan while based at Lincoln University, I was previously involved in a leopard radio-collaring study with WWF-Pakistan and has successfully collared common leopard for the first time in Pakistan. In the current research, I Established the genetic and taxonomic status of the leopard subspecies in Pakistan. I have experience of other wildlife management such as working on the bat, otters, musk deer.

Abstract

Despite being classified as critically endangered, little work has been done on leopard protection in Pakistan. Once widely present throughout this region, leopards are now sparsely distributed, and possibly extinct, from much of their previously recorded habitat. While leopards show morphological and genetic variation across their species range worldwide, resulting in the classification of nine different subspecies, the leopard genetic structure across Pakistan is unknown, with previous studies including only a very limited sampling. To clarify the genetic status of leopards in Pakistan, we investigated the sequence variation in the subunit 5 of the mitochondrial gene NADH from 43 tissue samples and compared it with 238 sequences available from online databases. Phylogenetic analysis clearly separates the Pakistani leopards from the African and Arabian clades, confirming that leopards from Pakistan are members of the Asian clade. Furthermore, we identified two separate subspecies haplotypes within our dataset: *P. p. fusca* (N=23) and *P. p. saxicolor* (N=12).

Help! What do I do with my data? Answering ecological questions using low-coverage next generation sequencing

Dr Rachael Ashby[1], **Mr Timothy Bilton**[1,2], Dr Rudiger Brauning[1], Dr Ken Dodds[1], Dr Marty Faville[3], Dr Andrew Griffiths[3], Dr Jeanne Jacobs[4], Mr John McEwan[1], Dr Shannon Clarke[1]

[1]AgResearch, Mosgiel, New Zealand, [2]University of Otago, Dunedin, New Zealand, [3]AgResearch, Palmerston North, New Zealand, [4]AgResearch, Lincoln,

Next Generation on Next-Generation Sequencing Symposium (I), Stewart Theatre 2, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Rachael Ashby is a postdoctoral researcher with the Bioinformatics team at AgResearch and Genomics Aoteroa. Her research focusses on the use of next generation sequencing for applications including genome assembly and genotyping-by-sequencing for genomic management of highly diverse species. Timothy Bilton is in the final stages of his PhD at the University of Otago and AgResearch where his PhD research has focused on developing new statistical methods and packages for analysing low-coverage next generation sequencing data.

The reduction in the cost of next generation sequencing (NGS) has enabled time-efficient and high-throughput approaches for generating genomic tools that are readily applicable across a wide range of species. These techniques are now being applied on an unprecedented scale to underpin studies that a few years ago were not feasible, including ecological, conservation and population studies. However, these genomic data can have issues not seen with previous genotyping technologies that may complicate downstream analyses. These issues can often be mitigated by sequencing at higher coverage. This requires further investment and is not feasible for many poorly resourced species. Development of appropriate tools and methods for processing low-coverage NGS data is vital for deducing reliable scientific conclusions in species with limited funding.

We describe various bioinformatic and statistical methods that we have developed for analysing low-coverage NGS data. We present an overview of how several pipelines have been applied to highly diverse species with a range of biological questions. In addition, the statistical methods we have developed cover a broad range of analyses, which have been implemented in freely available software. These include estimating relatedness and inbreeding, performing linkage mapping, and estimating effective population size. All these bioinformatics and statistical tools are useful for conducting population genetic studies, creating and validating *de novo* assemblies and genetic management of 'orphan' species with little prior knowledge of their genomes. Several examples illustrating the use and application of these methods are provided on a range of species including several ecological species.

Congruence of beetle and spider communities across sites and habitats: perspectives from Te Paki

Dr Olivier Ball[1], Dr Brian Fitzgerald[2], Mr Stephen Thorpe[3], Mr Patrick Whaley[4]

[1]NorthTec, Whangarei, New Zealand, [2]Te Papa Tongarewa/Museum of New Zealand, Wellington, New Zealand, [3]Independent researcher, Auckland, New Zealand, [4]Waikato Regional Council, Hamilton, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Olivier Ball has been a tutor in the Applied and Environmental Sciences Department at NorthTec since 2000. His research interests centre on invertebrate ecology and taxonomy of terrestrial amphipods.

Ground-dwelling beetle and spider communities in Te Paki Ecological District were sampled seasonally by pitfall trapping in three habitat types: native forest, pine plantation forest, and manuka/kanuka-dominant shrubland. Botanical composition was also assessed at each site. Beetle □ diversity was highest in native forest and lowest in shrubland, whereas spider α diversity was broadly similar across the three habitats. Separate multivariate analyses were conducted on the beetle, spider and plant community data. Clustering of sites in plant space corresponded closely to the three habitat types. Clustering of sites in beetle and spider space was also largely a reflection of the plant communities with the exception of one shrubland site, Darkies Ridge. The spider community at Darkies Ridge clustered with the native forest rather than shrubland sites. In beetle space, Darkies Ridge also gravitated towards the native forest sites, though not as strongly. Thus, congruence between the beetle and spider fauna across different sites and habitats was low as measured by richness, but high as measured by effects on community composition. Though botanically similar to the other shrubland sites, Darkies Ridge is more structurally complex and is undoubtedly in the process of regenerating into native forest more rapidly than the other, wetter, less fertile shrubland sites sampled. These differences, mostly relating to dissimilarities in underlying geology, hydrology and soil conditions, may partially obscure the effects of plant composition on invertebrate communities, and could help explain the relatively consistent differences in spider and beetle communities across sites and habitats.

What's up there and who eats whom? Macroinvertebrate community composition of South Island alpine tarns

Ms Alex Barclay[1], Doctor Helen Warburton[1], Professor Dave Kelly[1], Professor Angus McIntosh[1]
[1]*University of Canterbury, Christchurch, New Zealand*

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Alex is a master's student in her thesis year, at the University of Canterbury. She completed an undergraduate degree in ecology, with a particular interest in freshwater ecosystems. Her MSc research is on macroinvertebrate community composition and food-web structure of South Island, New Zealand alpine tarns.

Alpine tarns are likely to be sentinel ecosystems for global climate change because they are subjected to harsh conditions induced by surrounding ice and snow and are dominated by cold tolerant communities, often of high conservation value. The ecology of alpine tarns in some regions of the world is reasonably well known, however, New Zealand is data deficient. This lack of knowledge compounds threats posed by global change drivers because there is so little information to underpin management actions.

To better understand New Zealand alpine tarns, particularly how communities vary with altitude, we collected invertebrate samples from groups of tarns at eight locations between 980 m and 1740 m above sea level, in Canterbury-Westland. Tarns were intensively sampled for macroinvertebrates and physicochemical conditions measured, including: altitude, surface area, conductivity, pH, and temperature.

Macroinvertebrate community structure changed considerably with altitude, but contrary to expectations, overall species richness did not always. At high altitudes communities consisted of notably different community assemblages to those closer to sea level. In particular, high altitude assemblages were driven by the presence of Coleoptera and the absence of Odonata.

Alpine tarns are likely to experience substantial changes in physical conditions with climate warming, which will in turn alter community composition. Species may find themselves in 'summit traps' as temperatures increase, while others will be able to increase their altitudinal ranges. Our work demonstrates that there are unique macroinvertebrate assemblages at high altitude which will be especially vulnerable.

Shaped by stress: a trait-based meta-analysis of stream communities across stressor gradients in New Zealand

Isabelle Barrett[1], Professor Angus McIntosh[1], Dr Catherine Febria[2], Dr Elizabeth Graham[3], Dr Justin Pomeranz[4], Dr Francis Burdon[5], Professor Jon Harding[1], Dr Helen Warburton[1]

[1]University of Canterbury, Christchurch, NZ, [2]University of Windsor, Windsor, Canada, [3]NIWA, Hamilton, NZ, [4]Colorado Mesa University, Grand Junction, USA, [5]Swedish University of Agricultural Sciences, Uppsala, Sweden

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Issie is a PhD student at the University of Canterbury (Christchurch, NZ). Her interests lie in freshwater restoration ecology, with current research focussed on improving restoration outcomes from an invertebrate community perspective, often using trait-based approaches. Her experiments have primarily been mesocosm based, and at times it is unclear whether her PhD will be in ecology or plumbing!

Environmental filtering shapes communities by filtering out species with certain traits (characteristics, including morphology, behaviour and life history), resulting in communities associated with specific environmental conditions. Understanding how different environmental filters/conditions shape different communities may enable design of more effective restoration strategies which target biological recovery. To investigate if invertebrate community types were associated with different stressor gradients, a meta-analysis of New Zealand streams was conducted using data across drying, flooding, eutrophication, sedimentation and acid mine drainage (AMD) gradients. We hypothesised that whilst some stressors would apply different environmental filters resulting in different trait combinations, others might shape communities in similar ways, resulting in similar trait combinations. A trait-based ordination of communities using non-metric multidimensional scaling was conducted. Significant trait responses to stressor gradients were found for all stressors. Additionally, AMD and sedimentation worked to shape trait composition in the same direction, with higher stressor intensity leading to presence of hardier species. Flooding and eutrophication worked on the same axis but in opposite directions, with flooding selecting for more streamlined, mobile organisms and eutrophication for more sedentary organisms. Knowing that different stressors can work to filter organisms in opposite directions might be applicable as a restoration action to successfully displace less desired taxa. Whilst using stressors to further disturb degraded ecosystems seems counter-intuitive, it could be used to trigger positive community change as a restoration tool. In practice, this might involve identification and artificial application of stressors which act against a degraded community and in favour of a desired community.

Negative resistance and resilience: a mesocosm experiment demonstrating consequences for biological recovery in restoration

Isabelle Barrett[1], Professor Angus McIntosh[1], Dr Catherine Febria[2], Dr Helen Warburton[1]
[1]*University of Canterbury, Christchurch, New Zealand,* [2]*University of Windsor, Windsor, Canada*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:
Issie is a PhD student at the University of Canterbury (Christchurch, NZ). Her interests lie in freshwater restoration ecology, with current research focussed on improving restoration outcomes from an invertebrate community perspective, often using trait-based approaches. Her experiments have primarily been mesocosm based, and at times it is unclear whether her PhD will be in ecology or plumbing!

Traditionally, resistance and resilience are associated with good ecological health, often underpinning restoration goals. However, degraded ecosystems can also be resistant and resilient to disturbance (negative resistance and resilience) making them resistant to restoration. This may be a consequence of degraded communities becoming dominated by species whose traits enhance food-web stability, preventing recolonisation by other species and resulting in low biodiversity and poor ecosystem function.

We present a mesocosm experiment demonstrating how presence of a degraded community hinders biological recovery. We established 12 stream mesocosms, each mimicking a physically healthy stream. Degraded invertebrate communities were established in half, mimicking the post-restoration scenario of physical recovery without biological recovery. We then introduced a biodiverse, healthy colonist community to all tanks, to see if presence of the degraded community impacted establishment of a healthy community.

Colonists established less readily in the degraded community mesocosms. We observed decreases in abundance of sensitive taxa in the presence of the degraded community, potentially driven by changes in resources; algal biomass was reduced by degraded community presence, increasing resource competition. Reductions in abundances likely occur by drift, but also by changes in life history. For example, more *Deleatidium* mayflies emerged in the presence of the degraded community, and their nymphs were more developed at smaller sizes suggesting accelerated development.

Since presence of a degraded community prevents colonist establishment and community recovery, we propose that degraded communities must first be destabilised to facilitate recovery, creating the space required for re-establishment of a healthy community.

Sexual reproduction in the invasive myrtle rust pathogen Austropuccinia psidii in New Zealand

Dr Michael Bartlett[1], Dr Alistair McTaggart[2], Dr Stuart Fraser[1]
[1]Scion, Rotorua, New Zealand, [2]University of Queensland, Brisbane, Australia

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Michael completed a PhD in Evolutionary Biology at the University of Canterbury in 2018. He is now a Postdoctoral Fellow based at Crown Research Institute (CRI) Scion, and is part of the MBIE funded programme called Beyond Myrtle Rust: Towards Ecosystem Resilience. Michael's research has a particular focus on the evolution of reproductive systems and life cycles, and utilises multidisciplinary approaches, combining ecological and phenotypic data with molecular data. He is also an advocate for responsible behaviours and practices in science, and is part of the international 2019 eLife Community Ambassador programme.

The fungal pathogen *Austropuccinia psidii*, cause of myrtle rust, has spread globally from its origin in South America. Although multiple strains have been described in South America, only two strains have been found elsewhere. A single strain, the "pandemic biotype", has spread through the Pacific and South East Asia, while another strain has only been found in South Africa. Urediniospores are the dominant, clonal spore stage spread via wind. Teliospores, the sexual stage, and basidiospores, the gametic stage, are produced by *A. psidii* to complete its life cycle on Myrtaceae. The biological role of these sexual spore stages is currently poorly understood. The pathogen arrived in New Zealand in 2017 and is now established throughout the North Island and north of the South Island, where it threatens several species of native Myrtaceae. The aim of our research is to examine sexual reproduction of *A. psidii* in New Zealand, by monitoring disease incidence, occurrence of sexual spore stages, and recombination using genetic markers in several long-term monitoring populations in the North Island. Knowledge of sexual recombination by *A. psidii* will aid in understanding the adaptive potential of the pathogen. This will underpin the success of management programmes for both commercially productive species and conservation of native Myrtaceae in New Zealand, where options may include chemical control, biological control or breeding for host resistance to manage the disease.

Resolving the niche space of native perching lilies to match habitats with habitat formers

Mr André Bellvé[1], Prof. Bruce Burns[1], Prof. George Perry[1]
[1]*University of Auckland, Auckland, New Zealand*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:
André has completed a BA/BSc conjoint majoring in Statistics and Ecology and a MSc in Biological Sciences on native epiphyte community assembly. For the last three years he has worked for Plant and Food Research developing new quarantine statistical protocols and R packages. André also consults on experimental design and analysis for Auckland Council and the University of Auckland. In addition, he has run teaching labs, aided on field trips and guest lectured for the University of Auckland. André is presently a PhD candidate studying nutrient flux dynamics of seabirds in New Zealand prior to human arrival.

The epiphytic *Astelia* of New Zealand are key habitat formers, playing an important role in accumulating soil and water in the canopy which facilitates other epiphytes. However, the three species niches are poorly resolved. We used National Vegetation Survey data and geographic data from Land Environments of New Zealand to build species distribution models (SDM) of the restricted niche of three species of *Astelia*: *A. hastata*, *A. microsperma* and *A. solandri*. The SDMs showed clear niche differentiation between the three epiphytic *Astelia* along gradients of light and minimum temperature, which are strong predictors for vapour pressure deficit. *Astelia hastata* favoured high solar radiation and drier sites, while *A. microsperma* tended towards cool, dry sites. In contrast, *A. solandri* had the highest probability of occurrence in wetter habitats. The segregation of niche space across the native perching lilies allows us to better understand the abiotic factors determining their establishment sites. Experimental research to test the correlations established around the environmental requirements of the three species would reveal more of the ecology of these important habitat formers. Data on the niche space of these species can be used to inform epiphytic plantings to establish these species, and their dependent communities, in restoration plantings.

Monitoring emergence behaviour of lizards in a remote alpine environment

Mr. Aaron Bertoia[1], Dr. Jo Monks[1,2], Professor Alison Cree[1]

[1]*University of Otago, Dunedin, New Zealand,* [2]*Departlemt of Conservation, Dunedin , New Zealand*

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Aaron Bertoia is an MSc student from Canada currently studying wildlife management at the University of Otago. He is interested in learning about the alpine region and studying the ecology and biology of the species that inhabit it. Currently, Aaron is studying the thermal ecology and emergence behaviour of orange-spotted gecko (Mokopirirakau "Roys Peak") in the alpine zone. In his spare time, Aaron enjoys hiking, skiing, and exploring the New Zealand countryside.

Monitoring cryptic species that live in remote habitats and emerge infrequently is challenging. The orange-spotted gecko (*Mokopirirakau* "Roys Peak") is a rare species that lives under cover in rocky alpine slopes, and little is known about its activity periods or thermal biology. Several species of understudied skinks (*Oligosoma* spp.) also inhabit this area, providing a unique opportunity to learn about multiple species of alpine lizards. We used trail cameras to monitor the orange-spotted geckos and skinks in an alpine location (~ 1500 m asl) in the Queenstown-Lakes district. Our goal was to identify the relationships between environmental conditions and emergence activities (by day and night) for these lizards. We confirmed nocturnal emergence of the gecko as expected, but also obtained evidence for basking by day. During the day, both gecko and skink surface activity increased as temperatures increased at basking positions and within surface retreats. Skinks were very active during the day and we found no evidence of nocturnal emergence. At night, temperature was a poor predictor of gecko activity because individuals were active across a wide range of microhabitat temperatures. Lastly, all lizard activity substantially decreased in the presence of strong winds, rain, and snow. Through the use of trail cameras, we have gained an understanding of factors that influence lizard emergence in a remote, high-elevation environment, and thus can make recommendations for future population surveys.

Using mark-recapture to monitor threatened land snails

Dr Ruth Bollongino[1], Brian Lloyd[2]

[1]*Project Janszoon, Nelson, New Zealand,* [2]*Lloyds Ecological Consulting, Upper Moutere, New Zealand*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Dr. Ruth Bollongino studied biology at the University of Goettingen, Germany. Until 2015 she worked as a palaeogeneticist in Mainz, Germany, her main research focused on the origin of domestic cattle and early farmers in Neolithic Europe.

She moved to New Zealand, starting her position as a science advisor for Project Janszoon, i.a. working on outcome monitoring for snails and birds.

The results of long-term snail monitoring in Abel Tasman National Park indicate that populations of *Powelliphanta hochstetteri* and *Rhytida oconnori* have declined since monitoring began in 2002. The monitoring programme uses the standard snail monitoring method: diurnal subsurface searches of 10x10 m plots. Conclusions based on snail counts from the method are questionable because: snail counts are indices, not necessarily proportional to abundance; confidence intervals around snail counts are wide, consequently only massive population changes can be detected; and few *Rhytida* are found during plot searches.

To overcome problems with the standard method, we developed a mark-recapture (MR) method to estimate snail abundance. The method entails repeated nocturnal searches for snails on the surface of 70x70 m plots. Plots are searched 3–5 times per season and snails are individually tagged. Density estimates for *Powelliphanta* from MR were four times those from nearby standard plots (555 cf. 126 snails/ ha). The difference was higher for *Rhytidai* (506 cf. 42 snails/ ha). When repeated at yearly intervals, MR also provides valuable information on recruitment, growth-rate and age structure.

Although effective conservation management requires the reliable and robust information provided by MR, but not the standard method, conservation managers are generally reluctant to adopt MR. This reluctance stems from the convenience of the standard method and higher cost of MR. We anticipate that better understanding of the relative quality of information from the two methods, together with improvement in the efficiency of MR, to reduce its cost, will encourage uptake of MR.

Fern dispersal across the Pacific

Dr James Brock[1], Dr Bruce Burns[1], Dr George Perry[2], Dr Janet Wilmshurst[3], Edin Whitehead[1]

[1]School of Biological Sciences, The University of Auckland, Auckland, New Zealand, [2]School of Environment, The University of Auckland, Auckland, New Zealand, [3] Manaaki Whenua - Landcare Research, Lincoln, New Zealand

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

James is a post-doctoral research fellow at The University of Auckland working on fern spore and gametophyte ecology. Although the last few years of James' life have been focussed on ferns he does also enjoy and appreciate other forms of plant growth. He is also a part-time pirate.

Fern dispersal has long been described as anemochorous: that microscopic spores can travel long distances, including crossing oceans, by wind. However, only the smallest spores (<25 µm) have been sampled atmospherically at sea (<300 km from shore), and little published data provides evidence of fern spores being sampled above 500 m of elevation. Experimental work has shown that spores of ferns with short-statured sporophytes (max 80 cm) will travel a distance of 2–3 m, whereas spores of tree ferns travel 30–100 m in forest (up to 2 km in an open landscape). Furthermore, unlike lichens, mosses and liverworts, insular and continental fern communities across the southern oceans are correlated to geographical adjacency and not to wind patterns. Anemochory in ferns explained disjunct populations of fern species across Pacific islands before GPS tracking of migratory and sea bird journeys across the Pacific made the scientific community aware of the dispersal extent of these species. Our project is examining the hypothesis that wind dispersal is limited and birds also disperse fern spores at multiple spatial scales from within forests (vertically and horizontally) to long-distance across the Pacific region. We are looking at spore persistence (temporal: extraction from soil cores), resilience (tolerance to freshwater / saltwater / extreme temperatures) and dispersal potential (establishing dispersal kernels), as well as sampling feathers and skins of migratory birds and some sea birds. Initial sampling shows that migratory birds do carry fern spores, but work to fully comprehend the ecological implications of this are ongoing.

Braided rivers -- the land the law forgot

Dr Ann Brower[1]

[1]*University of Canterbury, Christchurch, New Zealand*

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Ann Brower is an environmental scientist and geographer at the University of Canterbury. She is a methodological pluralist, using lots of types of data to explore the intersection of environmental, economic, and social systems. She is also committed to making a difference to the life of the nation. She can claim:

a) The 2019 demise of South Island high country tenure review;

b) The 2016 'Brower amendment' to the Building Act.

Universities NZ awarded her the 'Critic and Conscience of Society' Award in 2018. In other words, she is the most annoying lecturer in the country.

Braided rivers are quintessentially Canterbury, yet capricious in nature. They are globally rare, yet visible from space. They are topologically, geologically, ecologically, economically, and legally complex. Our land use and land ownership decisions on the margins of braided rivers are 'whittling away' the rivers. Each of Canterbury's grand braided rivers is a complex mosaic of physical, social, economic, and ecological forces. These layers of forces operate at varying scales of time and space -- converging, interacting, diverging, and competing -- all in the same ever-shifting braid-plain. This capricious braid-plain is the land the law forgot, with much of it in the legal void of 'Unallocated Crown Land.' Through an obscure and arcane process called *Ad medium fillem*, the ownership of the margins of NZ's braided rivers is shifting from public to private hands. Correspondingly, remote sensing reveals significant development in the braid-plains – irrigation, direct drilling, tree planting, pig farming, gravel harvesting, etc. These micro-scale land ownership decisions have macro-scale landscape and ecological impacts. This presentation will explore some of the legal, economic, and political questions about the margins of braided rivers, which is the land the law forgot.

Communication for better biodiversity on farms

Ms Stacey Bryan[1]

[1]New Zealand's Biological Heritage National Science Challenge, Lincoln, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (III), Conference A/B, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Stacey is a science communicator with the Farming & Nature Conservation project and New Zealand's Biological Heritage National Science Challenge.

She has a Master of Science and a Postgraduate Diploma of Journalism, along with a passion for maximising the impact research has by translating it for non-scientists.

As scientists we get trained to speak a certain language that is specific, accurate and precise. It is not often engaging, inspiring or entertaining. But we need a combination of all of these things in order to achieve the greatest impact with anyone who is not a trained scientist. When it comes to on-farm biodiversity enhancement by farmers and local rural communities, the love and history of the land is often already there. However, they rely on scientists to provide them with relevant information for decision making in a language they can understand. We must walk a fine line between not giving enough advice and advocating, while tailoring advice for what the landowner can and wants to do. In the 'grey' world of science communication, researchers must get out of the comfort zone. Only then will our science truly make a difference in enhancing functional biodiversity in agroecosystems.

Nature conservation on New Zealand sheep and beef farms

Hannah Buckley[1], Md Azharul Alam[2], Anoek Brugman[3], Stacey Bryan[4], Bradley Case[1], Xinglei Cui[2], Timothy Curran[2], Estelle Dominati[5], Peter M. Edwards[1], Gemma England[1], Adam Forbes[6], Joshua Foster[6], Rebecca Jarvis[1], David Hall[8], Graham Hinchliffe[1], Alec Mackay[5], Fleur Maseyk[9], Ellis Nimick[1], David Norton[7], Cathy Nottingham[10], Jennifer Pannell[1], John Perrott[1], Siobhan Ryan[1], Valance Smith[11], Margaret Stanley[10], Febyana Suryaningrum[1], Fereita Timoteo[1], Leilani Walker[1], Jingjing Zhang[1]

[1]School of Science, Auckland University of Technology, Auckland, New Zealand, [2]Department of Pest-management and Conservation, Lincoln University, Lincoln, New Zealand, [3]HAS University of Applied Sciences, 's-Hertogenbosch, The Netherlands, [4]New Zealand's Biological Heritage National Science Challenge, Lincoln, New Zealand, [5]Farm Systems & Environment, AgResearch, Palmerston North, New Zealand, [6]Forbes Ecology, Havelock North, New Zealand, [7]School of Forestry, University of Canterbury, Christchurch, New Zealand, [8]Global Policy Observatory, Auckland University of Technology, Auckland, New Zealand, [9]The Catalyst Group, Wellington, New Zealand, [10]School of Biological Sciences, University of Auckland, Auckland, New Zealand, [11]Te Ara Poutama, Auckland University of Technology, Auckland, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Hannah Buckley is an Associate Professor of Ecology at Auckland University of Technology and co-leader of the Farming & Nature Conservation project within the BioHeritage National Science Challenge. Her research focuses on understanding the processes that drive biological diversity. In particular, Hannah is interested in spatiotemporal patterns in species diversity, genetic diversity and community assembly. She works with a wide range of taxa in a variety of natural and experimental systems.

New Zealand sheep and beef farmland provides huge potential for the conservation of native biodiversity. Key to unlocking this potential is creating a pathway from scientific understanding of how native species function within these landscapes through to engaging with land managers to enhance their native biodiversity as an integral part of the farm business. Here, we present an overview of our two-year pilot project that has explored the potential for multifunctionality on sheep and beef farms within New Zealand (www.farmingnatureconservation.org). We identify the key gaps in our knowledge of these social-ecological systems that need to be addressed to optimise their contribution to reversing New Zealand's biodiversity decline and present our ongoing research and implementation programme.

Effects of spatial configuration of non-production vegetation on agroecosystem processes

Assoc. Prof Hannah Buckley[1], Md Azharul Alam[2], Bradley Case[1], Xinglei Cui[2], Timothy Curran[2], David Norton[3], Jennifer Pannell[1], Margaret Stanley[4], Jingjing Zhang[1]

[1]Auckland University of Technology, Auckland, New Zealand, [2]Department of Pest-management and Conservation, Lincoln University, Lincoln, New Zealand, [3]School of Forestry, University of Canterbury, Christchurch, New Zealand, [4]School of Biological Sciences, University of Auckland, Auckland, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Hannah Buckley is an Associate Professor of Ecology at Auckland University of Technology and co-leader of the Farming & Nature Conservation project within the BioHeritage National Science Challenge. Her research focuses on understanding the processes that drive biological diversity. In particular, Hannah is interested in spatiotemporal patterns in species diversity, genetic diversity and community assembly. She works with a wide range of taxa in a variety of natural and experimental systems.

Non-production vegetation elements, such as remnant and regenerating forest patches and shelterbelts, are essential for conserving biodiversity in agricultural landscapes. These landscape elements are key building blocks that are managed and manipulated by human decisions, and can strongly affect abiotic and biotic agroecosystem processes. Here, we show how the spatial configuration and composition of non-production woody vegetation affects agroecosystem processes in New Zealand farming landscapes, represented by two key functional biodiversity indicators: vegetation flammability and bird movement. We discuss the implications of these results for the management of woody vegetation on sheep and beef farms for increasing the agroecosystem resilience and enhancing biodiversity conservation.

The evolution of thermal performance in New Zealand stick insects

Associate Professor Thomas Buckley[1,2], Dr Kate Augustine[1], Mr Claudio Cubillos[1,2], Professor Brent Sinclair[3]
[1]Manaaki Whenua - Landcare Research, Auckland, New Zealand, [2]The University of Auckland, Auckland, New Zealand, [3]University of Western Ontario, London, Canada

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:
Thomas Buckley is a Research Leader at Manaaki Whenua - Landcare Research and Associate Professor at The University of Auckland. He works on the systematics, genomics and evolution of New Zealand terrestrial invertebrates. He is also a principal investigator at Genomics Aotearoa.

Climate change has the potential to affect the ecology and evolution of every species on Earth. One major aspect of climate – temperature – is critical to governing the distribution of plants and animals. It is often proposed that temperate species have are more cold-tolerant and have broader thermal performance curves and lower optimal temperatures when compared to tropical species, but relatively little empirical work has provided support for this using large interspecific studies. We present preliminary findings from 14 native stick insects (Phasmatodea) in New Zealand covering the full latitudinal range - from northern lowland forests to South Island alpine environments. Preliminary results suggest that species from the warmer subtropics have narrower thermal performance curves than species that occur in colder, southern NZ that have broad thermal performance curves and are freeze tolerant. We also identify at least one species that is potentially plastic in response to temperature changes which will be important in surviving climate change. In addition to thermal performance we have also assessed cold tolerance strategies in the same species. These investigations reveal that both freeze avoidance and freeze tolerance strategies are operating in New Zealand stick insects. Gene expression analysis reveals that cuticular proteins are involved in this response. Our future research will further examine the genomic and epigenomic basis of thermal performance and plasticity in general, which will be important for predicting the effects of climate change on New Zealand ectothermic organisms.

Evolution in the introduced range: testing for local adaptation and phenotypic plasticity in an invasive plant

Jennifer Bufford[1], Prof. Philip Hulme[1]
[1]*Bio-Protection Research Centre, Lincoln, Canterbury*

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:
Jennifer is a postdoctoral fellow at the Bio-Protection Research Centre at Lincoln University. Her research centres on plant invasion ecology, particularly the drivers of invasiveness and the role of evolution on invasions. She currently uses field and greenhouse experiments as well as statistical modelling to understand the dynamics of plant invasions in New Zealand, using Rumex spp. as a model system.

Invasive alien species are a major component of global anthropogenic change, but the extent to which rapid evolution in the introduced range contributes to the success and impact of invasive species is still unclear. In the introduced range, alien species experience a novel environment and adaptive evolutionary changes post-introduction may play a key role in establishment and subsequent invasion. These changes could include the rapid evolution of locally adapted genotypes or the evolution of adaptive phenotypic plasticity. Using an abundant weed of anthropogenic habitats, dock (*Rumex* spp.), as a model system, we tested for the evolution of local adaptation and increased plasticity in the introduced range in response to rainfall and soil moisture gradients, which may be a source of selective pressure in New Zealand. Using both common garden and greenhouse experiments, we found evidence for limited local adaptation in these species, but high plasticity and wide environmental tolerances within clone lines. By connecting fitness and trait change, we found some evidence of increased adaptive plasticity in the introduced range, but there was also evidence that plasticity was sometimes costly, which may limit the evolution of greater plasticity in these species. We discuss our results in the context of the conditions under which rapid evolution of local adaptation and adaptive phenotypic plasticity might change the outcome of plant invasions.

A tenuous link: information transfer between ecological research and restoration practice

Miss Sarah Busbridge[1], Dr. Kiri Joy Wallace[1]
[1]*University of Waikato, Hamilton, New Zealand*

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:
I am a second year ecology MSc student at the University of Waikato, supervised by Dr. Kiri Joy Wallace and Professor Bruce Clarkson. My research explores the link between research and implementation in urban forest restoration, as well as factors influencing native tree regeneration. I'm interested in urban ecology, restoration ecology, and the study of socio-ecololgical systems.

A tenuous link: information transfer between ecological research and restoration practice

Despite a growing theoretical understanding of restoration ecology, this scientific knowledge is not well linked to practitioner decision-making. This weak link between research and implementation is detrimental to restoration project success and how it manifests in an urban context is unknown. We conducted a New Zealand-wide survey of urban forest restoration practitioners to examine their perspectives regarding planning, implementation, and management of urban forest restoration projects. Our goals were to 1) understand current trends in practitioner decision making 2) identify specific weak links in knowledge transfer between ecological theory and practice, and 3) suggest targeted methods to improve information transfer between restoration researchers and practitioners. We found a tenuous link between practitioner actions and current best-practice restoration knowledge. When restoring, practitioners tend to prioritise actions like planting or weed control over other vital elements such as project planning and quantifiable monitoring. Additionally, project objectives are commonly broad, vague, and focused on restoration of ecosystem components rather than entire ecosystems and their associated functions. Our results show that practitioners value interactions with ecology experts and fellow practitioners equally to more traditional forms of best-practice communication (e.g. scientific articles) as sources of restoration knowledge. This indicates that prioritising interactive, interpersonal modes of communication and encouraging collaborative partnerships between researchers and practitioners will strengthen the knowledge transfer link. Additionally, providing practitioners with time saving resources (e.g. restoration plan and monitoring templates) and training on how to navigate the range of socio-ecological constraints that arise in urban settings will help improve urban restoration outcomes.

The response of karepō/seagrass (Zostera muelleri subsp. novozelandica) in an intertidal flat habitat following power pole maintenance works at Wharekawa Harbour, Coromandel Peninsula

Dr Chris Bycroft[1], Dr Jo McQueen-Watton[1], William Shaw[1]
[1]*Wildland Consultants, Rotorua, New Zealand*

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Chris Bycroft is a Senior Ecologist and Botanist at Wildland Consultants (Rotorua office) where he has worked since 2000. He works in a diverse range of habitats including geothermal, alpine, wetlands, sand dunes and forest. He also undertakes avifauna surveys. Prior to working at Wildlands he completed a Ph.D. in the Botany Department, University of Otago on copper tussock grassland. Chris involvement with NZES has been as a Councillor 2007-2011, President (Nov 2013-Nov 2015) and since then he has been the society Treasurer. In his spare time he enjoys tramping, running, photography, and visiting wild places throughout New Zealand.

In October 2017, Powerco undertook maintenance works on a powerline distribution line in Wharekawa Harbour, Coromandel. Works were undertaken along a consented access route, using tracked vehicles with swamp pads and three power poles were replaced within an estuarine intertidal flat habitat. Disturbance to the karepō/seagrass in this intertidal flat habitat mainly occurred from vehicle tracking, although this was kept to a minimum through the use of good procedures. The works left obvious indentations in the karepō intertidal flat habitat. Plots were established on two transects: one disturbed karepō dominant intertidal habitat (treatment), and one in undisturbed karepō dominant intertidal habitat (control) adjacent to the treatment transect. These transects were measured approximately six, 12, and 18 months after the works. Each plot was a 0.25x0.25 m quadrat and each quadrat was subdivided into 5 x 5 cm subplots (cells). The cover and distribution of karepō was measured using two methods:

1 Estimated cover of karepō in each 0.25 x 0.25 m plot.
- Percent occupancy (number of the cells occupied by karepō).

Changes in the cover of karepō in disturbed and control plots are discussed. Wide fluctuations in the cover and occupancy of karepō on control and treatment plots was evident between surveys. By 18 months after the subject works, the tracking associated with power pole replacement was barely visible, and the cover of karepō in both methods of measurement (percent cover and occupancy) in control and treatment plots was only very small and no longer significant, indicating that almost complete recovery had occurred.

The forgotten fauna: native seed predators on islands

Jo Carpenter[1], Janet Wilmshurst[2], Kim McConkey[3], Julian Hume[4], Debra Wotton[5], Aaron Shiels[6], Don Drake[7]

[1]Manaaki Whenua - Landcare Research, Dunedin, New Zealand, [2]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [3]University of Nottingham, Semenyih, Malaysia, [4]Natural History Museum, London, UK, [5]Moa's Ark Research, Paraparaumu, New Zealamd, [6]USDA, Fort Collins, USA, [7]University of Hawaii, Honolulu, USA

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Jo Carpenter is a postdoctoral researcher at Manaaki Whenua - Landcare Research, studying drivers and predictors of forest rodents. She is interested in plant-animal interactions, conservation biology, and island biogeography.

Human colonisation of islands has resulted in the loss of many native species, and invasion by exotic species, producing novel faunas. The impacts of these changes on mutualistic plant-animal interaction networks have received considerable attention, but the potential effects on some antagonistic interactions, such as seed predation, are less thoroughly understood. Using datasets and examples from three iconic island groups—New Zealand, Hawai'i, and the Mascarenes—we compare the taxonomic and functional diversity of pre-human and contemporary vertebrate seed predator faunas. These archipelagos each once supported between 17 and 24 species of avian seed predators spread across 2 to 4 orders, nearly all of which are now extinct or rare. In comparison, the contemporary seed predator faunas are comprised of between 13 and 24 species, dominated by exotic granivorous birds, and several introduced mammals. Whereas most of the introduced birds have functional traits that are broadly comparable to those of the lost natives, the mammals are more generalist omnivores that may be truly novel in their ability to destroy a wide range of seeds. We highlight the need to 1) understand how these altered seed predator communities have affected plant populations, and 2) determine the extent to which seed predation by mammals is truly novel with respect to the range of plant species and populations affected. More broadly, we argue that negative interactions are an integral part of any ecosystem, and must be acknowledged as such if we are to achieve more holistic restoration frameworks for insular ecosystems.

Prioritising insular eradications throughout New Zealand for Predator Free 2050

Mr Zachary Carter[1], Dr James Russell[1], Dr Thomas Lumley[1]
[1]*University of Auckland, , New Zealand*

Invasive Species Impacts Symposium I (predators), Stewart Theatre 1, December 3, 2019, 2:00 PM - 3:00 PM

Biography:
Zach Carter is a doctoral candidate at the University of Auckland in the School of Biological Sciences. He is developing predictive models to assist with invasive pest eradication prioritisation throughout New Zealand.

New Zealand strives to eradicate the most harmful mammal pest species from the entirety of its borders by 2050. Encompassing the Predator Free 2050 campaign (PF2050), these mammal pests include rats (*Rattus rattus, R. exulans, R. norvegicus*), mustelids (*Mustela erminea, M. furo, M. nivalis*), and the common brushtail possum (*Trichosurus vulpecula*). Invaded offshore islands represent a logical first-step in this programme; they are a microcosm of the ecological and technical complexities present at the landscape-scale. However, a vexing socio-political environment, and reinvasion from accessible source areas, have slowed contemporary eradication efforts. In this study, we used a survival analysis framework and data from historical control programmes to investigate the effect of these factors on eradication success for invaded islands throughout New Zealand. We first described New Zealand's modern eradication history using a right-continuous decreasing step function (the Kaplan-Meier or product limit estimator). We then fit a parametric survival model to the step function and prioritised currently invaded islands for eradication, based on predicted success within the designated PF2050 timeline. Islands that met, or exceeded, a probability threshold were recommended for eradication using currently available control tools. Islands not meeting this threshold were identified and recommended for use of future control tools or innovative ways of thinking. This framework represents a novel extension to traditional prioritisation methods, maximising the likelihood of eradication success while still considering cost and expected conservation outcomes.

