Abstracts

2024 New Zealand Ecological Society Conference

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Note: Abstracts are ordered within each section by presenter last name.

Active Ecology

Sandra Anderson, MSc [1]
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* 2023 NZES Ecology in Action Award Recipient*

Biography:
I am an ecologist at the University of Auckland, where I deliver field-based teaching for ecology courses and research support for ecology postgraduate students. My research interest is in mutualistic interactions between animals and plants – particularly pollination and seed dispersal - and their role in maintaining native ecosystem biodiversity. The aim of my work is to better understand how these systems function, and to identify and predict risk, to inform native biodiversity management.

After almost three decades of action in the field of study (-logy) I will consider whether the house (eco-) is in order, starting where all things start - at home - and moving outwards to the neighbourhood, the workplace and the wider scientific community. Along the way I will mention people who have been 'influencers' in the way they have enacted ecology in their lives, opportunities for ecological action that have presented themselves, and issues that as ecologists we are well placed to appraise and contribute to proactively. I will highlight the joys of working with the perennially young and curious, the need to stay engaged with them by making ecology relevant to life in general, and the need to stay ahead of them by remaining active in the field. I will also consider some of the research that has resulted from collaborations with colleagues at the interface of ecological fields that I work across, and our duty to communicate this knowledge. Finally I will acknowledge the whanaungatanga in belonging to an ecological society and the increasing need for our active expertise in today's world.

Bringing indigenous nature back into New Zealand urban centres: progress over the last 20 years?

Professor Bruce Clarkson
[1] People, Cities and Nature, Environmental Research Institute, University of Waikato, Hamilton, New Zealand

Biography:
Professor Bruce Clarkson ONZM is recognised as one of New Zealand's foremost authorities on ecological restoration, making significant contributions to conservation through his ongoing research, education, protection, and restoration of native plants and ecosystems over a >40-year career. Since 2016 he has led 'People, Cities and Nature', a research programme focusing on restoring damaged or depleted indigenous ecosystems in urban environments. His research has guided biodiversity and restoration projects including the Waiwhakareke Natural Heritage Park and Hamilton's Nature in the City Programme, and he has contributed to many other North Island conservation and restoration projects. He is Chair of the Waiwhakareke Natural Heritage Park Advisory Group, a trustee of the Rotokare (Taranaki) Sanctuary, and patron of the Aongatete Forest Restoration Trust and the Pirongia Te Aroaro o Kahu Restoration Society. He is also a board member of the Australasian Chapter of the International Society of Restoration Ecology and was a member, by appointment of the Minister of Conservation, of the Interim Oversight Group for the Aotearoa New Zealand Biodiversity Strategy and the Wildlife Act Review Strategic Oversight Group.

I will review progress in bringing indigenous nature back into New Zealand urban centres based on experience with projects undertaken in several North Island cities. New Zealand's urban centres vary considerably in terms of the extent of indigenous vegetation and biodiversity remaining in the built-up matrix and surrounding peri-urban zones, and in their approach to protecting and enhancing indigenous nature. But momentum has grown despite longstanding myths around the biological fitness of our indigenous flora and fauna. Since 2016, the People, Cities and Nature team have built upon the concept that restored urban centres help reverse biodiversity decline while also providing sustainable, health-promoting, and resilient environments for people. We assert that reconnecting urban-dwellers (87% of New Zealanders) to nature, to empower their concerted action, is required to produce positive regional-scale biodiversity restoration. If urban populations value and act to protect the natural environment, cities could be the key to regional and national-scale environmental protection in all its dynamic forms.

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Teamwork and tenacity: Ecological science supporting biodiversity conservation policy in Queensland, Australia

Dr Teresa Eyre[1]
[1]Department Of Environment, Science and Innovation, Toowong, Australia

AERA Award Recipient

Biography:
Teresa is an applied ecologist and leads a highly skilled team of zoologists, botanists and ecologists within the Queensland Government. Her prime motivation is to help accumulate and share scientific knowledge so that land managers and policy makers can make informed decisions regarding the sustainable management, including restoration and conservation opportunities, of biodiversity and threatened species. Teresa has published widely on Queensland's wildlife and provides advice to all levels of government on biodiversity assessment, management, and recovery of threatened species. Her team are responsible for the development of protocols and frameworks for the assessment of Queensland's fauna and vegetation condition for biodiversity.

Safeguarding the progression of government-led biodiversity policy and management can test the endurance of even the most zen of ecologists. Governments can be transitory, ephemeral and risk-averse, but also motivating and game-changing for conservation. In the state of Queensland, Australia, ecological science has been a primary contributor to major biodiversity conservation reform. There are many ways to ensure the successful infusion of ecology into policy to improve conservation outcomes and societal trust, and I will touch on key themes that have worked for me. These include; Designing and implementing systematic collection and collation of discoverable ecological data; Communicating the science without being too boring; Gathering a multi-disciplinary team of hard-working scientists to work beside you and; Not giving up. These themes will pop up as we progress together through the recent history of biodiversity conservation in Queensland, to celebrate the wins but also evaluate the losses. Wins include the protection of large, old trees for hollow-dependent fauna in forests and woodlands managed for timber operations, retention of native regrowth and remnant vegetation across the state and changing entrenched perceptions on the impacts of fodder harvesting and broadscale establishment of exotic pastoral grasses on biodiversity. All thanks to ecologists working behind the scenes, assessing habitat, digging holes, identifying species, curating data, analysing, writing, presenting, and talking. However, there have been losses too, and important for us to also address.

Forest diversity and resistance to native and exotic insect pests

Dr Hervé Jactel[1]
[1]National Research Institute for Agriculture, Food and the Environment, France

Biography:
As a forest ecologist, I have been interested in biodiversity and forest health for over thirty years. My research deals with the relationship between tree diversity and the functioning of forest ecosystems. As an entomologist by training, I have focused on the effect of the specific and functional diversity of tree species on the resistance of forests to attacks by native and exotic insect pests, and on the conservation of forest insect biodiversity. Working in the largest and oldest artificial forest in Europe, I am particularly interested in plantation forests. My main aim is to offer forest stakeholders innovative solutions for managing forest stands and landscapes in order to prevent or mitigate the impact of disturbances that are increasing as a result of climate change, so as to maintain their contribution to society.

Faced with the increase in damage caused by forest insects due to climate change and biological invasions, effective preventive control methods are needed. Using a meta-analysis of around 600 case studies, we show that a given insect species, whether native or exotic, inflicts less damage on a given tree species when grown in mixed forest stands than in pure stands. This ecological resistance (by analogy with resistance of genetic origin) resulting from the mixing of tree species appears to be consistent for different feeding guilds of forest pest, but can vary with their host specificity. In addition, we will show that the associational resistance depends more on the tree species composition or their functional diversity than on the species richness of the mixed forest. We will also review the behavioural mechanisms of forest insects that explain their different responses to the attraction and exploitation of host trees, depending on the pure or mixed composition of the target forests. Finally, we will suggest how to design and manage mixed plantations, at different spatial scales, in order to improve their resistance but also to take into account the expectations and constraints of forest owners and managers.

The meta-crisis vs the climate-crisis – an ecologist's view

Dr Mike Joy[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Mike is a Senior Research Fellow at Victoria University, after obtaining an PhD in ecology from Massey. He has spent the last two decades working at the interface of science and policy in NZ with a goal of strengthening connections between science, policy and management to address multiple environmental issues facing NZ. After noticing the decline in freshwater health in NZ, he became an outspoken advocate for environmental protection – a journey described in his new book "A Fight for Freshwater". Mike has received a number of accolades for his work, including the 2009 NZES Ecology in Action award.

The perilous state of the life-supporting capacity of planet earth receives precious little media attention and when it does it is dominated by just one element – the climate crisis. This climate myopia is extremely problematic because there are multiple existential crises threatening the chances of a future liveable planet. This blinkered view is dangerous because it ignores the fact that we aren't facing one crisis, but a raft of crises. All the crises have two factors in common 1) they are all symptoms of planetary overshoot due to overconsumption; and 2) they are all inter-related and existential so all must be fixed, or we have no future. All the crises have on one thing in common - they can only be solved by a massive reduction in consumption. Alarmingly world leaders ignore this reality and instead promote various versions of a green-growth agenda that will only push us over the already teetering tipping points underpinning the life supporting capacity of the planet. This wilful blindness is reliant on delusions such as offsetting, carbon capture, clean energy and negative emissions technology.

Weaving mātauranga māori into each stage of conservation

Miss Sarah Wharekura

Biography:

Sarah Wharekura (Ngāti Kahungunu ki Horohoro, Ngāti Rangitihi, Ngāti Whare) is a passionate advocate for freshwater conservation. With a degree in Earth Science, Biodiversity and Ecology from the University of Waikato, Sarah weaves together mātauranga māori and western science to protect the awa and roto of Te Arawa. Working with Te Arawa Lakes Trust, she focuses on monitoring water quality and taonga species populations, biosecurity and pest control, restoring wetlands and riparian zones and advocating for better management of freshwater resources. Sarah also works with iwi, hapū, marae, schools, landowners, stakeholder organisations and communities to engage locals in conservation and empower people with knowledge and resources. Her passion and dedication to the taiao contribute to preserving freshwater resources for future generations and ensuring the role of Te Arawa as kaitiaki is upheld.

Incorporating mātauranga Māori, or traditional Māori knowledge systems, into conservation efforts offers a holistic approach that bridges traditional wisdom with western science practices. The integration of mātauranga māori has become a necessity for many conservation actions and research across Aotearoa, but the process of weaving traditional knowledge into western science can be fraught with many challenges. In this keynote speech, we will explore how mātauranga māori can enhance every stage of conservation projects, from planning to implementation. We will discuss the foundational principles that underpin mātauranga māori and kaitiakitanga, examine practical examples of incorporating these principles into conservation planning and explore how to integrate mātauranga māori into everyday conservation actions. By embracing mātauranga māori, conservation efforts can be more inclusive, effective, and aligned with the values of the communities they aim to support.

A 30-year perspective on ecological infrastructure in New Zealand

Dr Susan K. Wiser
[1]Manaaki Whenua - Landcare Research, Canterbury, New Zealand

2023 Te Tohu Taiao Award Recipient

Biography:
A major thrust of my research has been defining and classifying terrestrial ecosystems of Aotearoa, including naturally uncommon ones that may be threatened. I have explored how to best map ecosystems and how classifications frameworks can aid understanding of ecosystem properties such as carbon sequestration. Managing and sharing vegetation data to support synthetic research has been a key aspect. I've collaborated internationally to support management of these data and global data syntheses about plant biodiversity and ecosystem processes. Currently I have a strong interest in mentoring early-career vegetation scientists and illustrating how vegetation can enhance landscape resilience to climate change-induced disturbances.

Science infrastructure is essential to support ecology. Infrastructure includes systems for safeguarding our data and frameworks to guide study, reporting and management of our natural ecosystems. My efforts on data systems have focused on data associated with vegetation plots of the National Vegetation Survey (NVS) databank. My efforts on frameworks have focused on developing a typology to define, describe and map naturally uncommon ecosystems and the conceptually broader effort to develop quantitative-based frameworks for all terrestrial ecosystems based on their vegetation composition.

The NVS databank has grown in scope, accessibility, and breadth of use. Emphasis in data collection has expanded from catchment-based surveys to national and regional networks. Users have expanded from a few research departments to people across academic and research agencies, national, regional and local governments, consultants and international consortia. Data quantity, use and the types of questions addressed reflect these changes.

Naturally uncommon ecosystems are now part of the NZ conservation lexicon and incorporated into policy. A revision is underway to incorporate previously unidentified ecosystems into the typology, improve precision and diagnostic criteria to identify naturally uncommon ecosystems and improve mapping accuracy.

A multi-institutional project is underway encompassing ecosystem typologies for the six domains of Groundwater, Lakes, Marine and Estuarine, Rivers, Terrestrial, and Wetlands. We analysed the IUCN Global Ecosystem Typology and its potential utility for NZ. For each domain, we developed roadmaps outlining revisions needed to meet end-user defined principles. The terrestrial domain roadmap integrates expert-driven and quantitative approaches.

Simon Upton

[1]Parliamentary Commissioner for the Environment

Biography:

Simon Upton was sworn in as Parliamentary Commissioner for the Environment for a five-year term on 16 October 2017.

Mr Upton is a Fellow of the Royal Society of New Zealand and a Rhodes Scholar, with degrees in English literature, music and law from the University of Auckland, and an MLitt in political philosophy from Oxford University. He was sworn in as a member of the Privy Council in 1999.

A Member of Parliament between 1981 and 2000, Mr Upton held a variety of ministerial portfolios including environment, research, biosecurity, health and state services between 1990 and 1999.

After leaving Parliament, Mr Upton moved to Paris to chair the Round Table on Sustainable Development at the Organisation for Economic Co-operation and Development (OECD). In 2005, he returned to New Zealand to pursue a number of private sector roles while continuing to chair the Round Table.

In April 2010 he returned to the OECD full time as Environment Director, a post he held for seven years until returning to take up the role of Parliamentary Commissioner for the Environment.

Microplastics in New Zealand urban ponds and effects on amphibians raised in ponds with microplastics

Ms Bryony Alden[1], Professor Christoph Matthaei[1], Dr Stephanie Godfrey[1]
[1]University Of Otago, Dunedin, New Zealand

Biography:
Bryony is a PhD candidate in the Zoology Department at the University of Otago, being supervised by Christoph Matthaei and Steph Godfrey. Bryony has a background in freshwater ecology and conservation, and is interested in a range of ecological fields. Her current research is focused on microplastic pollution and the effects of microplastics on amphibians.

Microplastics have been identified in samples from freshwater ecosystems globally, however research on ponds remain limited. Microplastics are being recognised to negatively impact many organism groups, yet research into the effects of microplastic pollution on amphibians, an important bioindicator group, is minimal, with most being undertaken in highly artificial laboratory settings, with mixed results.
Our first project component involved a national-scale survey of urban ponds across New Zealand, with results indicating widespread contamination of these environments by microplastics. These findings have informed the design of a large outdoor field-realistic experiment in 42 pond mesocosms, where tadpoles of *Litoria ewingii* (Southern brown tree frog) were raised and monitored under different concentrations of polyethylene microplastic fragments, followed by studying frogs that metamorphosed from each of these treatments for five months.
To our knowledge, this is the first experiment worldwide on the effects of microplastics on tadpoles conducted in a field-realistic setting. The experimental duration is unique, as these amphibians were studied from hatchling tadpoles through metamorphosis until frogs were five months old. In the current literature, only one study has investigated the metamorphosis phase. That study ended a few days after metamorphosis was completed, meaning longer-term impacts on frogs were not addressed. Further, existing experiments have used microplastic beads or fibers; however, microplastic fragments were most common in urban ponds in New Zealand. The plastics manipulated in our experiment were therefore fragments.
Findings from the field survey and the experiment will be presented.

Integrating Environmental Stressor Data into Marine Spatial Planning for the Otago Coastal Marine Area

Mr Anirudh Arvind[1], Dr. Carolyn Lundquist[1,2]
[1]University Of Auckland, Auckland CBD, New Zealand, [2]NIWA, Hillcrest, New Zealand

Biography:
Anirudh Arvind - Young aspiring scientist with a background in marine spatial ecology, conservation, and biology, working towards *identifying key ecological zones for protection by incorporating essential environmental, socio-economic, and administrative priorities. These efforts have led to incredible collaborative opportunities with NIWA, the Otago Regional Council, the Department of Conservation (DOC), and the Ministry of Primary Industr*ies (MPI). Such an exposure to various *scientific disciplines has helped carve a professional perspective that is well informed, innovative, and adaptable, all of which have translated into research efforts to help advance conservation planning in an ever-changing world.*

The primary objective of this research was to use spatial prioritisation scenarios to help better understand the priorities for biodiversity conservation in Otago's coastal waters. Zonation was used to identify priority zones of significant ecological value and to visualise the impacts of different spatial settings. Scenarios were performed to map and quantify biodiversity conservation priority zones across the Otago Coastal Marine Area (CMA) for 12 different biodiversity and habitat groups individually and collectively. The inherent uncertainties in biodiversity data quality and anthropogenic and environmental stressors were also incorporated into the analysis using appropriate spatial data proxies and various analytical techniques.
The analysis revealed significant priority areas in the southern and northern parts of the focal CMA, emphasising their ecological importance due to the stable environmental conditions and nutrient-rich habitats supporting a diverse range of ecosystems across various spatial scales. Incorporating uncertainty helped enhance the planning effort by addressing data limitations and further highlighting the potential impact of having limited understanding of ecological dynamics can have on planning efforts. Furthermore, the integration of multiple stressors into models for further assessment highlighted the need for balanced conservation strategies that include both biodiversity priorities and the varied interacting uses of the marine environment when considering ecological, socio-economic, and practical factors. The more complex analytical approach is crucial for understanding how spatial priorities for biodiversity might shift due to impacts of stressors emerging from the socio-economic uses of the marine environment as well as from the neighbouring catchment.

Bridging Knowledge Systems: Integrating Indigenous Perspectives with Scientific Approaches in Climate Adaptation and Biosecurity.

Ms Waipaina Awarau-Morris[1], Mr Mark McNeill, Dr Louise Hennessy
[1]Agresearch, Hamilton, New Zealand, [2]AgResearch, Lincoln, New Zealand

Biography:
Waipaina was raised in Ngāti Porou on the East Coast. She was trained and educated at James Cook University in Queensland, Millenium Seed Bank (Kew Gardens, England) and Te Whare Wānanga o Awanuiārangi (Whakatane, Aotearoa, NZ). She has represented Māori as tangata whenua (people of the land) and a Botanist, in seed banking and in response to biosecurity threats, in Aotearoa New Zealand, Australia and England and is currently a Scientist/Kairangahau in the Māori Research and Partnerships Team at AgResearch and leads biosecurity kaupapa (projects) in B3 (Better Border Biosecurity).