Re-visioning the agricultural landscape: exploring native revegetation scenarios for multiple benefits in agroecosystems

Bradley Case[1], Hannah Buckley[1], Margaret Stanley[2], Jennifer Pannell[1], Graham Hinchliffe[1], Ellis Nimick[1], David Norton[3]

[1]School of Science, Auckland University of Technology, Auckland City, New Zealand, [2]School of Biological Sciences, University of Auckland, Tamaki, New Zealand, [3]School of Forestry, University of Canterbury, Ilam, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Brad is a Senior Lecturer in GIS and Remote Sensing at Auckland University of Technology. The focus of his research is understanding the linkage between ecological patterns and processes across multiple spatial and temporal scales. Currently, he is exploring these themes within NZ beech forest ecosystems and sheep and beef agroecosystems. He is a Research Aim leader within the Farming & Nature Conservation project within the BioHeritage National Science Challenge.

The New Zealand government has announced the goal of making New Zealand carbon neutral by 2050 and will be aiming to address the biodiversity crisis via a revamped Biodiversity Strategy. Further, the latest Parliamentary Report on the Environment paints a dismal picture for the state of our environment and calls for urgent action around issues such as water quality, erosion, and the potential effects of ongoing climatic changes. From an ecological perspective, this confluence of government policies and programmes provides an exciting opportunity to explore targeted and science-based revegetation of privately-owned agroecosystems to produce multiple beneficial outcomes. To achieve a step-change, one of the first requirements is the exploration of ecologically-designed spatial scenarios for identifying where and how agricultural landscapes could be revegetated to improve multiple objectives while minimising economic impacts for farmers. In this talk, I present some results from recent spatial analyses that our team has been carrying out towards these goals. I will discuss the relevance of these results in terms of the potential for achieving enhanced biodiversity, and other aligned goals such as carbon sequestration, within New Zealand's sheep and beef agroecosystems.

Pollinator functional responses: pollinator interference generates context dependent outcomes

Alba Cervantes[1], Dr. Daniel Stouffer[1], Dr. Berry Brosy[2], Carolyn Ayers[2]

[1]University of Canterbury, Christchurch, New Zealand , [2]Emory University, Atlanta, United States

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Alba Cervantes is a biologist from Mexico currently doing her PhD at the University of Canterbury at the Stouffer lab. She currently works with mathematical models to understand species interactions and their consequences for diversity maintenance.

Mutualistic interactions have slowly began to be conceptualized being as important as antagonistic interactions in their role of population and community dynamics. A new framework has emerged to understand the common themes behind these interactions in which benefits and costs are included, and saturating functional responses seem to be one of the ways mutualistic populations have bounded growth. However, few studies have explicitly measured functional responses of mutualists, and when they do they generally focus on a single pair of interacting species.Importantly, pollinating insects also tend to change their foraging behavior in response to other species and resource availability. The question if pollinators interfere with each other remains yet a part of the puzzle of the mutualistic bounded growth. In this study we use a Bayesian multilevel model to estimate the degree of pollinator interference and it's interaction with resource availability and the exposure to a neonicotinoid pesticide. In general greater bee density meant a decrease in visitation rates and the pesticide generated greater variability in how bees forage. The effect seems to be reversed when there is constant supply of resources, suggesting that interference occurs as a function of resource depletion. Overall these results achieve to quantify the effects of other pollinators in a saturating functional response and highlight the importance of resources in generating context dependent outcomes of mutualistic interactions.

Wildfire research related to conservation in New Zealand Aotearoa: DOC Summer student scholarships

Brendon Christensen[1]

[1]*Department Of Conservation, Rotorua, New Zealand*

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Brendon has over 20 years experience in the natural resource management sector (chiefly in the Department of Conservation) in a variety of roles including Conservation Support Manager (Acting), Advisory Scientist, Technical Advisor. I promote and seek to progress conservation-related wildfire research pertinent to New Zealand. A key focus is on the long-term ecological effects of wildfire and the management response. The research programme and recent research is outlined at: https://www.researchgate.net/project/Conservation-related-wildfire-research. Active research includes:

- Development of guideline criteria for allowing fires to burn
- *Quantifying the wildfire potential on NZ's offshore islands - using Prometheus, and fire response preparedness*

Knowledge of wildfire impact and management is important for effective terrestrial conservation in New Zealand Aotearoa. New Zealand has experienced significant historic fires in the last few hundred years, substantially changing the landscape, ecology and affecting conservation management. An overview of historic fires, current knowledge and conservation-related wildfire research needs is presented. Information is being collated and resources are available that offers researchers the ability to investigate recent fire occurrence such as: DOC national inventory of rural, forest and wildland fires from 1803 (and mapped fire events from 1898) to the present, the Scion Rural Fire Team Fire Behaviour Tools and the Prometheus wildfire extent spatial modelling, as well as NIWA information such as CliFlo, the National Climate Database. DOC has a Summer student scholarship programme that is suited for student researchers.

Using multispectral imagery to classify red tussock (Chionochloa rubra) mast seeding

Jennifer Christie[1], Terry Greene[1], Richard Earl[1]
[1]*Department of Conservation, Christchurch, New Zealand*

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:
Jenny Christie is a scientist working for the Department of Conservation. She is interested in how monitoring phenological changes can be used as an indicator for detecting changes in indigenous ecosystems caused by climate change.

Multispectral imagery may provide a cost-effective way to gather information on snow tussock mast seeding at a landscape scale. This scoping study focussed on the red tussock grassland of the upper Clarence River, Canterbury. We assessed the ability to discriminate red tussock distribution and mast seeding information in multispectral imagery in comparison with measures derived from field data collected using linear transects. Results showed accurate distributions of red tussock and the presence of mast seeding could be differentiated in the imagery. These initial results lend confidence in the use of multispectral imagery to classify red tussock mast seeding. We recommend further work be carried out to investigate whether it is possible to discriminate mast seeding in other snow tussock species. We also highlight the need to monitor broader scale phenological change nationally as an important indicator for detecting changes in indigenous ecosystems caused by climate change.

Complex ecological impacts of the giant willow aphid invasion in New Zealand

Kyaw Min Tun[1], Dr. Maria Minor[1], Dr. Trevor Jones[2], **Dr. Andrea Clavijo-McCormick[1]**

[1]Massey University, Palmerston North, New Zealand, [2]Plant & Food Research, Palmerston North, New Zealand

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Dr. Andrea Clavijo-McCormick is a Senior Lecturer in Ecology at Massey University, where she also leads the Chemical Ecology Research Group. She is interested in the chemical aspects underlying ecological interactions, in particular, those among insects and woody plants.

The giant willow aphid (GWA), *Tuberolachnus salignus*, is an invasive pest species first recorded in New Zealand in 2013. Since then, it has spread rapidly, affecting over 50 species and hybrids of willow and poplar throughout the country. These trees and shrubs have high agricultural importance as forage, to stabilize slopes and river banks, to prevent soil erosion, and as sources of nectar and pollen for bees. The GWA affects its surroundings in multiple ways, not only by reducing plant vigour, but by releasing copious amounts of honeydew that promotes the growth of sooty mould, attracts unwanted insects (such as wasps, ants, and flies), causes bee honey to crystalize (affecting apiculture), and alters soil composition and biota. Due to the extent of the invasion, eradication is no longer feasible, so there is a need to assess the environmental impact of this pest species and develop sustainable control strategies to mitigate it. This talk will present preliminary results of a semi-field study using 15 different willow clones, including the characterisation of plant volatile emissions, changes in soil enzyme activity due to honeydew deposition, and the effect of different host-plants on the chemical composition of aphid honeydew.

Embedding kaupapa Māori principles in genomic research of taonga species: a conservation genomics case study

Levi Collier-Robinson[1], Aisling Rayne[1], Makarini Rupene[2], Channell Thoms[1], Tammy Steeves[1]
[1]*University of Canterbury, Christchurch, New Zealand,* [2]*Ngāi Tahu Research Centre, Christchurch, New Zealand*

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:
I am a PhD student at the University of Canterbury and have strong links to Ngāi Tahu and Ngāti Apa ki te rā tō in Te Waipounamu. I am investigating adaptive variation in one of our taonga species, the kōwaro/Canterbury mudfish. Kōwaro is one of five taxonomically diverse Aotearoa endemics that are the focus of a larger interdisciplinary project that seeks to integrate mātauranga Māori with western science to develop a culturally-responsive, evidence-based position statement regarding the benefits and risks of prioritising adaptive potential to build resilience in threatened taonga species, including mahinga kai species.

In Te Ao Māori, genomic data obtained from taonga species have whakapapa and are therefore taonga in their own right. Thus, genomic data are tapu and best studied using kaupapa Māori principles. We contend it is the responsibility of researchers working with genomic data from taonga species to move beyond one-off Māori consultation toward building meaningful relationships with relevant Māori communities. Here, we reflect on our experience embedding kaupapa Māori principles in genomics research as leaders of a Biological Heritage National Science Challenge project entitled “Characterising adaptive variation in Aotearoa New Zealand’s terrestrial and freshwater biota”. We are co-developing a culturally-responsive evidence-based position statement regarding the benefits and risks of prioritising adaptive potential to build resilience in threatened taonga species, including mahinga kai species destined for customary or commercial harvest. To achieve this, we co-developed a research programme with Ngāi Tūāhuriri that integrates Mātauranga Māori with emerging genomic technologies and extensive ecological data for two taonga species, kōwaro (*Neochanna burrowsius*) and kēkēwai (*Paranephrops zealandicus*). The foundation of our research programme is an iterative decision-making framework that includes tissue sampling as well as data generation, storage and access. Beyond upholding the promises made in Te Tiriti o Waitangi, we contend the integration of kaupapa Māori principles in genomics research will enhance the recovery of taonga species and enable the realisation of Māori values.

The Living Water partnership: Can DOC and Fonterra really work together? Is it possible for dairying and freshwater thrive side-by-side?

Dr Katie Collins[1]

[1]*Department of Conservation, Hamilton, New Zealand*

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Katie is the science lead for Living Water (10 year partnership between the Department of Conservation and Fonterra) and a DOC freshwater technical advisor. She recently finished her PhD as part of CAREX (the Canterbury Waterway Rehabilitation Experiment) in the Freshwater Ecology Research Group at the University of Canterbury.

The Living Water partnership: Can DOC and Fonterra really work together? Can dairying and freshwater thrive side-by-side?

Katie Collins[1]

[1]Department of Conservation

Living Water is a 10-year partnership between the Department of Conservation (DOC) and Fonterra which aims to find game-changing and scalable solutions that will enable farming, freshwater and healthy ecosystems to thrive side-by-side. To achieve this, tools or solutions are being trialed in five regions across New Zealand. We are working with farmers, scientists, councils, mana whenua and communities to design and test solutions, and then develop a plan to implement successful methods regionally and nationally. By combining DOC's restoration expertise with Fonterra's responsible dairying knowledge, this long-term commitment will deliver tangible benefits to local catchments and communities, and learnings for all New Zealand.

1080 TO ZERO: can consecutive aerial applications of 1080 completely remove possums from the Perth River valley (South Westland)?

Miss Briar Cook[1], Mr Phil Bell[1]

[1]*Zero Invasive Predators Ltd, Wellington, New Zealand*

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Briar has worked for Zero Invasive Predators Ltd since 2015, beginning as a field ranger in the Marlborough Sounds after a three-year stint with the Department of Conservation. In early 2017, she took up a more technical role for the organisation, developing our research and development trial concepts and implementing them in the field. Her current focus is around the use of geographic features as barriers to rat and possum, reinvasion, urban predator barrier design and the use of biomarkers to measure predator behaviour.

New Zealand has been the world leader in the eradication of invasive mammalian predators from offshore islands. Now the focus for invasive predator management is shifting to larger landscapes – bigger, inhabited islands or the mainland itself – as momentum builds behind the Predator Free New Zealand by 2050 movement. Island eradication technologies (e.g. aerial brodifacoum) cannot be used, so a new approach is required. But could the answer be right under our noses? Building on earlier successful trials by ourselves and others, Zero Invasive Predators (ZIP) sought to determine whether two consecutive aerial 1080 operations, using double pre-feeding, increased sowing rates, and a change of bait-lure combination, could completely remove possums from approximately 9000 ha in the Perth River valley, South Westland. Phase One, using Wanganui #7 orange lured bait, achieved an estimated 99.5% kill of possums and rats (while seemingly removing all resident stoats). Phase Two, carried out 3 months later, using RS5 cinnamon lured bait, appears to have removed all surviving possums and rats (at the time of writing) – with no detections recorded as yet on the network of peanut-butter chew cards or lured cameras throughout the site. This result suggests that aerial 1080, delivered to eradication standard, could be the tool to completely remove possums (and perhaps even rats and stoats) in the back country of New Zealand; and help bring us closer to delivering the promise of a Predator Free New Zealand.

The Many Applications of a MotoLure

Miss Briar Cook[1]

[1]*Zero Invasive Predators Ltd, Wellington, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Briar has worked for Zero Invasive Predators Ltd since 2015, beginning as a field ranger in the Marlborough Sounds after a three-year stint with the Department of Conservation. In early 2017, she took up a more technical role for the organisation, developing our research and development trial concepts and implementing them in the field. Her current focus is around the use of geographic features as barriers to predator reinvasion, urban barrier design and the use of biomarkers to measure predator behaviour.

Conservation programmes have long suffered from the inability to provide fresh, attractive food lures for predators without regular manual servicing of traps. Prompted by the challenges of working in remote areas where regular trap access is highly inefficient, Zero Invasive Predators (ZIP) have developed a device to solve this long-running problem. The ZIP MotoLure is a simple device that uses a syringe full of lure coupled with a motor unit to dispense a small amount of fresh lure every night. During the past 12 months, ZIP have used the MotoLure for a variety of rat and stoat management applications. These include consistently supplying kill traps with fresh lure on a daily basis (best paired with a trap auto-reporting system to further reduce labour); pre-feeding to familiarise target animals with the lure also used in kill traps (increasing the trap catch rate by at least 25%); passively marking target animals with bio-markers to measure invasion rates across natural barriers; and luring predators to trail cameras used as a detection tool. These applications have the potential to change the way we do conservation work by increasing trap effectiveness and predator detection rates while greatly reducing labour costs traditionally associated with trap servicing.

Escaping specialist herbivores does not result in Rumex spp. shifting their defence chemistry towards increased growth in New Zealand

Mr. Andrei Costan[1], Dr. Jennifer Bufford[1], Dr. William Godsoe[1], Prof. Philip Hulme[1]
[1]*BPRC, Lincoln, New Zealand*

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Andrei Costan, from Romania, is currently enrolled as a PhD candidate at the Bio-protection Research Center, Lincoln University, New Zealand. He is in his final year of his PhD, which is mainly focused on looking into what are the mechanism that drive non-native plants to become invasive, by using the Enemy Release (ER), Evolution of Increased Competitive Ability (EICA) and Shifting Deference (SD) Hypotheses.

Release from natural enemies in the introduced range has often been implicated as one reason for the success of biological invasions, particularly as a result of the evolution of increased competitive ability (EICA). Formal tests of the EICA hypothesis require evidence of shifts in herbivory, competitive ability and chemical defence between native and introduced provenances of the target species. We have previously found that *Rumex obtusifolisus, R. crispus* and *R. conglomeratus* (Polygonaceae) experienced between 7 times lower leaf and 22 times lower root herbivory in the introduced range (NZ) than their native range (UK). We therefore examined the consequences of reduced herbivore pressure on the intraspecific competitive ability and plant chemistry of provenances from the native and introduced range. A large-scale glasshouse experiment revealed that despite plant biomass of each species being markedly reduced, by as much as 50%, when in competition with a congener from either the same or different provenance, there was no difference in competitive ability between native and introduced provenances for any of the three species. This result would be consistent with plants failing to re-allocate anti-herbivore defensive compounds to growth. *Rumex* spp. produce a number of compounds that may have anti-herbivore properties including oxalates, phenols and tannins. We assayed these compounds from plants derived from the same populations as used in the competition experiments and found there were no differences between native and introduced provenances. These results provide convincing evidence to counter EICA being a mechanism for the success of *Rumex* spp. in New Zealand.

Threatened forest ecosystems and the One Billion Trees programme

Dr Philippa Crisp[1]

[1]*Greater Wellington Regional Council, Wellington, New Zealand*

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Philippa Crisp has worked as a terrestrial ecologist over the past 30 years. She has been involved in conservation management activities such as pest control and restoration planting at the Department of Conservation and Greater Wellington Regional Council. In more recent years, she has had a greater focus on monitoring, research and conservation planning in her role in the Council's Environmental Science department.

The One Billion Trees programme run by MPI provides an opportunity to enhance the resilience of threatened forest ecosystem types in New Zealand. The programme allows for large areas of indigenous forest reversion or planting. Most of the threatened forest remnants in the landscape are vulnerable to loss as they are small and isolated. Bolstering of the size and connectivity of these threatened forest remnants would aid the survival of these ecosystems and help to maintain the natural range of indigenous biodiversity across the landscape.

Singers and Rogers published a classification of terrestrial ecosystems in 2014. Since that time, Wellington Regional Council (along with many other regional councils), have had the regional historic extent of those ecosystem types mapped on GIS by Nick Singers. This has enabled the use of GIS analyses to determine the remaining area of each ecosystem type and for regionally threatened ecosystem types to be highlighted as priorities for restoration.

In the Wellington region, twenty forest ecosystem types were identified. Over half of those forest types have been categorised as being regionally threatened by using IUCN criteria for determining ecosystem threat status: seven critically endangered, three endangered and one vulnerable.

http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Forest-ecosytems-of-the-Wellington-region-reduced.pdf

This data is now being overlain with other priority landscape information such as erosion risk, freshwater catchment priorities (as determined by zone communities) and potential wildlife corridors. The use of this technique to aid regional restoration prioritisation will be discussed.

Shoot flammability of vascular plants is phylogenetically-conserved and related to habitat fire-proneness and growth form

xinglei cui[1], Adrian Paterson[1], Sarah Wyse[1], Azharul Alam[1], Kévin Maurin[4], Robin Pieper[1], Josep Padullés[5], Dean O'Connell1[1], Djessie Donkers[1], Julien Bréda[1], Hannah Buckley[2], George Perry[3], Timothy Curran[1]
[1]lincoln university, Lincoln, , [2]Auckland University of Technology, , , [3]University of Auckland, , , [4]The University of Waikato, , , [5]University of Minnesota, ,

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Xinglei Cui is a PhD student in department of pest-management and conservation at Lincoln University. His research investigates the evolution of plant flammability and explores the potential factors that influenced the plant flammability.
He holds a master degree from Chinese Academy of Agricultural Science. During his master, he worked on the genome evolution of Gossypium genus.

Terrestrial plants and fire have interacted for at least 420 million years. Whether fire drives plants to evolve higher flammability, and if so, how this occurs, continue to be hotly debated. Here we showed that phylogeny, fire-proneness of habitat and growth form were important predictors of the shoot flammability of 194 vascular plant species (Tracheophyta). Shoot flammability was relatively conserved at family and order levels. The phylogenetic signal of shoot flammability and the variation in flammability among phylogenetic groups (families, orders and classes) further demonstrated that shoot flammability is phylogenetically conserved. Some closely-related species, such as *Dracophyllum* (Ericaceae), vary in their flammability, indicating that as a trait flammability exhibits evolutionary flexibility. Species in fire-prone ecosystems tend to have higher flammability than species from non-fire-prone ecosystems, suggesting that plant flammability is positively related to the fire-proneness of habitat. Growth form also influenced flammability: forbs were less flammable than grasses, trees and shrubs, while grasses had higher biomass consumption by fire than other groups. The results showed that shoot flammability of plants was largely correlated with phylogenetic relatedness and high flammability may result in parallel evolution driven by environmental factors, such as fire regime.

Careful planning is required to ensure that New Zealand's One Billion Tree Programme doesn't go up in smoke

Tim Curran[1], Md Azharul Alam[1], Xinglei Cui[1], Niger Sultana[1], Sarah Wyse[1], George Perry[2]
[1]*Lincoln University, Lincoln, New Zealand,* [2]*University of Auckland, Auckland, New Zealand*

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Tim is a senior lecturer in ecology at Lincoln University who is interested in using functional traits to understand how plants survive disturbances. Much of his recent work has focused on comparative plant flammability, to tackle a range of applied and basic topics. The main device used in this research is a 'plant BBQ', which is a lot of fun to operate.

In 2018 the New Zealand government announced an ambitious programme to plant one billion trees across the country over the next 10 years. Known as the One Billion Tree (1BT) Programme it aims to drive 'land use change that integrates forests and trees into the landscape to achieve improved environmental, economic, social and cultural outcomes'. Similar schemes have been established in other parts of the world (e.g. Pakistan, China, sub-Saharan Africa), and in March 2019 the United Nations General Assembly declared 2021 – 2030 the UN Decade on Ecosystem Restoration. Given the huge investment involved in such schemes it is important to maximise their chances of success and ascertain ways to ameliorate threats. One such threat is fire. Here we discuss how fire might threaten the success of the 1BT programme, how the 1BT programme might change fire regimes in Aotearoa New Zealand, and make suggestions on how to address these problems. Fire could threaten the success of 1BT objectives related to carbon sequestration, biodiversity conservation and erosion mitigation, as these are contingent on trees remaining healthy and intact for many decades to centuries. The 1BT programme will likely change fire regimes by altering the amount, the connectivity and the flammability of fuels in the landscape. We suggest that these problems can be mitigated by careful planting design, including the use of low flammability species as green firebreaks.

Agricultural intensification exacerbates ecological impacts in forest remnants

Liz Curry[1], Jason Tylianakis[2], Raphael Didham[3], Louis Schipper[4], Gary Barker[5]

[1]Tonkin & Taylor, Hamilton, New Zealand, [2]University of Canterbury, Christchurch, New Zealand, [3]University of Western Australia, Perth, Australia, [4]University of Waikato, Hamilton, New Zealand, [5]Landcare Research, Hamilton, New Zealand

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Liz is a Senior Terrestrial Ecologist at Tonkin & Taylor based in Hamilton. Liz has a PhD in Ecology from University of Canterbury (2013) and has worked in various consulting, research and NGO roles in the UK, NZ and the Tropics. Following her PhD, Liz was based in Jakarta, Indonesia at the Center for International Forestry Research (CIFOR) where she managed integrated landscape management projects in Africa, Central America and South-East Asia. Liz returned to New Zealand three years ago and now manages ecological assessment and management projects around the country for a range of clients.

To support the world's growing population, there has been a significant increase in the area devoted to agriculture, which has caused forest habitats to become highly fragmented. At the same time, agricultural production in surrounding landscapes has become more intensive and it is now recognised that resource subsidies from the agricultural matrix may 'spillover' into adjacent natural systems and act synergistically with fragmentation and edge effects to alter ecosystem dynamics. In a comparative landscape study in the Waikato, we investigated whether the degree of ecological impact and severity of edge effects in forest remnants scales in proportion to land-use intensification in surrounding agricultural landscapes. We also examined whether these responses differed in remnants spared for conservation purposes (i.e. with livestock excluded by fencing). We quantified ecological responses to agricultural intensity for a suite of 26 community- and ecosystem-level response measures, using an index of land-use intensification created for pastures surrounding 21 forest remnants. We found that multiple ecological response measures scaled significantly with increasing land-use intensity, although the magnitude of influence was not as strong as the absolute influences of the fencing treatment or edge effects. We also found that in the majority of cases, impacts of land-use intensity occurred irrespective of livestock exclusion and that ground-level measures (plant and invertebrate metrics) responded most sensitively to agricultural spillover. Our study has important implications for the conservation management of natural ecosystems embedded within production landscapes, as determining the relationship between land-use intensification and biodiversity loss is paramount for achieving sustainable agriculture.

Does shifting out of forest promote diversification in New Zealand plant lineages?

Dr Esther Dale[1,2], Dr Matthew Larcombe[2], Professor William Lee[1]

[1]Manaaki Whenua - Landcare Research, Dunedin, New Zealand, [2]Department of Botany, University of Otago, Dunedin, New Zealand

Spatial Ecology, Conference A/B, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Esther is interested in integrating ecology and phylogenetics to gain deeper insight into eco-evolutionary processes. She seeks to address questions around what drives diversification in plants and uses New Zealand lineages to explore these questions.

Biome shifts are typically regarded as difficult because they are rare. Despite this, biome shifts can be important for diversification by allowing exploration of new ecological opportunities. New Zealand offers an ideal setting to explore the importance of biome shifts during diversification, because the timing of biome chronology is relatively well constrained. We are interested in whether diversification rates are higher in lineages that have more biome shifts, and therefore a broader range of ecological opportunity, than lineages that have remained in their ancestral biome. We test this using biogeographic modelling of six New Zealand plant lineages in three biomes: 'Forest', 'Open', and 'Alpine'. We estimated the history of biome occupancy and inferred biome shifts and the timing of speciation events in each lineage.

There were generally two types of lineage: primarily forest dwellers not particularly affected by novel biomes appearing, or explorers that shifted into new biomes then diversified further. Forest dwellers exhibited few types of biome shift, maintained steady but low biome shift rates. Explorers that shifted out of Forest tended to have a variety of biome shift types, high shift rates when new biomes first appeared, and speciated largely within the novel biomes. In these lineages, species expanded into new biomes which likely provided ecological opportunities that fostered diversification. Our results demonstrate that environmental change can create opportunities for diversification, but only in lineages that are able to transition into novel biomes.

Provision of insect related ecosystem services through the use of designed native plantings on farms using an ecological network approach

Melanie Davidson[1], Franziska Schmidlin[1], Bryony Willcox[2], Brad Howlett[1]

[1]Plant & Food Research, Lincoln, New Zealand, [2]University of New England , Armidale , Australia

Ecosystem Services, Conference A/B, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

Melanie is a scientist in the Beneficial Biodiversity team of the Productive Biodiversity and Pollination group in the Sustainable Production Portfolio at Plant & Food Research. Melanie's specific area of research is in the development and implementation of sustainable technologies and strategies to protect and strengthen insect ecosystem services and beneficial biodiversity in New Zealand agroecosystems. A key component of this research is to understand and mitigate anthropogenic related impacts on beneficial organisms. Current projects include 'Native Plantings to support pollinators and natural enemies'.

Insect pollinators, predators and parasitoids provide valuable services in agroecosystems by increasing yields and reducing economic losses from insect pests. Natural and semi-natural vegetation, and other sources of floral resources (e.g. wildflowers) have been identified as habitats that can boost the abundance of such beneficial insects. The plant and insect interactions that generate these ecosystem services are influenced by the species present. Yet such interactions are rarely examined at the species level. We identified potential associations of native and exotic plant species with known beneficial and pest insect species using systematic and opportunistic searches of literature and existing databases. We used these data to design native plant communities to support beneficial insects on arable farms, based on a constructed network of identified plant-insect interactions. Designed native plant communities were then established on three arable farms to determine whether the plant-insect interactions identified in the literature predicted the actual networks measured. We sampled five commonly grown crop species and six plant species within each of the native plantings across the three farms, using observational surveys of flower visiting beneficial and pest insect species. We found that the actual networks measured strongly resembled the predicted networks we constructed based on our literature searches. We demonstrate that mapping of predicted networks using knowledge of the insect species and their interactions with plants is a useful tool to design habitats to boost beneficial insects, but not pests, and predict the ecosystem services provided by the native plantings.

Development of a new interactive key to identify NZ Myrtaceae

Mr Murray Dawson[1], Dr Rob Smissen[1]

[1]*Manaaki Whenua - Landcare Research, Lincoln, New Zealand*

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (II), Stewart Theatre 2, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Murray Dawson is a botanist at MWLR. His current interests include the creation of interactive identification keys, horticultural and systematic botany, natralised plants, citizen science and outreach. He has received the NZ Biosecurity Institute Peter Ingram Award (2015), an Associate of Honour (AHRIH) of the Royal NZ Institute of Horticulture (2016) and the CHS John Taylor Award for Leadership in Horticulture (2018). Murray has authored and co-authored some 40 refereed papers and more than 80 popular articles, reviews and reports.

In November 2018 the Ministry for Primary Industries (MPI) contracted Manaaki Whenua – Landcare Research (MWLR), in collaboration with Scion and Unitec to begin creating a Lucid™ online (browser-based) key and smartphone app to identify New Zealand Myrtaceae, including some 120 native, non-native, and invasive plant species.

This MPI funded project aims to enable easier identification of Myrtaceae plants for those who encounter suspected myrtle rust symptoms, so that reporting, control and long-term management of the devastating disease is enabled.

The completed key will contain images, species profiles and character explanations to help identify this culturally, ecologically, and economically important family. Completion is scheduled for July 2020.

This presentation will outline progress made to date and will demonstrate a working version of this significant new resource.

Long-term change in New Zealand tussock grasslands

Dr Nicola Day[1]

[1]Auckland University of Technology, Auckland, New Zealand

Spatial Ecology, Conference A/B, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Dr. Nicola Day is a Rutherford Postdoctoral Fellow in Applied Ecology at AUT. She is a community ecologist interested in plant and fungal ecology, soil ecology, and global change, particularly fire disturbance. She is particularly interested in tussock grassland ecology and how we can use past changes in biodiversity to prepare for future changes in grasslands.

To plan for future impacts of global change, there is a need for information on how terrestrial ecosystems have changed over past ecological time scales. This enables us to understand if changes in biodiversity represent short-term fluctuations or are indicative of a different state. Moreover, substantial changes in local areas, such as declines in native species or increases in exotic species, may not be representative of patterns across entire landscapes. Information on long-term vegetation change and drivers at a landscape scale in New Zealand's South Island tussock grasslands is limited due to a paucity of widespread temporal data. I will synthesise research on long-term changes in landscape-level changes in plant communities in tussock grasslands throughout Canterbury and Otago, and present a framework with testable hypotheses for us to better understand how this iconic ecosystem will change under future conditions.

Changing wildfire activity in a fire-adapted system: ecological impacts of a large fire year in Canadian boreal forests

Dr Nicola Day[1], Dr Steven Cumming[2], Dr Kari Dunfield[3], Dr Jill Johnstone[4,5], Dr Michelle Mack[6], Kirsten Reid[7], Dr Merritt Turetsky[3], Dr Xanthe Walker[6], Alison White[7], Dr Jennifer Baltzer[7]

[1]Auckland University of Technology, Auckland, New Zealand, [2]Université Laval, Quebec City, Canada, [3]University of Guelph, Guelph, Canada, [4]University of Saskatchewan, Saskatoon, Canada, [5]University of Alaska Fairbanks, Fairbanks, USA, [6]Northern Arizona University, Flagstaff, USA, [7]Wilfrid Laurier University, Waterloo, Canada

Fire Symposium (II), Stewart Theatre 2, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

Dr. Nicola Day is a Rutherford Postdoctoral Fellow in Applied Ecology at AUT. She is a community ecologist interested in plant and fungal ecology, soil ecology, and global change, particularly fire disturbance. She has recently returned from Canada where she was an NSERC postdoc as part of a large project assessing ecological impacts and recovery of boreal forests after extreme wildfires.

Wildfires are a natural phenomenon in boreal forests, contributing to productivity and diversity. However, with increased wildfire activity due to climate change there is concern that these forests are no longer able to recover in the same way as they have in the past. Northwestern Canada is experiencing one of the highest rates of warming globally, with associated increases in fire activity. Our study aims to understand the ecological impacts of large wildfires on forests, incorporating above and belowground perspectives in boreal forests after one of the largest fire years on record in the Northwest Territories of Canada. A synthesis will be presented on the effects of fire severity and frequency on plant regeneration, and soil microbial communities. Overall, our results show that drier parts of the landscape experienced greater fire severity. These areas were also more susceptible to large shifts in plant composition compared to pre-fire, while wetter areas experienced lower fire severity and showed a greater potential to recover to pre-fire conditions. While soil characteristics were a strong driver of soil fungal community structure, there were declines in soil fungal and mycorrhizal richness with increased fire severity. This suggests that as the climate continues to warm and dry, more of the landscape will experience high fire severity and potential shifts in plants and soil microbial communities.

Using para-aminopropiophenone (PAPP) as an effective tool to control feral cats in Hawke's Bay, New Zealand

Ms Natalie de Burgh[1], Lee Shapiro[2], Al Glen[3], Kellie Mayo[4], Mark Mitchell[1]

[1]Hawke's Bay Regional Council, Napier, New Zealand, [2]Boffa Miskell Ltd., Auckland, , [3]Manaaki Whenua-Landcare Research , Auckland, , [4]Department of Conservation, Napier,

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Natalie graduated from the University of Auckland with a BSc in Ecology in 2016. Since then she has been a part of the Predator Free Hawke's Bay team at the Hawke's Bay Regional Council. She is particularly interested in how research can inform adaptive management and the integration of biodiversity values into agricultural systems. Since 2017 she has also had three short stints in Greece volunteering on an in-water research project monitoring loggerhead sea turtles.

The impact of feral cats on native wildlife is becoming increasingly recognised worldwide, making their management a necessity. As New Zealand's Predator Free 2050 goal leads to larger and more ambitious landscape scale programmes, there is an important need for a number of cost- and time-effective tools. Para-aminopropiophenone (PAPP) was first registered in New Zealand for feral cats and stoats in 2011 under the name PredaSTOP® and has higher target specificity for feral cats than 1080. Following a successful trial of PAPP on Toronui Station, Hawke's Bay in 2017, a larger operation was undertaken in 2018 across 9123 ha of the Poutiri Ao ō Tāne project area in Hawke's Bay. Camera traps were used to monitor the relative abundance of feral cats on Opouahi Station and at a non-treatment site (Waitere Station). A network of 287 bait stations was established in 500m grid spacings across the treatment site. Two applications of non-toxic pre-feed minced meat baits were followed by two applications of toxic PAPP baits. PAPP baits were dyed green and contained 80 mg of PredaSTOP® in the centre of the bait. Each application of PredaSTOP® consisted of two baits placed at either end of each bait station. Toxic baits were removed from at least 130 bait stations. We assume that >130 feral cats are likely to have been killed, resulting in a 39% reduction in the detection of feral cats after the operation. Our results suggest that PAPP has the potential to be a useful management tool across large areas alongside other methods.

Kahikatea Green Wheel – a Warrant of Fitness tool for lowland forest fragments

Karen Denyer[1], **Dr Yanbin Deng[2]**, Daniel Tait[2], Catherine Beard[3]
[1]Papawera, Cambridge, New Zealand, [2]Waikato Regional Council, Hamilton, New Zealand, [3]Department of Conservation, Hamilton, New Zealand

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Waikato Regional Council has developed a "Kahikatea Forest Green Wheel" (KGW) to help landowners and resource managers assess the health of their kahikatea forest remnants, and track recovery in response to ecological restoration and management actions.
The KGW was adapted from the Ecosystem Recovery Wheel developed by the Society for Ecological Restoration Australasia. It ranks 31 sub-attributes against a theoretical reference site, based on data from a set of the best 13 kahikatea fragments in the Waikato lowland. Thus, the scores measure the degree to which a given kahikatea fragment represents the most healthy and functioning example we could expect in the contemporary landscape. Sub-attributes are grouped under the Pressure, State, Response framework used by the council for monitoring and reporting on the state of the environment.
Each sub-attribute is accorded a score from 1-5, and visually presented on a wheel graph to quickly identify areas that need improvement and track progress over time. While 31 sub-attributes seems daunting, tools have been developed to simplify the task: Council calculates and provides the data for 5 spatial attributes via its online vegetation maps; a supporting spreadsheet automatically generates scores for 6 botanical attributes by simply ticking the vascular plant species present; management attributes can be quickly applied using the landowner's knowledge of their site; and users can choose which sub-attributes to apply. A user-friendly illustrated guide, field datasheets and a completed example for a real-life kahikatea fragment are under development to assist application of the KGW.

Do modifications to Goodnature A24 traps that reduce non-target species harm decrease their effectiveness?

Dr Lisa Denmead[1], Dr Erin Kennedy[1], Liam Butler[1], Dr Debashis Dutta[1], Dr Christine Stockum[2], Henry Whyte[1]
[1]Toi Ohomai Institute of Technology, Tauranga, New Zealand, [2]Goodnature, Wellington, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Lisa is a lecturer at Toi Ohomai Institute of Technology in Tauranga. She teaches across invertebrate biology, conservation, freshwater and terrestrial ecology and statistics courses. Lisa's main research interest is invertebrate community ecology in agricultural landscapes, however, she recently has begun exploring pest management methods in conjunction with Goodnature.

The Goodnature A24 self-resetting rat and stoat trap can be more efficient compared with traditional traps used in New Zealand and suppresses rat numbers substantially. However, new evidence indicates that A24s may cause harm to non-target bird species (e.g. Kiwi beak injuries, and Kea have put their head into unset traps). These potential threats to native birds have spurred two research developments: 1.) the Department of Conservation recommends that A24s are raised to 1m above the ground (current Goodnature guidelines recommend 12cm) in Kiwi areas, and 2.) Goodnature created a bird blocker attachment that excludes birds such as kea from the traps. Although both approaches are already being used, to date, no studies have been conducted to determine if the changes influence A24 effectiveness. We set up two field trials in a native forest with high rat densities to determine if trap kill rates differ between 1) standard A24s and A24s with a bird blocker attached and 2) standard A24s set at 12cm above ground and A24s set at 1.2m. Preliminary results indicate that the bird blocker reduces kill rates of the A24 trap, which may be due to changes in rat behaviour around the traps. But, results from behavioural studies are still forthcoming to complement kill rate data. Data collection of the height experiment is ongoing and will be completed in November 2019. Our results have the potential to inform predator control projects for optimal conservation outcomes i.e. maximising rat kills while minimising the threat to non-target bird species.

Assembling communities: One OTU at a time

Dr Manpreet Kaur Dhami[1]

[1]*Manaaki Whenua Landcare Research, Lincoln, New Zealand*

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Manpreet is a Researcher/Capability Leader (Molecular Ecology) at Manaaki Whenua – Landcare Research. Her research is centered on the eco-evolutionary processes that shape microbial communities – using host-associated and environmental systems. Previously at Stanford University (2014-2017), she studied how competition and resources influence the nectar microbiome.

How communities are formed and maintained is a key question in ecology. Numerous processes can contribute to community assembly, including niche differentiation, historical contingency, environmental filtering, and dispersal. The outcomes of these processes can be measured as patterns of community membership and phylogenetic structure. Using a simple community phylogenetic similarity framework in nectar communities, we explore the influence of multiple processes that can determine community assembly. We characterize nectar microbial communities using high-throughput metabarcoding across a 200 Km geographic distribution of the host plant sticky monkeyflower. For each nectar community (*n* = 1152) we amplified bacterial and fungal barcoding genes and isolated viable species using culturing techniques. These simple yet ubiquitous communities are formed when microbes are dispersed to flowers via pollinators. Surprisingly however, across the large geographic gradient studied, dispersal did not play a detectable influence on community structure. We found, instead, that strong competition between bacterial and fungal members determined the overall community structure. Further, we find evidence of niche differentiation for the most dominant fungal species through metabolic specialization for limited nectar nitrogen resources. Exploring multiple mechanisms of community assembly across the large geographic scale was made possible by the ease of community characterization presented by high-throughput metabarcoding techniques.