Global climate change significantly impacts Indigenous communities, posing critical threats to food security and biosecurity around the world. Recent climate change impacts in Aotearoa, New Zealand and the Pacific have been profound and increasingly severe. The frequency of these extreme weather events has intensified, leading to widespread disruptions. Both regions are experiencing disruptions to ecosystems and biodiversity. These impacts are compounded by changes in oceanic conditions, which affect marine biodiversity and fisheries that are crucial for local food security. In Aotearoa, New Zealand and the Pacific, there is a growing recognition of the need to incorporate Indigenous perspectives and knowledge systems into climate adaptation and mitigation efforts, ensuring that responses are both culturally appropriate and effective in managing the evolving risks posed by climate change. Addressing these impacts requires integrated strategies that combine scientific research with traditional knowledge.
In the B3NZ (Better, Border, Biosecurity NZ) space, there are already strong partnerships formed between mana whenua and different Pacific nations peoples and ongoing partnerships with our colleagues at USDA, Hilo, Hawai'i around ROD (Rapid Ōhi'a Death).
This presentation offers a brief overview of B3 kaupapa currently underway, that focuses on integrating indigenous perspectives with scientific methods within biosecurity frameworks, and elevating Māori/indigenous research in this space. This approach will actively involve and support indigenous participation in research activities, enriching the data collection process and fostering a deeper connection with scientific methodologies so that it filters through to our next generations.

Trying to get bang for a buck: efficiency of monitoring approaches for Lakes skink (*Oligosoma chloronoton* aff. "West Otago")

Mr Scott Bourke[1,2], Ms Sam Turner[2], Dr Joanne Monks[1]
[1]University Of Otago, Dunedin, New Zealand, [2]Department of Conservation - Te Papa Atawhai, Twizel, New Zealand

Biography:
Scott Bourke is a PhD student studying the effectiveness of monitoring tools/techniques for lizards in the Mackenzie Basin.

Resourcing for conservation is one of the major challenges to its effective implementation. This challenge is amplified for lizards in New Zealand, that receive comparatively meagre funding for management and monitoring. Regardless, long-term monitoring is required to inform fundamental ecological knowledge such as population demography, the impact of threats and, subsequently, the effect of management. This leaves lizard research and management in a position where it must ensure it is extracting maximum value from minimum resource investment. Lakes skinks (*Oligosoma chloronoton* aff. "West Otago") are large ground-dwelling lizards currently classed as Threatened – Nationally Vulnerable. Little is known regarding this species' trajectory, particularly, the impact of predatory mammals. Here, we compile eight years (2016-2024) of monitoring data from a population of lake skinks occurring in an area with high mouse (*Mus musculus*) presence. We directly compare the precision of population estimates from within-year mark recapture (MR) and between-year MR (using photo identification) to determine which is a more efficient use of resources. Population estimates from between-year MR were slightly more precise but took significantly more resource to generate. Both estimates suggest that the population is stable, though with low confidence. This is unexpected given the high tracking rates of mice in the area and may contribute to thinking concerning the impact of mice on large-bodied skinks. Alternative monitoring approaches could be considered to derive more precise and accurate population estimates, and ultimately, improve efficiency of spending.

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Mapping coral cay morphology, vegetation and wildlife from drone imagery and its effect on seabirds.

Dr Dan Breen[1], Miss Anisha Khatoon[1], Miss Paloma Chawhan[1], Mr Kushaal Maharaj[1], Mr Graham Hinchliffe[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Dan Breen is a marine ecologist that specialises in Geographic Information Systems (GIS), spatial ecology and the use of unmanned remote sensing systems. Dan completed his PhD at James Cook University, Queensland on systematic conservation planning for marine protected areas (MPAs). After moving to New Zealand in 2006, he worked at the Department of Conservation in Auckland on MPAs, as scientist for the Auckland region and surveying species such as Maui's dolphin. He previously worked at the New South Wales Marine Parks Authority and NSW Fisheries mapping coastal marine biodiversity and helping to establish marine parks and aquatic reserves. At the Great Barrier Reef Marine Park Authority he mapped biophysical data to help protect over a third of this World Heritage Area within no-take marine reserve zones. As a consultant Dan works on environmental impact and monitoring projects in marine, freshwater and terrestrial environments and in marine spatial planning for biodiversity conservation and sustainable use.

Dan's research interests include quantitative marine ecology, spatial and statistical modelling, and applying GIS based decision support systems. Recent projects he has been involved in include mapping sand cays, turtles and seabird colonies on the Great Barrier Reef, seaweed farms, seagrass and coral in the Solomon Islands, marine habitats in New Zealand and marine spatial planning options for protected areas and sustainable use.

Raine Island is a 21ha coral sand cay on the outer edge of the far northern Great Barrier Reef. It is the largest green turtle (*Chelonia mydas*) rookery in the world and the most important seabird nesting area in the Great Barrier Reef Marine Park. Unmanned aerial vehicles (UAV) or drones are now used to monitor nesting turtles at night and in the surrounding waters by day. In response to concerns over the effect of drones on the island's seabird colonies, the island's morphology, vegetation and seabirds were mapped and counts of birds taking flight during trials for different drones, flying heights, directions and seasons were recorded by ground observers, a ground-based camera and from video captured from the drone itself. During drone trials, birds were rarely seen to leave eggs or young and returned to the nest within a few minutes. Non-nesting roosting seabirds frequently left the ground during drone flights, again returning to ground after a short flight. The number of roosting birds leaving the ground during drone flights varied with species and more birds took flight when flying a larger louder drone, when flying at heights under 60m, flying downwind and during surveys after the wet season when higher densities of birds were present. The trials arguably caused more disturbance than the much smaller number of flights required to map the island but helped inform guidelines for drone operation on this and other seabird islands on the Great Barrier Reef.

Of birds and bryophytes: Nesting ecology of and bryophyte use by New Zealand birds

Dr James Brock[1], Dr Ryan de Regnier[1], Ke Li[1], Dr Josie Galbraith[2]
[1]University Of Auckland, Auckland, New Zealand, [2]Auckland Museum, Auckland, New Zealand

Biography:
James is a plant ecologist, a fern obsessive, and a part-time pirate

Materials used in nest construction can affect structure, advertisement/attraction, camouflage, environmental controls, and disease or parasite mitigation. Angiosperms and bryophytes are commonly incorporated, and while the functions of many angiosperm tissues are understood, bryophyte functions as nesting material are not, yet are likely to have significant fitness benefits to bird populations. We aim to explore variation in structure and material use spatially and temporally, and to identify patterns of bryophyte use across NZ birds. The project is ongoing and initial results will be discussed; to date we have sampled nest construction of NZ bird species by examining c. 200 nests held in museum collections around the world. We surveyed the structure (e.g. cup depth, wall width), composition (% of total nest material of identified components), and bryophyte species used in nests of 44 species (32 native, 3 extinct, 12 exotic). We analysed nest structure using classification trees, and nest composition using non-metric multidimensional scaling and indicator species analysis (for nesting material); moss taxa across nest structure were examined through network analysis and ordination. Nest structure can predict species, composition coarsely predicts habitat association. Mosses represent a key indicator material for forest bird nests. A specific suite of bryophytes are faithfully used by different forest birds and bryophyte taxa used appear to relate to bird habit and habitat, yet are not the most abundant taxa present in the landscape.

Trait-based Climate Change Vulnerability Assessment of Aotearoa New Zealand's Terrestrial Species

Anni Brumby[1], Jane Marshall[1], Tara Murray[1], Colin O'Donnell[1], Rosalie Richards[1]
[1]Department of Conservation, New Zealand

Biography:
Anni Brumby (MConBio, B.Sc, B.Soc.Sc) is a science advisor at the Department of Conservation Te Papa Atawhai (DOC), where she uses her broad knowledge on climate change, conservation and environmental science to influence and lead strategic work to improve outcomes for threatened species. She is the lead of NZ's first large-scale climate change vulnerability assessment of species.

The Department of Conservation's (DOC) first Climate Change Vulnerability Assessment (CCVA) evaluated 1145 terrestrial taxa across five groups (bats, birds, herpetofauna, vascular plants, terrestrial invertebrates) in Aotearoa New Zealand to determine their relative vulnerability to climate change. The findings are essential for DOC to prioritise climate change adaptation, management, and research efforts. We used an established trait-based CCVA framework tailored to Aotearoa. Sixteen traits under three dimensions of climate change vulnerability – sensitivity, low adaptive capacity, and exposure – were assessed using expert elicitation. Highly Vulnerable taxa needed to trigger 'higher' vulnerability for at least one trait under each vulnerability dimension. Under the high emissions scenario (RCP8.5) by the Intergovernmental Panel on Climate Change, 351 taxa (31%) are projected to be Highly Vulnerable by mid-21st century, increasing to 746 taxa (65%) by late century. Under the moderate emissions scenario (RCP4.5), fewer Highly Vulnerable taxa—153 (13%) by mid-century and 215 (19%) by late century, were identified. Latent Risk taxa, those that are sensitive with limited adaptive capacity but are not yet exposed, were identified across all groups, highlighting the need for ongoing monitoring. The CCVA exposed significant data gaps, particularly for invertebrates and vascular plants, and many taxonomic groups were excluded because of a lack of expertise available to undertake the assessment. Despite this, the CCVA provides crucial insights for climate-related conservation actions. The current trajectory of carbon dioxide emissions, and the ongoing nature of climate change beyond the study's late-century timeframe, highlight the importance of global greenhouse gas mitigation efforts.

Driving from the back seat? Can understorey tree ferns influence nutrient cycling through modifying litter decomposition rates?

Assoc. Prof. Bruce Burns[1], Jiajia Zeng
[1]University Of Auckland, Auckland, New Zealand

Biography:
Bruce is a plant and restoration ecologist in the School of Biological Sciences at the University of Auckland. His main interest at a fundamental level is in understanding what mechanisms control plant community composition in natural and managed ecosystems, and how this knowledge can be applied to effective restoration. He is particularly interested in the influence of tree ferns in New Zealand forests.

Most conceptual models of forest ecosystems focus on canopy trees as the major determinants of structure and composition. Sometimes, however, prominent understorey guilds can have an oversized influence on forest development. In New Zealand forests, tree ferns often dominate the understoreys and have been implicated in shaping regeneration dynamics through shading effects on seedlings and the potentially smothering effects of the fall of their large fronds. We hypothesised that abundant tree fern litter also influences overall decomposition rates thereby controlling the rate of nutrient cycling for forest growth. To interrogate this hypothesis, we measured nutrient content and decomposition rates of fronds of *Cyathea dealbata* near Auckland and compared these against a common broadleaf (*Melicytus ramiflorus*) and conifer (*Dacrydium cupressinum*). Fronds were divided into two major components – rachis + stipe and pinnae. On average, rachis + stipe accounted for about 55% of frond dry weight, and pinnae 45%. Generally, nutrient contents of both components of *C. dealbata* fronds were low and similar to those of *D. cupressinum*. *C. dealbata* fronds had very low Ca concentrations, however. Decomposition rates of *C. dealbata* pinnae were slow and also similar to those of *D. cupressinum*, with decomposition rates of *C. dealbata* rachis + stipe intermediate between *D. cupressinum* and *M. ramiflorus*. Our results suggest that tree fern litter, particularly in high abundance, can slow decomposition rates and therefore nutrient recycling within forest ecosystems. Slowing down this process is likely to affect forest growth rates and the plant composition of tree fern-rich communities.

Possible decline of North Island kōkako after years of increases

Dr Rhys Burns[1], John Innes[2]
[1]Department of Conservation, [2]Manaaki Whenua Landcare Research

Biography:
Rhys is a Technical Advisor for fauna and ecology at the Department of Conservation, based in Rotorua. He has experience in the ecology and management of central NI forests, RMA consents (e.g. roads, windfarms, mines) and lizard salvage. He is the leader of the Kōkako and Weka Recovery Groups, and a member of the Frog Recovery Group.

The North Island kōkako is a 'deep endemic' species of Aotearoa/New Zealand and was once widespread over forested habitat throughout Te Ika o Maui/North Island and Aotea/Great Barrier Island. Since human arrival, the NI kōkako population has undergone drastic decline due to habitat loss and the introduction of mammalian predators. The species reached its nadir of approximately 330 pairs in the late 1990's, and only 11 sites now remain that have always had kōkako present. Effective pest control and translocations to new sites have seen the total population reach 2500 pairs across 29 management sites. This prolonged successful recovery is now being challenged, with several populations recording declines, some of which have been rapid and severe. The status of kōkako populations, possible causes of recent declines, future management options and potential emerging threats to this species are presented.

History and Future Management of Geothermal Vegetation and Habitats in the Wairākei Tauhara Geothermal System, Taupō, Aotearoa New Zealand

Dr Chris Bycroft[1], Dr Joanna McQueen[1], Sarah Beadel[1], Angela McQuillan[1], William Shaw[1]
[1]Wildland Consultants, Rotorua, New Zealand

Biography:
Chris Bycroft is a Senior Ecologist with Wildland Consultants based in Rotorua. He is currently Treasurer of the New Zealand Ecological Society and is a past President of the Society. He specialises in botany and avifauna surveys and has done many of the surveys for this project. Chris studied tussock grasslands in southern Aotearoa New Zealand in 1990s for his PhD. Since moving to Rotorua in 2000 Chris has taken a particular interest in geothermal systems. He enjoys visiting wild and remote places, particularly tramping and trail running.

The Wairākei-Tauhara Geothermal System (WTGS) contains c.164 hectares of discontinuous geothermal vegetation and habitat with a complex history of natural and anthropogenic change. Changes in the patterns and dynamics of geothermal vegetation are linked to the effects of energy extraction as well as other factors. Wairākei Power Station was the World's second geothermal power station and has been generating electricity since 1958. Extraction from the field has been subject to multiple modifications and expansions, resulting in changes and losses to steamy habitats (alongside geothermal streams, springs, and geysers), reducing habitat for threatened plant species. Between the 1950s and 1980s, there was a marked increase in geothermally-heated ground, which increased the extent of geothermal kanuka. Since the late 1980s the extent of geothermally-heated ground has been declining slowly, although the extent of geothermal kānuka-dominant vegetation remains considerably larger than before energy extraction began. Findings are presented of vegetation monitoring in the WTGS, including identification of recent changes at specific sites. We also present options for the future management of geothermal vegetation in the WTGS under two scenarios: continued use (through modified energy extraction), compared to the likely effects of no further energy extraction. Continued extraction, at least in the short term can provide opportunities to invest in the protection of geothermal habitats and species. For steamy habitats, this can in places be achieved through the artificial creation of lost habitats. Careful restoration management of the highest quality geothermal habitats is also required.

Land use intensity is a major driver of soil microbial and carbon cycling across an agricultural landscape

Dr Alexa Byers[1], Professor Leo Condron[1], Dr Steve A. Wakelin[2], Professor Amanda Black[1]
[1]Lincoln University, Lincoln, New Zealand, [2]Scion, Riccarton, New Zealand

Biography:
Alexa Byers is a Microbial Ecologist and Postdoctoral Researcher at Lincoln University. Her research specialises in assessing the impacts of ecological disturbances on the soil health and functioning of productive and natural ecosystems.

Soil carbon (C) storage is a critical ecosystem function underpinning human health and well-being. Developing sustainable land use practices that enhance agricultural productivity whilst protecting essential ecosystem functions such as soil C storage is vital. The soil microbiome has a critical role in regulating soil biogeochemical cycling processes and examining the impacts of land use intensity on the soil microbiome enables us to assess the potential effects on long-term soil C stocks. Using metagenomic DNA sequencing and phospholipid fatty acid analysis, we investigated differences in the diversity and structure of the soil microbiome associated with five contrasting land uses across an agricultural landscape. The land uses covered a gradient of disturbance intensities and included native forest, regenerating native bush, exotic forest, dryland pasture, and irrigated pasture. We identified pronounced differences in the soil microbiome associated with each land use, including the diversity and abundance of microbial C cycling genes. Notably, intensive agricultural land uses had a significantly higher diversity and abundance of microbial C-degrading genes, whilst native forest land uses had the lowest diversity and abundance of microbial C-degrading genes. Our findings suggest that intensive agricultural land use may increase the functional potential of the soil microbiome to mineralize soil C, potentially resulting in a greater loss of soil C. This research may be used to support the development of sustainable management practices that promote the persistence of soil C across agricultural landscapes, such as the protection of remnant native forest fragments and greater incorporation of regenerating native vegetation.

Do ship rats prey switch to native birds when mast seeding events finish?

Dr Jo Carpenter[1], Alex Verry[1], Kieren Mitchell[1], Katherine Trought[1], Adrian Monks[1], John Innes[1], James Griffiths[2], Max Harvey[3], Janet Wilmshurst[1]
[1]Manaaki Whenua - Landcare Research, New Zealand, [2]Department of Conservation, New Zealand
[3]University of Otago, Dunedin, New Zealand

Biography:
Jo Carpenter is a conservation biologist based at Manaaki Whenua in Dunedin. She is interested in plant-animal interactions, rodents, island biology, and indigenous predators.

Generalist predator populations often surge during resource pulses but decline sharply afterwards and shift to alternative prey sources, which experience elevated predation rates. Understanding these numerical and functional responses of predators to resource pulses is especially important for effectively managing island ecosystems, where invasive mammals are generalist predators and vulnerable indigenous birds are alternative prey. We used DNA metabarcoding of stomach contents to test whether the proportion of ship rats (*Rattus rattus*) consuming birds changed during and after a mast seeding year in a New Zealand beech forest. Contrary to prevailing assumptions that ship rats in forests consume birds only occasionally and increase their consumption of birds once a resource pulse finishes, we found that the overall proportion of rats consuming birds was surprisingly high (19.4%), and that the proportion of rats consuming birds did not change significantly across the 3 years of a beech mast cycle. We detected 15 unique bird taxa in the rat stomachs and 38 unique plant taxa. The frequency of beech consumption declined across the 3 years, as predicted. We conclude that (1) forest birds are a common part of rat diet rather than an occasional opportunistic prey item, and (2) the impact of ship rats on indigenous birds following seed pulses is predominantly driven by the numerical response (increased numbers of rats present) rather than a functional (prey switching) response. Conservation interventions that seek to maximally and consistently suppress rats are therefore likely to have the best outcomes for birds.