Rare but not local: spatially dispersed salvage logging does not mitigate threat to fungal biodiversity

Dr. Ian Dickie[1], Dr. Angela Wakelin[2], Dr. Sarah Richardson[3]

[1]University of Canterbury, , , [2]Lincoln University, , , [3]Manaaki Whenua - Landcare Research, ,

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Ian Dickie is a Professor of Microbial Ecology at the University of Canterbury and a project leader in the BioProtection Research Centre. His research group focusses on understanding the role of fungal communities in ecosystem processes, often using molecular tools. Current research projects include understanding plant-microbe interaction networks in invasion, and determining the ecosystem legacies of wilding pines.

Legislation to allow salvage timber harvesting of deadwood from temperate rainforests on conservation lands was passed following Cyclone Ita in 2014, which raised concerns over the potential impacts of harvesting on rare species of fungi and other biota. Management guidelines were developed in the absence of quantitative information on the spatial structure of fungal biodiversity in these ecosystems. We sampled fungi in logs of *Dacrydium cupressinum* (Podocarpaceae). DNA was extracted from 81 logs varying in decay state across a 40 km long region of West Coast forests, and sequenced using metabarcoding. We examined three axes of rarity: occupancy, dominance when present, and niche breadth (as spatial extent and decay state specialisation). Low occupancy fungal species were common, including a group of infrequently occurring but dominant when present fungal species. Despite this, there was an overall positive relationship between occupancy and dominance. Spatial structure in fungal communities was observed at large scales (300-500 m and 15 to 20 km) and to a greater degree based on decomposition state. Of the 351 low occupancy species found 2 to 4 times, only 12 had maximum range sizes < 900 m, with no more spatial restriction at scales < 900 m than would be expected by random chance. The results show that fungal communities in deadwood are highly diverse, and include many rare species. Nonetheless, the lack of spatial structure in fungal communities at < 300 m scales suggests that spatially dispersed timber harvesting does not mitigate risks of harvesting to rare fungal biodiversity.

Regenerating hill country landscapes that are valued by all New Zealanders

Dr Katherine Dixon[1], Prof. Emeritus Henrik Moller[2], Angela McFetridge[3], Dr Suzanne Keeling[3], Eleanor Linscott[3], Nicolas Caviale-Delzescaux[4], Sam Lang[5]

[1]Kunzea Consulting, Dunedin, New Zealand, [2]Centre for Sustainability, University of Otago, Dunedin, New Zealand, [3]Beef+Lamb New Zealand, Wellington, New Zealand, [4]Whangawehi Catchment Management Group, Te Mahia, New Zealand, [5]People to Paddock, Christchurch,

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Principal Investigator and Company Director. He has over 40 years of experience in applied ecology for efficient and effective wildlife management, conservation, harvest management and pest control.

Sited between the intensively farmed lowlands and the protected alpine environment, New Zealand's Hill Country Landscapes are subject to multiple land use pressures. Traditionally associated with sheep and beef farming but able to accommodate multiple land uses, hill country landscapes have the potential to be agro-ecological landscapes that are ecologically, economically and socially resilient.

As part of collaboration between Beef & Lamb NZ, the Ministry for Business Innovation and Employment, PGG Wrightson Seeds, Seed Force and the Federation for Maori Authorities, this research presents the preliminary findings from a qualitative analysis of over 80 interviews with farmers, advisors and influencers.

Using the information given in personal testimonies, we identify the main constraints and opportunities for broad scale environmental and social systems change. We draw on our research findings to suggest some useful changes in our conversations: from ecologists, farmers, regulators and policy makers, there is scope for us all to play a part in future-proofing New Zealand's Hill Country Landscapes that are valued by all New Zealanders.

New Zealand's treeline: Photoinhibition and spatial patterns of southern beech recruitment in the subalpine belt

Fabian Doeweler[1], Dr Martin Bader[1], Dr Hannah L. Buckley[1], Dr Bradley S. Case[1]
[1]*AUT, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
I am a 3rd year PhD student in the Department for Ecology at AUT. My research focusses on identifying ecological patterns at the treeline ecotone and identifying the drivers behind these patterns. My research combines techniques of plant physiological measurements with drone imagery and individual based modelling to draw a more complete picture of New Zealand's treeline.

Globally, New Zealand's treelines show a remarkably abrupt ecotone transition and their response to global warming has only been expressed as a relatively slow advance in their altitudinal limits. The treeline spans the Southern Alps from the humid West Coast to the dry east, comprising evergreen mountain and silver beech and covers a vast range of climatic conditions. The lack of rapid shift in treeline position is ultimately caused by the dynamics of seedling recruitment, which is dependent on microhabitat conditions. A sheltered environment for recruitment to the early seedling stage can be essential, since exposure to extreme deviations of temperature and light quickly translates into a question of survivability for the individual. This study combines plant physiological measurements by assessing the response of seedlings to high levels of irradiation in summer and winter and examine the spatial distribution of seedlings in the alpine belt by linking 40 years of treeline transect data at Mt Faust and Craigieburn with UAV measurements (LIDAR, Multispectral, Thermal, RGB). Assessments of the photosynthetic yield have revealed the strong physiological recovery potential of established seedlings after sunset and under experimental shading. The combination of remotely derived high-resolution datasets uncover an immense potential to draw a more complete picture of the treeline ecotone, giving a new perspective of how temperature and light are mediated by topography and vegetation cover over the course of a full day.

Assessing the impacts of land use change on soil invertebrate richness and endemism across New Zealand

Andrew Dopheide[1], Andreas Makiola[1], Kate Orwin[1], Robert Holdaway[1], Jamie Wood[1], Ian Dickie[2]
[1]Manaaki Whenua - Landcare Research, Auckland, New Zealand, [2]University of Canterbury, Christchurch, New Zealand

Next Generation on Next-Generation Sequencing Symposium (I), Stewart Theatre 2, December 4, 2019, 9:00 AM - 10:30 AM

Biography:
Andrew Dopheide is a researcher at Manaaki Whenua - Landcare Research, working on biodiversity analysis and estimation using DNA sequencing, metabarcoding, bioinformatics and data visualisation techniques.

Invertebrates are the most diverse and abundant group of terrestrial animals, and are major contributors of ecosystem services such as pollination, soil formation, and nutrient cycling. Long-term declines in invertebrate biodiversity are predicted to have major impacts on food webs and ecosystems. Despite this, most invertebrates are undescribed, and there is an incomplete understanding of land use effects on invertebrates, particularly for those that reside in soils. Impacts on invertebrate biodiversity are most commonly measured as changes in species richness, yet this metric provides no information about the rarity, distribution, or function of species or communities. This raises the question of whether species richness is the best metric for describing changes in invertebrate biodiversity.

We used a DNA metabarcoding approach to comprehensively assess the biodiversity of soil invertebrates across five major land use types throughout New Zealand. We investigated whether all soil invertebrate taxa show the same biodiversity trends across land use types. Furthermore, we investigated whether alternative metrics of biodiversity – endemism, phylogenetic diversity, and phylogenetic endemism – provide clearer insights into community change and land use impacts on soil invertebrates than species richness. Our results show that richness, effective species, and phylogenetic diversity underestimate the impacts of land use change on soil invertebrates, and that endemism provides a more informative and sensitive metric of biodiversity loss.

Recent Extensive Indigenous Biodiversity Loss in the Waikato Region

Dr Paul Dutton[1]

[1]*Waikato Regional Council, Hamilton, New Zealand*

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Paul Dutton is a terrestrial ecologist, working for the Waikato Regional Council since 2016, specializing in ecosystem identification and mapping. Paul completed a B.Sc. in Conservation and Ecology from Lincoln University in 2006, joint Masters in International Nature Conservation at the University of Gottingen/ Lincoln University in 2008 and a Ph.D. in Ecology at the University of Canterbury in 2012. Paul has published in various international journals including Journal of Tropical Ecology, American Journal of Primatology and Folia Primatologica. He is currently developing a biodiversity inventory for the Waikato region and documenting biodiversity loss. Paul Dutton lives in Waitoa, Waikato.

Since human settlement New Zealand has experienced large-scale land-use change resulting in the depletion of endemic ecosystems causing significant loss to indigenous biodiversity. More recently, there has been an overarching commitment by communities (assisted by councils) throughout New Zealand to rehabilitate and restore degraded ecosystems. However, the loss of biodiversity has continued and our evidence from the Waikato region suggests it is greater than our restoration efforts. Using a shared-services desktop approach we further develop a subset of data gathered during a project to map current ecosystem extent throughout the Waikato region. We use WRAPS and oblique imagery to identify and map the scale of biodiversity loss from 2002 to 2017. As a second step we relate the biodiversity loss to land-use change, land tenure/protection, habitat for threatened species, soil conservation, sedimentation and regional and national initiatives that contribute to enhancing biodiversity. From initial analysis we find that biodiversity loss is consistent across the surveyed area and is greatest on, but not exclusive to, privately-owned land. The greatest land-use change identified was from indigenous forest and scrub to pasture and exotic plantations. The largest conversion occurred between 2002 and 2007, with a decreasing trend observed in subsequent years. We identify that there is an opportunity to slow the rate of biodiversity loss by addressing and enhancing policies to protect biodiversity. We identify what local and regional council policies and central government regulations apply and identify gaps, improvements and recommend actions to reduce future biodiversity loss in the Waikato region.

Is there a place for customary harvest of taonga in Aotearoa, how can we value what we don't know?

Mr Peter Edwards[1]

[1]*Auckland University of Technology, Auckland, New Zealand*

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Currently I am a mature PhD student with a passion for science (marine & terrestrial, biology, ecology, conservation, socio-ecology) and how this can be coupled with my other passion which is mātauranga Māori. I believe that as scientists we need to engage Māori more so that both science and Māori can find common ground with each others perspectives and to engage with one another equally for the betterment of conservation in Aotearoa. I envisage that conservation initiatives can be successful through science and customary harvest.

This research investigates the role customary harvesting of wildlife plays in conservation mangement and the 'mana-economy' in Aotearoa New Zealand. Cultral harvesting of taonga is as much about keeping alive traditional ecological knowledge and practices, as it is about sustainable resource management. The problem for many Māori and indigenous species is the negative impact mammal predators play in preventing these cultural/conservation outcomes. Engaging mātauranga Māori offers solutions to many contemporary conservation problems and provides opportunities for the Department of Conservation to:

• demonstrate goodwill by honouring commitments to Te tiriti ō Waitangi ensuring science responds to the needs and values of hunga Māori.

• develop trust by co-creating equitable consultation and collaborative decision-making processes that build capability to better engage kaupapa Māori information.

• attract and engage Māori in research by strengthening education opportunities that build capability within iwi to better engage Western science information.

• unlock the sustainability and innovation potential of indigenous knowledge by assisting indigenous communities in their kaitiaki roles and developing long-term collaborations.

Based on mātauranga Māori and science based frameworks (Broughton & McBreen, 2015; Moller, 2009; Newman & Moller, 2005), we aim to glean Māori and non-Māori perspectives on customary harvesting and the use of genetic based modelling systems for kaupapa Māori ecological restoration planning. It is envisaged that data will reveal pathways to better engage and safeguard mātauranga and tikanga Māori in wildife mangement in Aotearoa. Customary harvesting incentives will lead to the acquisition of pride and mana motuhake (self-determination, independence) through an economy of mana (Dell, Staniland & Nicholson,

2018; Henwood & Henwood, 2011; Kawharu, 2000; Marsden & Henare, 1992; Morad & Jay, 2000; Roberts *et al*, 1995; Spiller *et al*, 2011).

Emission of volatile organic compounds by mānuka in response to conspecifics, native and invasive plant species

MSc Evans Effah[1], MSc Paul Barrett[1], MSc Paul Peterson[2], Professor Murray Potter[1], Professor Jarmo Holopainen[3], Dr Andrea Clavijo-McCormick[1]

[1]Wildlife and Ecology Group, Massey University, New Zealand, Palmerston North, New Zealand, [2]Manaaki Whenua - Landcare Research, Palmerston North, New Zealand, [3]Department of Environmental and Biological Sciences, University of Eastern Finland, Kuopio, Finland

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

I am originally from Ghana and currently a PhD student at Massey University, Palmerston North.

I completed my bachelors degree at University of Education Winneba, Ghana and my masters degree at University of Eastern Finland.

With my passion for science, I moved to New Zealand in 2017 to study for a PhD in Ecology. My current research focuses on chemical (volatile compounds) mediated interactions between native and invasive plants. Results of my research will increase our understanding about the complexity of invasive - native plants competition

Research on competition between native and invasive plants has focused on morphological traits to estimate the competitive ability of invaders and the responses of native species. However, plants release a variety of secondary metabolites that are ecologically relevant and may contribute to the success or demise of both emitters and receivers. This is the case of plant volatile organic compounds (VOCs), which mediate multiple interactions including host-plant selection by herbivores, indirect defence, and plant-plant communication. Unfortunately, our knowledge of the roles these compounds play in competitive interactions is still limited and the chemical responses of native plants towards invaders have rarely been studied. In this study, we characterised the VOCs emitted by mānuka (*Leptospermum scoparium*), a native New Zealand plant, during competition with conspecifics, another native species (*Dracophyllum subulatum*), and two European introduced plants (*Calluna vulgaris* and *Cytisus scoparius*). VOCs were collected under field conditions in the Central Plateau of the North Island of New Zealand using a “push-pull” headspace collection technique and analysed using GC-MS. We also collected information on arthropod community composition, herbivory and other environmental factors to estimate their effect on VOC emissions. The results show a significant reduction in mānuka VOC emissions when competing with introduced species relative to conspecifics or another native species, and suggest that the presence of invasive species impairs the native plants' ability to communicate chemically with their environment.

The capacity of restored urban forests to support native birds: Social or ecological restoration?

Ms Elizabeth Elliot Noe[1], Professor Bruce Clarkson[1], Dr Ottilie Stolte[1], Mr John Innes[2], Dr Chaitanya Joshi[1]
[1]The University of Waikato, Hamilton, New Zealand, [2]Manaaki Whenua-Landcare Research , Hamilton, New Zealand

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Biography:
I am a PhD candidate in terrestrial ecology at the University of Waikato. My areas of research interest include urban restoration ecology, human-wildlife interactions in cities and urban wildlife ecology. My Masters of International Nature Conservation was jointly awarded by the University of Göttingen and Lincoln University for my research on city residents' perceptions of and behaviour affecting urban coyotes in Chicago and Los Angeles.

Urban restoration can perform the dual role of creating refugia for native flora and fauna, and greenspaces where city residents can benefit from daily interaction with nature. Our research combines ecological and social science to evaluate the contribution that restored native forests in New Zealand cities can make to native bird conservation and reconnecting urbanites with nature.

Birds were monitored at 43 sites in two New Zealand cities. Sites represented three types of urban forest: unrestored (n = 6), restored (n = 26) remnant (n = 6), and rural forest remnants nearest to each city (n = 6). Restored sites formed an age gradient of 1 to 73 years since initial planting. Using qualitative interviews, we explored city residents' experiences of urban nature in parks and gardens.

Results reveal that native bird species' richness and diversity increases with time since restoration. Avian communities shift from being dominated by introduced granivores and generalists to supporting a greater number of native birds as the forest matures. Results suggest that habitat is a primary limiting factor for native birds, demonstrating the potential of restoration to increase bird numbers in cities.

The social study findings suggest that we cannot rely on urban gardens to support native biodiversity in the short-term and stress the need for local authorities to invest more time and resources in urban restoration. As the number of people living in cities continues to rise, our research offers renewed evidence for the importance of reserving a space for nature in cities.

Seeking evidence for the existence and underlying mechanisms of the Kauri Line.

Mr Toby Elliott[1], Associate Professor Cate Macinnis-Ng[1], Professor George Perry[1], Associate Professor Bruce Burns[1]

[1]*The University of Auckland, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Toby studied a Bachelor of Ecology at The University of Auckland, finishing in 2017. He then worked as a Research Intern at Cloudbridge Nature Reserve in Costa Rica, where he continued a long-term research project on butterfly distributions within forests with different land-use histories. He then completed a PgDipSci in Biosecurity and Conversation at the University of Auckland from July 2018 to June 2019. Over the Summer of 2018, he took part in a Summer Studentship with Cate Macinnis-Ng and Benjamin Cranston on the impacts of Drought on Kauri. He is currently completing a Masters degree at Auckland University.

Floristic boundaries are recognised by the coincidence of range limits of multiple plant species, and often separate two distinct botanic regions. The Kauri Line, a floristic boundary in the central North Island of New Zealand (~38°S), has been described as marking the southern limits for multiple plant species, including the conifer *Agathis australis*. I aim to study the validity of the Kauri Line as a floristic boundary in terms of the coincidence of species range limits and compositional multi-tier changes in vegetation with latitude. The strength of the Kauri Line will be judged on the density of southern limits coinciding with it compared to other latitudes. Furthermore, the role of frost at preventing the southward spread of species with southern limits approximating with the Kauri Line (Kauri Line species) will be examined by comparing the frost tolerance of four Kauri Line species with that of three species with larger natural ranges. The comparison will be made by subjecting seedlings of these species to moderate (-3°C) or heavy (-5°C) artificial frosts and examining their growth and survival for two months following these treatments. Also, the xylem vulnerability of each species will be examined using the air injection method to look for differences among species groups. Frost is likely contributing to the manifestation of the Kauri Line if frost-induced damage to Kauri Line species is greater than that in the widespread species. Understanding the mechanisms determining range limit boundaries has multiple applications, including its ability to predict their responses to climate change.

Biotic Resistance Hypothesis supported in Auckland's forests

Miss Claire Ellis[1]

[1]*Auckland University of Technology, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

A Bachelor of Advanced Science, majoring in Environmental Science (Hons) student, graduating in December of this year. I have worked part time as a Teaching Assistant and Data specialist for RIMU at the Auckland Council.

Auckland city has a unique combination of rural and urbanized areas culminating in range of forest types; from highly modified to regenerative and restored (Sullivan *et al*, 2009). Like many urban cities, these forests have been invaded by weeds and as a result are seeing a decline in native species (Sullivan *et al*, 2009; Given & Meurck, 2000). For the past 15 years the Auckland Council has been collecting vegetation data from over 300 sites across the region. Using this data, I will employ multivariate, univariate and spatial data analysis to discuss the ecological patterns of the top 20 most problematic weed species. The aim of this study is to gain a better understanding of how these weeds are affecting the forests they inhabit as well as the influencing factors that are contributing to their invasion.

Given, D., Meurk, C., 2000. Biodiversity of the urban environment: the importance of indigenous species and the role of the urban environment in their preservation. In: Stewart, G.H., Ignatieva, M.E. (Eds.), *Proceedings of Workshop on Urban Biodiversity and Ecology as a Basis for Holistic Planning and Design*, Lincoln University, Lincoln, 28–29

Sullivan, J. J., Meurk, C. D., Whaley, K., & Simcock, R. (2009). Restoring native ecosystems in urban Auckland: urban soils, isolation, and weeds as impediments to forest establishment. *New Zealand Ecological Society, (2009) 33*(1), 60-71

Human accessibility across New Zealand

Thomas Etherington[1]

[1]*Manaaki Whenua - Landcare Research, ,*

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Tom's research is interdisciplinary, using geocomputational methods to examine environmental questions and problems through the combination of theories and methods from geography and ecology. Primary applications have included modelling species' distributions and connectivity across landscapes for applications in conservation ecology, epidemiology, and invasion ecology. While Tom's research is generally driven by environmental questions and problems, where necessary his research also includes the development of new methods, data sets, and algorithms. Therefore, he also has interests in computer programming and the use and development of open-source and cross-platform scientific software and data.

Human accessibility across New Zealand

The ability of humans to access a landscape is relevant to ecology in several ways. Previous studies have demonstrated that ecological processes such as range sizes, wildfires, disease occurrence, and species invasions can be explained by patterns in human accessibility. Similarly, the way in which ecologists try to observe these processes using both structured and unstructured surveys is also influenced by the accessibility of the landscape for humans. Therefore, being able to estimate how human accessibility changes across New Zealand may allow ecological data to be better analysed, and ecological processes to be better understood. Mapping human accessibility can be done using least-cost modelling, which is a geocomputational method that is underpinned by graph theory connectivity methods. Least-cost modelling provides a promising framework within which to make estimates of human accessibility, as various hierarchical factors such as roads, terrain, and landcover that are relevant to human mobility can be easily integrated. Using a least-cost modelling approach I present an accessibility map that visualises that while some parts of New Zealand remain inaccessible, many parts of New Zealand are no longer isolated as they can be easily accessed by many people. These accessible areas are therefore likely to be at greater ecological risk from human initiated ecological perturbations. I also hypothesise that some parts of New Zealand may have passed a tipping point of accessibility, and that they now need to be considered as part of a globally connected system.

A Vegetation Map for Dunedin City

Richard Ewans[1]

[1]*Dunedin City Council, Dunedin, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Richard Ewans joined Dunedin City Council in late 2018 as a Biodiversity Advisor in the City Development team. For the previous five years Richard worked as an ecological consultant specialising in indigenous vegetation and ecosystem assessment, and biodiversity management advice. Prior to that Richard spent ten years working for the Department of Conservation (DOC), mostly in Fiordland National Park, planning and delivering ecological monitoring programmes as well as threatened species and pest control programmes.

Dunedin City Council (DCC) has commissioned a vegetation map of the district that is of higher resolution than currently available national classifications such as the Land Cover Database (LCDB).

Dunedin City is large (c. 328,000 ha) and ecologically diverse, ranging from alpine areas to the coast, with both vegetation types characteristic of dryland central Otago, and wildlife characteristic of the subantarctic islands.

The map includes multiple classifications to allow vertical and horizontal integration with comparable mapping at district, regional or national scales. The higher resolution mapping includes sometimes overlooked ecosystems and habitats like cushion bogs in tussock grasslands, and volcanic screes in forest.

The map also identifies potential local hotspots of indigenous biodiversity in mid-altitude mixed grasslands mapped in LCDB as low-producing exotic grassland, such as ephemeral wetlands and groups of schist rock tors.

The timing is good for establishing an accurate baseline of indigenous vegetation at the district scale as DCC is transitioning between district plans, and national strategic documents for biodiversity are imminent.

It is expected that greater insight will provide a basis for better local indigenous biodiversity outcomes for the district via the following; identification of a more comprehensive suite of ecologically significant areas, regular district-wide monitoring of the extent of indigenous vegetation and habitats of indigenous fauna, prioritisation of council biodiversity management and support, and greater compliance oversight. A version of the map will be made publicly available.

Examples of recent mapping and preliminary data from this project are included.

Unmanned aerial systems for dune vegetation monitoring and management at Kaitorete Spit

Mr Michael Fake[1]

[1]*Lincoln University, , New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

I have recently completed my MSc. in environmental studies from Lincoln University. I also have a BSc. from Lincoln University where I took and interest in Wine and Viticultural Ecology.

My academic interests included the use of UAS for small scale community monitoring projects, as well as large scale spatial ecological concepts.

Plant community monitoring was conducted at Kaitorete Spit Scientific Reserve using UAS based remote sensing and traditional field-basedtechniques. Multispectral, high resolution UAS imagery was used as the basis for image classification. Different classification methods and data manipulation techniques were evaluated in order to present the most accurate representation of plant communities for comparison against those derived from the field data. Overall image classifcation results were on par with those from similar studies, however their suitability for application to the monitoring of the specific environmental and ecological conditions at Kaitorete Spit remains of low confidence. UAS imagery was able to be used to identify coarse scale ecological features which could then be used to define distinct ecological communities in a simlar but not identical manner to that of the field data. At a finer-scale, UAS imagery could detect some, but not all, key ecological features such as individual species or fine-scale indicators of diverse habitat types.

Stay or Leave? Avian Responses to Urbanisation

Mrs. Sahar Firoozkoohi[1], Dr. Adrian M. Paterson[1], Dr. Jon J. Sullivan[1]
[1]*Lincoln University, Christchurch, New Zealand*

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:
Sahar Firoozkoohi is currently pursuing her PhD at Lincoln University, Department of Pest-management and Conservation. She completed a masters in Iran where she looked at the structure, composition and configurations attributes of the cultural landscapes through using landscape ecology. Sahar is investigating the role of urbanisation and human activities on birdlife through studying morphological, behavioural traits and genetic variations among urban-rural populations and how the study of invasions can help to inform our understanding of applied problems, such as extinction, ecosystem function and the response of species to climate change.

Understanding the demographic, ecological, and evolutionary processes resulting from urbanisation is an essential goal in conservation and evolutionary biology. Little is known about the responses of most birds to human disturbance despite many being sensitive to habitat disruption. The colonisation of urban environments by birds has been related to their inter-individual variability in their fear of humans, measured as their flight initiation distance (FID) to an approaching human, such that urban life would select for fearless individuals. This behaviour has been demonstrated to be heritable and highly consistent throughout the adult lifespan of blackbirds (*Turdus merula*) and song thrushes (*Turdus philomelos)*. Here, we tested how birds distributed across an urban-rural gradient respond to human disturbances by calculating (FID), start distance (SD), the direction of movements, and response behaviour to potential risk, as well as sex and age differences. Data were collected from the Wellington and Canterbury regions at sites along a gradient of human density. Our preliminary results support out hypothesis that the flight initiation distance of urban birds was on average more than 10 m closer than rural birds, maybe as a consequence of the local adaptation during colonisation of urban areas as well as the different ecological environment encountered by individuals. We hope to next untangle the relative contributions made by genetics and learning to such urban-rural differences. These findings have potential to expand understanding of eco-evolutionary feedbacks and may provide insights for maintaining ecosystem function over the long term.

The future of parentage analysis: From microsatellites to SNPs and beyond

Dr Sarah Flanagan[1], Professor Adam Jones[2]

[1]University of Canterbury, , New Zealand, [2]University of Idaho, Moscow, USA

Next Generation on Next-Generation Sequencing Symposium (I), Stewart Theatre 2, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Dr Sarah Flanagan is a Lecturer at the University of Canterbury. She studies the evolution of multivariate traits (such as mating displays), primarily using population and quantitative genetics, genomic datasets, and simulation modeling. In her empirical work, she has mainly focused on pipefish and seahorses.

Parentage analysis is a cornerstone of molecular ecology that has delivered fundamental insights into behaviour, ecology and evolution. Microsatellite markers have long been the king of parentage, their hypervariable nature conferring sufficient power to correctly assign offspring to parents. However, microsatellite markers have seen a sharp decline in use with the rise of next-generation sequencing technologies, especially in the study of population genetics and local adaptation. The time is ripe to review the current state of parentage analysis and see how it stands to be affected by the emergence of next-generation sequencing approaches. We find that single nucleotide polymorphisms (SNPs), the typical next-generation sequencing marker, remain underutilized in parentage analysis but are gaining momentum, with 58 SNP-based parentage analyses published thus far. Many of these papers, particularly the earlier ones, compare the power of SNPs and microsatellites in a parentage context. In virtually every case, SNPs are at least as powerful as microsatellite markers. As few as 100–500 SNPs are sufficient to resolve parentage completely in most situations. We also provide an overview of the analytical programs that are commonly used and compatible with SNP data. As the next-generation parentage enterprise grows, a reliance on likelihood and Bayesian approaches, as opposed to strict exclusion, will become increasingly important. We discuss some of the caveats surrounding the use of next-generation sequencing data for parentage analysis and conclude that the future is bright for this important realm of molecular ecology.

Distribution and upper altitudinal limits of invasive small mammals in a mountainous drylands tussock environment

Nicholas Foster[1]

[1]*University of Otago, Dunedin, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Nick Foster is a PhD candidate at the University of Otago. Nick comes from a background of threatened species management and optimisation of camera trapping methodology for marsupials.

Invasive small mammals exploit a wide range of New Zealand's terrestrial ecosystems and pose the single most significant threat to native biodiversity and threatened species. Several invasive species are known to inhabit New Zealand's upland and alpine areas, yet how these species are distributed and how their abundances in these areas differ to other habitat types is not well understood. Programs that aim to suppress or eradicate invasive species in these extensive and complex areas demand that resources are used to achieve the highest conservation outcome per dollar and require an advanced understanding of invasive species distributions. Furthermore, knowledge of altitudinal limitations of invasive species may present opportunities to use high-altitude landforms as barriers to reinvasion, and thereby improve the efficacy of supressing or permanently removing invasive species in such landscapes.

This project employed a variety of concurrently-deployed detection devices (camera traps, tracking tunnels, chew cards and plastaline eggs) to explore the distribution of invasive small mammal species across an altitudinal gradient (550-2300 m a.s.l.) in four areas in the upper Mackenzie Basin in South Canterbury. We found distinct patterns in the altitudinal distributions and habitat selection of nine invasive small mammal species. We identified ostensible upper altitudinal limits of several species which may be exploited to isolate populations of pests with the topographic features present in New Zealand's Southern alps. These findings provide the first investigation of invasive small mammal distributions across a wide altitudinal gradient and identify promising opportunities to integrate landscape barriers in pest management strategies.

Trophic consequences of evolutionary thermal adaptation in a freshwater predator

David Fryxell[1], Finn Arnesen[2], Michael Kinnison[3], Eric Palkovacs[2], Kevin Simon[1]

[1]University of Auckland, , , [2]University of California Santa Cruz, , , [3]University of Maine, ,

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

David completed his honours in biology at the University of Connecticut, USA. He recently finished his Ph.D. in Ecology and Evolution at the University of California Santa Cruz. He is currently a postdoc funded by a Marsden award to his advisor Kevin Simon, that is largely an extension of his Ph.D. research. He is looking for another postdoc position!

Predator functional traits are likely to evolve in response to current ecosystem warming, but the trophic consequences of this evolution have not been tested. We evaluated this hypothesis using mosquitofish (*Gambusia affinis*) from a common source population recently (<100 yrs) used to establish populations across a unique geothermal spring gradient. Each spring population comprises individuals experiencing a remarkably constrained and stable temperature regime, with little possibility of gene flow from other temperatures. Consistent with selection against large size and fast growth at higher temperatures, wild-caught fish from warmer sites showed constrained maximum body sizes and relatively low fecundity at large sizes. When reared in a common environment to reveal any recently evolved trait differences, warmer-source populations expressed increased size-specific reproductive effort and decreased somatic growth rates. When these common-reared fish were introduced to pond mesocosms, warmer-source populations exhibited stronger top-down effects on prey. These results suggest that increased temperature causes the evolution of increased reproductive effort, decreased somatic growth rates, and increased feeding rates. These evolved responses in predators have cascading ecological consequences that should be accounted for in ecological forecasting efforts.

Is seed predation a limiting factor to invasion by Pinus radiata and its hybrid in Canterbury high country?

Robert Gibson II[1], Dr. Sarah Wyse[1], Dr. Jon Sullivan[2], Professor Philip Hulme[1]

[1]Bio-Protection Research Centre, Lincoln University, Lincoln, New Zealand, [2]Department of Agriculture and Life Science, Lincoln University, Lincoln, New Zealand

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Rob is a 2nd year PhD candidate with the Bio-Protection Research Centre at Lincoln University. He is interested in species interactions and their role in plant population dynamics. His research investigates how climate, microhabitat and biotic interactions limit the establishment of Pinus radiata and its hybrid along an elevation gradient to enhance species risk assessments and future management regimes for wilding conifers.

Wilding conifers, non-native conifers that establish, disperse, and self-perpetuate, are a growing concern to the conservation and function of native New Zealand ecosystems. The most widely utilized and distributed conifer is *Pinus radiata*, which is well adapted to the climate of New Zealand yet generally assumed non-threatening at higher elevations due to its low cold-tolerance. Recognized as the top forestry species, *P. radiata*'s distribution is expected to increase over the next decade with the establishment of additional Crown Forestry plantations and the continuation of the One Billion Tree programme. The fate of *P. radiata* seeds dispersed throughout higher elevations is unknown. Studies on *P. radiata* seed fate are few throughout New Zealand with emphasis on seed emergence, while the impact of seed predation prior to emergence is rarely tested. To assess seed predation, we conducted a field cafeteria trial comparing the rate and proportion of *P. radiata* seeds removed by vertebrates and invertebrates in different microhabitats, shrubs, tussock grasses, and low-growing inter-tussock areas, at six sites in Canterbury. Sites spanned an elevation gradient from 600 – 1100m a.s.l. We also assessed seed predation on the more cold-tolerant hybrid, *P. radiata* × *P. attenuata*, which has recently been developed for expansion of economical plantations to higher elevations. Overall, no seed preference was found between taxa, while removal was significantly different among microhabitats and predator guilds along the elevation gradient. Our findings suggest seed predation by vertebrates may be a limiting factor to invasion at low (600m) and high (1100m) elevations in Canterbury.

How do on-farm constructed wetlands shape up for enhancing native biodiversity?

Dr Brandon Goeller[1], Mr James Sukias[1], Dr Chris Tanner[1], Dr Bev Clarkson[2]

[1]NIWA, Hamilton, New Zealand, [2]Manaaki Whenua - Landcare, Hamilton, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Brandon Goeller is a post-doctoral Riparian and Wetland Scientist at NIWA, Hamilton. Brandon's research interests include designing and implementing stream rehabilitation tools to attenuate diffuse pollution and boost key ecosystem functions in agriculturally-impacted waterways. These tools include riparian buffers, constructed wetlands, and woodchip bioreactors. To inform the appropriate selection, siting, and scaling of these tools, Brandon is also involved in NIWA research to map contaminant transport flow paths intercepted by agricultural waterways.

Constructed wetlands (CW) designed to treat diffuse sources of agricultural pollution commonly focus on water quality goals (e.g., water storage, nutrient transformation, sediment capture, etc). While CW have been proven to improve water quality, there is little evidence showing how they might achieve a broader range of habitat diversity and biodiversity goals. These wider goals are the aim of a new concept, 'integrated constructed wetlands' (ICW). To inform the design of ICW, we are conducting a standardised, rapid assessment of five established agricultural CW in the Waikato to determine how ICW might enhance biodiversity in pastoral landscapes. This work complements a larger, multi-year ICW research project led by Manaaki Whenua - Landcare Research, where final biodiversity outcomes are unlikely to be apparent until several years after wetland plantings have been completed. The wetlands we are surveying span a range from low planting diversity, small size, and few hot spots for biodiversity, up to wetlands with high planting diversity, large size, and nearby hot spots for biodiversity (e.g., lakes, river corridors, native bush fragments). Our sampling encompasses vegetation surveys, aerial drone mapping, bird call recordings, tracking tunnels, camera trapping, terrestrial and aquatic invertebrate sampling, and fish trapping. To determine which CW and landscape features are key for enhancing biodiversity, we will use a semi-quantitative scoring system to compare biodiversity across wetlands. Our results should reveal critical values or thresholds associated with high biodiversity and landscape elements which should be incorporated into ICW to achieve both water quality and biodiversity goals.

Biocontrol-driven evolution in a New Zealand pasture pest

Dr Stephen Goldson[1,2], Mr Morgan Shields[2]

[1]AgResearch and Bioprotection Res Center, Lincoln, New Zealand, [2]Bioprotection Res Center, Lincoln, New Zealand

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

Stephen Goldson, with some interruption, has worked for many years on pest population ecology and damage potential in New Zealand pastures. He was also the Executive Director of Better Border Biosecurity (2010-13) and is now a Principal Scientist in AgResearch, Professorial Fellow at Lincoln University and Deputy Director of the Bio-protection Research Centre. He is currently focused on pest rapid evolution in New Zealand's pasture ecosystems resulting from very high selection pressures by introduced parasitoid biological control agents.
He has variably worked for central government as a science adviser/strategist.

This contribution discusses to the lack of invertebrate functional diversity in New Zealand's pasture ecosystems, which accounts for the low levels of biotic resistance to exotic invasive species. Indications are that the indigenous natural enemy fauna stays put, hence the recurring exotic pest outbreaks. Conversely, the low levels of natural enemy intensity have also meant that three introduced *Microctonus* spp. parasitoids, active against three major weevil pest species, have been very effective, presumably through their own enemy release.

However, this triumph has been such that selection pressure was so high that resistance has occurred in the Argentine stem weevil in response to the parthenogenetic braconid wasp *Microctonus hyperodae*.

Recent investigation has shown that enhanced evasion behaviour by weevil populations in the presence of the parasitoid is the most likely source of this observed resistance. Furthermore, investigation has indicated that the intensity of this response is very strongly affected by the latitude from which the test-weevils are collected; far stronger in Hamilton weevils than those from Dunedin. Evidence is therefore pointing to resistance being driven by extent of accumulated heat above the parasitoid's activity threshold of 10^{o}C during summer-autumn.

While the mechanism of resistance has been found, what actually causes it has yet to be determined. Genotyping is underway in order to discern any genetic changes in the weevils since parasitoid's release. Furthermore, the extent of any changes in Hamilton weevils will be compared to those from Dunedin.

Effect of Seriphium plumosum densification on grassland biodiversity in the Mpumalanga Province of South Africa

Mrs Susannah Cleo Graham[1,2], Dr Hanneline Smit-Robinson[2,3], Dr Alan Barrett[1,2], Prof Leslie Brown[1,2]
[1]University of South Africa, Johannesburg, South Africa, [2]Applied Behavioural Ecology & Ecosystem Research Unit, Johannesburg, South Africa, [3]BirdLife South Africa, Johannesburg, South Africa

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Susannah Graham is a junior lecturer in the Department of Environmental Sciences, Nature Conservation. She obtained her MSc in Nature Conservation looking at how Bankrupt bush densification affects biodiversity. She is involved in various collaborative research projects in the field of plant ecology throughout South Africa. Current projects involve vegetation ecology and animal behaviour research in Loskop Dam Nature Reserve and Telperion Nature Reserve. Her research interests include biodiversity, climate change, veld management, fire ecology, restoration, long-term monitoring, wetlands and plant-animal interactions. She also founded the UNISA & Rural, Environment & Agricultural Development (READ) Bankrupt bush (Seriphium plumosum) Working Group.

Mesic Highveld Grassland is important for biodiversity conservation, but is threatened by densification of the dwarf shrub *Seriphium plumosum*. This indigenous encroacher spreads rapidly and outcompetes other herbaceous species in disturbed grassland vegetation. This study investigated the effect of different *S. plumosum* densities on grassland biodiversity, species composition and vegetation structure within Telperion, Mpumalanga, South Africa. An assessment of the vegetation, small mammals and birds within three grassland sites with various *S. plumosum* densities were undertaken. The results indicate that *S. plumosum* at high densities negatively affect diversity of small mammals and birds together with vegetation composition and structure. Certain bird and small mammal species were found to prefer or avoid dense *S. plumosum.* Generalist species may exploit the altered habitat, whilst specialised species will decline in number. The presence of *S. plumosum* at low densities is considered an integral part of the environment. It is however, important that areas where *S. plumosum* occurs are monitored. An increase in density of *S. plumosum* as a result of degradation, could negatively affect the biodiversity, species composition and structure of the habitat. The results of this study provides valuable information for land owners, conservation management and policy makers about the effects of *S. plumosum* densification on biodiversity.