Research on the Ecological Function of Submerged Plants

Professor Kaining Chen[1], Doctor Yu Wu[1]
[1]Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, Nanjing, China

Biography:
Professor and doctoral advisor of Nanjing Institute of Geography and Lakes, Chinese Academy of Sciences, State Key Laboratory of Lakes and Environment. Mainly engaged in aquatic botany, lake wetland ecology, eutrophication control and ecological restoration mechanism research and application technology development of lakes and reservoirs. The research results provide theoretical and technical support for the smooth implementation of wetland ecosystem restoration, cyanobacteria control and water quality improvement projects in China, such as the Taihu Lake, Chaohu Lake, Dianchi Lake, Nansihu Lake, Tianmu Lake, rivers in Jiaxing City, Zhejiang Province, rivers in Henan Province, drinking water sources in Tianjin, etc. Published over 80 papers, including more than 30 SCI papers, obtained over 30 national authorized patents, and 4 international patents. Received two first and second prizes respectively in the National Environmental Protection Science and Technology Award, two second prizes in Anhui Province Science and Technology Award and Yunnan Province Science and Technology Award, and two China Invention Patent Excellence Awards and Jiangsu Province Patent Excellence Awards.

This study compared water, sediment, and sediment microbial data from areas with high and low coverage of submerged vegetation (HC and LC) in Dongshan Bay of Lake Taihu in China to explore the impact of submerged plants on aquatic ecosystem function. The results showed that HC areas had significantly lower algal biomass, suspended particulate matter, and phosphorus concentrations in the water compared to LC areas. Sediment analysis revealed significantly higher carbon, nitrogen, and phosphorus content in the sediment of HC areas. PCoA analysis indicated that categorizing sediment microbial samples based on plant coverage was more effective than categorizing by sampling season, suggesting that submerged vegetation significantly influences sediment microbial community composition. Microbial diversity, evenness, and species richness were all significantly lower in HC areas than in LC areas. Null model analysis further indicated that microbial communities in high coverage areas were more assembled by homogenizing selection. LDA results showed that HC areas were enriched in Proteobacteria and Cyanobacteria. In contrast, LC areas were enriched in Nitrospirota, indicating that nitrogen cycling in these areas relied more on this phylum. Additionally, microbial communities in LC areas were enriched with pathways related to amino acid, carbohydrate, and coenzyme metabolism, possibly due to lower environmental selection pressure, allowing nutritionally deficient microorganisms to survive through cross-feeding. No significant enrichment of pathways related to greenhouse gas production (e.g., methane and N2O) was detected in high coverage areas. This study indicates that submerged plants play an important role in reducing nutrients and carbon sequestration.

Reevaluating the loss of divarication hypothesis on New Zealand's outlying islands

Mr Riccardo Ciarle[1], Mr Peter de Lange[2], Mr Kevin Burns[1]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]Unitech Institute of Technology, Auckland, New Zealand

Biography:
Riccardo Ciarle is a PhD student at Te Herenga Waka (Victoria University of Wellington), Aotearoa (New Zealand). He received his master's degree in evolutionary biology at the University of Padua. He has a broad interest in Evolutionary biology, Island biogeography and the ecological and evolutionary aspects of the island syndrome in plants.

The loss of divarication hypothesis posits that divaricate-related traits should be lost on New Zealand outlying islands following predatorial release. Like most evolutionary components of the island syndrome, this hypothesis was tested through the pairwise comparison method, i.e. by comparing traits of island endemics to those of their closest relative(s) on the mainland, assuming that the most recent common ancestor (MRCA) was divaricate. Here, we test this assumption.
We amassed data for 32 island endemics, including all but one genus comprising at least one divaricate species in the New Zealand region. We then used ancestral state reconstruction to test whether the MRCA of each island lineage was divaricate and to quantify the degree of morphological evolution in leaf size and branching angle (i.e. significant divaricate traits).
25 out of 32 MRCAs were estimated as most likely non-divaricate. Nonetheless, when the MRCA was estimated as divaricate, divarication was always lost in the island lineage and significant morphological evolution always occurred, resulting in larger leaves and smaller branching angles.
Results confirm the loss of divarication hypothesis, albeit significantly restricting its scope and highlighting how the in-situ evolution of divaricate-related traits appears to be widespread on islands and not confined to taxa descending from a divaricate ancestor. In addition, these results have broader implications for the field of island biogeography, as they showed the limited utility of the pairwise comparison method and the need to also consider morphological evolutionary in the mainland sister species.

First Investigations of Diet and Habitat Niche Overlap in Three Deep-Sea Flying Squid Species

Mr Samuel Clough[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Originally from the UK, I became interested in cephalopod biology while doing my undergraduate degree at Glasgow University. The AUT laboratory for Cephalopod Ecology & Systematics (ALCES) has a worldwide reputation for their research on the biology of these animals, prompting me to work with them. Currently my PhD research is focused on the ontogenetic trophic dynamics of three poorly understood flying squid species residing in Aotearoa New Zealand's waters.

Marine taonga ('treasure' in Te Reo Māori) species like toroa and hoki depend on deep-sea habitats yet these habitats are subject to rising exploitation. Effective conservation should ensure that taonga will endure but much ecological information that could support effective conservation practices remains unknown. Deep-sea squid food-web ecology is one poorly studied area and their environmental importance will substantially increase as global squid populations fill the void left behind by over harvested fish. My research focuses on the dietary ecology of 4 poorly described deep-sea squid species sampled from local waters: the Angolan flying squid, the southern flying squid, and two large warty hooked squids. To do this, I am analysing the squids' gut contents via morphological prey identification and DNA barcoding of prey tissues, yet this only provides a snapshot of the squids' most recent meals, but longer-term comparative data can be obtained through stable isotope analysis. Squid beaks are chitinous structures formed in layers over their lives and stable isotope values of carbon and nitrogen are indices for habitat and food ladder placement. By sub-sampling the beaks and measuring their stable isotope values, we can quantify habitat and dietary changes throughout their lives. Multivariate analysis of variance of identified prey items and stable isotope data will provide further insight into how prey influence the movement of nutrients in Aotearoa New Zealand's waters. My presentation aims to show how multiple, complementary methods can robustly model the dietary and habitat niches of these poorly studied yet increasingly important species.

What's the risk? An analysis of the risk of rats, mice and stoats invading islands.

Mr Pete Corson[1], Mr Grant Harper[2]
[1]Quality Conservation Ltd, Rotorua, New Zealand, [2]Biodiversity Restoration Specialists, Murchison, New Zealand

Biography:
Pete is the Director of Quality Conservation Ltd, a one-person company based here in Rotorua. Pete had a 20+ year career in DOC before starting Quality Conservation in 2019 where he's providing conservation planning and services nationally and internationally, particularly for pest management, restoration, island biosecurity and eradications.

Islands are critical for conservation with disproportionately high species diversity and disproportionately high numbers of threatened species. Islands account for 5.3% of the earth's land area but 61% of extinct species and 37% of critically endangered species. Eradications of mammalian species accelerated from the late 1980s. Many offshore, uninhabited islands remain pest free but numerous incursions have occurred, and some islands have been re-infested. Over the last two decades more and more inhabited islands have become, or their communities are wanting to become, pest free. Information and analysis are required to help assess resourcing levels for island biosecurity and feasibility of future eradications. We present an analysis of island incursion data for rats, mice and stoats to help assess invasion risk.

Dama wallaby are not bouncy possums: operational and research learnings from attempted wallaby elimination projects

Dr Tim Day[1]
[1]Day in the Bush, Rotorua, New Zealand

Biography:
Dr Tim Day has a PhD in pest animal behaviour and has been actively involved in the research, development and delivery delivery of pest management solutions for over 30 years. Tim's business, Day in the Bush, provide expert wildlife management advice and services to a wide range of groups, from private landowners, iwi stakeholders, forestry companies, community conservation groups, international clients and NZ government agencies. His specialty is using sound research and theory to design and implement practical and pragmatic animal management solutions.

Dama wallaby cause significant ecological impacts in the Bay of Plenty but have historically had minimal focused control. The Tipu Mātoro National Wallaby Eradication Programme aims to contain dama (and parma) wallaby within a 'core' geographical boundary and eliminate satellite populations from outside of the containment zone. Existing wallaby control tools and methods are limited, are largely based on possum control technology, do not always have social licence, and have rarely focused on population elimination. We discuss key operational and research learnings, challenges, and opportunities from several recent wallaby elimination attempts. We demonstrate possum dominance over wallaby, inter- and intra-specific competition at control sites, and cautious feeding behaviour leading to a risk of bait shyness. We conclude that: wallaby behaviour is significantly different to possums; satellite wallaby populations have fewer behavioural and ecological constraints than the core population; some current tools and technology do not cater to wallaby behaviour and may sometimes reduce the likelihood of local elimination; broadcast control methods are likely to better target wallaby than point-source methods; monitoring satellite wallaby is an essential component of effective control; elimination of satellite wallaby populations can be achieved when the focus is on the surviving individual animals, not on population-level control. Ongoing investment in further wallaby-specific knowledge, methods and tools will be essential before we can be confident in achieving local elimination of satellite wallaby populations.

Insect herbivores increase soil respiration by increasing soil bacterial abundance in an alpine tussock grassland

Mr Jim Den Uyl[1], Dr Aimée Classen[2], Dr Julie Deslippe[1]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]University of Michigan, Ann Arbor, United States of America

Biography:
James (Jim) Den Uyl is a field ecologist specializing in natural community responses to climate change. He holds a Bachelor of Science from the University of Michigan and a Master of Science from the University of Colorado. Jim recently defended his PhD thesis at Victoria University of Wellington, where his research integrates ecosystem ecology and community ecology. His work focuses on enhancing our understanding of how carbon cycling and biological communities interact in the face of ongoing climate change.

Soil respiration is the release of carbon dioxide from the soil to the atmosphere, representing a crucial component of the global carbon cycle. Insect herbivore outbreaks generally increase soil respiration, but the underlying drivers of this relationship are poorly understood. As climate change increases the frequency of insect outbreaks, this knowledge gap hampers predictions of future soil carbon dynamics. In this study, we examine soil respiration beneath two shrubs that host distinct insect communities in Tongariro National Park. *Calluna vulgaris* (CV), an invasive shrub, is exclusively browsed by a biocontrol insect herbivore (*Lochmaea suturalis*). *Dracophyllum subulatum* (DS), a native shrub, is browsed by a more diverse community of native herbivores. In a replicated field experiment (n= 60), we monitored soil respiration and insect abundance on DS and CV during the growing season and conducted lipid analyses to characterise soil microbial communities. Each insect herbivore observed on a host plant increased soil respiration by an average of 3.6%, an effect consistent across plant and insect species. Increasing soil respiration was closely linked to bacterial abundance and Gram positive bacteria in particular. Given that plant responses to herbivory, such as altered metabolite production and carbon allocation belowground, are known to influence the size and composition of soil bacterial communities, our results suggest that plant-mediated processes may underlie the stimulatory effects of herbivory on soil respiration. These findings highlight previously unknown ecological relationships with the potential to significantly influence soil carbon cycling.

Kahikatea (*Dacrycarpus dacrydioides*) Green Wheel Assessment update in Waikato

Dr Yanbin Deng[1], Ms Karen Denyer[2], Mr Daniel Tait[1], Mr Craig Briggs[1], Ms Rebecca Finnerty[1], Ms Ashley Cloke[3]
[1]Waikato Regional Council, Hamilton, New Zealand, [2]Papawera Geological Consulting Ltd , Cambridge, New Zealand, [3]3, Hamilton, New Zealand

Biography:

Yanbin Deng, terrestrial ecologist. Yanbin provides the expertise, knowledge and information needed to look after our indigenous terrestrial ecosystems in the Waikato region. Following list is Yanbin's working area:

Since 2018, Waikato Regional Council has been developing a kahikatea forest fragment assessment method; Kahikatea Green Wheel (KGW). The council has mapped all remaining kahikatea fragments. Restoration factsheets and KGW tools are available online, ranking 31 characteristic attributes using a five-point rating system. The methodology has been further refined as a result of the surveys. Currently, 29 kahikatea fragments (126 ha in total) across seven district council areas, have been assessed using KGW, 86% of which on private land. The site ranking scores ranged from 11.4 to 28.8, with a maximum 35.

The KGW surveys revealed further unhealthy kahikatea stands, adding to those mapped by the Council and Wintec students. Landowners and communities have also been contacting WRC concerned they may lose their trees. Pathogen analysis (SCION) of 14 soil and foliage samples from both healthy and unhealthy kahikatea trees were collected with iwi permission, revealing the presence of *Phytophthora* and *Pythuim* species in soil beneath both healthy and unhealthy trees. The council has initiated a citizen science project using webforms and iNaturalist platforms for members of the public to report kahikatea trees. Further research into correlations with hydrology, grazing and other potential causes will continue, but meanwhile, as a precaution, the council is spraying boots with Virkon when working in kahikatea stands.

The KGW assessment and pathogen analysis results have been shared with key stakeholders including landowners, iwi, and territorial authorities, to help identify appropriate restoration/management activities to improve the resilience of kahikatea forest fragments.

Possum exclusion boosts mangeao seed production in Waikato forests

Mrs Margaret Dickinson[1]
[1]University Of Waikato, Taupo, New Zealand

Biography:
When Margaret completed her BSc in marine and forest ecology in 1985, jobs in ecology were scarce. Margaret returned to her previous career in medical laboratory science and later moved into quality assurance and food safety management. Since retiring in 2017 she has completed a MSc in Forest Ecology. Her thesis "Do rats and possums reduce the reproductive capacity of large-fruited broadleaved species in Waikato hill country forests" left Margaret with more questions than answers so she has continued her fequent visits to the forests on Maungakawa and Maungatautari to further explore the complexities of possums, environment and tree health.

Mature *Litsea calicaris* (mangeao), is a codominant tree in Waikato forest remnants, including Maungatautari and Maungakawa Scenic Reserves. The large fruit of this broadleaved endemic tree are an important food for kererū. Mangeao is dioecious with flower bud development occurring in early summer, the buds breaking the following spring and fruit ripening in autumn 18 months post bud break. Seeds germinate in the following spring. There has been concern about the health of mangeao trees in some Waikato forests, and a lack of mangeao regeneration has been noted at Maungakawa. Invasive mammals apart from mice have been excluded from Maungatautari forest since 2006 but continue to be abundant at Maungakawa. To determine the impacts of invasive mammals on mangeao reproduction, we compared seed fall of mangeao in the two forests and monitored reproductive phenology. Flower buds were observed annually in both forests, however abundant seed fall was only recorded at Maungatautari: abundant in 2020 and to a lesser extent in 2022. Phenological observations show the vulnerability of mangeao reproductive cycles to climatic variation. Many flower buds did not survive hot summer conditions, and many immature fruit were aborted. At Maungakawa, wildlife cam videos showed possums browsing on immature foliage in early spring, causing collateral flower damage. The impact of unfavourable environmental conditions on mangeao tree resources is exacerbated by possums browsing foliage. Results highlight the scientific and conservation values of ecological sanctuaries which protect ecosystems representative of regional native biodiversity.

Invertebrate herbivory in ferns – a New Zealand case study

Miss Janelle Evans[1], Dr James Brock[1], Associate Professor Anne Gaskett[1]
[1]University of Auckland, Auckland, New Zealand

Biography:
Janelle is a master's student at the University of Auckland, studying how invertebrate herbivores interact with ferns in Aotearoa New Zealand. She's particularly fascinated by plants, invertebrates, and the relationships between them. For fun, she enjoys tramping, making illustrations, and playing instruments (like the Irish tin whistle!).

Invertebrate herbivory is vital for ecosystem function, influencing everything from nutrient cycling to community dynamics. Traditionally, research into invertebrate herbivory has focussed on interactions with flowering plants, mainly due to an assumption that other plant groups, such as ferns, are not targeted by herbivores. However, recent research suggests that ferns may be fed on at similar rates to seed plants. Uncertainty remains, however, due to a global lack of in-depth case studies and, where studies have been completed, the incidence or extent of herbivory are examined in isolation. New Zealand has a high diversity of fern species, making it an ideal candidate for investigating invertebrate-fern interactions in greater depth.
My project aims to investigate invertebrate-fern herbivory in New Zealand. To date, I have focused on (1) performing a systematic quantitative literature review comparing New Zealand invertebrate-fern interactions to global patterns and (2) comparing the incidence and extent of invertebrate-leaf consumption of ferns and angiosperms across the ground and shrub layer in Auckland native forests. As of yet, I have found that a broad array of invertebrates interact with ferns, and when total herbivory is considered, ferns are fed on just as much as angiosperms. My findings highlight the likely significance of invertebrate-fern herbivory in New Zealand's ecosystems, which stands in contrast with global patterns. Additionally (and significantly), my findings also demonstrate the importance of measuring both the incidence and extent of herbivory, which reveals nuances that may have contributed to a lack of clarity around invertebrate-fern herbivory thus far.

Provision of Ecosystem Services and Disservices by Birds in Horticulture: Knowledge Gaps, Trends and the Neglect of Native Species

Miss Giuliana Ferrari[1], Professor Isabel Castro, Professor Alastair Robertson, Ms. Karen Mason
[1]Massey University, Palmerston North, New Zealand

Biography:
Ms. Ferrari is a PhD student in Ecology at Massey University, but before reaching New Zealand, she has acquired her Bachelors and Master's Degree in Ecology and Conservation in her home country of Brasil. Primarily working with reintroduction of endangered species and the illegal wildlife trade, she is now focused on the roles of birds, especially natives, to food production systems, recognising the importance of human-managed land to current and future conservation efforts.