Developing tools for building engagement and social licence in response to myrtle rust

Dr Andrea Grant[1], Dr Will Allen[2], Dr Dean Stronge[3], Karen Bayne[1], Simon Wegner[1], Dr Tarek Soliman[3]

[1]Scion, Christchurch, New Zealand, [2]Will Allen and Associates, Christchurch, New Zealand, [3]Manaaki Whenua Landcare, Hamilton, New Zealand

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (II), Stewart Theatre 2, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Dr Andrea Grant is a social scientist and completed a PhD at Charles Sturt University in communicating biosecurity risk. She has a multidisciplinary background in social studies of science, natural resource management and rural sociology. Andrea has conducted research with communities and the public sector in areas of floodplain management, conservation and disaster volunteering, agricultural and conservation biosecurity and climate change adaptation. She has presented her work at several international conferences and published as an interdisciplinary researcher in Rural Sociology, Environment and Planning C, Systemic Practice and Action Research, and Forests.

Developing tools for building engagement and social licence in response to myrtle rust

Successful biosecurity and plant disease management is inherently a collective endeavour. Policymakers and agencies cannot address New Zealand's biosecurity challenges without significant good will and collective action from land managers and a whole range of publics. Agencies need tools for effectively engaging communities and building biosecurity social licence to operate. Myrtle rust provided a rich bed for learning about how communities respond to biosecurity risk. An appreciation of myrtle rust impacts and response operations was built from the perspective of those interested, impacted and involved in response operations. A programme of social research drew upon these experiences and relevant international learnings to support an understanding of the key elements required for maintaining social licence to operate and for developing effective cross-sector partnerships for biosecurity. Further analysis of the New Zealand experiences produced a set of personas and a values-based scale for examining diverse community responses to various management options including seed collection, plant movement restrictions, chemical treatments and restricted site access. This research has underpinned the development of a set of tools and accompanying process guidance that can be used by agencies and their stakeholders to support mutual learning and relationship building with communities for biosecurity and plant disease management. [WC 200]

A new method for assessing Beech mast in NZ.

James Griffiths[1]

[1]DOC, Nelson , New Zealand

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

James works as a plant and animal pest ecologist for the Department of Conservation in Nelson, New Zealand.

Beech (*Fuscospora* and *Lophozonia* spp.) are a dominant component of New Zealand upland forests at latitudes > 38° south and are an important ecological driver. Large beech seedfall events called "masts" are associated with increased native bird and invertebrate breeding but can also trigger irruptions of introduced rodents and mustelids that have negative impacts on native biodiversity. Conservation managers are interested in measuring and forecasting beech seed production so they know where and when to apply pest control pest control to prevent rodent and mustelid irruptions.

Here we present a new approach to quantifying beech seed production that involves counting seeds on beech branchlets snipped from a helicopter. The technique is very quick, elevation and latitudinal gradients are easily traversed, and all beech forest can be sampled within 2 months. We modelled beech seed counts collected using this method as a function of climate, topography and beech species. Models were fit using boosted regression trees and validated on a holdout dataset. As in previous studies, summer temperature two years and one year before seed production were important, but rainfall, latitude, elevation and beech species were also informative. The fitted model explained >70% of the variation in seed counts in the holdout dataset and can be used to produce accurate national beech mast forecasts to meet the needs of Conservation managers.

Behaviour of invasive ship rats, Rattus rattus, around self-resetting traps

Markus Gronwald[1]

[1]*University of Auckland, Auckland, New Zealand*

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

I am currently a PhD student at the University of Auckland studying the behaviour of invasive rats around control devices with a focus on rats in low abundance. I am interested in behavioural responses to rat management and the influence of interspecific competition on rat behaviour. Camera traps are used in all parts of my study to analyse behaviour and monitor abundance of invasive rats on islands. My study aims on understanding behaviour to improve rat control and eradication programmes.

Invasive ship rats (*Rattus rattus*) are the major threat to the native species and ecosystem of Goat Island (9.3 ha), New Zealand. In December 2015 a grid of 8 kill traps (DOC200s) was installed across the island to manage rat numbers. In June 2016 we extended the trapping grid with 10 self-resetting traps (GoodNature A24s), monitored with motion-activated cameras and trigger counters. All devices were checked approximately monthly until November 2017. Data on rat abundance from the kill trapping devices were consistently low. The number of animals killed by the self-resetting traps varied among months and peaked in summer. The videos reveal high rat activity on the island, which reduced over time, with the highest number of interactions happening in the first months after installing the self-resetting traps. The rats showed interest in the self-resetting traps and interacted with them when rat abundance was high, resulting in deaths, but along with the kill traps (i.e. two devices per hectare) the number of rats killed was insufficient to offset intrinsic population growth and reinvasion from the adjacent coast, and hence achieve eradication on the island. Size selectivity is potentially an issue for both traps as young rats were not observed being killed. Self-resetting devices at one per hectare did reduce rat numbers in an area where kill trap maintenance was time and cost intensive, but maintaining very low rat numbers or achieving eradication requires additional refinement of the system (e.g. a combination of different tools or a higher density of devices).

Optimising enrichment planting during urban forest restoration in the Central North Island

Miss Monique Hall[1]

[1]*University of Waikato, ,*

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

I am an MSc (Research) student, majoring in Ecology and Biodiversity at the University of Waikato. After finishing school in Hamilton, I spent five years travelling internationally and working which eventually saw me return to Raglan to study. While completing my BSc in biology, I became passionate for ecology. During the summers of 2018 and 2019, I received university research scholarships. In 2018, I studied New Zealand's only fully parasitic plant, Dactylanthus taylorii, on Mount Pirongia and in 2019 I studied urban forest restoration ecology, leading me to my current MSc research with Dr Kiri Wallace and Prof Bruce Clarkson.

Forest ecosystem restoration is an important area of study within ecology because it provides knowledge about re-establishment following damage. Restoring damaged forests is important for the provision of ecosystem services, such as conserving endangered species, improving water and air quality, and mental health benefits for people. To maximise benefits from forest restoration, a goal is to recreate a self-perpetuating ecosystem. Success in this regard is indicated by the establishment of late-successional plant species which is reliant on closed forest canopy conditions. Re-establishment normally occurs naturally through passive seed dispersal over a long period of time but can be catalysed by enrichment planting. In fact, the passive establishment of late-successional species often does not occur spontaneously in cities because these forests are fragmented and isolated. It is, therefore, crucial to conduct enrichment planting in the urban areas being restored. There is little research done on the establishment through enrichment planting of late-successional species in urban forests. This study investigates the best conditions for enrichment planting of environmentally sensitive late-successional native plant species within restored urban forest environments. Study sites are in twenty-seven urban forests across Hamilton, Napier and New Plymouth, that span an age gradient ranging 5-47 years since planting from scratch. The three late-successional species planted are Rimu (*Dacrydium cupressinum*), Kawakawa (*Piper excelsum*) and Puka (*Griselinia lucida*). The objective is to study their establishment success through mortality and growth, and relate to weed competition, air and soil temperature fluctuations and light availability across the different forest restoration ages.

Hotspots and habitat associations of urban mammals: mice, rats, cats, possums and hedgehogs

Associate Professor Stephen Hartley[1], Cherie Balls[1], Neil Fitzgerald[2], John Innes[2], Kim Miller[4], Hayley Ricardo[3], Yolanda van Heezik[4], Deborah Wilson[3]

[1]Victoria University of Wellington, Wellington, New Zealand, [2]Manaaki Whenua, Hamilton, New Zealand, [3]Manaaki Whenua, Dunedin, New Zealand, [4]University of Otago, Dunedin, New Zealand

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Stephen Hartley is an Associate Professor with broad research interests in conservation and restoration ecology of urban, rural and wilderness landscapes. He is director of Victoria University of Wellington's Centre for Biodiversity and Restoration Ecology, and a member of the "People, Cities and Nature" research team.

Introduced mammals have long been the focus of ecological study in New Zealand forests and rural grasslands, however their habits in urban New Zealand have been largely unstudied. We present data on the detection rates of rats, mice, hedgehogs, possums and cats from 720 tracking tunnels and 144 camera sites deployed across 5 New Zealand cities in residential gardens, urban bush reserves and amenity grassland. Tracking rates of rats, mice and hedgehogs were fairly similar across all urban habitats studied, possums were positively associated with urban forest patches and cats were much more visible in residential gardens. Comparing across cities, possums and hedgehogs were most commonly detected in Dunedin; rat tracking rates were higher in the northern cities of Tauranga, New Plymouth and Hamilton. We discuss the extent to which current management by communities and councils may be effective in reducing the abundance of introduced mammals.

Tree survival, growth, sequestration and natural regeneration of a Wairarapa swamp forest restoration project.

Associate Professor Stephen Hartley[1], Benoit Magat[2], Aurore Fanal[3], Manon Helluy[2]

[1]Victoria University of Wellington, Wellington, New Zealand, [2]AgroSup Dijon, Dijon, France, [3]Gembloux Agro-Bio Tech, University of Liège, Gembloux, Belgium

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Stephen Hartley is an Associate Professor with broad research interests in conservation and restoration ecology of urban, rural and wilderness landscapes. He is director of Victoria University of Wellington's Centre for Biodiversity and Restoration Ecology and has been collaborating with the Wario Wetland Restoration Trust since 2011.

Growth and survival of c.2000 native tree and shrubs (n = 8 species) has been monitored annually since 2011 when woody vegetation was planted as part of a wetland restoration at Wairio Wetland near Lake Wairararpa. After eight years, mānuka and cabbage trees had the highest survival rates (52-56%), kahikatea and tōtara had survival rates of 41-48%. Allometric and volumetric equations were used to estimate carbon sequestration rates. *Pittosporum tenuifolium* and *Olearia virgata* sequestered the most carbon over the eight years (7.4 and 5.1 kg per tree, respectively) and kahikatea and tōtara the least (0.1 to 0.8 kg per tree). At initial planting densities of 4440 trees per hectare (1.5m spacing), similar planting projects bordering ephemeral wetlands in the lower North Island using the same species mix may expect to sequester 33 tonnes of CO_2 per hectare in the first eight years. More importantly, the eight year old mānuka and *Pittosporum tenuifolium* at Wairio have shaded out tall fescue grass and created conditions in which natural regeneration of kahikatea and tōtara can begin.

Nitrogen stable isotope depth profiles in a seabird forest soil, and contextualization into non-seabird systems

David Hawke[1]

[1]*Ara Institute of Canterbury, Christchurch, New Zealand*

Ecosystem Services, Conference A/B, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

David Hawke is an environmental chemist, with particular interests in landscape-scale cycling of nutrients and

in data quality. As such, he works at the interface between ecology, geochemistry and analytical chemistry. Much of his work involves stable isotopes of carbon and nitrogen. His PhD came from University of Otago and was followed by post-doctoral work at University of Miami and University of Canterbury.

Recent conceptualisations of nutrient cycling in non-seabird forest soils have emphasised the role of mycorrhizal associations, with characteristic depth dependencies of soil $^{15}N/^{14}N$ ratios. Forests dominated by arbuscular mycorrhizal associations and a relatively high N status show a steady decline in $\delta^{15}N$ values with depth below the litter layer, and losses are dominated by leaching of inorganic N. In contrast, forests with lower N status dominated by ectomycorrhizal associations show steady increases in $\delta^{15}N$ values with depth and N cycling is dominated by organic N. Furthermore, an ample supply of nutrients tends to suppress soil fungi in favour of bacteria.

Seabirds contribute copious amounts of marine N and P to their breeding colony soils, but turnover rates are high and the enhancement of total soil nutrient concentrations is surprisingly small. Although stable isotope data in soils have been published from many petrel breeding sites, few have included depth dependence. Based on the characterisations from other sites, I predicted that the nutrient-rich status of forested seabird sites would result in a steady decline down-profile in soil $\delta^{15}N$. Soil profile data from a Westland petrel (*Procellaria westlandica*) colony on mineral soil (n=5 profiles) did not support this hypothesis. Instead, soil $\delta^{15}N$ values remained constant with depth even as soil N concentrations declined.

I conclude that the seabird forest soil profile results define a third class of soil N cycling, and propose that this class would have been common in seabird-rich pre-human New Zealand.

Why did the kiwi cross the road?

Mr Sam Heggie-gracie[1]

[1]*Tonkin + Taylor , ,*

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Sam undertook an MSc at the University of Auckland in urban bird composition before working at Auckland Council as a graduate ecologist. He has now worked as an ecologist for Tonkin & Taylor for two years, working with a variety of clients in such sectors as transport, energy and housing. Sam is passionate about delivering positive environmental outcomes for our birds, bats, lizards and plants, especially given the current pressures of increasing population growth and environmental change in New Zealand.

Heggie-Gracie, S. & Mt Messenger Alliance

Why did the kiwi cross the road?

Roads, developments and other large construction projects can have adverse effects on flora and fauna. One such adverse effect is fragmentation, the division of habitat areas into increasingly small parcels, which can result in the loss of ecological connectivity for plant and animal populations. Fragmentation impacts can be especially pronounced for species which have limited dispersal ability, such as kiwi, which require landscape connectivity for territorial, breeding and feeding purposes.

The Mt Messenger Bypass is a proposed six kilometre road north of New Plymouth, being constructed to increase safety and efficiency for motorists driving SH3. The proposed road has been selected to minimise impacts to the ecology of the area, however it nonetheless passes through native forest and North Island brown kiwi (*Apteryx mantelli*) habitat. In order to minimise impacts to kiwi, extensive surveying and tracking has been undertaken to determine the number of kiwi that may be affected, and the size of their territories. Once construction begins, kiwi will be tracked daily to safeguard kiwi from adverse construction effects. Exclusion fencing, road signage and kiwi culverts will be used to further protect kiwi. To determine the effectiveness of kiwi culverts in providing connectivity between the forests either side of the road, trail cameras will be deployed. It is expected that in combination with intensive pest control, such measures shall minimise impacts to kiwi as a result of the road, and ensure they retain connectivity throughout the landscape.

Black mudfish in a novel situation: culverts, construction and management methodology adaptation.

Ms Andree Hickey-Elliott[1]

[1]*Tonkin & Taylor Ltd, Hamilton, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Andree is an Ecologist having over four years experience in the Industry, having completed a BSc in Zoology and Ecology and a Master of Environmental Management at Massey University. Andree has experience and knowledge in:

- Freshwater ecosystems and management (including fish, invertebrates and aquatic habitat);
- Indigenous avifauna and management (survey, and management);
- Lizard management (survey, management, and monitoring);
- Restoration (mitigation / offset and compensation: vegetation, stream & freshwater, pest animal and weed management).

Andree is enthusiastic about our native flora and fauna and enjoys discussing New Zealand ecology.

The Waikato Expressway Hamilton Section, currently under construction, lies on the outskirts of Hamilton and traverses many waterbodies. Some existing culverts installed as a part of the adjoining Ngaruawahia Section of the Expressway, require CCTV imaging to confirm structural integrity before the road can be considered usable. However, these 60 m long /1.3-1.5 m diameter culverts have reportedly become home to black mudfish (*Neochanna diversus*), classified as At Risk - Declining (Dunn et al 2018). The culvert habitat makes mudfish management complicated as Health and Safety and physical constraints make traditional management options difficult to apply.

The Project has a Fish Management Plan (FMP), and Mudfish Management Plan (MMP), which require waterways to be fished following specific protocols, before instream works can occur. In this case, this includes several streams within very long culverts.

This novel situation require considerable pre-fishing planning and method consideration to balance risk and best practice management for mudfish.

We considered several scenarios to determine the most appropriate method to ensure the best outcome possible for the mudfish, whilst adhering to management plans

I will present the different method options considered and the preferred fishing method. I am interested in feedback and suggestions.

Repeated patterns of climate adaptation during range expansion in an invasive plant

Kathryn Hodgins[1]

[1]*Monash University, ,*

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

Kay Hodgins is a Senior lecturer at Monash University in the field of Ecological Genomics. She conducted her PhD at the University of Toronto and continued as a Postdoc at the University of British Colombia. She uses ecological and population genomic approaches to understand the genetics of local adaptation.

Local adaptation is a common feature of many species, yet its genetic and molecular basis is still poorly understood. Research on the genetic basis of adaptation increasingly focuses on the speed and repeatability of genomic and phenotypic adaptation and the effect of genomic architecture on evolutionary response. Unravelling such processes could provide insight into the predictability of adaptive shifts, key in the face of on-going environmental change. We used samples of the invasive weed *Ambrosia artemisiifolia* (common ragweed) across its widespread native North American and the non-native European and Australian ranges and combined phenotypic, genomic and environmental data. We explored neutral variation in molecular markers at a global scale, conducted phenotype-environment, genotype-environment and genotype-phenotype associations to examine signatures of natural selection experienced during multiple range expansions. Our results provide strong evidence for rapid local adaptation on a phenotypic and genomic level, where repeated patterns of adaptation evolved in <100 generations. Even though genetic variation and patterns of linkage disequilibrium were distinctly affected by alternative demographic histories, adaptive divergence was seemingly undeterred during range expansion.

Utilising UAV technology for radio-tracking fauna

Kathryn Longstaff[1]

[1]*Tonkin + Taylor, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Kathryn is an ecologist who has undertaken consulting roles across Australasia. Her expertise is reflected across a diverse range of projects providing ecological services for a variety of public and private clients. She specialises in native fauna and is driven to find pragmatic solutions for successful management of our unique wildlife and ecosystems.

Radio-tracking fauna is a common task in species management, to monitor fauna and research their behaviour, habitat preferences, and spatial and temporal distribution. Ground-based radio-tracking is compounded when the target fauna species is highly mobile and/or the terrain is vast and/or difficult. When faced with these challenges the traditional route has been to use helicopters to radio-track highly mobile fauna from the air, at considerable cost and logistic inputs.

Unmanned Aerial Vehicles (UAV – commonly referred to as drones) is a technological development enabling aerial applications with greater accessability to people, both in terms of cost and operation, particularly in comparison to engaging traditional helicopter or fixed-wing craft.

The modification and development of a UAV to become an aerial radio-tracking device, enables transmitter signals to be relayed to ecologists on the ground. The 'radio-tracking drone' has been used successfully to radio-track fauna in wide, remote, densely forested, steep, and heavily dissected landscapes.

The benefits of adopting the 'radio-tracking drone' approach include sizeable reductions in cost and time resources, the ability to reach desired 'height is king' for radio-tracking in a relatively short time, improvements in health & safety concerns in remote dense bush in steep bluff and gut terrain, ability to mobilise the ecology team rapidly, and considerable efficiencies in locating fauna.

Tau humi mō karoī (year of abundance for kahikatea)

Clayson Howell[1], James Griffiths[1]
[1]*Department of Conservation, Wellington, NZ*

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:
Clayson is a Science Advisor in the Biodiversity Group at Te Papa Atawhai - Department of Conservation. He works on understanding the impacts and management of invasive pests.

Kahikatea (*Dacrycarpus dacrydioides* (A.Rich.) de Laub.) is a tall forest tree endemic to New Zealand that has been long known to produce highly variable annual crops of fruit (karoī) and seed. Kahikatea forests are much less extensive than they were 300 years ago, but within remnants, large karoī crops are important as they provide abundant food for birds and likely drive population increases in invertebrates and rodents. Unlike other mast-seeding species, there has been scant investigation into the climate drivers of seed production in kahikatea. We used climate parameters to investigate karoī abundance at seven monitoring locations across New Zealand over 10 years. The delta-T model was tested for fit with the counts of karoī in fixed traps. Boosted regression trees were used to develop estimates for a wider range of climate parameters. The best model was identified by iteratively dropping parameters from the model. Tau humi mō karoī (year of abundance) are best predicted by warm and dry summers one year prior to seedfall and cold summers two years prior. Kahikatea responds to broadly similar climate parameters as other New Zealand forest trees that initiate and ripen seed within 18 months. But, including rainfall parameters and using boosted regression trees improved the accuracy of predictions of withheld data. Karoī production will likely have important implications for management of rodent populations in lowlands. Better models will also enable accurate forecasts and planning for regional seed collection to support restoration.

Wild bees as crop pollinators in New Zealand: which ones and how should we approach managing them?

Dr Brad Howlett[1], Dr Barry Donovan[2], Mr Brian Cutting[4], Dr David Pattemore[3], Ms Samantha Read[1], Ms Melanie Walker[1], Mr Warrick Nelson[1], Ms Heather McBrydie[3], Dr Lisa Evans[3]

[1]The New Zealand Institute for Plant & Food Research Limited, Lincoln, New Zealand, [2]Donovan Scientific Insect Research, Lincoln, New Zealand, [3]The New Zealand Institute for Plant & Food Research Limited, Ruakura, New Zealand, [4]Plant & Food Research Australia, Brisbane, Australia

Ecosystem Services, Conference A/B, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

Brad Howlett has been researching the role of bee and non-bee insects as pollinators of many New Zealand crops for the past 16 years. He is particualrly interested in their pollination efficiency, their life histories and how they can be better managed.

It has been suggested that strategies to manage wild bees for crop pollination should focus on common species that are widespread across agricultural systems. But is this the best approach for New Zealand crop growers? We examined the actual and potential contribution of New Zealand's wild bee fauna as pollinators of fifteen exotic crops. Furthermore, we identify life-history constraints that may limit their effectiveness as pollinators of particular crops. In our assessment we included unpublished data alongside published data/information. We found 62% of the 42 native and exotic bee species visit the flowers of exotic crops with 24% proven pollinators. Moreover, the efficiency (measured as single visit pollen deposition or crop yields) of native *Leioproctus* species and introduced *Bombus terrestris* as crop pollinators were equal to honey bees across multiple crops. Other species were also found to contribute to the pollination of these crops. Instead of focusing management strategies on a few common wild bee species, our findings highlight the significant potential to improve the effectiveness of many species as crop pollinators in New Zealand. However, to optimise management strategies will require better documentation of bee species identity and understanding of their life histories.

Threats to physical habitat in braided rivers

Dr Jo Hoyle[1], Mr Jochen Bind[1], Dr Murray Hicks[1]
[1]NIWA, , New Zealand

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:
Jo Hoyle is a river geomorphologist in the sediment processes group at NIWA Christchurch. Jo has 17 years' research and consulting experience related to river geomorphology, sediment transport and how these impact ecological habitat. Jo has a particular interest in braided rivers. Jo is leading the 'effects of flow regime change on physical river characteristics' project under NIWA's Environmental Flow research programme, and is currently investigating the effects of flood harvesting and riverbed vegetation on river geomorphology.

New Zealand's braided rivers are highly valued natural landscapes, supporting high biodiversity and providing vital habitat for many native species. A key aspect of a braided rivers natural character is its ability to frequently rework its bed, preserving habitat quality and diversity. This is fundamentally controlled by flow regime, sediment supply and the degree of lateral confinement and vegetation cover. This talk will provide an overview of how these factors interact to influence the geomorphology of braided rivers and describe three current threats to the natural character of braided rivers.

Agricultural encroachment into braided river margins is a key issue, reducing braidplain width and a river's ability to adjust laterally. Regional councils have policies in place which outline permitted activities within the river bed and these are intended to protect braided river margins. However, the definitions of 'river bed' under the Resource Management Act do not adequately incorporate the area required to maintain braided river dynamics.

Vegetation encroachment is another issue, with many braided rivers now home to a suite of invasive exotic plant species. These weeds grow rapidly, not only reducing the area of bare gravel preferred as nesting habitat by many threatened bird species but also resulting in fewer, deeper and more stable braids.

Water is in demand for hydropower and irrigation, with a relatively recent move towards increased flood harvesting. This threatens to reduce bed mobility and alter river morphology. It is also hypothesised that flood harvesting may increase fine sediment deposition in these rivers.

The Structure, Survivorship, and Growth rate of Auckland Street Trees

Miss Sandy Huang[1], Dr Bruce Burns[1], Dr Margaret Stanley[1]
[1]*University of Auckland, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Sandy Huang is currently undertaking her MSc (Biosecurity and Conservation), after completing a BSc (Biology and Statistics) and PGDipSci (Biosecurity and Conservation) at the University of Auckland. Her master's research evaluates the current value of Auckland's street trees, in order to maximize its future integration and potential. Sandy is interested in urban ecology, and environmental management in a human-dominated landscape. She is also interested in terrestrial ecology, particularly improving degraded ecosystems through ecological restoration and management.

Intense urbanization in Auckland both constrains and highlights the significant environmental, social, and economic benefits of street trees. Tree planting currently forefronts major governmental plans, however effective implementation and management requires preliminary research into Auckland's standing urban forest. This study will determine Auckland's street tree structure, survivorship, and growth rate. We will evaluate tree condition, occupancy, species composition, and size distribution, and the relationship of street trees with their legacy city, suburb age, socio-economic characteristics, and soil type. Data collection will be conducted using existing tree inventories, and by surveying randomly sampled street units, stratified by the Auckland local boards. By assessing the current values represented by Auckland's street trees, we will be able to assess future opportunities. The findings can support managers in improving urban forest integration by making more informed decisions on what and where to plant. Furthermore, it can help develop strategies to maximize vegetation cover, biodiversity, and the provision of ecosystem services.

Alpine predator control and rock wren (Xenicus gilviventris) monitoring in the Makarora Catchment

Ms Rachel Hufton[1], Mr Anthony Coote[1]

[1]*Aspiring Biodiversity Trust, Wanaka, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Rachel is an experienced Ecologist and Ornithologist with over 15 years international experience; working as a county ecologist safeguarding local biodiversity for local government, as an environmental consultant on infrastructure schemes and a field project officer and ornithologist for NGO's. She is a certified member of the Chartered Institute of Ecology and Environmental Management (MCIEEM), has a Bachelor of Science in Ecology with Hons and has completed post-graduate studies in biological recording and ornithology.

The study is focused on two key alpine sites; the Crucible Basin within the Siberia Valley and the Upper Lucidus/Castalia Basin within the north branch of the Wilkin Valley. Rock wren monitoring transects were defined and surveyed for both sites during 2017/2018. The results of this survey work guided deployment of alpine invasive mammal traps and subsequent installation of Encounter Solutions Ltd (ESL) Celium remote trap monitoring technology to improve predator control trap servicing efficiency and provide additional information on predator movements.

Rock wren breeding pairs were identified at both sites during transect monitoring visits. Passerine banding is planned to help discriminate between different individuals when mapping the population and as output monitoring in terms of the trapping programme.

Both study site locations are with possible natural barriers to stoat movement. Crucible appears to experience less stoat activity possibly because of better naturally afforded physiographic barriers; topographically more confined at Crucible relative to Lucidus Castalia: possibly reflected in stoat kill.

Both study site locations have proximally located alternative habitats (cirques) to which rock wren dispersal is possible, these being the subject of further surveys and monitoring to help ascertain the current status of rock wren within the Makarora catchment area.

The ESL Celium remote monitoring has provided insight into the behaviour of invasive mammals in the alpine environment during the winter. This includes time of climate variation with capture.

This work provides additional information on rock wren within an area which has not previously been investigated at this effort level, alongside other study sites and contributes to overall knowledge to promote effective future conservation management for this nationally endangered species.

Does awareness of invasive freshwater plants mitigate the dispersal risk posed by lake users?

Professor Philip Hulme[1], Mr Sam Beaumont[2], Dr Paul Champion[3], Dr Daniel Clements[3]

[1]Lincoln University, Lincoln, New Zealand, [2]Ministry of Primary Industries, Wellington, New Zealand, [3]NIWA, Hamilton, New Zealand

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Philip Hulme is the Distinguished Professor in Plant Biosecurity in the Bio-Protection Research Centre at Lincoln University. His research focuses on the dynamics and impacts of invasive species, especially plants.

Recreational users of freshwaters (e.g. fishers, boat users etc.) are recognised as leading vectors by which alien plants are spread among lakes in New Zealand. To date no study has integrated information on the associations between awareness, mitigation and residual risk of different lake users, that might provide insights into more effective management of this introduction pathway. Using data from 1351 interviews of lake users across New Zealand to capture details of more than 1700 lake visits, we present the first comprehensive analysis of this pathway. The dominant lake users were water-skiers (27%), swimmers (21%) boat fishers (18%), jetskiers (10%) kayakers (7%) and lakeside fishers (5%) with other users including jetboater, sailors and hikers, less frequent. Awareness of alien plant species was high overall (78%) but with marked variation among user groups. In general, awareness was higher in users who had been directly affected by alien plants, particularly those whose equipment (fishers) or boat engines (jetboaters) were fouled causing negative associations. To derive an overall assessment of the risk posed by different users, data on distances travelled, likelihood of visiting invaded lakes, willingness to take action to prevent spread and the relative abundance of users were integrated. As a result, this study highlights that the highest risk to lakes is posed by powerboat users (water-skiers and boat fishers). This study recommends that awareness raising should better target boat users, particularly water-skiers, focusing on the impacts upon their leisure activity rather than biodiversity.

Beyond Myrtle Rust: Towards Ecosystem Resilience

Dr Renee Johansen[1], Dr Mahajabeen Padamsee[1]
[1]*Landcare Research, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Currently the Project Manager for 'Beyond Myrtle Rust', Renee recently returned to New Zealand having undertaken post-doctoral research in microbial ecology at Los Alamos National Laboratory in the United States. This work focused on microbial control over carbon cycling in soils. Prior to this, she completed a PhD on fungal biogeography through Auckland University, with support from Landcare Research and from Duke University. Her undergraduate studies are in ecology. Renee now looks forward to working with researchers throughout New Zealand to facilitate progress towards myrtle rust mitigation and ecosystem resilience.

Many of New Zealand's best-known, highly-valued native trees - pōhutukawa, rātā, mānuka - are in the plant group Myrtaceae. They urgently need protection from a recently-arrived exotic fungal disease called myrtle rust (MR), which can cause plant/tree death. The causal agent, *Austropuccinia psidii*, arrived in New Zealand from Australia via wind dispersal in 2017. Significantly, MR has never been eradicated from any country, despite significant effort to control its spread. MR has now been recorded throughout the North Island and is making inroads into the top of the South Island. It is probable that MR is now part of the story of New Zealand, and we have a narrow window of opportunity to reduce the disease's impact on our forested landscapes. This poster introduces the programme 'Beyond Myrtle Rust: Towards Ecosystem Resilience'. Hosted by Manaaki Whenua – Landcare Research, this multi-disciplinary multi-year research effort draws upon expertise from eight research institutions. It has four key interlinking elements: pathogen dynamics, ecosystem impacts, novel mitigation techniques, and Kaitiakitanga & Māori lead solutions. Laboratory, greenhouse, and field studies will be engaged. Altogether, this research will provide tools to engineer landscape resilience in the face of this serious threat. Through proactive stakeholder engagement, on-the-ground adoption of tools and techniques will be optimised. In addition, the approach provides a model for future responses to plant pathogen incursions into New Zealand.

Mapping beech flowering in New Zealand from Sentinel-2 satellite imagery

Dr Ben Jolly[1], Dr James Shepherd[1], Dr John Dymond[1]
[1]*Manaaki Whenua - Landcare Research, Palmerston North, New Zealand*

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:
Dr Ben Jolly is a Remote Sensing and Data Scientist at Manaaki Whenua – Landcare Research with a strong background in Engineering and a PhD in Atmospheric Physics. He is primarily involved with relating remotely sensed satellite data with ground-based observations with respect to land cover at a national scale. Part of this work involves the use of aerial and drone-based observations to help with up-scaling the primarily point-based ground data to make it easier to relate to satellite observations.

Mapping beech flowering in New Zealand from Sentinel-2 satellite imagery

We have developed temporal analysis methods for producing national maps of beech flowering. From a complete temporal sequence of Sentinel-2 imagery in indigenous forest areas, we can quantify excessive colouring associated with flowering. In beech forests this is proportional to the number of flowers and is an early indication of beech masting. We provided a national map of beech flowering for the 2018 spring to the Department of Conservation to assist with their pest control operations in this extreme masting year. Further work is required to relate the national flowering layers to measured seedfall in autumn and winter. Temporal analysis of Sentinel-2 satellite imagery should provide quantitative information on food resources (seeds and fruit) for pests over national scales. This is required for improved spatial modelling of pest populations.

Ecological restoration or population decimation? (Un)expected consequences of native fish restoration attempts

Dr Matt Kavermann[1]

[1]*Wellington Fish and Game, Palmerston North, New Zealand*

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

The disastrous impacts introduced terrestrial vertebrates have had on New Zealand's indigenous biota are well documented. However, the impacts of the 20 introduced fish species has been far less dramatic for native fish fauna. While it is acknowledged that several native fish species have experienced population reductions and range restrictions since these introductions, only one native species, the greyling, has become nationally extinct. For over 150 years, native and alien fish fauna have coexisted, and research is showing that some introduced species are now a fundamental part of modern ecosystems. Manipulations to these fish assemblages in the guise of adaptive management restoration attempts can have dramatic and deleterious impacts on indigenous fish communities. Here we critique the results of a fish removal experiment from a 7.5 ha shallow lagoon within the Lake Wairarapa wetland system. Over the two-year manipulation period, 240 kg of trout, perch and rudd were removed from the lagoon which correlated with a reduction in the catch rates of shortfin and longfin eel by 93% and 88% respectively ($\rho = 0.99$). Similar results have been published for perch removal experiments elsewhere in New Zealand, yet the authors claim the results were influenced by the weather. The impacts of the fish removal on piscivorous birds at the lagoon were not monitored. After four further years of taxpayer-funded fish suppression the only species with a meaningful population increase is the common bully. Predation pressure by introduced species on bully populations prior to the introduced fish removal was not explored.

While the introduction of over 70 terrestrial vertebrates has had a devastating impact on New Zealand's national biodistinctiveness, the impact of 20 freshwater fish introduced to our streams, rivers and lakes is less pronounced. Compared to the *43* terrestial extinctions since human colonisation, only one native fish, the greyling (*Prototroctes oxyrhynchus*) has become nationally extinct. Brown trout (*Salmo trutta*), arrived over 150 years ago their introduction, and subsequent protection under the Resource Management Act has played a key role in the protection of New Zealand's waterways and rivers. There is now a growing body of evidence that some of these introduced, whilst controversial, are playing key roles in supporting native species. A recent restoration attempt in a 7.5 ha shallow lagoon at Lake Wairarapa saw the removal of over 230 kg of trout, perch (*Perca fluviatilis*) and rudd (*Scardinius erythrophthalmus*) over a two-year period. This corresponded with a reduction in the catch rates of shortfin and longfin eel by 93% and 88% respectively. However, the researchers doggedly claimed the result was due to a weather event and not the removal of the introduced fish biomass. Four years later, the short fin eel population remains depressed and only the native bully () populations has shown any signs of increase. This is one example of paid consultant r

Mast seeding and climate change: are resources the answer?

Prof Dave Kelly[1], Juanita Miln[1], Samarth[1], Prof Matthew Turnbull[1], Prof Paula Jameson[1], Prof Richard Macknight[2]

[1]*University of Canterbury, Christchurch, NZ,* [2]*University of Otago, Dunedin, NZ*

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

Dave Kelly has worked on mast seeding at Mt Hutt for 33 years, though he can't say that was the original intention. Even more of a surprise is to now hear mast seeding discussed on the morning radio news, after some decades of having to explain to everyone what the term meant.

How mast seeding will respond to climate change is a very important question, since every *Nothofagus* mast year now requires the Department of Conservation to spend $15M protecting biodiversity, and there have been three of these masting events in the last 5 years (2014, 2016, 2019).

The answer depends on what mechanism controls large seed crops. Is it the delta-T (temperature difference) model, which suggests plants measure the temperature difference between successive summers? Or is it the alternative “last year’s temperatures plus resouces” model, under which scheme DT is just a proxy? These two models are superficially similar but make different predictions about the consequences of a warming climate.

To try and unveil the true mechanism, we report new data on the responses of alpine masting plants (*Chionochloa pallens* and *Celmisia lyallii*) to fertilizer applications, in low and high-flowering years (2018 and 2019). We also show some relevant results from RNA activity assays and long term observational studies.

Remotely sensing ecology: Assessing the habitat quality of braided river birds in southern New Zealand with high resolution aerial imagery

Mr Saif Khan[1]

[1]Otago University, DUNEDIN, New Zealand

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Currently a PhD student at Department of Zoology of Otago University. A forestry graduate with MSc in biology. A passionate conservationist with experience of working with IUCN, UNDP and FAO for several years. Has been a civil servant for Bangladesh Government for few years. Worked also as post graduate researcher at UNEP WCMC.

Braided river ecosystems provide breeding ground for several threatened native and endemic birds of New Zealand. Limited availability of expertise and resources have resulted in only partial, inconsistent and sporadic assessment and monitoring of these significant habitats of New Zealand birdlife. This research explored the applicability of high-resolution aerial image analysis for habitat quality assessment within braided river ecosystems. Aerial image with 5 cm ground resolution of Tasman River, Canterbury (~ 20 km) and a section of Aparima River, Southland (~ 10 km) was captured with a manned aircraft. Ortho-mosaics of these images were created by ArcGIS Pro and were classified with object-based image analysis software eCognition to (i) measure open gravel areas preferred by the birds as breeding sites, (ii) physical dimensions of islands (width to length ratio, area) , (iii) calculate the amount of vegetation encroachment into the open gravel areas , (iv) delineate potential predator habitats, (v) measure width and number of braided channels. The spatial pattern of open gravel areas is an indicator of bird habitat availability. The distances from predator habitats and the total width of required water crossings is indicative of habitat safety for these disturbance sensitive birds. Aerial image analysis provides an objective and quantifiable way of assessing habitat quality for braided river birds. Mapping of the micro-habitats from the image analysis is also helpful for planning predator control, pest plant removal and designing physical restoration of braided river bird habitat. Aerial imagery can be a resource efficient tool for monitoring habitats within a landscape.

Can the commercial venison recovery industry protect Fiordland's alpine flora? Drawing a link between ungulate hunting effort and alpine ecosystem health.

Mr George Ledgard[1], **Mr Richard Ewans**[2], Dr Norman Mason[3]

[1]Department of Conservation, Te Anau, New Zealand, [2]Dunedin City Council, Dunedin, New Zealand, [3]Manaaki Whenua Landcare Research, Hamilton, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Currently I provide technical and strategic input into the creation and maintenance of various biodiversity projects within Fiordland National Park: Dusky/Doubtful Sounds, Waitutu, Murchison Mtns, Wapiti Area amongst others. I coordinate, analyse and report on outcome based vegetation monitoring within Fiordland National Park and translate this back into management improvements. I also provide regional and national support and advice on land use impacts on biodiversity, soil and freshwater quality, particularly in relation to the Southland region, where as a scientist for the Regional Council, I developed and led the Land Use Impacts science program.

Between 2000 and 2006 commercial deer recovery in Fiordland National Park ceased. Correspondingly feral deer numbers rapidly increased in alpine areas and significant browse on sensitive alpine plant communities was observed.

In 2006 the Department of Conservation established monitoring at 40 sites in alpine areas throughout Fiordland National Park to quantify deer browse on selected alpine plant species. The establishment of these monitoring sites coincided with the resumption of feral deer recovery in alpine areas of Fiordland National Park.

Between 2006 and 2015 monitoring revealed significant declines in browse on the selected indicator species; Mount Cook buttercup (*Ranunculus lyallii*), snow marguerite (*Dolichoglottis scorzoneroides*) and the mountain daisy (*Celmisia verbascifolia* subsp. *verbascifolia*). The decline in browse correlated with increased deer harvesting rates and corresponding declines in deer pellet counts.

The study has revealed that sustained harvest rates of >3000 deer per annum is likely to achieve very low browse rates on deer-palatable species in alpine grasslands and herbfields.

The next steps in this study are to evaluate what measures of hunting effort best correlate with browse scores. If a reliable density impact function can be developed, then GPS data of kill locations and flight tracks from operators will enable the Department to determine annually if deer harvest rates are meeting desired browse targets.

When operating at capacity, commercial venison recovery operators are a key conservation partner in Fiordland, providing around $1 million of deer control annually at no cost to the public and protecting alpine habitat within 1.2 million hectares of national park.

Whole genome duplication: a random event with a predictable ecological outcome?

Dr William Lee[1]

[1]*Manaaki Whenua Landcare Research, Dunedin, New Zealand*

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Bill is a conservation ecologist interested in the eco-evolutionary processes shaping NZ biodiversity.

Whole-genome duplication (WGD), traditionally known as polyploidy, is the most extensive form of genomic mutation in plants, but the basis for its success is unclear. It has long been considered an evolutionary dead-end because of complications and costs linked with growth and reproduction caused by expanded genomes. However, molecular studies following WGD are revealing major dynamic genomic processes that may mitigate the risks and facilitate new adaptive options that favour species persistence. Although WGD is a random event, the ecological outcome of successful WGD occurrences may be more predictable, reflecting the costs associated with additional DNA, irrespective of the novel adaptive options that may arise.

WGD is widespread amongst indigenous plants with over 40 genera having several different ploidy levels. Using examples from *Poa, Rytidosperma, Plantago, Coprosma, Veronica* and *Melicytus* we are exploring the ecological context, niche dimensions and growth and regenerative trait innovations involved in WGD in order to understand where and why this process is successful. Our initial results suggest that WGD has been critical in facilitating species occupancy in certain biomes and habitats, increasing diversification and species richness, and augmenting many distinctive features associated with the New Zealand flora.

Saving the terrestrial biodiversity of the distant past: Foulden and Hindon Maar ecosystems highlight life in Miocene Zealandia

Dr Daphne Lee[1], Dr Uwe Kaulfuss[1], Jennifer Bannister[1], Dr Jon Lindqvist[1], Dr John Conran[2], Dr Elizabeth Kennedy[3], Dr Dallas Mildenhall[3]

[1]University of Otago, Dunedin, NZ, [2]University of Adelaide, Adelaide, Australia, [3]GNS Science, Lower Hutt, NZ

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Daphne Lee is a paleontologist with a particular interest in New Zealand Miocene terrestrial biotas

Two of New Zealand's most significant terrestrial fossil sites are at risk of destruction because of antiquated laws designed to protect mining interests and economic profit above scientific and educational values. These sites are globally rare *Konservat-Lagerstätten* deposits and contain exquisitely preserved fossils from lake and forest ecosystems. The 23 m.y. old Foulden Maar holds the most important fossiliferous lake deposits of earliest Miocene age in the Southern Hemisphere and the best-resolved mid-latitude climate record for this period. About 100 species of plant macrofossils (leaves, fruits and seeds) and 40 flowers, many with pollen, represent ~ 40 plant families from the Lauraceae-dominated rainforest that surrounded the lake. Extremely rare fossils such as orchids provide phylogenetic time-calibration points and many taxa link New Zealand to Australia, New Caledonia and South America. The diatomite also contains the Southern Hemisphere's oldest galaxiids and freshwater eels. Fossil spiders and 266 insects representing 21 families and 9 orders have also been discovered. Similarly, the diverse fossil record in the nearby 15 m.y. old Hindon Maar complex includes many plant taxa from a Nothofagaceae-dominated rainforest as well as over 200 different insects, galaxiids with skin and eye details preserved and long-finned eels. Both sites provide unique records of ecological diversity, confirming the antiquity of major components of our current biodiversity and later extinctions of subtropical elements. We suggest that both fossil sites are taonga – holding treasures for all New Zealanders. Both need formal legal protection and should be preserved in perpetuity for scientific and educational purposes.

New Zealand Fish Passage Advisory Group: an interdisciplinary approach to fish passage management

Mr Patrick Lees[1]

[1]*Tonkin & Taylor Ltd, Christchurch, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Patrick is a freshwater ecologist at Tonkin & Taylor Ltd, his primary role is undertaking a broad range of freshwater ecological assessments, research and science communication. In particular, Patrick has been working on assisting infrastructure managers, waterway managers, environmental officers, iwi and local communities with understanding and promoting better management of fish passage requirements in New Zealand.

In New Zealand, the cumulative pressures from increasing water demand, deteriorating water quality, loss and degradation of habitats, impacts of invasive species and reductions in river connectivity have had large impacts on our native freshwater fish. As such, more than 70% of native freshwater fish species are classified as threatened or at risk.

Around one third of New Zealand's freshwater fish fauna must migrate to and from the sea to complete their life cycle. Likewise, freshwater resident species need to move between habitats within waterways. Blocking or limiting fish passage within freshwater habitats is therefore a significant and ongoing threat to New Zealand's freshwater fish. For many native fish species, protecting fish passage between habitats is as important as protecting the habitats themselves.

The New Zealand Fish Passage Advisory Group brings together ecologists, engineers and environmental advisors to promote, support and develop resources for fish passage, and advocates for better guidance and policy for our waterways. The group represents the many different businesses, organisations, councils and government agencies that are involved in fish passage management in New Zealand.

We present an overview and update on the advisory groups recent work, introduce the fish passage guidelines and the intent to set a foundation for improved fish passage management in New Zealand. We provide an overview of recommended practices for the design of instream infrastructure to provide fish passage and introduce the NIWA Fish Passage Assessment Tool for recording instream structures and assessing their impact on fish movements and river connectivity.

Land Typing: utility and accessibility

Di Lucas, Ian Lynn

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Di Lucas BSc, MLA, ONZM landscape architect, Lucas Associates, Christchurch
Di works extensively in landscape ecology, and for 27 years chaired the Nature Heritage Fund, protecting indigenous ecosystems across NZ. Beginning with her masters research investigating vegetation change in high country landscapes, she's utilised land typing. Primarily with geomorphologist and soil scientist Ian Lynn, Manaaki Whenua, Lincoln, plus ecologists, they've undertaken extensive land typing, e.g. "A Framework for Monitoring Ecological Integrity in the Bay of Plenty Region". For 20 years these studies have won national awards, including "Indigenous Ecosystems. An Ecological Plan Structure for the (Queenstown) Lakes District".

Land Typing: utility and accessibility

Land systems have been variously utilised for several decades as a basis for differentiating and understanding the underlying natural diversity of Aotearoa lands, ecosystems and landscapes, as a basis for assessing, characterising, planning and managing lands and waters. This land typing explicitly provides for natural habitat diversity. The method assists people in "making sense" of different land and ecosystem typologies. Underpinned by geomorphology, as an information system the method is timeless and not vulnerable to upsets by land use or land cover change.

A nested hierarchy approach, the land systems/typing method involves mapping, modelling and information charts typically at 3 spatial scales. The spatial hierarchy from 'landscape types', to 'land types', and, 'landform components' enables a windowing-in on information, and for application.

This land typing method is formally recognised for characterising natural features and natural landscapes (NZ Coastal Policy Statement Policy 15 c). It has been utilised as a basis for regional and district studies, and coverage at least at the landscape scale is available for much of the country.

Coordination of the land typing undertaken for public agencies over the decades would be appropriate with provision as a publicly accessible information system.

Influence of advancing biodiversity enhancement programmes on the operation and income of sheep and beef farms

Estelle Dominati[1], Andrew Wall[2], John Rendel[2], David Norton[3], Jennifer Pannell[4], **Alec Mackay[1]**

[1]AgResearch, Grasslands Research Centre , New Zealand , [2]Consultant, , , [3]Te Kura Ngahere School of Forestry , University of Canterbury, New Zealand , [4]School of Science, Auckland University of Technology, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Alec, a Principal Scientist in Farm Systems & Environment, research interests are in soil science, land and resource management, and farm systems. Advancing land evaluation and farm planning to include all stocks, including indigenous biodiversity, and services beyond food and fibre from landscapes is a current focus of work. With Māori partners he is part of a team exploring trans-cultural inquiry in resource management. Alec is a past President, Fellow and Life Member of the New Zealand Society of Soil Science

An integral part of New Zealand's biodiversity strategy going forward must include the protection and enhancement of indigenous biodiversity located on private land outside of the public conservation land. It is estimated that there are 2.8 million ha of indigenous vegetation on sheep and beef farms. To explore what the impact might be of advancing biodiversity outcomes on individual farm sheep and beef farms, we quantified the impact a biodiversity enhancement programme would have on the physical operation, cost structure and profitability of three sheep and beef operations, two located in the North Island and one in the South Island. The study included a stock take of the existing farm resources, including native vegetation and the development of a biodiversity enhancement programme. Factors that need to be considered in the integration of the biodiversity enhancement programme into the farm business were also explored, as was an evaluation of indigenous species as a mechanism for increasing the sustainability and resilience of the farm business. This is a step beyond the protection of raw resources. An initial analysis of the implications of implementing the enhancement programme on the livestock policy and financial performance of the farm business was also completed as part of the study.

Genetic diversity of parasitoids enhances biological control

Msc. Lais Maia[1], Dr. Amy Osborne[1], Dr. Jason Tylianakis[1]
[1]*University of Canterbury, Christchurch, New Zealand*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:
Lais Maia got her masters in Applied Ecology from the Federal University of Lavras in Brazil and she is currently a PhD Candidate at the University of Canterbury studying the role of genetic diversity in the biological control.

Biological control is worldwide considered to be a long-term solution for pests in agriculture. However, a decline in biological control effectiveness can be expected as interacting species coevolve. Our knowledge on the importance of genetic diversity for biological control is limited by a lack of research assessing how genetic variability at multiple trophic levels could influence short- and long-term success in parasitism rates. We address this knowledge gap using an experimental tri-trophic system (yeast-fruit fly-parasitoid) and manipulating genetic diversity within these trophic levels. Starting from wild-caught populations, we used different population bottleneck sizes to generate a genetic diversity gradient of hosts and parasitoids, ranging from low (inbred populations) to high diversity (population made by many pairs). For the basal resource (yeast), we had one strain and a mixture of strains as the low and high genetic diversity treatments, respectively. Initial data show that parasitoid genetic diversity is a key driver of higher parasitism rates, while the influence of host and resource genetic diversity may increase over time. By demonstrating that parasitoid intraspecific genetic diversity can influence parasitism rates, we give support to the importance of considering the genetic component when developing biological control strategies.

Trials and tribulations of inferring species interactions from time-series data

Michelle Marraffini[1], Dr. Daniel Stouffer[1]
[1]*University of Canterbury, Christchurch, New Zealand*

Next Generation Symposium (II) + Funct/Tax Diversity + Species Interactions, Stewart Theatre 2, December 4, 2019, 11:00 AM - 12:30 PM

Biography:
I am a phd student in the Stouffer lab. I describe myself as a community ecologist. I am interested in the causes and consequences of diversity within a variety of systems. Using a combination on mathematical models and statistics as tools to understand how many species interact and coexist, and thus how diversity is created and maintained in biological communities.

Species interactions, both negative and positive, are integral to explaining patterns of diversity, and estimating these interactions can lead to a greater understanding of complex processes leading to community stability and species coexistence. In order for species to coexist or co-occur for periods of time, a species must limit its own growth more than it limits competitors. The bulk of our empirical knowledge about species interactions comes from snap shots of simplified communities where slopes of density-dependence are inferred as the effect of one species on another. However, these snap shots may not capture the full extent of species interactions and thus often fail to predict coexistence. Measuring populations of species through time captures a greater number of species interactions. But with more data come more problems. For example, computational models struggle to estimate all species interactions which may occur in the sampling period. Introducing convergence issues as well as issues assessing the importance of these rare interactions. Here we used of time series data for inferring species interactions make predictions about coexistence using generalised linear models with data from two diverse communities: annual plants and perennial marine invertebrates. We will show how predictions made from time series data compare with those of snap-shots and can allow for estimation of more species interactions and predict coexistence of more species pairs in these communities.

A network analysis of pathogen prevalence and biosecurity protocols in New Zealand forestry nurseries

Madeline Marshall[1], Professor Philip Hulme[1], Roanne Sutherland[2], Dr Crile Doscher[3]

[1]Bio-Protection Research Centre, Lincoln, New Zealand, [2]Scion, Rotorua, New Zealand, [3]Lincoln University, Lincoln, New Zealand

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Madeline Marshall is a PhD Candidate under the Bio-Protection Research Centre at Lincoln University in New Zealand. For her thesis she is networking multiple horticultural and forestry trade networks through New Zealand and relating these networks to the spread of invasive pests and pathogens. She has previously completed her MSc in Biology at the University of Texas - Rio Grande Valley and worked as a research technician with the United States Department of Agriculture on insect biological control of invasive weeds.

The forestry industry in New Zealand is vulnerable to pathogen introduction due to a lack of standardized hygiene practices and regular introduction of pathogens into the New Zealand landscape. In order to effectively mitigate a pathogen outbreak, pre-existing knowledge of network structure is vital. This project aims to develop a network characterised by links between seed orchards, nurseries, and plantation forests as well as collect data on the biosecurity protocols and hygiene standards in place at the nursery level. An understanding of product movement within the network as well as the general practices within nurseries can identify points of particular risk for pathogen introduction and spread. In the event of a pathogen outbreak, this pre-formed network can be used to identify intervention points for pathogen screening and treatment to slow or stop its spread. Alternatively, simulating a pathogen outbreak in the network can also provide insight as to where weak links in biosecurity are located. These weak links can then be pre-emptively addressed so as to lessen the risk of pathogen acquisition and transmission in the event a pathogen is truly introduced to the system.

Farmer perspectives on native biodiversity on-farm

Dr Fleur Maseyk[1], Dr Bruce Small[2], Roxanne Henwood[3], Dr Jennifer Pannell[4]

[1]The Catalyst Group, Wellington, New Zealand, [2]AgResearch, Ruakura Agricultural Centre, Hamilton, New Zealand, [3]AgResearch, Lincoln Research Centre, Lincoln, New Zealand, [4]Auckland University of Technology, Auckland, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Over the last 20 years Fleur has worked for central and local government, for a private ecological consultancy, an international conservation NGO, and as a postdoctoral research fellow. This has given her a broad-ranging experience in conservation and natural resource management across theoretical, strategic, and policy levels, and first-hand experience in the realities of its implementation. Fleur relies on robust evidence to inform decision-making and links science, policy, and on-the-ground actions to solve crunchy problems. Key interest areas include biodiversity policy; biodiversity offsetting, ecosystem services approaches to land management, and farm planning to integrate biodiversity into production landscapes.

A large proportion of New Zealand's remaining native biodiversity occurs within agroecosystems in private ownership and is largely unprotected. Consequently, biodiversity has continued to decline on private land at the national scale. Individual land management choices have a large influence on the extent and condition of remaining native biodiversity on-farm, and we sought to better understand motivations behind these choices. We conducted a phone survey of 500 mostly sheep and beef farmers from around New Zealand on their beliefs and attitudes towards the protection and management of native biodiversity using a questionnaire based on the Theory of Planned Behaviour. A central tenet of the Theory of Planned Behaviour is that an individual's intention is the proximal influence on their behaviour. Intentions can be predicted by three main components: attitudes, subjective norms, and perceived behavioural control. We found that the vast majority of surveyed farmers had a good understanding of the term 'native biodiversity' and believed that listed management actions (such as fencing, and pest control) benefited native biodiversity. There was also a strong match between believing a specific action was of benefit and undertaking that action on-farm, with the exception of placing areas into a legally binding covenant. This presentation explores the relationship between beliefs, attitudes, and intentions of our survey group, providing insights into which beliefs have the greatest influence on intentions. Our findings advance understandings as to the forms of intervention that are mostly likely to influence behaviour change aimed at enhancing native biodiversity on-farm.

Thinking fast and slow in ecological research: a wilding conifer case study

Dr. Norman Mason[1], Dr. Olivia Burge[1]

[1]*Manaaki Whenua-Landcare Research, Hamilton, New Zealand*

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Dr. Norman Mason trained as a plant ecologist, but through his role at Manaaki Whenua has gained experience in many areas of environmental research. His current research interests revolve around devising pathways linking science excellence to environmental management decisions.

By the time we've identified a plant species as invasive, it's usually causing significant impacts and requires an urgent management response. At the same time, minimising invasive plant impacts is a complex exercise spanning multiple biophysical, social and ecological research disciplines as well as a wide range of stakeholders. This complexity means that no single research project can hope to fill the many gaping knowledge gaps. Thus, invasive plant researchers are faced with the challenge of providing advice to managers despite huge levels of uncertainty. This is a problem encountered not just in invasive plant research, but across many of our most pressing environmental challenges.

In this presentation, I outline work in the Winning Against Wildings (WAW) Endeavour-funded programme which incorporates two broad research strands:

- fundamental research on wilding conifer demography and ecosystem impacts
- applied research on surveillance strategies, control methods and stakeholder priorities

In WAW we aim to retain the full richness and complexity of fundamental processes while devising streamlined methods for linking research across disciplines into a living body of knowledge. I outline how we have achieved this by linking site, landscape and national-scale invasion models in forecasting future ecosystem impacts and management costs arising from wilding conifer invasion. In doing this I detail an example of how this system of models has been used in providing advice to managers. I also illustrate how it has been designed for agility, so that future wilding conifer research can be efficiently incorporated into the existing body of knowledge.

Wilding conifers will be a major challenge for New Zealand decades into the future. If research is to be effective in responding to this challenge, we need a conceptual and quantitative platform that can be incrementally improved over decadal timescales.

Using spatial models to identify refugia and guide restoration as part of Aotearoa's response to myrtle rust

Dr James McCarthy[1], Dr Sarah Richardson[1], Dr Peter Bellingham[1], Dr Robert Beresford[2], Dr Rebecca Campbell[3], Dr Richard Turner[4], Dr Susan Wiser[1]

[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand, [2]Plant and Food Research, Auckland, New Zealand, [3]Plant and Food Research, Motueka, New Zealand, [4]NIWA, Wellington, New Zealand

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (II), Stewart Theatre 2, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

James is a terrestrial ecologist at Manaaki Whenua – Landcare Research. He is interested in patterns of species occurrence and abundance, and using spatial models to project these across large scales. He likes using these models to map patterns of ecosystem functions, and make predictions for how these will be affected by events such as disease outbreak or large-scale climate change. Originally from Christchurch, James earned his MSc at the University of Canterbury before completing a PhD at the University of Queensland. He has been working at Manaaki Whenua for almost two years.

After its 2017 detection in New Zealand, myrtle rust has quickly spread from its initial detection on Raoul Island, across much of the North Island, reaching as far south as Greymouth. Over the two years since its initial incursion, the disease is still primarily observed on non-native and planted native individuals, however wild populations are still prone to infection, especially highly susceptible species like *Lophomyrtus bullata*. Distribution models of the disease and the hosts can be useful when responding to invasive diseases because they can help inform control and management efforts. As part of the early response to myrtle rust, separate models were developed to predict the spatial distribution of the disease and its potential native hosts. Here, we briefly describe these models, and present our subsequent analyses using them to identify species-specific areas of potential refugia (areas outside the disease range but inside the host range). We also used these models to identify areas that could be most suited for restoration efforts to conserve susceptible or threatened species. Finally, we characterised the range of the disease and hosts across two of New Zealand's most influential climate axes – temperature and precipitation – to explore the extent to which the disease and different host species share an environmental niche.

Proximate controls on the dimensions of stream food webs across land use types: evidence from a stable isotope meta-analysis

Angus McIntosh[1], Richard White[1], Timothy Jardine[2], Helen Warburton[1], Kristy Hogsden[1,3], Jonathan Harding[1], Fancis Burdon[1,4], Catherine Febria[1,5], Elizabeth Graham[1,6], Peter McHugh[1,7], Christopher Meijer[1]

[1]School of Biological Sciences, University of Canterbury, Christchurch, New Zealand, [2]School of Environment and Sustainability and the Canadian Rivers Institute, University of Saskatchewan, Saskatoon, Canada, [3]NIWA, Christchurch, New Zealand, [4]Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Uppsala, Sweden, [5]Great Lakes Institute for Environmental Research & Department of Integrative Biology, University of Windsor, Windsor, Canada, [6]NIWA, Hamilton, New Zealand, [7]Vermont Fish and Wildlife Department, Montpelier, USA

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Angus is a professor in the Freshwater Ecology Research Group (#UCNZferg) at the University of Canterbury, and works from population through to ecosystem and landscape levels. He has combined investigation of food webs with spatial analysis of waterways to reveal how environmental change both affects rivers and how deleterious effects can be overcome. This has included work on river flows, extreme events, invaders and restoration of agricultural streams. Collaborations with students have been an important part of this work, and Angus is a member of the Academy of Ako Aoteatroa, New Zealand's national centre for tertiary teaching excellence.

A myriad of global change processes are deleteriously affecting freshwater ecosystems, but our ability to develop mitigations is limited by a lack of understanding of the fundamental ways those processes change the functioning of aquatic systems. We used ^{15}N and ^{13}C stable isotopes from 171 waterways in the South Island (2456 samples) spanning the widest possible gradient in impacts to assess effects on energy flow in aquatic food webs. Sites included those associated with flow loss, sedimentation, eutrophication, flooding, and acid mine drainage, as well as relatively pristine high country sites. We accounted for differences between sites in sample size by bootstrap resampling using within-taxon measures of variability derived from the dataset. Trophic width was increased by primary consumer richness, but only when predatory invertebrate taxon richness was low, and so was lowest in locations with severe impacts (acid mine drainage and drying). Trophic height was lowest in severely impacted sites as well and was also affected by an interaction whereby the positive effect of fish on trophic height was moderated by increasing numbers of primary consumers. These patterns suggest the most severe impacts on aquatic ecosystems drastically alter food web dimensions. However, increasing richness doesn't necessarily translate into increased trophic height and width, and depends on relative richness within each trophic group. Thus, the influence of global change drivers on the functioning of aquatic food webs might be able to be mitigated by addressing richness within particular trophic groups.

Hāpua morphodynamics and why they are important for ecology

Mr Richard Measures[1,2]

[1]NIWA, Christchurch, New Zealand, [2]University of Canterbury, Christchurch, New Zealand

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Richard Measures is a hydrodynamics scientist in the sediment processes group at NIWA Christchurch. Richard has 14 years' research and consulting experience related to river hydrodynamics, sediment transport and morphology, particularly focussing on braided rivers. As part of NIWA's Environmental Flow research programme Richard is currently investigating the effects of flood harvesting on fine sediment deposition, artificial freshes for management of nuisance periphyton, and the impact of water allocation on Hāpua morphology (which he is studying as a part time PhD at the University of Canterbury).

Hāpua are highly dynamic freshwater-dominated shore-parallel coastal lagoons formed by the interplay of wave and river driven sediment transport at the mouths of braided rivers. Conserving and managing hāpua ecosystems is becoming increasingly important in the face of growing pressure to harvest braided river flows and the compounding effects of climate change on flows, water demand, and coastal processes. Hāpua size, water quality, habitat and connectivity to the sea are all strongly influenced by the highly dynamic behaviour of the outlet channel, which in turn is controlled by river flow regime, sediment supply, and wave climate. In order to interpret water quality or ecological data from hāpua, or to predict the implications of changes to flow regime, understanding the physical behaviour of hāpua is essential. Recent research, including monitoring of the Hurunui Hāpua in North Canterbury using time-lapse cameras, has revealed new insights into hāpua behaviour which have been compiled into an improved conceptual model. This presentation will introduce the important physical characteristics of hāpua, describe the ongoing monitoring of the Hurunui Hāpua, and summarise the new conceptual model of hāpua behaviour.

Kauri detection by remote sensing

Jane Meiforth

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
I am fascinated by the potential of remotes sensing and spatial analysis for applied nature conservation. During 18 years professional experience I was working with various governmental and research organisations in New Zealand, Norway and Germany. I currently joint the Ecosystems and Conservation team at Landcare Research in Lincoln. Areas of expertise include airborne hyper- and multispectral remote sensing, LiDAR analysis and advanced Geographical Information Analysis for nature management.

New Zealand kauri trees (*Agathis australis*) are under threat from the deadly kauri dieback disease (*Phytophthora agathidicida* − PTA). We have developed a method to identify the location of kauri trees by remote sensing that can be applied in a wall-to-wall mapping campaign for larger areas. The reference dataset covers a representative selection of 3,165 precisely located reference crowns of kauri and 21 other species and species groups of canopy vegetation in the Waitakere Ranges, west of Auckland. The analysis is based on an airborne hyperspectral AISA Fenix image (437–2,337 nm, 1 m^2 pixel resolution), a HiRAMS 4-band image, WorldView02 satellite data, and LiDAR data. Kauri canopies show characteristic spectral features in the far near-infrared (NIR2) region at around 1,200 nm. We identified a selection of five multispectral bands in the visible to NIR2 spectral range that enable kauri to be distinguished with user's and producer's accuracies of over 94% in a pixel-based analysis. When NIR2 bands are not available, it is possible to achieve detection accuracies over 90% by combining standard multispectral bands in the visible to NIR1 spectral range (400−1,000 nm) with LiDAR data in a crown-based analysis. The project also successfully addressed the detection of canopy stress symptoms, which will be presented in further publications. These results have important implications for the monitoring of kauri dieback disease in New Zealand's native kauri forests.

Rapid evolution in introduced species: will introduced plant species eventually be accepted as unique native taxa?

Angela Moles

Keynote Angela Moles, Stewart Theatre 1, December 4, 2019, 3:30 PM - 4:10 PM

Biography:

Angela Moles leads the Big Ecology Lab, in the School of Biological, Earth and Environmental Sciences at UNSW Sydney. Her research interests include studying rapid evolution in introduced species, understanding how native plants are responding to climate change, and quantifying global patterns in the ecological strategies used by plants and animals. Angela is passionate about science outreach and teaching, and is a member of the New South Wales Biodiversity Conservation Advisory Panel. Angela grew up in New Zealand, but accidentally became an Australian.

Introducing species to a new environment creates excellent conditions for evolution, as the species are released from their old enemies and subjected to a new suite of biotic and abiotic pressures. Our work with herbarium specimens has shown that 70% of the plant species introduced to Australia have undergone significant morphological change since their introduction. Differences between source and introduced populations are retained when they are grown in common conditions, and there is evidence for reproductive isolation developing between introduced and source populations. If we can't eradicate introduced species (and we seldom can), then it seems inevitable that they will eventually evolve to become unique new taxa (whether we like it or not). At this point, we will have to decide whether to accept them as new native species, or try to exterminate them. While most ecologists don't like the idea yet, I think acceptance of introduced species is just a matter of time. I have been called a witch for these ideas before - bring on the arguments!

Individual level mast-seeding strategies vary with access to resources

Dr Adrian Monks[1], Dr Sarah Richardson[2]

[1]Manaaki Whenua Landcare Research, Dunedin, New Zealand, [2]Manaaki Whenua Landcare Research, Lincoln, New Zealand

Mast Seeding Symposium, Stewart Theatre 1, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

Adrian Monks is a Dunedin-based ecologist with Manaaki Whenua Landcare Research. His ecological interests are broad, encompassing both plants and animals, often using field experiments and/or painfully complicated Bayesian models.

Mast seeding in higher plants is often selected for by the benefits of economies of scale. However, in any year, there can be considerable variation between individuals at a site in seeding effort. We describe some of the proximate causes of local variation in mast intensity with particular reference to New Zealand snow tussocks and beech trees. We show that individual seeding strategies vary with access to resources due to intrinsic (e.g. plant size) and extrinsic (e.g. site fertility) factors. Some of the more extreme interannual seeding variability occurs where resource acquisition is difficult. We suggest that under these conditions, intermediate levels of seeding are not a viable strategy because the benefits of economies of scale are not fully realised and do not balance the opportunity cost of having insufficient resources to reproduce if a big year occurs in the near future. We discuss the implications of these findings for the evolution of mast seeding and, more pragmatically, to our understanding of variation between seed monitoring sites.

Bio

Adrian Monks is a Dunedin-based ecologist with Manaaki Whenua Landcare Research. His ecological interests are broad, encompassing both plants and animals, often using field experiments and/or painfully complicated Bayesian models.

The Shifting Complexion of Molesworth - Floristic Winners and Losers

Simon Moore[1], Sean Husheer

[1]*Department of Conservation, Nelson, New Zealand,* [2]*New Zealand Forest Surveys, Hastings, New Zealand*

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Simon Moore is a terrestrial ecologist with the Department of Conservation based in Nelson. He has worked extensively in survey and monitoring, strategy, land management, statutory advocacy and operational support. His experience in Molesworth Recreation Reserve spans the past 20 years and covers a variety of projects including field monitoring of vegetation in parts of the property which are leased for cattle grazing.

Drought-resistant indigenous woody communities were once widespread in the intermontane basins of Molesworth Recreation Reserve in New Zealand's north-eastern South Island. However, these forests, woodlands and shrublands were largely converted by fire to tussock grassland by 1800 AD. Further regular burning, sheep grazing and rabbit plagues profoundly altered the landscape up to the 1930s. From the 1950s, conversion to beef cattle grazing, suppression of rabbits, cessation of regular burning, and the oversowing of exotic pasture species further changed the character of the vegetation on Molesworth. Permanent plots were established from the 1980s and were re-measured in 2016. Additional presence data from plots measured in 1952, 1960, 1987 and 2012 were used to model predicted changes in vegetation. The proportion of native species cover has declined over the past 60 years, particularly on low elevation and low gradient landforms. The biomass of woody indigenous species has increased over the whole property but has reduced on terraces and areas which had been subject to the most intensive history of modification. Paired grazed versus ungrazed plots showed no significant differences in indigenous species composition or abundance, though this may be due to factors including insufficient time since monitoring began, insufficient replication of paired plots, and breaches in fence lines. It is recommended that current monitoring is continued and supplemented with targeted wetland monitoring in areas which continue to be grazed.

Does the chew card survey protocol correlate with the tracking tunnel survey protocol for rodents?

Dai Morgan[1], Joyce Palmer, Jean Stalmann
[1]*NorthTec, Whangarei, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Dai is a tutor in on the Environmental Management programs at NorthTec in Whangarei. He has research interests in ornithology, behavioural ecology, and wildlife management. In addition, he is involved in several community conservation projects in Northland.

Determining the residual size of rodent populations through monitoring is important because the indices produced have been calibrated against conservation outcomes. The Department of Conservation's tracking tunnel protocol is one of the most common methods to monitor rodent populations in New Zealand; however, the set up and running of these surveys can be costly. The National Pest Control Agencies (NPCA) chew card protocol was initially developed to monitor possum (*Trichosurus vulpecula*) populations, but rodents also interfere with them and this protocol is often used to obtain information about these populations. A direct comparison between the tracking tunnel and chew card protocols has never been conducted. Accordingly, the aim of this study was to compare the indices produced by the 7-night CTC protocol and 1-night TT protocol to determine if a relationship exists. Although we found significant correlations between the indices produced by the two protocols for both rats (*Rattus* spp.) and mice (*Mus musculus*), there was considerable amount variation that was not explained by the statistical model. In addition, the tracking tunnel protocol was much more sensitive at detecting rodents when they were at apparent low abundances. Chew cards are a cost effective option that can provide population indices for both rodents and possums; however, tracking tunnels appear to be more sensitive at detecting rodents at low densities, and we suggest that this protocol should be employed in such instances

Terrestrial Invertebrate Biodiversity and Management on Braided Rivers

Dr Tara J Murray[1], Susan J Anderson[2]

[1]*University of Canterbury, Christchurch, New Zealand,* [2]*Department of Conservation, Dunedin, New Zealand*

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Dr Tara Murray is a Senior Lecturer at the University of Canterbury where she teaches biosecurity and entomology into Forestry, Biology and Environmental Science courses. Her research interests include conservation management of threatened invertebrates, developing sustainable pest management for pests based on biological control, and understanding the impacts of climate change on invertebrate trophic dynamics. Since 2015 a large part of her research has been focused on the biodiversity and conservation of invertebrates in braided rivers and dryland ecosystems.

Although invertebrates account for around 80% of all multicellular organisms on earth, little is known about their diversity or conservation status in most ecosystems across New Zealand, or internationally. This is particularly true for braided rivers in New Zealand, which represent a globally unique habitat. Braided rivers cover an area of more than 250,000 ha in New Zealand, with around 64% of this found in Canterbury. Although these rivers have been recognised as providing key breeding and feeding grounds for > 80 species of native New Zealand birds, the majority of their biodiversity values, threats to these values, and means to protect them, remain unknown. Here we report on the most extensive study of terrestrial braided river invertebrates conducted in New Zealand to date, undertaken as part of the Department of Conservations Project River Recovery. Using a range of sampling methods, more than 150,000 invertebrates were collected from the *Raoulia haastii - R. australis* cushion field community of the Tasman River floodplain in the Upper Waitaki Basin. Specimens were identified to recognisable taxonomic units (RTUs) and found to represent more than 900 species across five invertebrate classes. Spatial and temporal trends in community composition were detected across the 10km and 240m altitudinal range of the study, and 5 month sampling period. Data were analysed to determine optimal sampling strategies for future braided river biodiversity assessments to inform management decisions.

Protection of biodiversity by councils - is it working?

Ms Shona Myers[1]

[1]*Myers Ecology Ltd, Northcote, New Zealand*

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Shona is a Director and Principal Ecologist of Myers Ecology Ltd, and often works at the interface with policy, legal and planning disciplines. This includes being an Independent Hearing Commissioner for resource management issues. She published a review of the effectiveness of NZ wetland policy and resource management in 2013 and has recently worked with DOC on the development of the NPS for Indigenous Biodiversity.

Shona is a Trustee of the Forest Bridge Trust, is an Honorary Life Member of the New Zealand Ecological Society, and the immediate Past President of the International Association for Ecology (INTECOL).

A draft National Policy Statement on Indigenous Biodiversity is being developed which will establish statutory requirements for regional and district councils to protect and maintain indigenous biodiversity, including the identification of significant natural areas. This will set policies and objectives for implementing Section 6c (significant indigenous vegetation and significant habitats of indigenous fauna) and Sections 30 and 31 (maintenance of indigenous biodiversity) of the Resource Management Act. Regional and district plans are variable in their approaches to addressing the protection of significant indigenous vegetation and habitats for indigenous fauna, and the management and enhancement of ecosystems and habitats. An NPS should provide greater consistency in plans than is currently in place. This paper will provide an updated 2019 analysis of the strengths and weaknesses of policies, methods and rules currently in district and regional plans across New Zealand. It will provide an update on earlier analysis of regional and district plans undertaken in 2018 and 2014 (presented at the NZES conferences) and an earlier analysis undertaken on wetland policies in Myers *et al.* 2013 (Ecological Engineering 56 (2013) 107–120).

A novel approach to mitigating the risk to kea from an aerial 1080 operation, and assessing that risk at the individual and population level.

Dr Maggie Nichols[1]

[1]*Zero Invasive Predators, Wellington, New Zealand*

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

I am a wildlife ecologist specializing in predator animal behaviour. My thesis pertained to feral cat monitoring using different camera trap arrays; and I have continued to research and enhance our knowledge of detection tools and deployment for cryptic predator species. I have also extended my applied animal behaviour research to kea, an endangered parrot species endemic to the South Island of New Zealand.I am currently researching and trialing different mitigation strategies to reduce kea mortality during aerial 1080 operations in kea habitat.

Kea (*Nestor notabilis*) are an endangered parrot, endemic to the South Island, New Zealand. Aerially applied 1080 (sodium fluoroacetate) is a widely used tool for the removal of predators from remote landscapes. Removal of predators improves kea productivity, however, there is still some risk of individual kea death through direct poisoning. In conjunction with a modified aerial operation in the Perth River Valley, South Westland (2019), we deployed a sequence of novel kea risk mitigation measures for the local population of kea (estimated to be approx. 75-100 birds). This kea mitigation strategy included the deployment of tahr carcasses to attract kea to sites where aversion bait was available. Aversion bait is non-toxic cereal bait that mimics the visual and olfactory nature of 1080 baits, and treated with the secondary repellent anthraquinone. In 2018, camera trap surveys recorded 56% of the banded kea population (31 of 55 birds), and evidence of repellent effects in kea that consumed aversion bait. A small sample of banded kea that wore radio tags and were known to be in the study area during the operation were monitored throughout each phase of baiting using SkyRanger. Two out of 13 kea died in the first phase of baiting, and all remaining kea survived the second phase. The kea population continues to be monitored in the Perth valley study area by camera traps lured with tahr carcasses, and SkyRanger for location and productivity.

Obtaining positive native biodiversity outcomes in agroecosystems

Professor David Norton[1], Professor Nick Reid[2], Dr Mark Stafford Smith[3], Associate Professor Hannah Buckley[4], Dr Brad Case[4]

[1]University of Canterbury, , , [2]University of New England, , , [3]CSIRO, , , [4]Auckland University of Technology, ,

Enhancing Functional Biodiversity in Agroecosystems Symposium (III), Conference A/B, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

My primary research interest is in funding ways to sustain and enhance native biodiversity across the pastoral landscapes that dominate New Zealand in a way that also allows for productive pastoral farming.

Obtaining positive biodiversity outcomes in agroecosystems requires consideration of the private property rights of individual landowners and incentivising them to change these in favour of native biodiversity which has a strong public good component. While some view regulation as the preferred way to manage native biodiversity in agroecosystems, we suggest that such an approach is doomed to fail and may result in perverse outcomes for native biodiversity. Instead we suggest that in order to achieve positive native biodiversity outcomes in agroecosystems, land owners and managers need to feel 'ownership' of biodiversity and this requires them to be incentivised and rewarded for their management. In this presentation we propose four steps, which need to be applied within the context of a clearly articulated regional biodiversity strategy, that we see as key to doing this.

1Farm management planning that incorporates biodiversity conservation.