Food production systems dominate the Earth's landscape, with land use intensification as a main driver of biodiversity loss. Wild species that thrive in these systems can cause benefits or damages to food production, investigated through the lenses of ecosystem services and disservices. The wide diversity of avian feeding guilds lends to birds garnering attention as potential ecosystem services and disservices providers. Published literature indicates a rapidly increase in the number of studies conducted in the past two decades. Most studies surveyed the systems without focusing on the servicing taxa, with species richness and abundance being the most common metrics used in studies looking at bird assemblages. Most documents investigated either ecosystem services or disservices, which hinders the holistic understanding of how these can interact in horticultural systems. Biases are also present in the studies of crop damage, which are significantly more likely to be overestimated than in studies of pest control. Methods on the studies were compiled in 9 distinct groups, dissecting the technological trends and advances in this field. Bridging gaps of knowledge also allows for potential opportunities to change grower's assumptions and attitudes towards wild birds, an important consideration given that most studies neglected looking at native and/or endangered bird species, or the dynamics of human-wildlife conflicts. Changing this current scenario not only assists better conservation practices for the permanence of wild birds in an ever-changing world, but also provide opportunities for the betterment of human societies through the reduction of damages and increase of potential benefits.

Managing one of New Zealand's most threatened and misunderstood ecosystems: gumlands

Mr Marley Ford[1]
[1]Auckland Of University, Whangārei, New Zealand

Biography:
Marley Ford is a consultant ecologist based in Northland working with forest, wetland and fungal ecology with a focus on plants. He is currently studying a PhD part time. at the University of Auckland on gumland ecology.

Gumlands are a critically endangered ecosystem, only found in northern New Zealand. They are a sclerophyllous wet heathland, occurring on extremely infertile soils that are acidic and seasonally waterlogged due to a shallow iron hardpan. Gumlands support unique biodiversity but low endemism. Their name is derived from the kauri gum deposits that they contain, a vestige of the kauri forest that once grew in their place. Gumlands appear to require fire for their formation and persistence in the landscape. What constitutes a gumland is unclear, which makes their management challenging in some settings. For example, are they wetlands and how extensive were they prior to human settlement of Aotearoa? Many remaining gumlands occur on whānau land, the largest is on the Ahipara plateau, west of Kaitaia, in the Far North. Here, we are working with whanau to understand how historical and environmental factors, such as soil conditions, fire history, manual vegetation clearance, and proximity to road edges, influence community composition and structure. In this talk we will provide a preliminary look at early data from this work and discuss potential implications for any future management.

Bigger on their own: size structure of Chatham Island mudfish (*Neochanna rekohua*) populations with tuna (*Anguilla* spp.)

Mx Grace Fortune-Kelly[1], Dr Travis Ingram[1]
[1]Ōtākou Whakaihu Waka (University of Otago), Ōtepoti (Dunedin), Aotearoa (New Zealand)

Biography:
Ko Aerana te whakapaparanga mai, ko Iwikatea te whenua tupu, ko Ōtepoti te kāinga, ko Grace Fortune-Kelly te ingoa. Grace is studying towards a PhD at Ōtākou Whakaihu Waka (Otago University). She is researching freshwater fish ecology and trophic interactions in dune and peat lakes on Rēkohu (Wharekauri, Chatham Island).

In aquatic systems body size is central to interspecific relationships, both impacting and impacted by interactions like predation. With the prevalence of invasive fish in freshwaters in Aotearoa, New Zealand, little is known about predator-prey interactions of native fish in their absence. Rēkohu (Wharekauri, Chatham Island) provides opportunity for studying native freshwater species interactions due the absence of introduced fish in the many lakes across the island. The Chatham Island mudfish (*Neochanna rekohua*; Galaxiidae), endemic to Rēkohu, is an understudied peat lake fish that co-occurs with tuna (longfin and shortfin eels; *Anguilla* spp.). We used size surveys from overnight trapping and age estimates from otoliths to investigate the impacts of tuna on size and growth of the Chatham Island mudfish. Mudfish showed smaller average (55mm) and maximum (112mm) length with unimodal size distributions in lakes with tuna. In contrast, mudfish in lakes where they were the only fish species showed bimodal size distributions and larger average (84mm) and maximum (211mm) length. Length at age patterns were similar between lakes with and without tuna, suggesting growth rate is not a major driver of these size differences. This contrasts to patterns found in co-occurring trout and galaxiids in mainland Aotearoa, and highlights the importance of understanding such interactions between our native species. As body size is fundamental to many aspects of biology, these patterns have broad potential impacts on mudfish populations and the ecosystems they inhabit.

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Colourful fruity fungi: adapting to bird and reptile sensory ecology

Dr Amy Brunton-Martin[1,2], Dr Ryan deRegnier[1], Gabrielle Johns[1], Gyoungsu Lee[1], Dr Jamie Wood[2,3], Assoc. Prof. Anne Gaskett[1]
[1]Biological Sciences, Auckland Uni|Te Kura Mātauranga Koiora, Waipapa Taumata Rau, New Zealand, [2]Manaaki Whenua|Landcare, New Zealand, [3]Faculty of Sciences, Engineering and Technology, The University of Adelaide, Australia

Biography:
Anne Gaskett is a mum and nature lover who enjoys studying interactions between diverse species. Research in sensory ecology is fascinating - how wonderful to listen in on the conversations plants, fungi and animals have with each other! Anne also enjoys cooking, opshopping, colourful outfits and making systemic changes to improve Equity.

Fruit dispersal is a classic plant-animal mutualism, but fungi can also evolve traits to attract animal vectors. Truffle fungi are typically dull-coloured, subterranean, strongly scented and attractive to mammals like marsupials, rodents, truffle pigs and dogs and people! However, Aotearoa's truffle-like fungi emerge aboveground and seem unscented and uniquely colourful with a rainbow of red, orange, yellow, blue, purple and white sporocarps. Our fruits are often dispersed by tūī, korimako and kererū, moko and wētā … are our truffle-like fungi similarly adapted to the sensory ecologies of birds, reptiles and insects?
Here's an update of our work exploring potential convergent evolution of fruit-like traits in fungi. We've evaluated whether Aotearoa's fungi really are surprisingly colourful in a global context and tested resemblance to native fruits by comparing sizes, spectral reflectances, UV, brightness and detectability when modelled into bird and reptile vision systems (10 fungi spp., 32 fruit spp). We are midway through analyses of dung, coprolites and isotopes to assess fungal ingestion by living and extinct birds. Just like we all suspected - Aotearoa's colourful, fruity truffle-like fungi are indeed exceptional!

Aotearoa needs you: contribute to the models on the front lines of the fight for biodiversity

Dr Justyna Giejsztowt[1]
[1]Wildland Consultants Ltd., Christchurch, New Zealand

Biography:
Justyna is an ecological consultant at Wildland Consultants Ltd. She has a passion for ecology, numbers, and the wild places of Aotearoa/New Zealand. She is involved in a wide variety of projects, working with councils, government departments, conservation organisations and developers alike to find solutions that safeguard nature. Justyna completed a PhD in Ecology and Biodiversity at the Victoria University of Wellington, her research combining extensive field surveys and experiments in Tongariro National Park with spatial statistical modelling. Prior to working at Wildlands, Justyna was a postdoctoral researcher and international fellow in Germany.

Habitat degradation and loss through development is a significant driver of biodiversity decline in Aotearoa/New Zealand. Ecologists can make an immediate difference in curbing biodiversity declines by adequately applying the effects management hierarchy to ensure projects achieve 'No Net Loss' of biodiversity.
Biodiversity offsetting and compensation accounting models are routinely employed through the resource consenting process as part of the effects management hierarchy. They address development-induced biodiversity losses by calculating whether planned mitigation actions are adequate. Thus, biodiversity offset models are a fundamental component of mitigation design, a critical tool for decision makers, and a bottom-line mechanism to decelerate biodiversity loss.
There are currently no required industry standards for calculating offsets. Existing models do not meet standards that are typically expected in the wider ecological modelling discipline, including addressing uncertainties. Further, models are poorly understood and frequently misapplied. Consequently, models of insufficient ecological and mathematical robustness perpetuate systematic biodiversity losses and distract decision-makers from discussions regarding real-world ecological consequences of development.
Collaboration and guidance from ecological researchers, modellers, and practitioners as well as attention from research funding bodies is necessary to ensure that models protect the values of Aotearoa's natural places. Recent court rulings have highlighted that a disciplinary consensus regarding appropriate standards is required, as judges are ill-equipped to assess standards for technical disciplines. In this talk, I will contextualise biodiversity offset models, summarise how these models work 'under the hood' and underline some aspects that require improvement. I welcome constructive discussion from the audience on this topic.

Freshwater inputs and elevation define estuarine community assembly

Mr Anthony 'AJ' Gillis[1], Dr. Mads Thomsen[1,2], Dr. Jonathan Tonkin[1,3]
[1]University Of Canterbury, Christchurch, New Zealand, [2]Marine Ecology Research Group, Christchurch, New Zealand, [3]Te Pūnaha Matatini Center of Research Excellence, Christchurch, New Zealand

Biography:
Maps and animals have captured my curiosity, fueled my imagination, and guided my life and career choices. Throughout my career, I've been drawn to answering questions that help us better understand how species use their habitat and how communities turnover through time and species due to shifting environments. My Ph.D. will explore the importance of direct and indirect interactions in rocky shore kelp and estuarine communities. With each chapter, I intend to gain deeper insights into community assembly, interaction change, and the impacts shifting ecological contexts will have on each.