1. Extension to support farmers implement management plans.
2. An outcome focused independent audit system to verify that farmers are doing what they say they are doing.
3. A financial and voluntary incentive system to support farmers implementing biodiversity conservation management actions, coupled with a regulatory backstop.

All four need to be considered across multiple spatial scales from the farm-unit up to the regional and national scale.

How does landscape heterogeneity influence feral cats' home range and movement?

Cathy Nottingham[1], Dr Brad Case[2], Dr Hannah Buckley[2], Dr Al Glen[3], Dr Margaret Stanley[1]

[1]University of Auckland, Auckland, New Zealand, [2]AUT, Auckland, New Zealand, [3]Manaaki Whenua – Landcare Research, Auckland, New Zealand

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Cathy is a PhD candidate studying the effects of landscape connectivity on invasive mammalian predators in agricultural ecosystems. Her study aims to determine occupancy of a range of invasive mammals and to look at feral cat movement on farms with differing levels of landscape connectivity. Her MSc project studied the impact of hedgehogs in urban forest fragments. She is particularly interested in the ecology of invasive mammalian predators in New Zealand.

Managing invasive species requires specific knowledge of their ecology, including distribution, habitat use and home range. In particular, understanding how biotic and abiotic factors influence pest home range can help with pest management decision-making, as well as informing native species management. Restoring agroecosystems and improving connectivity for native biodiversity function, could also improve connectivity for pest species. Feral cats have caused numerous extinctions and continue to adversely affect native species globally. Managing feral cat populations requires spatially-explicit knowledge to enable appropriate deployment of management devices, understand where native species are most likely to be at risk, and to mitigate the spread of cat-vectored diseases such as toxoplasmosis. Our project investigates how feral cats are using the landscape on sheep and beef farms, particularly where connectivity is enhanced via native species revegetation. Here we present the results of a systematic literature review on factors that influence feral cat home range size, including land use types, differing levels of heterogeneity, levels of prey availability and numbers of competitors. We also considered how methods used to determine home range might influence the result, with 28 studies using VHF and 16 using GPS. The majority of the studies used minimum convex polygons to determine home range but other methods such as kernel density estimates were also used, making comparison between studies difficult. Based on our results, we recommend that farmers, and land and conservation managers consider prey availability and the heterogeneity of the environment when planning control operations of feral cat populations.

Overview II

Dr Maureen O'Callaghan

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Overview: Current research programmes and management activities for myrtle rust
Speakers: Mahajabeen Padamsee, Maureen O'Callaghan, Katrin Webb
Myrtle rust has been present on the New Zealand mainland since 2017 and threatens many ecologically, culturally and economically important native host species. In response, multiple research and management efforts are underway or being planned, many of which follow on from work previously commissioned by MPI following initial disease incursion. This overview will be divided into three parts, which collectively will summarise major activities taking place in New Zealand at this time. The research programme Beyond Myrtle Rust, the largest multi-agency research effort into myrtle rust currently taking place, will be introduced by the programme leader Mahajabeen Padamsee. The BioHeritage National Science Challenge programme Ngā Rākau Taketake will be introduced by co-leader Maureen O'Callaghan. Katrin Webb will discuss Department of Conservation management activities and plans.

Biodiversity values and conservation management of braided rivers: progress and directions

Dr Colin O'Donnell[1]

[1]*Department of Conservation, Christchurch,*

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

I am Principal Science Advisor for terrestrial ecosystems and species based at the Department of Conservation in Christchurch. My research focuses on threatened species and threatened ecosystems, especially on the ecology of rainforest bats and birds, developing effective predator control techniques for forests and wetlands, ecology of braided river species, threats to alpine biodiversity, and development of monitoring methods to measure outcomes of restoration for birds, bats, lizards and invertebrates. I currently oversee threatened species science planning for DOC and am a member of a number of species recovery groups.

Braided rivers form extensive riverine habitats occurring widely in New Zealand, often from head water rivers in the mountains to lagoons and estuaries on the coast. They are characterised by ever changing flowing channels, and associated spring creeks, terrestrial islands and adjacent flood plain terraces. There are more than 300 rivers with braided stretches that support unique communities of plants and animals and many threatened species. These communities are threatened by predation, weed invasion, water and gravel abstraction, dams, flood protection works and human recreational activities on rivers. In recent years, public awareness of the natural values of braided rivers and threats to these values has increased. The number of initiatives to undertake conservation work within braided rivers has likewise increased. At the same time, greater demands are being placed on braided rivers, particularly as sources of water for irrigation and hydro development, but also for gravel extraction and recreational purposes such as jet-boating, four-wheel driving and fishing. This paper will discuss the biodiversity values and ecological significance of braided rivers, recent advances in conservation management techniques being applied to restoring biodiversity values, and conservation programmes that have been initiated by community groups, regional councils and DOC.

On the relationship between biodiversity and scientific inspiration

Dr Ralf Ohlemüller[1], Dr Mark J. Brewer[2], Prof Robert B. O'Hara[3], Mr Robbert McCann[1], Dr Barbara J. Anderson[4]

[1]School of Geography, University of Otago, Dunedin, New Zealand, [2]Biomathematics and Statistics Scotland, Aberdeen, Scotland, [3]Department of Mathematical Sciences, Norwegian University of Science and Technology, Trondheim, Norway, [4]Otago Museum, Dunedin, New Zealand

Ecosystem Services, Conference A/B, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

RO is a biogeographer with a passion for species and ecosystem responses to natural and anthropogenic environmental change. His research covers a wide range of temporal and spatial scales and typically leads to a map of some kind. He likes maps.

The natural environment is a key stimulus for scientific investigation and the advancement of knowledge. Ongoing loss of biodiversity negatively affects many physical ecosystem services but its impact on cultural ecosystem services is more difficult to quantify and assess. Here, we investigate the relationship between biodiversity and scientific activity as a key cultural ecosystem service. We use the number of articles published on a clade as a measure of the degree to which that clade has provided scientific inspiration for the three globally best resolved taxa birds, mammals and plants. For all three taxa we show a significant positive relationship between the number of species in a family and the total number of articles published on that family. This relationship is non-linear with the rate of increase in the number of articles published per species being highest in species-poor families. Whereas at the species level, important drivers of scientific activity include the species' domestic use, threat status and whether the species is a scientific model organism, we here show that at higher taxonomic levels, scientific activity is positively correlated with biodiversity. We argue that the loss of species may therefore diminish scientific inspiration and activity.

Developing a novel zero-density management strategy for possums – initiatives for Predator Free 2050

Tess O'Malley[1]

[1]*University of Auckland, Auckland, New Zealand*

Invasive Species Impacts Symposium I (predators), Stewart Theatre 1, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

Tess is a PhD candidate at the University of Auckland. She is passionate about the study of conservation, particularly the control of invasive species. She is interested in pursuing a combination of applied and fundamental research. This includes the development of novel management strategies and tools, as well as understanding how invasive species interactions may affect control operations. Although not part of her current PhD, she also holds a strong interest in animal cognition, particularly problem solving, tool use and language.

A Predator Free 2050 initiative from the Taranaki Mounga Project aims to establish a novel zero-density management strategy for controlling brushtail possums (*Trichosurus vulpecula*). The project is ambitious, taking place in a contiguous landscape without natural barriers to reinvasion, and incorporating public, private and conservation land. The project covers the Kaitake Ranges, a 2000 hectare (ha) forest budding off of Egmont National Park and surrounded by farmland on three sides. Control efforts started in April 2019 and are ongoing. The project first aimed to remove resident possums using aerial application of 1080. Thereafter, reinvasion is being controlled through poisoning and trapping around the Kaitake Ranges. Reinvaders which make it through these barriers are removed by a network of detection and removal tools within the ranges. Effectiveness of these control methods is monitored partially through GPS collaring of possums to observe reinvasion behaviour, fine-scale movement patterns and time from reinvasion to removal. This monitoring includes simulating reinvasion through translocation of possums. Additionally, potential for competitor release of rats (*Rattus rattus*) is monitored by comparing rat density at two locations: one within the Kaitake Ranges and one within the main body of the park. This work is expected to be supported by pen trials investigating behavioural interactions between wild-caught possums and rats. Monitoring began in March 2019 and will persist for approximately two years. This talk will present results to date, which thus far suggest the presence of behaviourally distinct sub-groups of possums, that present different patterns of interaction with control tools.

Nationally threatened and regionally uncommon species of the Waikato region

Dr Elizabeth Overdyck[1], Dr Yanbin Deng[2], Daniel Tait[2]

[1]Self-employed ecologist, Hamilton, New Zealand, [2]Waikato Regional Council, Hamilton, New Zealand

Large Scale Ecology, Stewart Theatre 2, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

I am a self-employed terrestrial ecologist currently working part-time with Waikato Regional Council. I specialise in plant ecology, botany and restoration and completed a PhD at Waikato University in urban forest restoration, with particular focus on seed dispersal and regeneration. I have worked previously for the Department of Conservation in vegetation survey and monitoring and threatened plant management.

Waikato Regional Council has a role through the Regional Policy Statement to protect threatened indigenous habitats and species, safeguard remnant populations of indigenous species, and recreate ecological links for threatened species habitat. To better meet these obligations for biodiversity protection on private and public land, the council began an inventory for all nationally threatened and regionally uncommon species occurring within the Waikato region.

A database was created using the New Zealand Threat Classification System with data for selected taxonomic groups derived primarily from council Significant Natural Area datasets and Department of Conservation internal data sources. Attributes of the database include: conservation status; species translocations; regional endemism; data sensitivity; habitat; ecosystem classification; international conservation status; and occurrence in territorial authorities.

Currently, 305 threatened, at risk and data deficient species are recorded as occurring in the region including: vascular plants (196); birds (50); herpetofauna (20); invertebrates (23); freshwater fish (10); marine mammals (4); and terrestrial mammals (2). Additionally, 60 species are recognised as recently lost from the region while 109 species are recorded as regionally uncommon. The Waikato has at least 16 regionally endemic species, including 11 invertebrates, three plants, one frog and one lizard, and is a stronghold for breeding populations of several other threatened species.

The database requires regular updating for accurate conservation status and spatial information, and addition of further taxonomic groups. Ultimately, this will enable the council and territorial authorities to more effectively monitor, protect and restore habitat for threatened species in a collaborative manner with other landowners/mangers.

Overview I

Renee Johansen, **Dr Mahajabeen Padamsee**

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Overview: Current research programmes and management activities for myrtle rust
Speakers: Mahajabeen Padamsee, Maureen O'Callaghan, Katrin Webb
Myrtle rust has been present on the New Zealand mainland since 2017 and threatens many ecologically, culturally and economically important native host species. In response, multiple research and management efforts are underway or being planned, many of which follow on from work previously commissioned by MPI following initial disease incursion. This overview will be divided into three parts, which collectively will summarise major activities taking place in New Zealand at this time. The research programme Beyond Myrtle Rust, the largest multi-agency research effort into myrtle rust currently taking place, will be introduced by the programme leader Mahajabeen Padamsee. The BioHeritage National Science Challenge programme Ngā Rākau Taketake will be introduced by co-leader Maureen O'Callaghan. Katrin Webb will discuss Department of Conservation management activities and plans.

Reinvasion prevention of the common brushtail possum (Trichosurus vulpecula) within a New Zealand urban centre via spatially explicit, agent-based modelling

Ms Charlotte Patterson[1], Yolanda van Heezik[1], Philip Seddon[1], Deb Wilson[2]

[1]Department of Zoology, University of Otago, Dunedin, New Zealand, [2]Manaaki Whenua Landcare Research, Dunedin, New Zealand

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Currently completing the thesis component of her Masters of Ecology at the University of Otago, Charlotte is an engaged student researcher with a passion for the outdoors. At present her particular research interests include the spatial ecology of invasive species, as well as urban ecology and biodiversity management.

Invasive mammalian pests threaten biodiversity globally, and do so across a diverse range of habitats. Recent interest in urban biodiversity enhancement has increased the need for effective urban pest control. Mainland eradication goals are often hampered by the ongoing threat of reinvasion, with sites instead remaining in a state of "perpetual eradication". As such, efforts to control mammalian pests in cities often represent a significant long-term investment, further complicated by the interests of urban residents. It is therefore imperative that urban pest management is integrated and evidence-based. Spatial modelling tools can help to facilitate urban management decision-making, reducing uncertainty and allowing for the exploration of alternative future scenarios. In this study we have applied a spatially explicit, agent-based model of the common brushtail possum (*Trichosurus vulpecula*), a significant folivorous and predatory pest, within the city of Dunedin, New Zealand to ask specific management questions. In particular, we have investigated the trapping effort and spatiotemporal design within an urban buffer zone necessary to minimise long-term reinvasion of the Otago Peninsula, the 10,000ha eastern edge of the Dunedin city harbour, which after 10 years of possum control is nearing eradication status but will continue to receive immigrants from the central city. Results from simulations are used to highlight possum population trajectories and potential reinvasion pathways based on current and alternative management practices, with recommendations being made. Through application we demonstrate the potential for this important tool to inform mainland predator management in Dunedin and elsewhere in New Zealand.

New Zealand's changing fire environment – current and future

V Clifforf[1], L Langer[1], **Grant Pearce[1]**, T Strand[1]
[1]Scion Rural Fire Research Group, Christchurch,

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

New Zealand's changing fire environment – current and future

H. Grant Pearce, T. Strand, V. Clifford and L. Langer
Scion Rural Fire Research Group, Christchurch.

Abstract

New Zealand currently experiences some 4100 wildfires annually that burn on average around 5500 ha, although this fluctuates widely from year to year. Fire climate severity also varies widely across the country due to the effects of latitude and terrain on microclimates. However the potential exists for fire risk to increase significantly with climate change. Analyses have shown that fire seasons could become longer, and the frequency of severe fire weather days could double, or even treble, in some parts of the country. Potential also exists for a greater number of fire starts, as a result of increasing population, more people moving to rural lifestyle blocks, increased recreational use and changing land cover. The impact of wildfire events on New Zealand's rural and urban communities has grown in recent years with, for example, 16 homes destroyed (and many other damaged or threatened) across the country during the 2016-2017 fire season, the greatest number lost in 100 years. The 2017 Port Hills and 2019 Pigeon Valley wildfires, in the Canterbury and Nelson/Tasman regions respectively, are recent examples of this, destroying homes and causing large numbers of evacuations. The changing New Zealand climate and fire environment will mean the potential for more extreme fires – unpredictable, and highly dangerous – posing increased risks to life, property and the environment.

* Pearce, H.G.; Strand, T.; Clifford, V.; Langer, L. 2019. New Zealand's changing fire environment – current and future. Abstract submitted for the Symposium on Fire Ecology and Management, 1 December, Lincoln. [held as part of the New Zealand Ecological Society Annual Conference, 1-5 December 2019, Lincoln University].

What do ecological networks tell us about ecosystem functions?

Dr. Guadalupe Peralta[1]

[1]*University of Canterbury, Christchurch, New Zealand*

Species Interaction Networks Symposium, Stewart Theatre 1, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

am an ecologist with special interest in species interactions. My research is focused on understanding why species interaction patterns change across space and time, and how does this affect ecosystem functioning and services. I am also interested in using interaction networks as tools for unravelling the mechanisms behind community composition and diversity patterns. I am currently a post-doctoral fellow at the University of Canterbury, New Zealand.

Species interactions are key determinants of ecosystem functions and therefore highly valuable from an applied perspective. The presence of species in a community does not guarantee that an interaction is occurring and hence monitoring species interactions is essential for understanding changes in ecosystem functions and managing ecological communities for ecosystem services. Different aspects of the structure of ecological networks can inform us about the state of ecosystem functions. For example, the structure of ecological networks can inform us about complementarity in resource of predators in a community, which in turn is positively related to predation rates. Moreover, valuable information about the temporal and spatial stability of ecosystem functions can be extracted from ecological networks. For instance, from species interaction network data it is possible to determine the number of different species fulfilling the same functional role, i.e. functional redundancy, which can be used as an estimate of how variable those functions might be, and therefore how much could we rely on them. Overall, ecological networks can be useful tools for assessing both ecosystem functions and the spatio-temporal stability of these functions, providing us with valuable information with which to make informed decisions for management and conservation.

Protecting indigenous biodiversity within plantation forestry landscapes: A case study at Tangimoana Forest.

Mr Paul Peterson, Dr Robyn Simcock

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Opportunities to create broad indigenous biodiversity gains within plantation forestry landscapes have received limited attention in New Zealand. Most effort and resource to date has been targeted at individual species' programmes. Most plantation forestry landscapes contain non-productive, either planted or unplanted, areas. A small proportion of these areas are already protected for their high conservation value however the remainder may also have potential to support indigenous biodiversity. Given that opportunities to create habitat for indigenous biodiversity are often site-specific, case studies are important to see if gains are currently being made, or if fresh approaches can be adopted, to better promote indigenous biodiversity. We investigate one such site within the Manawatu-Wanganui Region where landscape modification has been particularly severe and indigenous biodiversity is under-represented.

Within Tangimoana plantation forest, retired non-native pines and macrocarpa covering approximately 180 ha form a shelter belt running along the Foxton Ecological District coastline. Over time native wet/swamp land, lake, scrubland and forest habitats have been replaced with plantation forestry, farmland and cropping, and are now all under-represented. This case study investigates current biodiversity, and the potential for creating further indigenous biodiversity gains, within this area of retired exotic forest. Of the options discussed with Ernslaw One Ltd, shrub regeneration in forest gaps, weed and pest control, and modification of decommissioned fire ponds were all seen as potentially viable activities to create more natural habitats in conjunction with an existing dune erosion control programme.

Rapid evolution in parasites: New Zealand trematodes keeping up with a changing world

Prof. Robert Poulin[1]

[1]*University of Otago, Dunedin, New Zealand*

Contemporary Evolution in Response to Environmental Change Symposium, Stewart Theatre 2, December 4, 2019, 1:30 PM - 3:00 PM

Biography:

Robert Poulin is a Professor in the Zoology Department, University of Otago. He leads the Parasitology Research Group, which conducts research on all ecological and evolutionary aspects of host-parasite interactions, across multiple taxa, and using a range of approaches (experiments, field studies, genetics and genomics, meta-analyses, etc).

High fecundity and short generation times are key attributes allowing species to evolve rapidly in response to anthropogenically-induced environmental change. These happen to be common properties of parasitic worms. Another essential element necessary for rapid evolution is the existence of genetic variation in key traits in a population. We used flatworms (trematodes) parasitic in native New Zealand animals as models to test whether they display phenotypic and genotypic variation in response to environmental change. Trematodes typically have a complex life cycle, involving three different host species. The asexual replication of juvenile trematodes within their intermediate host provides clonal replicates of each genotype, allowing for robust experimental tests. In the marine trematode *Maritrema novaezealandense*, a key member of our intertidal ecosystems, we found significant differences among genotypes in their host preferences, in their responses to rising temperatures, and in their ability to tolerate ocean acidification. In the freshwater trematode *Coitocaecum parvum*, we demonstrated that genotypes using the normal three-host life cycle can, in the very next generation, switch to a truncated two-host life cycle in immediate response to the absence (i.e. simulated extinction) of their final fish host. Our findings indicate that local populations of these parasites possess the genetic variation necessary to adapt quickly to rapid environmental changes, possibly giving them an edge in the coevolutionary arms race with their hosts.

Have your kēkēwai and eat it too: dual prioritisation of species recovery and ecosystem rehabilitation for better bioheritage outcomes

Aisling Rayne[1], Greg Byrnes[2], Levi Collier-Robinson[1], John Hollows[3], Professor Angus McIntosh[1], Mananui Ramsden[6], Makarini Rupene[4], Paulette Tamati-Elliffe[5], Channell Thoms[1], Associate Professor Tammy Steeves[1]

[1]University of Canterbury, Ōtautahi Christchurch, Aotearoa New Zealand, [2]Te Kōhaka o Tūhaitara Trust, Woodend Beach, Aotearoa New Zealand, [3]KEEWAI, , Aotearoa New Zealand, [4]Ngāi Tahu Research Centre, Ōtautahi Christchurch, Aotearoa New Zealand, [5]Te Nohoaka o Tukiauau Trust, , Aotearoa New Zealand, [6]Environment Canterbury, Ōtautahi Christchurch, Aotearoa New Zealand

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Aisling is a PhD candidate at the University of Canterbury, situated near the rural community where she grew up. For her research, she is privileged to work in partnership with an exceptional team including mana whenua, conservation practitioners and primary industry to enhance resilience in kēkēwai / freshwater crayfish using genomic and non-genomic tools.

Aotearoa New Zealand is globally renowned for innovative conservation management of threatened terrestrial biota, including evidenced-based bird translocations to offshore predator-free islands. Conservation strategies are increasingly focused on weaving mātauranga Māori and Western science through a Te Ao Māori lens. For example, as mana whenua, practitioners and scientists, we are co-leading approaches to enhance resilience of threatened species by incorporating adaptive potential (i.e., capacity to respond to a changing environment) into translocation decisions. Approaches that centre Te Ao Māori consider both threatened taonga species and the habitats in which they live. However, recent national and international dialogue appears to be signalling a shift away from targeted recovery of at-risk species toward prioritising ecosystem rehabilitation. While we applaud holistic approaches, what happens when we rehabilitate ecosystems without addressing the threats to, or investing in the recovery of, the species that inhabit them? Most at risk are our legally unprotected species, such as indigenous freshwater fish and invertebrates. Here, we reflect on Māori-led and co-led restoration projects at Tūhaitara Coastal Park and Te Nohoaka o Tukiauau / Sinclair Wetlands as case studies for incorporating mātauranga Māori and Western science-based species recovery tools into ecosystem rehabilitation. These examples demonstrate that resilient bioheritage can be achieved by investing in the dual recovery of threatened species and ecosystems, both in Aotearoa and beyond.

The microbiome of New Zealand myrtaceous species is diverse and contains members important for plant defence

Dr Hayley Ridgway[1], Dr Fernanda Nieto-Jacobo[1], Dr Soonie Chng[1], Dr Julia Soewarto[2], Mrs Monika Joshi[1], Ms Kirsty Boyd-Wilson[1], Dr Beccy Ganley[3]

[1]The New Zealand Institute of Plant and Food Research Ltd, Lincoln, New Zealand, [2]Scion, Private Bag 3020, Rotorua, New Zealand, [3]The New Zealand Institute of Plant and Food Research Ltd, Te Puke, New Zealand

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (II), Stewart Theatre 2, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

I am a senior scientist and the team leader of Microbial Systems for Plant Protection at Plant & Food Research. I joined the organisation after 19 years with Lincoln University where I was an Associate Professor in plant microbiology, lecturing in plant pathology, genetics and soil microbiology. My area of research is on microbial ecology of plants. Like animals, they are hosts to a large and complex community of microorganisms that can be both beneficial and detrimental to plant growth and health. The ancillary genomes provided by the millions of microbes inhabiting plants shape their ecological success.

Plants are metaorganisms whose ecological success is modulated by the community of micro-organisms that lives on them and in them. Previous work on the New Zealand myrtaceous species *Leptospermum scoparium* (mānuka) demonstrated that re-inoculation with selected bacterial endophytes could improve plant growth and enhance the amount of grandiflorone (essential oil) in the leaves. For New Zealand Myrtaceae it was unknown whether the plant associated microbial community could also influence infection by the recent invader *Austropuccinia psidii* (myrtle rust). In other countries it has been shown that young tissue is more susceptible to infection by *A. psidii*. Thus, we tested the hypothesis that the endomicrobiome would differ between last and new season's growth and that endophytes found in mature tissue would be antagonistic towards rust spores. A live collection of 815 endophytes was obtained of which 71% were fungi and 29% were bacteria. Of these 56% and 44% were from *L. scoparium* and *Meterosideros excelsa*, respectively. This was complemented by amplicon sequencing. The results from both approaches showed that host, tissue type and age were major drivers of the endophyte community structure. An *in vitro* assay was developed to assess the ability of bacterial endophytes to inhibit the germination of rust spores. Using poplar rust (*Melampsora larici-populina*) as a proxy, the results showed that the endomicrobiome of *L. scoparium* and *M. excelsa* contained bacteria that were antagonistic towards germination of urediniospores. These findings support the possibility that there is a role for the microbial community pathogen defence.

sTWIST – Theory and Workflows for Alien and Invasive Species Tracking

Dr Mariona Roige[1], David Clarke[2], Dr Joana Vicente[3], Professor Melodie McGeoch[2]

[1]AgResearch, Lincoln, New Zealand, [2]Monash University, Melbourne, Australia, [3]CIBIO Research Center in Biodiversity and Genetic Resources - InBIO, Vairão, Portugal

Invasive Species, Stewart Theatre 1, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Mariona is a Postdoc at AgResearch working on validating quantitative approaches for modeling the risk invasive species pose to Biosecurity. She is interested in quantitative Ecology, and all things modeling.

The most recent report issued by Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) identified invasive species, along with climate change and habit loss, as one of the main threats to biodiversity. The year 2020 marks the end of the United Nations Decade on Biodiversity and it is also the moment to evaluate the Aichi targets. To assess the accomplishment of the Strategic Plan for Biodiversity 2011-2020, the Convention on Biological Diversity (CBD) crafted and published a list of generic and specific indicators related to each one of the Aichi targets. Seven categories of indicators were identified as required to report on the Aichi Target 9, however only for four of the seven categories there was a suitable specific indicator. Developing theory rich, synthetic workflows to deal with this highly policy-relevant problem and key threat to biodiversity is essential. sTWIST has been communicating closely with the CBD, GBIF and the IUCN (ISSG) on invasion policy targets with the aim to deliver key elements of the foundation needed for long-term monitoring of biological invasions, for improved assessments and more robust reporting. This presentation will summarise the problems and challenges faced in the design of suitable global invasive species indicators and will give an outline of the progress made towards having a scientifically robust method for tracking invasions globally.

Climate matching for Pest Risk Analysis: a model validation

Dr Mariona Roige[1], Dr Craig B. Phillips[1]
[1]*AgResearch, Lincoln, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Mariona is a Postdoc at AgResearch working on validating quantitative approaches for modeling the risk invasive species pose to Biosecurity. She is interested in quantitative Ecology, and all things modeling.

Pest risk analysis (PRA) is conducted by plant health authorities to identify and implement the necessary phytosanitary measures to protect from species that can become a pest. In New Zealand, the Ministry for Primary Industries is the lead agency for Biosecurity, and its Risk Analysts are in charge of performing PRA for potential threatening species.
Ideally, Risk Analysts would use a set of quantitative and modelling tools to calculate the habitat suitability to inform their risk assessments. However, frequently, the models need to be constructed under time pressure and with minimal information.
An option for fast, yet science-based tool to estimate habitat suitability for threatening species is Climate Matching. Climate Matching has been widely applied in PRA to estimate the potential geographic distributions of weeds, insects and mites. However, there is a lack of studies that address its predictive validity and its sensitivity to the quality of the input data.
Here we propose the use of the algorithm Match Climates Regional (from CLIMEX) as a climate envelope model to create potential distributions for species of Biosecurity concern, assess the validity of those potential distributions and perform an uncertainty analysis to understand the effects of data input on the model results.

Outgrowing our Mowing: Encouraging low-cost, biodiverse lawns in Auckland

Ms Olivia Rooke-Devoy[1], Dr Bruce Burns[1]
[1]*University of Auckland, Auckland, New Zealand*

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Biography:
Olivia recently completed her BSc(Hons) under the guidance of Dr Bruce Burns, researching the social and ecological characteristics of urban lawns in Auckland. She intends to pursue this research further as a PhD study. Her broader research interests encompass applied urban ecology and conservation, especially from an interdisciplinary perspective. Olivia currently works at the Auckland Botanic Gardens, where she is engaged in both horticultural and ecological projects.

Tied to New Zealand's colonial history, lawns are valued recreational spaces that buffer our dwellings. However, lawns also incur significant environmental and financial costs. Despite these benefits and costs, few studies have comprehensively evaluated the social and ecological roles of lawns in New Zealand. Throughout 2018, we investigated the perceptions and lawn maintenance habits of the Auckland population, variation in lawn composition, and the impacts of maintenance intensity on lawn communities. A mail survey of Auckland households (n=108) revealed that lawns were a ubiquitous component of private residences (98/108). These lawns were most commonly maintained with a petrol mower every two weeks (121/224). On average, respondents estimated they spent $277.10 (±57.90 CI) yearly on lawn maintenance, driven by aesthetic concerns influenced by social norms. A field study of 30 lawn sites across Auckland reflected a broader trend towards homogenisation of lawns globally; 49 out of 54 species identified were exotic and found in lawns in other western cities. Correlations between social factors (visibility of lawn from road, distance to nearest building) and lawn site variation suggested lawn maintenance intensity may influence lawn plant community composition. Results from an experimental mowing trial supported this finding. Disturbance intensity (mowing frequency) was found to impact both types and abundances of species; infrequent mowing favoured flowering forbs, whereas higher mowing intensities favoured leguminous species. Ultimately, the results of this project confirm that, as green spaces, Auckland lawns have considerable financial, social and ecological impacts and opportunities. Further research building on these results is suggested.

The fate of cutover forest: a case study in the Kauaeranga Valley, Coromandel.

Miss Hayley Roos[1]

[1]*The University of Auckland, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Hayley Roos is a MSc student at the Joint School of Biodiversity and Biosecurity, University of Auckland. Her research is focusing on the spatial and temporal dynamics of New Zealand's indigenous forests that were disturbed by partial logging during New Zealand's pioneering history. This study is supervised by Bruce Burns of the University of Auckland.

The spatial and temporal dynamics of forests are determined by interactions between abiotic, biotic and disturbance factors. Large areas of New Zealand's indigenous forests were disturbed by partial logging during New Zealand's pioneering history, but there is little information on how these cutover forests are developing since this exploitation ceased. Will they recover to their original structure and composition? The Kauaeranga Valley (c. 1500 ha) is an area with varied topography and elevation and an extensive history of logging, mostly of kauri (*Agathis australis*) between 1870 and 1920. The aims of this study are to (1) assess spatial variation in vegetation composition across the Kauaeranga Valley cutover forest landscape in relation to logging history, and (2) examine temporal changes over decades in cutover forest structure and composition. Landscape-scale vegetation patterns will be described from a network of temporary plots located in different types of forest with varied topography and elevation and their relationship with the environment will be examined using indirect gradient analysis techniques. Temporal changes in forest structure and composition in response to logging will be assessed using permanent plots established between 1980 and 1993 from which we have between 21 to 39 years of change data. In understanding the spatial and temporal responses of forests to partial logging, appropriate decisions can be made in relation to conservation and ecosystem restoration.

Risks of unintended human-mediated dispersal using visitors' travelling patterns

Rogini Runghen[1], Dr Daniel Stouffer[1]

[1]*University of Cantgerbury, Christchurch, New Zealand*

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

I am a current PhD student from the School of Biological Sciences at the University of Canterbury. I am mainly interested in ecological networks and invasion ecology.

Human-mediated dispersal is considered a significant contributor to biological invasion.
As a consequence of globalisation, transportation networks are being extensively developed, which results in the spread of exotic species over longer distances. In our current study, we attempt to predict unintended human-mediated dispersal by using information on the visitors' travelling patterns. Conventionally to understand and predict human travelling patterns, individuals are often categorised based on metadata such as their age, gender, nationality and their interests; or places to which individuals travel to which are categorised based on their characteristics such as whether they are recreational sites, national heritage sites or main cities. Though these categorisations seem intuitive, it oversimplifies the actual travelling pattern by assuming that: 1) all individuals or places of particular characteristics behave similarly or receive visits from similar types of visitors and 2) the particular characteristicsused to categorise the travelling patterns are assumed to be ground-truth – i.e. we assume that those characterisitcs might strongly affect the way individuals interact.
To address these issues, we will show how we used national survey data – depicting the visitors' travelling pattern across New Zealand – to assess the extent to which metadata are informative when predicting future travelling patterns. To do so, we compare how different modelling frameworks behave when adding covariates to them when predicting new interactions. We will conclude by demonstrating how these approaches could be used to improve national survey designs and assess the risks of unintended human-mediated dispersal at a national scale.

Consequences of multi-species introductions on island ecosystems

Dr James Russell

Invasive Species Impacts Symposium I (predators), Stewart Theatre 1, December 3, 2019, 2:00 PM - 3:00 PM

The rate of non-native species introductions continues to increase, with directionality from continents to islands. It is no longer single species, but entire networks of co-evolved and newly interacting continental species, that are establishing on islands. The consequences of multi-species introductions on the population dynamics and interactions of native and introduced species will depend on the form of trophic limitation on island ecosystems. Freed from biotic constraints in their native range, species introduced to islands no longer experience top-down limitation, instead becoming limited by and disrupting bottom-up processes that dominate on resource-limited islands. This framing of the ecological and evolutionary relationships among introduced species with one another and their ecosystem has important consequences for conservation. Whereas on continents the focus of conservation is on restoring native apex species and top-down limitation, on islands the focus must instead be on removing introduced animal and plant species to restore bottom-up limitation.

Towards a framework for understanding the context-dependencies of the impacts of non-native tree species

Dr. Sarah Sapsford[1], Dr. Angela Brandt[2], Dr. Kimberley Davis[3], Dr. Guadalupe Peralta[1,4], Professor Ian Dickie[1], Mr. Rob Gibson II[5], Ms. Joanna Green[1], Professor Phil Hulme[5], Dr. Martin Nunez[6], Dr Kate Orwin[4], Professor Anibal Pauchard[7], Professor David Wardle[8], Dr Duane Peltzer[4]

[1]University of Canterbury, Christchurch, New Zealand, [2]Manaaki Whenua Landcare Research, Dunedin, New Zealand, [3]University of Montana, Missoula, United States of America, [4]Manaaki Whenua Landcare Research, Lincoln, New Zealand, [5]Lincoln University, Lincoln, New Zealand, [6]CONICET-Universidad Nacional del Comahue, Bariloche, Argentina, [7]Universidad de Concepcion, Concepcion, Chile, [8]Nanyang Technological University, Singapore, Singapore

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

I am a disease and fungal ecologist who focuses on the roles of fungi and pathogens in communities and ecosystems. I have particular interest in mycorrhizal fungi and using molecular tools to detect these fungi in the field. I completed my PhD at Murdoch University in Perth, Western Australia.

I am currently a postdoctoral fellow involved in the belowground legacies of wilding pine invasions and the role of invasive fungi. I am specifically interested in how the introduction of invasive pines and mycorrhizal fungi into grasslands alter soil ecosystem function through changes in microbial communities and soil enzyme activity.

Biological invasions are a major driver of ecosystem change but causes of variation in impacts over space and time remain poorly understood. Most approaches used to quantify impacts assume there are interactions among *per capita* effects, abundance and area occupied by non-native species. However, these factors and their interactions are rarely evaluated in practice and do not recognise that the magnitude of impacts can be highly context-dependent. We use Pinaceae to illustrate how context-dependency in the impacts of non-native species can be generated by at least three processes: non-linearity in relationships between non-native species effects and density; intraspecific variation in functional traits; and shifts in impacts along environmental gradients. We also demonstrate how non-native species impacts change over time and through relationships with antagonists and mutualists. Our results demonstrate how impacts of non-native species can occur at both low and high density: changes in soil enzyme activity occurs across a density gradient of Pinaceae which can have cascading effects on soil nutrient cycling. By not accounting for intraspecific variation in the prediction of non-native species impacts, significant errors can occur. We also develop a model that demonstrates ecosystem impacts of non-native species are not fixed but vary predictably along an environmental gradient as a function of density and *per capita* effects. Lastly, our results demonstrate how removal of non-native species through management provides an important tool for revealing biological and ecosystem legacy effects. Taking context-dependencies of non-native species impacts into consideration is critical for refining decisions on management effectiveness.

Do genetic shifts explain the success of invasive plant species?

Sandra Savinen[1], Dr Jeanne Jacobs[2], Dr Christopher Winefield[3], Professor Philip Hulme[1]

[1]Bio-Protection Research Centre, Lincoln, New Zealand, [2]AgResearch Ltd, Lincoln, New Zealand, [3]Lincoln University, Lincoln, New Zealand

Next Generation on Next-Generation Sequencing Symposium (I), Stewart Theatre 2, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Sandra Savinen is a PhD student at the Bio-Protection Research Centre, working under the supervision of Prof Philip Hulme. Her PhD is a part of a project on contemporary evolution in weed invasions. Sandra's focus is on genetics of the invasive dock (Rumex) species, looking at genetic shifts in native and introduced populations. She has a BSc and MSc in ecology and evolutionary biology, both from University of Jyväskylä in Central Finland.

What can the genetic structure of introduced populations tell us about the process of biological invasions? Where few individuals have been introduced to a country, we may explain low genetic variation both within and across multiple populations. In contrast, multiple introduction, while perhaps not increasing genetic diversity to the same extent as in the native range may lead to greater variation at the population level. Such greater variation may facilitate invasion through admixture effects. I examined genetic variation in three weedy Rumex species that are native to Europe and were introduced to New Zealand roughly 150 years ago. I compared diversity within and between their native and introduced provenances (United Kingdom and New Zealand, respectively). I used next-generation-sequencing method called genotyping-by-sequencing. It yields thousands of single nucleotide polymorphisms (SNPs) which can be used in standard genetic analyses, such as measures of genetic differentiation and distance (e.g. F_{ST} and PCA), to observe and visualize the variation between individuals. As assumed, native range was more diverse compared to the introduced, although not by much, and patterns were similar between all three species. However, overall the provenances differed from each other very little, which gives us a reason to believe that the NZ plants have not experienced bottlenecks, but rather have been introduced multiple times from multiple sources in the UK and have thus kept most of the variation present in their native range.

Climatic Niches of New Zealand's Extinct and Extant Plant Genera

Nora Schlenker[1], Ralf Ohlemüller[1], William Lee[2], Daphne Lee[1]
[1]*University of Otago, Dunedin, New Zealand,* [2]*Landcare Research, Dunedin, New Zealand*

Spatial Ecology, Conference A/B, December 3, 2019, 3:30 PM - 5:00 PM

Biography:
Nora graduated from the University of British Columbia with a BSc in Natural Resource Conservation and then worked as an Environmental Planner at Anchor QEA in Seattle, Washington. She is currently completing her Master of Environmental Science in Biogeography at the University of Otago in Dunedin, New Zealand under the supervision of Dr. Ralf Ohlemüller.

Throughout Earth history, changes in environmental conditions have caused plant species to either adapt or become regionally extinct. However, the drivers of this phenomenon are poorly understood. This project investigates Cenozoic plant extinctions in New Zealand to understand the impact of environmental change on the fate of plants. We analyse the climatic niche of extant and locally extinct New Zealand plant genera to determine the role that climate (temperature, precipitation, seasonality) may have played in the disappearance of many genera during climatic cooling in the late Miocene to Pleistocene. Species distribution data in Australia and New Zealand was obtained from the Global Biodiversity Information Facility (GBIF) and gridded climate data from WorldClim2 was used to determine the climatic niche of each genus. Most genera (70%) that are locally extinct in New Zealand occupy significantly different niche space compared to closely related extant genera in Australia. All genera currently extant in New Zealand occupy different climatic niches between their Australian and New Zealand distributions. This suggests that locally extinct New Zealand genera now occupy different climate niche than closely related extant New Zealand genera, indicating some degree of niche differentiation. Additionally, we found no relationship between extinction age and the level of niche overlap between the extinct and closely related extant genera. Overall, understanding the differences in the climate niche occupied by extinct and extant plant genera can provide insight to the drivers of these historic extinctions.

Genetic and morphometric patterns indicate black-fronted terns are a habitat-tracking metapopulation

Ann-Kathrin Schlesselmann[1,2], Nicolas Dussex[2], Jamie Cooper[1], Jo Monks[4], Colin O'Donnell[5], Bruce Robertson[1]
[1]Manaaki Whenua, Dunedin, New Zealand, [2]Department of Zoology, University of Otago, Dunedin, New Zealand, [3]Department of Bioinformatics and Genetics, Swedish Museum of Natural History, Stockholm, Sweden, [4]Biodiversity Group, Department of Conservation, Dunedin, New Zealand, [5]Biodiversity Group, Department of Conservation, Christchurch, New Zealand

Braided Rivers Symposium, Stewart Theatre 1, December 2, 2019, 10:45 AM - 12:15 PM

Biography:
Ann-Kathrin Schlesselmann has broad interests in applied conservation research, ecological modelling, and restoration. Currently, Ann-Kathrin works as a postdoctoral researcher at Manaaki Whenua as part of the "More birds in the bush - Large-scale restoration across complex forests" project, with a focus on modelling bird population responses across predation and food resource gradients.

Many species exist in metapopulations, as they occur in discrete local populations that occupy suitable habitat patches separated by unsuitable habitat. For species adapted to ephemeral habitat, patches often become unsuitable and stay unsuitable for some time, requiring species to track patches of optimal habitat in space and time. The endemic black-fronted terns (*Chlidonias albostriatus*) specialise on using ephemeral nesting and feeding habitats, forming loose colonies on bare gravel bars of braided rivers. The species is of great conservation concern as populations are in decline. We used a three-pronged approach based on 17 microsatellites, two mitochondrial loci, and phenotypic data to investigate population structure. Across their range black-fronted terns were effectively panmictic, with overall low genetic divergence between breeding colonies and no isolation-by-distance. At fine geographical scales, black-fronted terns accrued significant genetic structure for distances up to 75 km. Furthermore, a phenotypic cline in accordance with Bergmann's rule was evident and the P_{ST}–F_{ST} comparison was suggestive of local adaptation. We conclude that black-fronted terns function as a habitat-tracking metapopulation, with high turn-over and mixing of colonies on local scale by repeatedly colonising optimal habitat nearby. Conservation management will need to include protecting currently uninhabited patches to facilitate natural colonisation of suitable habitat and preferably manage whole catchments throughout the breeding range. In general, significant fine-scale structure can be present in highly mobile, specialist species while not affecting spatial structures at larger scales. Hence, methodologies applied to whole landscapes and local scales are important to understand connectivity in dynamic metapopulations.

The great assisted escape: Improving conservation translocation success for threatened insects using the robust grasshopper as a case study.

Jennifer Schori[1], Assoc. Prof. Tammy Steeves[1], Dr. Tara Murray[1]

[1]*University of Canterbury, Christchurch, New Zealand*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Jennifer Schori is in the final year of her PhD at the University of Canterbury. She has interests in conservation biology and entomology. Using the robust grasshopper as a case study, she has worked on improving conservation translocation success for threatened insects.

Despite there being > 700 species of endemic New Zealand insects classified as Threatened or At Risk, the application of conservation translocations for insects has been limited. Here, we develop strategies for improving conservation translocation success for insects using the Nationally Endangered robust grasshopper, *Brachaspis robustus,* as a case study. We focus on four key knowledge-gaps; (1) the biology of the species, (2) how to select a suitable receiving habitat, (3) the causes of population decline, and (4) how to accurately monitor translocation outcomes. We show that multiple releases of *B. robustus* on consecutive years are required to establish a resilient translocated population. We determine that the optimal receiving habitat for *B. robustus* is open, bare gravel that receives ongoing extensive weed management and high intensity mammalian predator control, because we found dense vegetation to be a barrier to grasshopper movement and introduced mammalian predators to be a key threat to persistence. To overcome errors arising from poor visual detectability of a highly cryptic insect, and to maximise the biological relevance of data, we also show that monitoring translocated and source populations of *B. robustus* will require repeated counts of adult female grasshoppers in November or early December over several consecutive days. We discuss how tools including captive rearing, miniaturised radio transmitters, and experimental translocation were used to fill the key knowledge-gaps, and the applications that our research has for improving conservation translocation success for other threatened insect species.

Words: 239.

Ecohydrology of trees in karst: a case study from Central Texas

Sarah Elizabeth Crouchet[1], James Heilman[2], Jennifer Jensen[1], Benjamin Schwartz[1], **Susan Schwinning[1]**
[1]Department of Biology, Texas State University, San Marcos, TX, USA, , , [2]Department of Soil and Crop Science, Texas A&M University, College Station, TX, USA, ,

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Susanne Schwinning is a native of Bremen, Germany and earned her PhD from the University of Arizona in Tucson (Department of Ecology and Evolutionary Biology). Since 2005 she has been a faculty member at Texas State University in San Marcos and is currently on sabbatical at the University of Waikato in Hamilton, NZ.

Karst is formed by the dissolution of soluble rock, often limestone, and is characterized by sinkholes, caves and underground streams. Where soils are thin, precipitation is transferred rapidly into the drainage networks of the bedrock below. Nevertheless, trees can grow in karst regions because their roots grow into and extract water from weathered layers of bedrock (epikarst) below the soil horizon. Just how much groundwater – or water destined to become groundwater - trees are consuming, is an important question for ecosystem management. I summarize what we have learned about the ecohydrology of oak-juniper woodlands in Central Texas, including estimates of plant-available soil storage capacity, how different tree species respond to drought and patterns of tree mortality during the extreme drought of 2011. I discuss the novel hypothesis that soil and epikarst may have antagonistic effects on the population dynamics of trees: More soil cover may promote tree productivity but reduce access to, or the amount of water stored in epikast, thereby amplifying tree mortality under relatively rare, severe drought conditions. By contrast, less soil may slow tree growth but increase access to epikarst-stored water, which may allow tree stands to avoid lethal water deficit under most drought conditions.

Stacking ecosystem services for biodiversity restoration: co-developing interventions through participatory approaches and farm planning

Dr Robyn Simcock[1], Dr Suzie Greenhalgh[1], Mr Ben Wiercinski[1]

[1]*Manaaki Whenua Landcare Research, Auckland, New Zealand*

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Dr Simcock is a restoration ecologist and soil scientist who has worked in grossly disturbed environments such as highways, cities and mines for over 20 years and has enjoyed working with Waikato farmers and Regional Council staff for the last 18 months on farm-scale biodiversity interventions where soils are generally marvellous!

We tested the value of using ecosystem services (ES) to inform biodiversity restoration planning in the Mangapiko catchment using a participatory approach with the local community and Regional Council. Five workshops covered problem definition, ES scoping and prioritisation, and articulation of costs/benefits of options (including field visits). This culminated in a draft Catchment Biodiversity Plan and Farm Environment Plans that adopt four main biodiversity interventions: riparian strips, pocket wetlands, hedges/shelterbelts and natural afforestation through weed control with grazing exclusion. Supporting material was developed to help farmers identify locations, alternative components (e.g., fencing types, plant species) and complementary 'clip-on' interventions (e.g., sediment traps, culverts) that 'stacked' services they valued most and that were part-externally fundable because they also delivered services of high priority to Council. We also identified localised practices to enhance biodiversity across the four interventions: treatment of dead wood, bare banks, buffering and 'bulking' edges, and managing weeds. Costings for interventions were developed using demonstration sites to 'localise' national data and identify key factors that inflate, or reduce, costs. Key cost-inflating factors were the weed species present and/or likely to invade, fencing choices, and how riparian willows/poplars were transitioned to lower-maintenance native species. Successful interventions are more likely where farmers and regulators have the flexibility and time to listen to each other and to develop biodiversity options that complement each unique farming system, available resources and priorities. Poorer outcomes are achieved if standardised, single-purpose approaches are used, e.g. standard riparian strip widths or setbacks from wetlands or narrow plant species range. We found enhancing native biodiversity in farmed landscapes can deliver benefits that enhance farm production and/or reduce environmental impacts of grazed areas, rather than being seen as 'non-productive'.

Keywords: ecosystem services, decision-making, biodiversity restoration planning, participatory process

How ‘wall of wood’ 1990s pine plantations could contribute to NZ biodiversity

Dr Robyn Simcock[1], Dr Suzie Greenhalgh[1], Ms Oshadhi Samarasinghe[1]
[1]*Manaaki Whenua Landcare Research, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Dr Simcock works in the area of restoration ecology and soil science. One of her first projects with Manaaki Whenua Landcare Research was supporting a national series of trials with (then) Forest Research Institute and LIRO investigating sensitivity of soils and second-rotation pines to simulated harvesting damage. During that time she and her partner planted a forest near Whangarei; harvesting that 'wall of wood' forest in 2018 stimulated this research project

The National Environmental Standard for Plantation Forests (NES-PF, 2018) explicitly recognises plantation forestry has a role in ‘improving indigenous vegetation and fauna’. The Forest Stewardship Council (FSC) requires a minimum proportion of indigenous ecosystems within certified forests with restoration required to meet minimum values. We investigated potential biodiversity outcomes linked to harvesting plantations, focusing on 1990s ‘wall of wood’ plantings being harvested from about 2016 to 2028. Most of these forests are <100 ha; many were planted to control erosion by catchment boards through farmland retirement/conversion incentives.

We used national land cover databases to map plantation forestry, and defined post-1990 forests as ‘wall of wood’ forests. We then used Land Environments of New Zealand and ecosystem threat classifications to investigate potential values of remnants. Four case studies in Northland, Waikato, Manawatu and Blenheim were used to investigate harvest (including roading) and post-harvest impacts, and ecosystem values within their landscapes. Each case study had native remnant forest, shrubland and/or wetland ecosystems which had not been grazed by stock, fertilised or drained for 25 years. One case study site had scattered puriri within the pine forest which were habitat for threatened fauna.

The severity of impact on remnants is was influenced by the location and method of road upgrades (especially culverting), physical damage on edges from falling or dragged trees, and by method of slash management/site preparation. However, depending on re-growth of smothering weeds and native plants, edges can recover quickly. Hence, with suitable incentives, harvesting the wall of wood trees (or not) is a ‘once in a generation’ opportunity to enhance NZ’s native biodiversity by delivering naturally-regenerated, well-buffered, native remnants, without needing fencing, that enhance aquatic and terrestrial connectivity in landscapes where native biodiversity is under-represented. However, in some cases the loss of productive plantation area may not be economic.

Protecting Urban Biodiversity: Saving Susceptible Saltmarshes

Environmental Scientist Amber Simmonds[1]
[1]Pattle Delamore Partners Ltd, Auckland, New Zealand, [2]Auckland Council, Auckland, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Amber is an Environmental Scientist with a background in environmental monitoring and ecological restoration. She has designed and managed environmental monitoring programmes to monitor water quality, biodiversity and ecological values. Amber has been involved in many projects assessing ecological values and options for remediation and enhancement. Amber has a passion for urban biodiversity and would like to see more unique habitats protected and restored. She believes highlighting these spaces can help people to begin appreciating the value and beauty these habitats can bring into the grey urban landscape.

Ecotones are the transitional zones between two plant communities where they meet and overlap. Saltmarshes serve as an ecotone between the marine and terrestrial environment. Saltmarshes are some of the most productive ecosystems in the world, yet, in New Zealand they have experienced a significant reduction in habitat availability due to urbanisation and human modification. Small pockets of coastal biodiversity remain in and near urban centres, however, they are under threat from invasion from exotic species, pollution and eutrophication. We need to preserve, protect and restore these unique remnants of habitat to maintain biodiversity in our urban centres.

In Wairau Estuary, a small area of 3.66 ha in Auckland's Hauraki Gulf, PDP has mapped eight unique habitats, including salt marsh and salt meadows, which demonstrates the diversity of habitats that can be found in urban areas. Ecotone mapping has been conducted as part of an enhancement plan to improve the health of the estuary. This Auckland Council project has included working with the local community to develop restoration and enhancement opportunities for the remaining saltmarsh/meadow areas. The project aims to incorporate the public's ideas into the enhancement plan whilst highlighting the importance of unique and vulnerable ecosystems such as saltmarshes.

The economy of mana as a framework for enhancing native biodiversity on farms

Dr Valance Smith, **Peter M Edwards**, **Dr John Perrott**
[1]*AUT, Auckland, New Zealand*

Enhancing Functional Biodiversity in Agroecosystems Symposium (I), Conference A/B, December 2, 2019, 10:45 AM - 12:15 PM

Biography:
Valance has recently been appointed to Assistant Pro-Vice Chancellor (Māori Adavncement) and leads the Mātauranga Māori Strategy at AUT. He provides cultural leadership to AUT, his whānau and abroad, this year accompanying the Pacific Mission Delegation to Vanuatu and the Solomon Islands alongside Rt Hon Deputy Prime Minister Winston Peters. While his doctoral thesis looked at the role of contemporary Māori music in promoting te reo Māori (2014), his most recent research applies mātauranga Māori across many disciplines of research such as mental wellness and native biodiversity restoration.

In contributing to a Māori understanding of agroecology, it would be useful to take into account the relationship between kaitiakitanga and the economy of mana and how they might shape and inform efforts to the enhancement of native biodiversity on farms. In modern times, kaitiakitanga is having the ability and the right to manaaki (care for) the natural environment and continue conservation practises our tūpuna (ancestors) carried out sustainably mai rā anō (since time immemorial). Practices such as mahinga kai (farming food and resources) are conducted with rāhui (restricted access) in order to manage human access to allow food sources to replenish. Likewise, the economy of mana as an exchange system emphasises the enhancement and protection of mana within and between people and the natural environment. Posited from a Māori world view, at the heart of the economy of mana is positive transformational change in the areas of spirituality, ecology, kinship and economics (Dell et al, 2018). How might kaitiakitanga and the economy of mana heighten our ability to promote positive transformational change in native biodiversity on farms? Building upon the literature, this paper will discuss Māori traditional practices in agroecology and its consideration of kaitiakitanga within this tikanga (practice). Further it will explore the economy of mana as a framework to mobilise this tikanga to potentially improve native biodiversity on farms.

KEYWORDS: Indigenous/traditional knowledge, Mātauranga Māori, Traditional Ecological Knowledge (TEK), Māori Ecological Knowledge, Kaitiakitanga, New Zealand Agroecology

Pekepekekiore – An edible native fungus, a genome, some cryptic endemism and a bit of functional analysis too

Mr Chris Smith[1]

[1]*Manaaki Whenua - Landcare Research, Auckland, New Zealand*

Next Generation on Next-Generation Sequencing Symposium (I), Stewart Theatre 2, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

I'm part of the fungal systematics team at MWLR where I'm focused primarily on edible fungi. My work ranges from cultivation of fruit bodies with a commercial focus, to sequencing and assembling whole genomes to be used in phylogenetic and functional analysis projects.

My research is focused on edible New Zealand native mushrooms. Over the course of this research one of the most unique species I've worked with is the species known by Maori as Pekepekekiore. When I first started working on this species in 2018 it was known as *Hericium coralloides*, a species found in the Northern Hemisphere to which ours holds a striking resemblance. During my work I was fortunate enough to find the funding and time to sequence and assemble a high-quality reference genome for this species. My talk will be based around the techniques and methods I used to do this, with a focus on the sequencing technologies used, as well as the subsequent analysis and results I've attained to date that are of potential relevance for understanding the ecology of this organism. This latter part of the talk will revolve around a phylogenetic analysis of the genus as well as my initial characterization of the core metabolic functional profile of the species.

Austropuccinia psidii, the causal agent of myrtle rust, is a threat to New Zealand's native Myrtaceae species

Grant Smith[1], Beecy Ganley[2], David Chagné[3], Jayanthi Nadarajan[3], Ranjith Pathirana[3], Julie Ryan[3], Elise Arnst[4], Roanne Sutherland[5], Julia Soewarto[5], Gary Houliston[4], Alby Marsh[3], Emily Koot[3], Angus Carnegie[6], Tracey Menzies[7], David Lee[8], Louise Shuey[7], Geoff Pegg[7]

[1]The New Zealand Institute for Plant & Food Research Limited, Lincoln, New Zealand, [2]The New Zealand Institute for Plant & Food Research Limited, Te Puke, New Zealand, [3]The New Zealand Institute for Plant & Food Research Limited, Palmerston North, New Zealand, [4]Manaaki Whenua Landcare Research, Lincoln, New Zealand, [5]Scion Limited, Rotorua, New Zealand, [6]New South Wales Department of Primary Industries, Sydney, Australia, [7]The Queensland Department of Agriculture and Fisheries, Brisbane, Australia, [8]The University of the Sunshine Coast, Sippy Downs, Australia

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Grant is a Principal Scientist/Program Leader at Plant and Food Research, Lincoln. He is a plant pathologist with experience across a wide range of viral, bacterial, fungal and oomycete pathogens on different host species. Grant currently leads the MBIE-Catalyst Myrtle Rust: a significant threat to Australasia and the Pacific program that was submitted in March 2017, one month prior to the discovery of myrtle rust on Raoul Island, and was Program Leader of the recently completed MPI RFP18608 Myrtle Rust Research 2017/18 program. He also leads RA1.3 Novel mitigation technologies in the MBIE-Endeavour Program, Beyond Myrtle Rust: Towards Ecosystem Resilience.

In April 2017 myrtle rust, caused by the fungal pathogen *Austropuccinia psidii*, was found on *Metrosideros kermadecensis* (Kermadec pōhutukawa) on Raoul Island and a month later on *Metrosideros* sp. plants in Kerikeri, Northland. These findings were seven years after the discovery of myrtle rust in Australia in April 2010 in New South Wales. The subsequent spread of the pathogen along most of the eastern seaboard of Australia initially resulted in localised extinctions (eg in a valley) of susceptible myrtaceae species. In 2017, serious concerns were raised about the likelihood of extinction of two once dominant species, *Rhodamnia rubescens* (malletwood) & *Rhodomyrtus psidioides* (native guava) from their c. 1,500 km natural host range along the eastern seaboard.

Resistance to *A. psidii* in New Zealand provenance myrtaceae has been found in *Leptospermum scoparium* (mānuka), Kunzea robusta (kānuka) and *Kunzea linearis* (rawiri mānuka). This resistance is found in seedlings grown from seed from many different seed families: however the number of individual plants that are resistant is relativity low. Only one resistant *Metrosideros excelsa* (pōhutukawa) seedling, and no resistant *Lophomyrtus bullata* (ramarama) or *Lophomyrtus obcordata* (rohutu) seedlings, were found from over 600 plants assessed too date. The almost, or complete, absence of resistance in three species, and the relativity low number of resistant plants, despite the widespread distribution of resistance in seed families, in the other three species, suggests there will be substantial ecological, social and cultural consequences as the incursion of this wide-host range pathogen progresses over the next decade.

Grasslands under threat: The spread of wilding conifers and the community action to stop it

Dr Rowan Sprague[1]

[1]NZ Wilding Conifer Group, Christchurch, NZ

Applied Ecology, Stewart Theatre 1, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Rowan is the National Coordinator for the NZ Wilding Conifer Group. She has recently completed a PhD at Lincoln University focused on the population growth of wilding conifers in New Zealand.

Our indigenous and productive grasslands are threatened from wilding conifers. Wildings spread into grasslands, changing the soil nutrient cycles, reducing water in these ecosystems, and shading out low-lying herbaceous plants. To better control wilding conifer invasions and reduce their impacts, we need to understand how they spread in these ecosystems. To address this issue, I have estimated the population growth rate of wildings in grasslands across Canterbury using data gathered from aerial imagery over time. I found that our predictions tend to over-estimate population growth by not accounting for density dependence. In spite of this, the population growth of wildings in grasslands is rapid, and areas are quickly infested in only a number of years. However, hope is not lost for the future of our grasslands. Community groups are taking action to facilitate volunteers pulling up pine seedlings and to fundraise for wilding conifer control. Additionally, partnerships between central government agencies, regional councils, and community groups have enabled effective collaboration and information sharing to control wildings.

In this presentation, I will briefly describe and explore the growth and impacts of wilding conifer invasions in native and productive grasslands. Drawing on my experiences as the coordinator for the New Zealand Wilding Conifer Group, I will highlight how community action and engagement seeks to combat and stop the spread of wildings. I will explore the successes and challenges facing communities and will end on recommendations for empowering community action seeking to protect the biodiversity in our grasslands.

Finding fungi and fun at the fungarium – documenting and understanding New Zealand fungal biodiversity into the future

Adrienne Stanton[1], Dr Mahajabeen Padamsee[1], Dr Bevan Weir[1]
[1]*Manaaki Whenua - Landcare Research, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
NZ Fungarium (PDD) Collection Manager since 2015

Ecological studies can be enhanced with data from natural history collections and databases, including from New Zealand Fungarium (PDD) Te Kohinga Hekaheka O Aotearoa, the national reference collection of dried fungi. The entire Fungarium PDD collection, located at Manaaki Whenua – Landcare Research, Auckland, is searchable online at https://scd.landcareresearch.co.nz/ and https://nzfungi2.landcareresearch. A key feature is the data on associated host species, providing access to details of interspecies relationships which may be cryptic or only intermittently apparent.
Current international trends in natural history collecting include the concept of nested sampling, where associated species and environmental data are collected along with the target specimen. Digital links are being made between related specimens in different Collections and to other associated phenotypic, genetic and environmental data to form an extended specimen network.
Only about 20% of estimated fungal species diversity in New Zealand has been recorded and little is known about the biology and geographic range of many species. High quality specimen collections, with extended associated data, assist in filling this knowledge gap. Ecologists are well placed to add value to the Fungarium PDD reference collection in this way, for the benefit of future biodiversity and biosecurity studies.

Linking networks to function: the hidden role of species dominance

Jamie Stavert[1,3], Ignasi Bartomeus[2], Jacqueline Beggs[3], Anne Gaskett[4], David Pattemore[4,5]

[1]Department of Conservation, Auckland, New Zealand, [2]Integrative Ecology Department, Estacion Biologica de Donana (EBD-CSIC), Sevilla, Spain, [3]Centre for Biodiversity and Biosecurity, School of Biological Sciences, The University of Auckland, Auckland, New Zealand, [4]School of Biological Sciences, The University of Auckland, Auckland, New Zealand, [5]The New Zealand Institute for Plant & Food Research Limited, Hamilton, New Zealand

Species Interaction Networks Symposium, Stewart Theatre 1, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Jamie Stavert is a science advisor for threatened ecosystems at the Department of Conservation. His research is focused on understanding how human activities impact biodiversity and associated ecosystem functions.

Human activities are causing biodiversity loss on an unprecedented scale, disrupting many critical ecosystem functions. Most studies investigating the relationship between biodiversity and ecosystem functioning focus on species richness, predominantly within the context of productivity-related functions. Consequently, we have limited understanding of how other biodiversity components, such as species evenness, affect complex multitrophic functions such as pollination. We investigated the effect of species evenness on the ecosystem function of pollination using a controlled experiment with selected plants and pollinators. We manipulated the relative abundances of plant and pollinator species, while holding species richness, composition, and total abundance constant. Then, we tested how species evenness affected network structure and consequently, plant reproduction. Contrary to our expectation, dominance in plant communities increased complementarity in pollinator use among plant species. This increased complementarity resulted in higher seed production for the most dominant and rare plant species. Our findings indicate that species evenness can alter important aspects of plant–pollinator networks and plant reproduction, irrespective of species richness, composition, and total abundance. Extending this understanding of how species evenness affects ecosystem functioning to natural systems is crucial as anthropogenic disturbances continue to alter species' abundances, likely disrupting ecosystem functions long before extinctions occur.

Hidden non-linearities, non-additivies, and higher-order interactions in predator-prey functional responses

Daniel B Stouffer[1], Mark Novak[2]

[1]*University of Canterbury, Christchurch, New Zealand,* [2]*Oregon State University, Corvallis, USA*

Species Interaction Networks Symposium, Stewart Theatre 1, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Daniel B. Stouffer works on a range of problems across biology, but is particularly interested in the role of species–species interactions in driving emergent *ecological and evolutionary phenomena.*

Community ecology is currently experiencing a renewed interest in the role of non-linearities, non-additivies, and higher-order interactions in influencing the realized strength of ecological interactions. Though the study of predator-prey interactions, and predator-prey functional responses in particular, has a rich history, there is a limited set of ways in which such phenomena have been incorporated to date. There are multiple reasons for this, including but not limited to (i) an understandable emphasis away from model complexity, (ii) the costly nature of functional-response experiments even when they are restricted to a single predator-prey interaction, (iii) the phenomenological nature of most common approaches to HOIs found in the literature, and (iv) a lack of a general, non-phenomenological framework within which they could be included. Here, we introduce a novel extension of classic functional-response models which allows the seamless, mechanistic emergence of non-additivities and HOIs. We will show that even the simplest multi-species functional responses found in the literature have “hidden” parameters that directly relate to HOIs (or assumptions about their biological relevance and/or when they can be expected to emerge), that they can easily emerge even in two-species systems, and that there is widespread evidence for their prevalence and importance across a large database of empirical datasets.

Biodiversity where you are now: trends, patterns, and opportunities for wild indigenous biodiversity at Lincoln

Jon Sullivan[1], Mike Bowie[1], Nathan Curtis[1], Laura Molles[2], Tim Curran[1]

[1]Department of Pest-Management and Conservation, Lincoln University, Lincoln, New Zealand, [2]Christchurch City Council, Christchurch, New Zealand

Urban Ecology, Conference A/B, December 4, 2019, 9:00 AM - 10:30 AM

Biography:

Jon Sullivan is a senior lecturer in ecology at Lincoln University. He is increasingly focused on using technology-facilitated, human-powered local sensing, by both citizens and experts, to document how nature is changing in response to changing land use, species invasions, and climate change. As part of this he makes thousands of observations a week and is one of the founders and site admin of iNaturalist NZ (previously NatureWatch NZ), the NZ branch of the global iNaturalist Network.
https://inaturalist.nz/people/jon_sullivan

It's a strange state of affairs that we often know more about the biodiversity of our remote wildlands than the places where we live and work. While New Zealanders aspire to bring more indigenous species back into our cities and farms, we can learn a lot from the species that already persist, and even thrive, wild in our modified landscapes. Over the past 16 years, we have been monitoring a range of wild species at Lincoln University and Lincoln town. The landscape in and around Lincoln is among the most modified in New Zealand. Where once there was tall native podocarp-broadleaf forest and wetlands, there is now a town with no original remnant vegetation, dominated by exotic plants, and surrounded by intensive pastoral farming. Our monitoring has been undertaken by undergraduate students in our ecology and biodiversity courses and the continuous personal wild counts of Jon Sullivan. These focus on birds, mammals, and selected plants, invertebrates, and fungi. Monitoring has been complemented by biodiscovery from two Lincoln BioBlitz events and the frequent use of iNaturalist NZ, which has documented over 1,200 taxa wild in Lincoln. We present the main trends and patterns in Lincoln biodiversity: which habitats contain the most indigenous species, which species have increased and which have declined, which species have recently arrived and which remain notably absent, which species show strong seasonality, and which show signs of already responding to the warming climate.

Drought tolerance is not necessarily a good surrogate for low plant flammability

Niger Sultana[1], Dr Cate Macinnis-Ng[2], Mr Azharul Alam[1], Mr Xinglei Cui[1], Katherine Seward[2], Dr Timothy J Curran[1]

[1]Lincoln University, Lincoln, New Zealand, [2]University of Auckland, Auckland, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Niger Sultana is a Bangladeshi forest ecologist. She completed BSc (Hons.) and MSc in Forestry from Khulna University, Bangladesh. Currently, she is continuing her research as a PhD candidate at Lincoln University, New Zealand. Her PhD topic is "Which traits underpin the ecophysiological process linking drought and plant flammability".

Identifying low flammability plant species is an important tool in fire management. However, it has been impractical to quantitatively test the flammability of a wide range of plant species, and so researchers, fire managers and homeowners have relied upon surrogate measures for flammability, such as species' drought tolerance. However, many drought tolerant species possess traits (e.g. small leaves, low moisture content, high dry matter content, leaf shedding) that cause flammability. We used existing data on shoot flammability and three different measures of species drought tolerance (minimum leaf water potentials, root zone water potential of the species distribution throughout New Zealand, and days to death of plants in a seedling dry-down experiment) to test whether drought tolerance was correlated with low flammability in 37 New Zealand species. We found shoot flammability was positively correlated with low leaf water potential and that there was no correlation between shoot flammability and root zone water potential and days to plant death. Moreover, species flammability rank was positively correlated with drought tolerance rank. This shows that high drought tolerance did not predict low flammability, and that by some measures high drought tolerance was related to high flammability. This suggests that some drought tolerance traits may also be flammability-enhancing traits, showing there is a clear need to further examine traits related to both flammability and drought to find low flammability species.

Beyond the One Billion Trees programme: multifunctionality of sheep and beef agroecosystems for carbon, biodiversity and farming

Febyana Suryaningrum[1], Dr. Bradley Case[1], Dr. Rebecca Jarvis[1], Dr. Hannah Buckley[1]
[1]*Auckland University of Technology, Auckland, New Zealand*

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:
Febyana Suryaningrum is currently a PhD Candidate at Auckland University of Technology, working on the topic of 'Carbon Distribution in the Agricultural Landscape'. Prior to her PhD, she had been working in the area of climate change mitigation in Land Use and Land Use Change and Forestry sector (LULUCF) and Reducing Emissions from Deforestation and Forest Degradation (REDD+) in Indonesia and South East Asia.

Woody vegetation on sheep and beef farms in New Zealand, such as remnant native forest, willow patches, or poplar stands, are features that serve a variety of functions such as stock shelter from wind and weather, erosion control, and provision of habitat for native fauna and flora. However, some of these features are too small to be defined as ‘forest’ under the definition currently used in New Zealand’s carbon accounting system. Hence, most land in sheep and beef farm is classified as grassland with woody biomass, and is not eligible for incentives under the emissions trading scheme. Through the One Billion Trees programme, tree planting on farms is being strongly encouraged; however, it is uncertain which species and which spatial locations and configurations of woody vegetation will be of greatest benefit for both the farm business and biodiversity. Here, we present preliminary results showing the quantification of baseline carbon on farms, and predict the impact of different land management scenarios at a farm scale, as an illustration of the biodiversity-carbon trade-off in agricultural landscapes and how we can use this understanding to both enhance the multifunctionality of woody vegetation and develop better incentives for farmers, such as carbon credit schemes or payment for ecosystem functions.

Myrtle rust attacks native Myrtaceae in New Zealand forests, monitoring the impact and disease progression

Ms Roanne Sutherland[1], Dr Julia Soewarto[1], Dr Robert Beresford[2], Dr Beccy Ganley[3]

[1]Scion, Rotorua, New Zealand, [2]The New Zealand Institute for Plant and Food Research, Auckland, New Zealand, [3]The New Zealand Institute for Plant and Food Research, Te Puke, New Zealand

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Biography:

Roanne Sutherland is a researcher working in the entomology and pathology teams at Scion. She has always had a passion for ecology and protecting what makes New Zealand special. After completing her studies at Waikato University, Roanne started her career at Scion in a role working on myrtle rust, which had only recently established in New Zealand. In this role, Roanne has been developing methods to survey for myrtle rust and to remove infected trees, she has also been involved in seed collection and resistance screening of native Myrtaceae.

Austropuccinia psidii (myrtle rust) was first identified on mainland New Zealand in May 2017 and has since established in urban areas and native forests. The highly invasive pathogen threatens the health and survival of our native Myrtaceae. To be able to understand the spread of the fungus and the impacts of this disease on native and exotic Myrtaceae in New Zealand, monitoring is essential. In October 2018 a long-term surveillance plot to monitor the impacts of myrtle rust was established in a stand of native forest infected with *A. psidii*. The rust has severely impacted rōhutu/ramarama (*Lophomyrtus* spp.) in the stand with up to 90-100% of new flush leaves and stems becoming infected and dying. The pathogen also infected the developing fruits of *Lophomyrtus* spp. causing the fruits to prematurely drop. Seedling death of *Lophomyrtus* spp. occurred within two months of the first signs of infection. Regeneration of these species is likely to be greatly impacted and localised extinction possible, as has occurred in Australia. Myrtle rust also infected other Myrtaceae in the stand including climbing rātā (*Metrosideros diffusa*) and mānuka (*Leptospermum scoparium*), although the level of infection was less than that observed on the *Lophomyrtus* spp. However, the long-term impact of myrtle rust on these species under continuing disease pressure is unknown. Continued monitoring of the impact myrtle rust on native plant is essential to understand the susceptibility under natural conditions and increasing inoculum levels, and to provide information for effective management.

Tree factors and Competition Primarily Affect Lichen Communities at Tree-level in Beech Forest, New Zealand

Assoc. Prof Hannah Buckley[2], Tim Curran[1], Jon Sullivan[1], **Akika Takada[1]**

[1]Lincoln University, , , [2]Auckland University of Technology, ,

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Lichens have been widely used as an ecological indicator at various scales since they are slow growing but long-lived organisms, which are highly sensitive to prevailing environmental conditions. Three factors have been found by past studies to affect lichen communities. First, tree factors such as tree age lead to variations in microhabitats. Second, competition for light and space with other trunk-dwelling organisms shapes community composition. Third, the spatial pattern of host trees indicates heterogeneity of resource and conditions. However, the factors that primarily determine the tree-scale pattern of lichen communities are poorly known. We investigated how tree factors, competition and spatial pattern affect lichen community composition at a small scale on two beech tree species. Results showed that tree factors and competition primarily affect lichen communities, whereas spatial pattern was not important at tree-level. Ordination showed that diameter at breast height, mean crack depth, tree species and the percentage cover of sooty mould explained the community pattern mainly in red beech. The percentage cover of bryophyte and bare bark primarily drove the community structure in silver beech. However, the impacts of tree factors and competition were hard to disentangle due to the high correlation of variables with host tree species. The study also revealed the complex interactions between trunk-dwelling organisms. A broader understanding of how tree factors, competition and spatial pattern affect the fine-scale pattern of lichen community provides insights into their conservation and the potential development of ecological indicators of the beech forest.

Keywords: Lichen, Community, Richness, Competition, Spatial, Beech forest

Mycorrhizal Fungi: providing kauri mush-room to grow

Miss Megan Tan[1], Associate Professor Bruce Burns[1], Doctor Mahajabeen Padamsee[2]
[1]University of Auckland, Auckland, New Zealand, [2]Manaaki Whenua Landcare Research, Auckland, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:
Megan Tan is a MSc student at the Joint School of Biodiversity and Biosecurity, University of Auckland. She is a recipient of the Sustainability Research Award for Students 2019 and has also received funding from the Centre for Biodiversity and Biosecurity. Megan became interested in symbiotic relationships in her undergraduate years, which lead her to her current postgraduate studies. Her research is focusing on the effects of mycorrhizal fungi symbiosis on kauri growth. This study is supervised by Bruce Burns of the University of Auckland and Maj Padamsee of Manaaki Whenua Landcare Research.

Kauri (*Agathis australis*) is a Gondwanan conifer plant species endemic to northern North Island of New Zealand. The majority of modern kauri are regenerative stands due to heavy logging efforts in the past. This has caused disruptions in kauri forest ecosystems. There has been difficulty restoring these ecosystems due to the slow growing properties of kauri. A potential solution to aid their growth is inoculating kauri roots with mycorrhizal fungi. Mycorrhizae are known to enhance nutrient uptake from soils, as well as increase disease resistance in their host plants. There may also be a link between the identity of the mycorrhizal species and the growth response of kauri. Kauri have been known to have their own mutualistic relationship with arbuscular mycorrhizal fungi in their roots, although the species identity is currently unknown. We are investigating kauri growth in response to different mycorrhizal types. We will be inoculating year old kauri seedlings with various mycorrhizal identities. These plants will be given either a control treatment, a kauri duff treatment, a bait plant or a commercial mycorrhizae treatment. After 24 weeks, various parameters will be measured that reflect plant growth. With these findings we hope to see growth differences with different mycorrhizal types. This study could provide insight to the importance of mycorrhizal identity to kauri. New management plans could be made for restoring kauri forests. The results from this study could also be applied to finding solutions to the current kauri dieback problem.

Port Hills vegetation changes: from the 1970s to the 2017 fire

Ana M C Teixeira[1], Dr Vega C Xu[1], Professor Paula Jameson[1], Dr Colin D Meurk[3], Dr Timothy Curran[2], Professor David Norton[1]

[1]University of Canterbury, Christchurch, New Zealand, [2]Lincoln University, Lincoln, New Zealand, [3]Landcare Research, Lincoln, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Ana Teixeira is a forest scientist and botanist from Brazil, currently doing her PhD research at the University of Canterbury, in New Zealand. Since 2017, she has been studying the post-fire natural regeneration and restoration of the Port Hills, in the city of Christchurch. Her research was recently published during international conferences held in Germany (IAVS 2019) and Australia (SERA 2108). In Brazil, Ana developed research on floristics and biogeography in the Cerrado (Brazilian savanna). She also worked as an environmental analyst at the Ministry of the Environment, and as a restoration practitioner at Eletrobras.

Main publications: https://www.researchgate.net/profile/Ana_Teixeira64/research

Understanding historical vegetation change is a crucial element for planning biodiversity conservation and management as it shows the main trends in both natural vegetation dynamics and anthropogenic land use. This study provides a recent history of vegetation change on the western Port Hills, Banks Peninsula ecological region, in the city of Christchurch. We compared aerial photography from the 1970s with orthophotos from 2016 and 2017, when the region was affected by a wildfire. The manual interpretation and analysis resulted in 13 land use classes. The main change detected was the reduction in open areas, mainly used for pasture, from 2080 ha in the 1970's to 1021 ha in 2016. A significant part of this former pastureland was converted into *Pinus radiata* plantations. The area covered by regenerating native bush doubled from the 1970s to 2016 (204 ha to 412 ha), and most of this increase (137 ha) was related to natural successional processes in which exotic shrublands have been slowly replaced by native species. We also recorded the prolific regeneration of kānuka over rough pastureland and bare ground. The 2017 fire burnt approximately 1500 ha, and the main classes affected were pine plantations (35%), exotic shrublands (33%), pasturelands (21%), and regenerating native forest (9%). The results and maps produced from this study will be of value for developing conservation strategies for the Port Hills and for the restoration of the burnt area.

Preserving our native Myrtaceae from Myrtle rust: A germplasm approach

Dr Fiona Thomson[1], Jacqui Bond[1], Madeleine Thacker[1], Cris Winkworth[2], Gina Aubia[2], Craig McGill[2], Jeremy Rolfe[1], Shannel Courtney[1]

[1]Department of Conservation, Wellington, New Zealand, [2]New Zealand Indigenous Flora Seedbank, , New Zealand

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (II), Stewart Theatre 2, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Fiona Thomson is the Project Manager for the Department of Conservation's Myrtle Rust Project. In her previous life she was an ecologist and researcher with a focus on seed ecology. She has spent many years running around the NZ bush for both fun and work and has a broad interest in a range of subjects including detection dogs, biosecurity, monitoring, dispersal and botany.

Myrtle rust, a fungus known to kill plants in the Myrtaceae family, arrived in New Zealand in 2017. A large biosecurity response followed, led by the Ministry for Primary Industries and assisted by others including the Department of Conservation. Myrtle rust's arrival caused immediate concern that local or national extinctions of our native Myrtaceae species may occur. This led to 36 native Myrtaceae taxa being placed on the threatened plant list. To act as an insurance policy against extinctions, the Department of Conservation developed a germplasm strategy and nationwide seed collection programme. This talk will summarise the Department of Conservation's germplasm strategy and present the results of our seed collection work. Thirty-five Myrtaceae taxa were identified as being able to be stored through standard seed-banking procedures. Since 2017 three seed collection seasons have occurred with >400 seed collections now banked with the New Zealand Indigenous Flora Seed Bank (NZIFSB). Understanding long-term viability of stored seed and ongoing maintenance of collections remains two of the key critical issues. Insights from developing a national seed collection project during a biosecurity response will be given and the future directions of the myrtle rust work discussed.

Consequences of species role plasticity in multilayer interaction networks

Jonathan Tonkin[1], Warwick Allen[1], Ian Dickie[1], Bernat Bramon Mora[1], Daniel Stouffer[1], Lauren Waller[1], Jason Tylianakis[1]

[1]School of Biological Sciences, University of Canterbury, Christchurch, New Zealand

Species Interaction Networks Symposium, Stewart Theatre 1, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Jonathan Tonkin is a Rutherford Discovery Fellow at the University of Canterbury. His research focuses on understanding population and community responses to environmental variability, with the goal of developing mechanistic forecasts of responses to uncertain environmental futures.

Species may switch their roles in interaction networks when in the presence of different potential interaction partners. However, it is not clear how such role switching that comes with turnover in community composition affects species performance in communities. Using fungi-plant-herbivore interaction data from 180 experimental mesocosms, we asked whether the ecological performance of plant species is a function of their network role plasticity. We hypothesised that (1) plant species with flexibility in their network roles and partners would have more consistent performance (measured as plant biomass) across different communities than those with fixed role profiles (role flexibility buffers species from changing community contexts); and (2) species with fixed roles outperform those with plastic roles in favourable community contexts, but underperform in unfavourable contexts. We also hypothesised that the functional roles of plant species in their communities (uniqueness and originality of traits) mediates both their role and their performance. To test these questions, we used a newly-developed method to calculate species roles via multilayer network motifs. Initial results highlight considerable variability in plant biomass across different communities and that this variability declines with increasing variability in species' network roles, consistent with our first hypothesis.

Ecological networks in biological control

Prof. Jason Tylianakis[1]

[1]*University of Canterbury, Christchurch, New Zealand*

Species Interaction Networks Symposium, Stewart Theatre 1, December 4, 2019, 11:00 AM - 12:30 PM

Biography:

Jason is a professor in ecology at the University of Canterbury, and a principal investigator in the Bioprotection Research Centre. His research examines how communities of interacting species respond to environmental changes. In particular, he is interested in how the architecture of interaction networks (such as food webs or pollination networks) comes to exist, and how it responds to environmental drivers. He is also interested in the conditions under which biodiversity loss has the greatest impact on ecosystem functioning and services, and in searching for win-win scenarios to balance agricultural production and conservation.

Growing concern about the health and environmental effects of pesticides has strengthened the demand for sustainable methods to control agricultural pests. Biological control offers an opportunity to provide this control, but it suffers from uncertain success and the potential for non-target direct or indirect impacts on native species. Network theory has improved our understanding of multiple consumer impacts on prey and of indirect effects. Moreover, there is a growing suite of network tools for predicting interactions among species. These insights may offer solutions to some of the problems facing biological control, and provide an example of the closing gap between network theory and application to contemporary ecological problems

A sighting of a ghost taxon; modelling the distribution of Beilschmiedia tawa in indigenous forests through co-occurring species and pollen signals, New Zealand.

Jacqui Vanderhoorn[1], George Perry[1], Janet Wilmshurst[1,2], Sarah Richardson[2]

[1]University of Auckland, Auckland, New Zealand, [2]Manaaki Whenua - Landcare Research, Christchurch, New Zealand

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

I am currently a masters student in the School of Environment at the University of Auckland, and part of a research group which uses modelling approaches to explore a broad range of topics within spatial ecology.

Beilschmiedia tawa (tawa; Lauraceae) is a dominant canopy species in lowland forests of the North Island of New Zealand, yet it is severely under-represented in fossil and modern pollen records. Low pollen production, poor pollen preservation, and low taxonomic resolution all contribute to its extremely weak pollen signal, translating into a lack of information on tawa's paleoecology. In response to this 'information gap', this research will explore whether tawa's distribution can be accurately predicted through co-occurring species with strong pollen signals. To determine which species may act as a proxy for tawa occurrence, the community composition of tawa forest communities will be analysed for positive associations using a range of co-occurrence analyses. Distribution models of those species associated with tawa will then be combined to produce a 'co-occurrence model' which predicts tawa distribution. By then repeating these analyses at the 'pollen type' level, we can assess the impact of low taxonomic resolution on the co-occurrence network analysis, and predictive ability of the co-occurrence model. If suitable proxies for tawa occurrence are found, then the scope of this analysis and future research will extend into modelling the historical distribution of tawa through quantitative reconstruction of indigenous forest communities from fossil pollen data across New Zealand.

Are gene drives the solution to make New Zealand 'predator free' by 2050?

Dr Andrew Veale[1]

[1]*Manaaki Whenua Landcare Research, Auckland, New Zealand*

Invasive Species Impacts Symposium I (predators), Stewart Theatre 1, December 3, 2019, 2:00 PM - 3:00 PM

Biography:

Dr Veale is an ecologist in the Wildlife Ecology and Management group at Manaaki Whenua Landcare Research. His research combines genetic and statistical techniques to help assess and advise invasive species management programs. His PhD was on stoat invasion ecology and genetics, and since then he has completed two postdocs in the genomics of salmon in Canada at UBC, and of stoneflies at the University of Otago. He is currently involved in multiple invasive species research programs including leading the stoat genome sequencing project.

Gene drive technologies create a bias in inheritance patterns, whereby some DNA becomes more likely to be inherited than the usual 50:50 ratio, with a perfect gene drive yielding 100% inheritance. When such a gene drive is linked to sex determining genes, there is the theoretical potential to create an extinction drive, whereby all individuals eventually become male. This novel technology is being considered by some the 'magic bullet' for eradicating invasive species. In this talk, I evaluate from a population ecology perspective the potential for gene drives to achieve the predator free 2050 goal. There remain many significant obstacles before this technology can be developed across the target species, including the facts that: 1) no research team has yet created a rodent model in the lab with the efficiency required for an extinction drive, 2) we cannot yet genetically modify the germline cells of marsupials, and 3) we cannot currently breed stoats in captivity. Even in the most optimistic scenarios it remains impossible that gene drives alone could remove mustelids and possums (though some rodents may be feasible) within the 2050 timeframe, primarily due to the number of generations required. For comparatively longer-lived mammal species (possums and mustelids) with multi-year average generation times, we need to be realistic in terms of the timeframes required. Despite these challenges, it remains possible that gene drives will be relevant for longer term goals beyond 2050, and we should continue researching the biological, social, ethical, and ecological challenges they present.

Using te reo Māori and ta re Moriori in taxonomy

Dr Andrew Veale[1,2], Associate Professor Peter de Lange[2], Dr Thomas Buckley[1,3], Mana Cracknell[4], Holden Hohaia[1], Dr Katharina Parry[5], Kamera Raharaha-Nehemia[6], Kiri Reihana[1], Dr Dave Seldon[1,3], Katarina Tawiri[1], Dr Leilani Walker[7]

[1]Manaaki Whenua Landcare Research, Auckland, New Zealand, [2]Unitec, Auckland, New Zealand, [3]University of Auckland, Auckland, New Zealand, [4]Kaiangaroa, Chatham Island, New Zealand, [5]Massey University, Palmerston North, New Zealand, [6]Ngāti Kuri, , New Zealand, [7]Auckland University of Technology, Auckland, New Zealand

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Dr Veale is an ecologist in the Wildlife Ecology and Management group at Manaaki Whenua Landcare Research. His research combines genetic and statistical techniques to help assess and advise invasive species management programs. His PhD was on stoat invasion ecology and genetics, and since then he has completed two postdocs in the genomics of salmon in Canada at UBC, and of stoneflies at the University of Otago. He is currently involved in multiple invasive species research programs including leading the stoat genome sequencing project.

Linnaean names are an anchor for biological information about a species, and having clear, unique, taxonomic names is vital for scientific communication. Aotearoa / New Zealand has a long history of using both the indigenous Māori language – te reo, and the indigenous language of Rekohu (the Chatham Islands) – ta re Moriori, in taxonomic description, but not necessarily one of engaging Māori in this process. In this presentation, we review and describe this history, showing that since its first use in 1830, te reo and ta re have been incorporated over 1,288 times within taxonomic nomenclature, and that this usage is increasing. From this review, we identify several ways in which te reo and ta re have been incorporated, including the use of: 1) variations of the words “Māori” and “Moriori” to designate Aotearoa / New Zealand origins, 2) Māori/Moriori vernacular names for the species, 3) Māori/Moriori place names associated with species, 4) novel descriptive names created from Māori and Moriori words, and 5) novel names suggested by Māori in collaboration with taxonomists. We will highlight and promote through multiple case studies this last, collaborative system for species description, emphasizing the advantages and the potential challenges of this process, and we will provide guidance for taxonomists to better engage with iwi / imi in species description. Specifically, we discuss issues relating to the Latinization of Māori words, the use of macrons, and the need for engagement of Māori throughout the naming process.

Soil biodiversity assessment for the lazy: How sample pooling affects perceived impacts of Cytisus scoparius (Scotch broom) on fungal communities

Mr Ralph Wainer[1], Prof Ian Dickie[1], Dr Hayley Ridgway[2], Dr Eirian Jones[3]

[1]Bio-Protection Research Centre, School of Biological Sciences, University of Canterbury, Christchurch, New Zealand, [2]Plant & Food Research, Lincoln, New Zealand, [3]Faculty of Agriculture and Life Sciences, Lincoln, New Zealand

Spatial Ecology, Conference A/B, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Ralph Wainer is a PhD student at the University of Canterbury funded by the Bio-Protection Research Centre and the National Science Challenge. He is supervised by Prof Ian Dickie.

Second generation DNA sequencing technology and metabarcoding are increasingly used for measuring the composition of ecological communities (both terrestrial and aquatic). This has brought to attention the need for robust field collection and sampling protocols. Using second generation sequencing data from 432 georeferenced soil samples collected from 18 sites across a Cytisus scoparius (Scotch broom) invasion gradient we demonstrate how different levels of pooling collected eDNA samples (post extraction and pre-PCR) could influence the identification of fungal community responses to invasion. One advantage of not pooling samples is a greater ability to detect changes in spatial heterogeneity. Using our invasion gradient, we test the hypothesis that Cytisus invasion is associated with a loss of spatial heterogeneity in soil fungal communities.

The experience of organisations conducting native afforestation in the North Island, New Zealand

Dr Leilani Walker[1], Associate Professor Hannah Buckley[1], Dr Bradley Case[1], Dr Valance Smith[1], Dr David Hall[1]

[1]*Auckland University of Technology, Auckland, New Zealand*

Enhancing Functional Biodiversity in Agroecosystems Symposium (II), Conference A/B, December 2, 2019, 1:15 PM - 2:45 PM

Biography:

Leilani (Whakatōhea) is a Postdoctoral Research Fellow working with Associate Professor Hannah Buckley, Dr Bradley Case and Dr David Hall at Auckland University of Technology on the Living Laboratories project. Leilani completed her PhD in 2018 in behavioural ecology in the School of Biological Sciences at the University of Auckland.

Afforestation using native species, frequently on retired farmland, generates a range of social, environmental and, to an extent, economic benefits. Of these, preventing erosion, conserving native habitats, and carbon sequestration are of interest nationally and internationally as mechanisms for mitigating the effects of climate change and human activities. To this end, mechanisms such as the 1 Billion Trees programme in New Zealand have been established to encourage afforestation but have largely resulted in replacement and expansion of monocultural pine plantations. Non-forestry organisations, potential end users of such mechanisms, should have significant roles to play in native afforestation going forward, especially given the social and financial investment required to conduct native afforestation. However, how such organisations conducting native afforestation perceive and navigate their social and environmental contexts to achieve their desired outcomes is poorly studied. This research aims to understand the experience of organisations that conduct native afforestation and we present preliminary analyses of organisational documents and interviews with organisation representatives. These data demonstrate how organisations can be significantly impacted by broader discussions around forestry and conservation, and how these, along with other perceived challenges, inform the trade-offs that organisations take on when making management decisions. Critically, we analysed data on Māori and non-Māori organisations in parallel to recognise the different social contexts that these organisations originate from and operate within. By properly characterising the decision-making landscape that different organisations navigate, we hope to inform how mechanisms to encourage native afforestation may be better implemented within communities.

Kaitiakitanga in the urban space

Erana Walker[1]

[1]*The University of Waikato, ,*

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Erana Walker is PhD candidate at the University of Waikato. Her doctoral research focusses on how Kaitiakitanga is understood and applied within the urban space of Hamilton, New Zealand. Her research supports the Peoples, Cities and Nature programme which is a multi-disciplinary programme leading urban ecological restoration research in New Zealand.

Indigenous relationships to the environment are embedded in narratives and cultural practices. Such relationships to the environment have been maintained by Māori in Aotearoa New Zealand for many generations through a practical philosophy often described as kaitiakitanga. Place and practice are inextricably linked in traditional Māori narratives; a connection constructed through the creation narratives and the concept of whakapapa. However, colonisation and capitalism have changed societal structures and narratives, and many Indigenous peoples now grapple with new circumstances, including the rise of urban spaces. Urban spaces now present new challenges in maintaining the place-making processes of connection to the natural world. As the population of urban Māori continues to grow, exploration of key components of kaitiakitanga such as place, whakapapa, intergenerational knowledge, engagement and spirituality is needed. How these components of kaitiakitanga intersect with the ecological restoration of the urban space and the kaitiakitanga aspirations of tribal groups provides new collaborative opportunities.

Plant-soil feedbacks explain competitive success of exotic plants in mixed communities

Dr Lauren Waller[1], Dr Warwick Allen[2], Dr. Jonathan Tonkin[2], Dr. Jason Tylianakis[2], Dr Ian Dickie[2]
[1]Lincoln University , Lincoln, New Zealand, [2]University of Canterbury, Christchurch, New Zealand

Invasive Species Impacts Symposium II (plants, microorganisms, and insects), Stewart Theatre 1, December 3, 2019, 3:30 PM - 5:00 PM

Biography:
Dr Lauren Waller studied ecology at the University of Montana in the United States. For her PhD she combined molecular and field research to understand interactions at the root-soil interface and how they affect broader scale community-level processes in temperate grasslands. Lauren is currently a postdoctoral fellow at Lincoln University, working with Dr. Amanda Black, in a project focused on disease resistance traits in soils in kauri forests.

Understanding how antagonists influence exotic plant success in recipient communities is a central goal in invasion ecology. Exotics can escape from specialist enemies in a new range lacking co-evolved relationships, or accumulate generalist enemies that already occur there. Both scenarios are expected to increase the competitive success of exotic invaders, but we lack empirical tests linking plant-soil feedbacks with competitive success in plant communities. Here, we grew 20 native and 20 exotic plant species in soils cultured by themselves, by any of the other 39 species, and in sterile soil. We also grew all 40 species in twenty unique, 8-species communities that varied in their proportion of exotic species. Each community was grown in soil cultured by the residents of that community or in soils cultured by eight different species. When grown alone, native plants were equally suppressed by their own soil and soil cultured by other species, suggesting natives are equally susceptible to generalists and specialists occurring in the soil microbial community. Exotic plants accumulated strong negative feedbacks in their own soil. However, native plants suffered higher mortality in exotic-, compared with native-dominated communities. This occurred even though native plants showed susceptibility to enemies cultured by themselves and by other species. Further, exotic plants harbored more putative root pathogens than natives, and those pathogens were shared with native plants. These data suggest that exotic plants accumulate generalist pathogens that are shared with native plants and those pathogens harm the natives to a greater extent than they harm exotics.

Major leaf vein density and its relationship with functional traits of New Zealand native angiosperms

Tim Curran[1], **Flora Wang[1]**
[1]Lincoln University, Christchurch,

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Leaf veins have the role of transporting water, minerals and nutrients to allow photosynthesis and respiration for growth. A recent study has found that vein density can explain global biogeographical trends in plant species. However, vein densities of New Zealand native angiosperms have not been well recorded to allow comparison with existing functional traits. This study will build the database for vein density in New Zealand and look at vein density between species, within species in different climates and its correlation with leaf area, frost susceptibility, drought sensitivity and flammability. Leaf samples were collected in Auckland Botanic Gardens, Boyle River (Lewis Pass) and Lincoln town (Selwyn District). In total, 21 species were sampled. For each species, one leaf from each of five trees was sampled, cleared and stained. Vein imaging was used to obtain a single mean measurement of vein density (major vein length per area, M.VLA) for each species. Unexpectedly, we found that M.VLA of *Fuscospora fusca* were not significantly different across populations from different climates. Smaller leaves had higher M.VLA, matching trends from global studies. We found frost susceptibility and flammability were significantly correlated with M.VLA; however, the strengths of these relationships were either moderate or weak, and there was no relationship between M.VLA with drought sensitivity. This suggests that M.VLA is not a strong indicator of plant survivability under environmental stress or disturbance on its own, but is an important element to build future ecological models with other traits.

Keywords: Venation, Major vein length per area, Functional traits, Environmental stress

Delayed biological recovery after restoration – a result of negative resistance and resilience?

Helen Warburton[1], Catherine Febria[1,2], Kristy Hogsden[1,3], Elizabeth Graham[3], Issie Barrett[1], Jon Harding[1], Angus McIntosh[1]

[1]University of Canterbury, , New Zealand, [2]University of Windsor, , Canada, [3]NIWA, , New Zealand

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

I am an early career freshwater ecologist based at the University of Canterbury. My research focuses on understanding the structure and dynamics of freshwater communities with the aim of testing and developing ecological theory that is fundamental for the effective management of ecosystems.

Resistance and resilience (R&R) are terms used to describe the capacity of an ecosystem to withstand and recover from a perturbation. R&R are commonly associated with healthy communities able to tolerate and recuperate from perturbations (*positive* R&R). However, degraded ecosystems can also be resistant and resilient to perturbations (*negative* R&R) making them *restoration-resistant*. We hypothesize that this resistance to restoration is a consequence of communities becoming dominated by species with traits such as trophic generalism which enhance food-web stability. To identify properties of restoration-resistant communities, we conducted a literature synthesis focusing on studies reporting delayed biological recovery after restoration actions. We found a paucity of studies testing or reporting biotic mechanisms that likely contribute to delayed biological recovery. Moreover, most studies focused on recovery in a single trophic level, with very few considering interactions among species or across trophic levels. Nonetheless, many authors acknowledged that communities became dominated by species with traits which likely enhanced food-web stability. Despite this, tools to overcome negative R&R have not been widely developed or tested. These findings suggest we should implement restoration differently or at the very least reframe our expectations for biological recovery.

Overview III

Katrin Webb

Myrtles for Tomorrow: Myrtle Rust Research Updates Symposium (I), Stewart Theatre 2, December 2, 2019, 10:45 AM - 12:15 PM

Overview: Current research programmes and management activities for myrtle rust
Speakers: Mahajabeen Padamsee, Maureen O'Callaghan, Katrin Webb
Myrtle rust has been present on the New Zealand mainland since 2017 and threatens many ecologically, culturally and economically important native host species. In response, multiple research and management efforts are underway or being planned, many of which follow on from work previously commissioned by MPI following initial disease incursion. This overview will be divided into three parts, which collectively will summarise major activities taking place in New Zealand at this time. The research programme Beyond Myrtle Rust, the largest multi-agency research effort into myrtle rust currently taking place, will be introduced by the programme leader Mahajabeen Padamsee. The BioHeritage National Science Challenge programme Ngā Rākau Taketake will be introduced by co-leader Maureen O'Callaghan. Katrin Webb will discuss Department of Conservation management activities and plans.

Ka mua, ka muri: the inclusion of mātauranga Māori in New Zealand ecology

Dr Priscilla Wehi[1,2], **Dr Tara McAllister[2,3]**, **Prof Jacqueline Beggs[3]**

[1]Manaaki Whenua Landcare Research, Dunedin, NZ, [2]Te Pūnaha Matatini, Auckland, NZ, [3]University of Auckland, Auckland, NZ

Mātauranga Māori and Shaping Ecological Futures Symposium, Stewart Theatre 2, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Cilla is a conservation biologist at Manaaki Whenua Landcare Research, and incoming co-director of Te Pūnaha Matatini Centre of Research Excellence for Complex Systems. Tara is a postdoctoral fellow at Te Pūnaha Matatini, specialising in both freshwater biologist and working with Māori communities, and is from Te Aitanga a Mahaki. Jacqueline is Professor of Ecology at the University of Auckland, and is an invasions ecologist.

Worldwide, there is growing recognition of the mutual benefits of collaborative partnerships between indigenous peoples, governments and conservation practitioners. The contribution of indigenous knowledge, including mātauranga Māori, has become ever more critical as we attempt to mitigate the threats of habitat fragmentation, climate change and introduced species. Here, as an introduction to the symposium today, we consider mātauranga Māori as a knowledge system that connects hapū and iwi to their landscapes but which has also become a defining tool at the interface between social sciences, sciences and indigenous knowledge regeneration, spanning disciplinary boundaries. We discuss some of the leading initiatives, people and institutions that have worked over the last 30 years to bring mātauranga into contact with the ecology that is better known to scientists. We examine the role of the NZ Ecological Society in these initiatives, from the 1995 submission on the discussion paper on Māori customary use, to research published in the Journal. We also consider engagement with mātauranga within the NZ ecological fraternity more generally; future directions; and in particular we celebrate the support of the New Zealand Ecological Society for the development of the journal special issue on “mātauranga Māori shaping ecological futures”, to be launched at this meeting.

Harakeke fast-tracks old-field succession to forest on Tiritiri Matangi Island

Dr Carol West[1]

[1]*Department of Conservation, Wellington, New Zealand*

Applied Ecology + Restoration, Stewart Theatre 1, December 2, 2019, 3:15 PM - 5:15 PM

Biography:

Dr Carol West is an Honorary Research Associate of the Department of Conservation. A graduate of Auckland University, Carol's MSc thesis examined the potential for natural regeneration on Tiritiri Matangi Island. She began her career with DSIR as an ecologist then became Editor of NZ Journal of Botany. This was followed by 25 years of service in DOC as a scientist and manager based in Wellington and Invercargill. Her work has taken her to every corner of Aotearoa, enabling an overview and understanding of a wide range of ecosystems with forests and islands to the forefront.

In the late 1970s, sampling of seed rain, seed banks and pasture vegetation on a broad ridge between two shrubland-fringed forest remnants on Tiritiri Matangi Island led to the conclusion that succession of the pasture to native forest would take at least a century. Although seeds of three Myrtaceous species were being dispersed into the pasture, none were recorded in the seed bank or the vegetation. Succession to forest was expected to proceed via native forest species colonising (a) the bracken (*Pteridium esculentum*) that was spreading into the pasture and (b) pasture that might become shaded and sparser as the adjacent shrubland matured. Like a good cheese, these things take time so planting of trees to accelerate forest cover on the island was recommended and commenced in 1984. The ridge on which these studies were undertaken was included in the areas to be left unplanted in order to see how natural succession would proceed. In 2001, naturally established harakeke (*Phormium tenax*) was observed, in a range of size classes, growing on the study ridge indicating a different successional pathway than could be deduced in the 1970s. Resampling of the vegetation in 2006 and 2018 shows how succession to forest is proceeding more quickly via harakeke.

Restoration at a snails pace? Differences in prey vulnerability to predation have implications for stream restoration.

Bridget White[1], Professor Angus McIntosh[1], Doctor Helen Warburton[1]
[1]*University of Canterbury, Christchurch, New Zealand*

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

Biography:
Bridget is a fourth year Honours student from the University of Canterbury. Her research explores how the biotic interactions occurring in degraded stream communities can lead to the resistance and resilience of degraded communities to recolonization of more desired taxa.

Food web properties in degraded stream communities may increase their resistance and resilience to the successful reinvasion of desired taxa after physical restoration, resulting in restoration failure. Degraded stream communities in New Zealand are often dominated by protected prey, such as freshwater snails, which are less vulnerable to predation than desired taxa such as mayflies. Therefore, recolonizing vulnerable taxa may be preferentially preyed on, limiting restoration success. Moreover, vulnerable prey may modify behaviours in the presence of protected prey e.g. changing feeding behaviour, leading to long term decreased prey fitness in these organisms. Using stream mesocosms, we investigated how differences in prey vulnerability to predation could impact restoration success. Different densities of protected snails, *Potamoprygus antipodarum* and vulnerable mayfly larvae, *Deleatidium* spp. were added to stream mesocosms alongside a predatory fish, upland bully, for 24 hours.
We calculated consumption-based interaction strengths, and also observed prey behaviour. Interaction strengths were stronger between *Deleatidium* and fish when fewer *Deleatidium* were present, and less total prey biomass was consumed when higher relative densities of protected prey to vulnerable prey were present. A minimum density of *Deleatidium* may therefore be required to re-establish in degraded communities containing fish. High densities of snails modified *Deleatidium* behaviour so they appeared less on surfaces, which could lead to long term fitness reductions. These decreased levels of fitness could lead to reduced colonization success of vulnerable biota, preventing the biotic restoration of abiotically restored streams. Therefore, the degraded community structure should be considered in stream restoration planning.

Counteracting effects of extreme climate events maintains metapopulation persistence under global warming

Dr. Richard White[1], Dr. Angus McIntosh[1], Dr. Brendan Wintle[2]

[1]*University of Canterbury, Christchurch, New Zealand,* [2]*University of Melbourne, Melbourne, Australia*

Spatial Ecology, Conference A/B, December 3, 2019, 3:30 PM - 5:00 PM

Biography:

Richard completed his PhD in 2017 wherein he researched the effects of extreme climate events on brown mudfish metapopulation dynamics in forest ecosystems using a combination of field measurements and spatially explicit modelling. He has a general interest in the effects of environmental stochasticity on population dynamics and how this is modulated by different landscapes and species life-history strategies such as allocation of resources to reproduction, survival and migration. He has also worked large meta-analyses of stable isotopes to quantify the effects of trophic richness and global change drivers on food-web dimensions.

Extreme disturbances play a critical role driving metapopulation dynamics both by increasing mortality and patch availability. These counteracting influences of disturbances on mortality and patch formation will complicate our ability to forecast metapopulation dynamics as extreme disturbances increase in frequency due to climate change. Here we show that future metapopulation persistence of forest-dwelling mudfish under climate scenarios hinges on extreme wind-throw events that form new patches by tree tip-ups. Mark-recapture surveys in Saltwater Forest, South Westland showed that densities of large patches (tree tip-ups) and sub-populations were highest in forest transects impacted by a recent devastating wind-throw event (tornado), and were lowest in transects impacted by historic clear-felling which has prevented new patch formation over the last 30-50 years. Large tree tip-up patches were also associated with significantly higher survival during an extreme 1-in-30 year drought occurring in 2013. An empirically-derived spatially-explicit metapopulation model showed that increases in large patches lead to significantly higher metapopulation persistence in wind-throw-disturbed forest compared to clear-felled forest, even under the most severe extreme drought scenarios predicted for New Zealand under climate change. These results show that counteracting effects of mortality and patch formation caused by extreme disturbances can lead to persistent metapopulations under climate change provided these effects are not broken by land-use changes. In this context, the largest threat to populations may be posed not by extreme climate events, but rather by anthropogenic processes that interfere with natural disturbance regimes maintaining metapopulation and forest dynamics.

Reducing the impact of LED streetlight conversions on cultural and ecological values

Dr Amy Whitehead[1], Dr Michelle Greenwood[1], Dr Jon Bennie[2], Dr Kristy Hogsden[1]
[1]NIWA, Christchurch, New Zealand, [2]University of Exeter, Exeter, England

Urban Ecology + Land Typing + Animal Behaviour, Conference A/B, December 4, 2019, 11:00 AM - 12:30 PM

Biography:
Dr Amy Whitehead is a quantitative ecologist in the Freshwater Ecology group at NIWA Christchurch. Her research interests and experience are wide-ranging but typically focus on applying well-grounded ecological theory and quantitative tools to provide science-based advice for policy and management. Amy's work has encompassed applied freshwater, terrestrial and marine ecology, spatial conservation planning, resource management and planning, and the development of interactive and technical tools to aid decision-makers and practitioners. Current passions include developing spatial models and online interactive methods of communicating science – she's happiest on a bike or playing with R code.

Artificial light at night negatively affects terrestrial and aquatic ecosystems and reduces night sky visibility. Across New Zealand, 370,000 high-pressure sodium yellow streetlights are currently being replaced by energy-efficient, blue-white light-emitting diodes (LEDs). While the economic benefits of conversion are significant (~$10 million/year operational costs), the potential cultural and environmental impacts of the increased blue light emitted by LEDs are unclear. The night sky is integral to Māori culture, demonstrated by the revival in Matariki celebrations. Yet >50% of New Zealanders cannot see the Milky Way from home, a percentage likely to increase with LED conversions. Healthy urban waterways provide important ecosystem services and contribute to cultural wellbeing, but their health is declining globally. Urban skies and waterways are ideal systems in which to investigate the potential cultural and ecological impacts of such LED conversions and develop recommendations to minimise the impacts of large-scale streetlight conversions.

We will discuss how Christchurch's Residential Red Zone, cleared of housing after the 2010/11 earthquakes, allowed us to undertake a street-scale experimental manipulation of operational streetlighting to quantify potential ecological impacts, focussing on how freshwater insects respond to different lighting types. We will also demonstrate an interactive 3D model of the Christchurch lightscape and show how and where light can fragment the landscape. Combining the ecological results and lightscape maps will allow planners to prioritise critical areas for alternative lighting solutions and aid in the design of culturally and ecologically-sensitive streetlighting.

Urban Streams: Dead or Alive?
An investigation into the current and potential ecological values of urban streams in Auckland

Mrs Emma Willmore[1]

[1]*Pattle Delamore Partners Ltd, Newmarket, Auckland, New Zealand*

Poster Presenters, December 2, 2019, 7:30 AM - 8:00 AM

Biography:

Emma is an environmental scientist with over 11 years of experience working across public and private sectors. Emma has a background in consenting, compliance and impact assessments, with a focus on water quality and ecology. Emma has been involved in a range of freshwater ecology projects, to inform future land use development, assess impacts on ecological values, and determine required mitigation and offsets, and has a special interest in urban stream restoration.

Urban streams in Auckland are often characterised by low aquatic biodiversity, degraded habitat and poor water quality. Many are highly modified, contained within concrete channels and devoid of riparian vegetation.

PDP is undertaking a series of urban stream investigations for Auckland Council, to assess their current ecological value and identify opportunities for enhancement. Subject stream reaches are located in Henderson Valley Park, Blackgate Reserve, and along the Upper Oakley Creek and Puhinui Stream. A key objective of these projects is to create functioning ecosystems along the stream corridors by restoring aquatic values and riparian planting. The wider project aim is to increase the ecological value of these streams to compensate for the loss of value from stream impacts elsewhere in the region. In essence, creating a bank of suitable sites for biodiversity offsetting.

Our investigations have adopted the Stream Ecological Valuation (SEV) method to quantify the current and potential ecological functions of the streams. This will allow Environmental Compensation Ratios (ECR) to be calculated to fulfil compensation requirements on other projects. SEV scores have been used to inform enhancement opportunities and conceptual designs for each of the subject reaches. PDP has also considered stream benefits for the community, giving higher regard to amenity and aesthetic values.

This presentation will look at the work we have completed to date, which demonstrates that life does exist even in the poorest habitat conditions. It discusses the restoration activities that provide the greatest potential enhancement, and the challenges we envision to achieving successful restoration outcomes.

Using satellite imagery to detect and map ephemeral wetlands

Dr Susan Wiser[1], Dr Andrew McMillan[2]

[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Manaaki Whenua - Landcare Research, Palmerston North, New Zealand

Freshwater & Estuarine Ecology, Conference A/B, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

I have been plant community ecologist at Manaaki Whenua -- Landcare Research, New Zealand since 1997. My current research interests include classification and mapping of NZ vegetation, ecoinformatics and the integration of plot-based with remotely sensed data to address a range of ecological questions. I have a long-term interest in the biota of naturally uncommon ecosystems and how improving our knowledge base can underpin more effective preservation and management.

Ephemeral wetlands are naturally uncommon and have declined markedly in extent and condition, resulting in a Critically Endangered designation. We developed a technique to detect and map these wetlands using high resolution, ~weekly imagery from the Sentinel 2 satellite. For training and testing, we used shape files of ephemeral wetlands in the Lake Coleridge and Ashburton Lakes areas. We identified spectral bands and associated indices indicative of ephemeral wetlands using transects extending from mapped wetlands into the surrounding vegetation. Based on seasonal pattern strength, and sensitivity to periodic inundation, as opposed to vegetation seasonality, we selected the Normalized Difference Snow Index (NDSI) as the best indicator. We then developed a pixel-based predictive algorithm using the amplitude and strength of the seasonal signal of NDSI. The algorithm was effective at specific locations but did not reliably detect the full set of 70 ephemeral wetlands in a 6 × 9 km test area. We then tested a machine-learning classification approach that combined models of seasonal change in multiple spectral indices. This model accurately defined 67 of the 70 wetlands in the test area. That no single spectral band or index was universally predictive likely reflects that ephemeral wetlands vary in reflectance owing to their depth, substrate, drying stage, and surrounding vegetation. Conservation applications of this technique include a) identification and mapping of ephemeral wetlands and other seasonally inundated ecosystems; b) detecting changes in hydroperiods in response to threats (e.g. climate change, afforestation) or management; and c) supporting site-based monitoring.

Blazing forest floor: potential contributions of soil seedbank in New Zealand's post-fire recovery

Alicia Wong[1,2], George Perry[1], Luitgard Schwendenmann[1], Craig Bishop[3]

[1]University of Auckland, Auckland, New Zealand, [2]Tonkin & Taylor, Auckland, New Zealand, [3]Auckland Council, Auckland, New Zealand

Fire Symposium (I), Stewart Theatre 2, December 3, 2019, 11:00 AM - 12:30 PM

Biography:

Alicia Wong joined Tonkin & Taylor as an ecologist consultant since graduating with a MSc in Environmental Science at the University of Auckland. Her primary field of interest include the dynamics of forest fire. Her research thesis focused on understanding early post-fire recovery and trajectories in New Zealand.

The rarity of fire in New Zealand prior to human arrival means that much of the native flora lacks adaption to frequent fire. As a result, increased fire frequency associated with human occupancy *c.* 1280 AD has driven widespread forest loss. Remnant forests are threatened by recurrent fires and invasion by exotic fire-adapted plants. Little is known about either the effects of post-fire soil conditions or the potential contributions of soil seedbanks on early post-fire succession and community dynamics. We selected four recent post-fire study sites, across northern New Zealand, to assess the effects of heat-shock (a fire related germination trigger) on soil seedbank and the potential contribution (in terms of composition) of soil seedbank to post-fire vegetation regeneration. We collected vegetation data and soil seedbank samples, and conducted heat-shock experiments and germination trials. Germination trials and field vegetation surveys showed that the soil seedbank and post-fire regeneration were decoupled in their composition. Soil seedbanks were dominated by exotic herbaceous taxa, while the regenerating vegetation comprised predominately of native early-successional species and exotic fire-adapted species. Furthermore, heat-shock suppressed the overall germination of New Zealand species, while promoting the germination of exotic species with persistent and fire-tolerant seeds. Persistent and heat-tolerant seeds and post-fire soil conditions contribute to positive fire-vegetation feedbacks in post-fire communities, which would likely increase their flammability and sensitivity to recurrent fires, and slow succession to forest.

Dispersal potential of Pinus radiata in New Zealand

Dr Sarah Wyse[1], Prof. Philip Hulme[1]
[1]*Lincoln University, ,*

Ecology of Dispersal Symposium, Stewart Theatre 1, December 4, 2019, 9:00 AM - 10:30 AM

Biography:
Sarah is a post-doctoral plant ecologist in the Bio-Protection Research Centre at Lincoln University, where her research focusses on the dispersal ecology of introduced conifers and its contribution to invasion risk. Her broader research interests encompass forest, seed, and fire ecology. Sarah obtained her PhD from the University of Auckland, before spending two years in the United Kingdom working at the Royal Botanic Gardens, Kew. Sarah has been based at the Bio-Protection Research Centre at Lincoln University since 2018.

The process of seed dispersal is an important component of plant invasions, being a major factor in the ability of species to spread throughout a landscape. Seed dispersal can be considered in two stages: seed release, and seed transport. For serotinous (closed-cone) pines, seed release is typically associated with a heat stimulus such as fire, which can facilitate invasion of the species in fire-prone environments, but may theoretically impede dispersal in the absence of the required conditions. For species that are dispersed by wind, seed terminal velocity is the key plant trait that then determines the potential distances the seeds are transported by wind once released. *Pinus radiata* (radiata pine) is a wind-dispersed, serotinous species that is becoming recognised as a wilding species in lowland areas of NZ. Here, we assessed the conditions required to open radiata cones, both in laboratory and field conditions. We then quantified seed terminal velocity for 750 radiata seeds, and used the WALD model to predict likely dispersal kernels for typical New Zealand environmental conditions, comparing our findings for radiata with data obtained for a range of other pines present in NZ. We show that although radiata cones opened at a mean of 45 °C, solar heating caused cones in the field to reach temperatures 15 °C higher than ambient, allowing cones to open in hot summer weather. Seed terminal velocity was higher for radiata than many other pines assessed, however the high trait variability led to considerable overlap in dispersal potential among species.