Environmental conditions influence community architecture, by regulating species abundances and interactions. How environmental conditions modulate community assembly remains unclear, partly reflecting the context dependency of species movements. Due to limited mobility, susceptibility to stressors, and the ability to measure species interactions *in situ*, sessile species communities are ideal for testing the drivers of community assembly in dynamic environments. We set out to determine whether deconstructed interaction turnover was driven more by partner matching, measured as rewiring, or species turnover, reflecting species sorting and whether each component changed along gradients of freshwater input and elevation relative to water level (a proxy for desiccation). Where communities were more dissimilar in freshwater input and elevation, interaction turnover was primarily driven by species turnover. By contrast, as environments became more similar in freshwater flow and elevation, rewiring contributed more to interaction turnover. Freshwater flow and desiccation stress were significant environmental factors, influencing species sorting between environmentally dissimilar sites and interaction partner matching via rewiring, at more ecologically similar sites. Combined with facultative interactions, these analytical methods provide powerful measures into community assembly and, considering these results can capture community assembly variability within a single system, prompting the inclusion of species interactions into conservation goals and actions.

Fernal Destination? The Mysterious Mechanisms of Monospecific mātātā Colonies and Their Effects on Restoration and Succession in Northern Aotearoa.

Mr Cameron Guy[1]
[1]University Of Auckland, Auckland, New Zealand

Biography:
Hailing from Te Tai Tokerau, Cameron Guy is a PhD candidate based at the University of Auckland. He completed a Bachelor of Science in Biology and Psychology in 2021 and a Master of Ecology focused on the colony dynamics of the native fern mātātā in 2023. Since then, Cameron has been working with Te Rarawa to learn about the social-ecological networks of Ahipara's kauri gumlands. He is interested in researching and applying multi-disciplinary, mixed-methods approaches from a range of knowledge sources to past, present and future ecological challenges in Aotearoa. Please feel free to chat with Cam at any time!

In Aotearoa numerous projects aim to restore previously-cleared sites to high-value native forest, including at Tāwharanui Regional Park. Colony-forming ferns are often present in these ecosystems, with each species having different mechanisms of spread and impacts on succession and restoration. At Tāwharanui one such species, *Paesia scaberula* (mātātā), has been described as a stubborn agricultural pest and is present in several restoration planting sites. Mātātā's, sweet scent, sticky fronds and relationship to the allelopathic bracken (*Pteridium esculentum*) has led to allelopathy being identified as a possible mechanism of colonisation. To identify the mechanism and consequences of mātātā colonisation I investigated vegetation dynamics, colony characteristics and allelopathic potential through field observations and laboratory bioassays. Nine months of observations at Tāwharanui Regional Park revealed that as mean mātātā cover decreases, sward height decreases and pasture grass species increase in cover. Species richness and composition is unaffected by mātātā, which gradually expands into kikuyu pasture using a seasonal phalanx growth strategy. The allelopathic potential of mātātā was investigated using laboratory bioassays on seeds and seedlings. No significant effect was seen on germination or radicle length in lettuce (*Lactuca sativa*) or mānuka (*Leptospermum scoparium*). Over ten weeks, no significant changes in relative growth rate were observed among treatments in karamu (*Coprosma robusa*), mānuka and ponga (*Cyathea dealbata*) seedlings, suggesting a lack of allelopathy in mātātā and that colonosiation is promoted by some mechanism.

What would happen to the Lake Benmore trout fishery if the sockeye salmon population collapsed?

Mr Blake Harper[1,2], Mr Rhys Adams[1], Dr Amandine Sabadel[2,3,4]
[1]Central South Island Fish & Game, Temuka, New Zealand, [2]University Of Otago, Dunedin, New Zealand, [3]Auckland University of Technology, Auckland, New Zealand, [4]National Institute of Water and Atmospheric Research, Wellington, New Zealand

Biography:
Blake Harper is a Master of Science student in Zoology at the University of Otago, researching sockeye salmon in Lake Benmore in collaboration with Central South Island Fish & Game. Blake has recently been employed by Central South Island Fish & Game as an Ecologist and previously collaborated with Southland Fish & Game on a published stable isotope study investigating the impact of non-native fish species on native eels. Blake has presented at the Stable Isotope Network for New Zealand Conference and has expertise in statistical analysis, project management, and ecological research, driven by a deep passion for New Zealand's natural environment and the outdoor recreational opportunities it offers.

Population fluctuations and ongoing climate change are raising concerns about sockeye salmon (*Oncorhynchus nerka*) in Lake Benmore, a popular fishing spot in New Zealand known for its large brown and rainbow trout. These are thought to be benefited from sockeye smolt in their diet, but the trophic interactions between sockeye and both trout species in Lake Benmore are largely unknown. This study, we hypothesised that trout diets would primarily consist of sockeye smolt during the smolt season, contributing to their size and good condition. To investigate this, we measured stable isotope values of tissue samples of trout, sockeye smolt, snails and other potential food sources identified with eDNA. The results revealed that snails were the main contributor to the diet of rainbow trout in Lake Benmore, making up 42.8% of their diet, followed by sockeye smolt comprising 18.5%. For brown trout, the primary food source was sockeye smolt, comprising 28.1% of their diet, closely followed by snails at 27.3%. A decreasing intake of sockeye smolt was observed in brown trout living further away from the tributaries where the sockeye smolt originated. At the main tributary where the sockeye spawn, sockeye smolt made up 24.7% of the brown trout's diet, but this percentage dropped to 17.9% for brown trout living 3 km away from the tributary. Understanding these interactions is crucial, as a sockeye collapse could significantly impact Lake Benmore's trout fishery and ecosystem, with broad economic and recreational implications for Aotearoa New Zealand.

Soil plant growth-promoting bacterial diversity changes with land use intensity and environmental conditions.

Dr Syrie Hermans[1], Professor Hannah Buckley[1], Associate Professor Brad Case[1], Dr. Fiona Curran-Cournane[2], Dr. Matthew Taylor[3], Professor Gavin Lear[4]
[1]Auckland University of Technology, Auckland, New Zealand, [2]Ministry for the Environment, Auckland, New Zealand, [3]Waikato Regional Council, Hamilton, New Zealand, [4]University of Auckland, Auckland, New Zealand

Biography:
Syrie is a microbial ecologist interested in understanding how human activities, such as agriculture, affect the microbial communities in our environments, and how in turn we might be able to utilize these communities to help us understand and monitor ecosystem health and the consequences of human land-use activities on our environments.

Plant growth-promoting bacteria (PGPB) play crucial roles in supporting and enhancing plant growth and, therefore, in maintaining biodiversity in undisturbed ecosystems, and underpinning plant production in agricultural systems. Understanding how land use and environmental changes impact these microbial communities allows us to understand how the ecosystem services provided by PGPB can negatively or positively impacted. This is an important prerequisite to taking advantage of the positive impact PGPB could have for sustainable food production. We surveyed the PGPB in over 500 indigenous forest, exotic plantation forest, grazed pasture and horticulture sites using high-throughput 16S rRNA gene sequencing. We showed that PGPB community diversity increased with land use intensity, and the greatest portion of the explainable variation in diversity was accounted for by soil nutrients and metal concentrations, as well as unexplained spatial patterns. Variation in PGPB community composition, on the other hand, was highest in the forest and horticulture sites and lowest in the grazed pastures. The variation was best accounted for by shared variation among land use, soil nutrients and soil metal concentrations. The relative abundance of nitrogen-fixing PGPB taxa decreased with land use intensity, largely driven by a decrease in Rhizobiales. In contrast, taxa in the order Bacillales, known for phosphate and potassium solubilisation, increased in abundance. Key environmental variables limiting the distributions of specific PGPB taxa included soil pH, several nutrients, and the concentrations of cadmium and zinc. Overall, our results contribute towards an understanding of the interplay between how we use our soil, their physicochemical properties, and the function of the microbial communities within them. This increased understanding of the distribution of PGPB, and therefore the ecosystem services they provide, helps us better understand the benefits these bacteria bring to both natural and agricultural land, and how we can ensure the benefits are delivered optimally.

Estimating the impact of Predator Free Wellington on Wellington tree wētā (*Hemideina crassidens*) via spatially explicit capture and recapture

Mr Jarrod Hosnell[1], Prof Stephen Hartley[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Jarrod Hosnell is currently conducting their Master's by Thesis in Ecological Restoration and is studying the impact of the Predator Free Wellington initiative on the populations presence and abundance on Wellington tree wētā. Jarrod has experience volunteering and working with native taonga species such as kākā, kea, Lizards, and freshwater fish. Besides conservation and ecology, Jarrod has a key interest in paleontology, and hopes to be able to combine his two interests into a career one day. Jarrod currently works part time for GNS Science, where he started work there as a curator for a Paleobotanist.

Predator Free Wellington (PFW) is a New Zealand Government backed organisation set on removing possums, rats, and stoats from the Wellington region. They have successfully accomplished Phase One, meaning that the Miramar Peninsula is now free from possums, stoats, and rats. Multiple environmental organizations assume that native species will respond positively by recolonizing old habitats and increasing in population abundance after the removal of mammalian predators. The Wellington tree wētā (*Hemideina crassidens*) is a large-bodied native insect which can coinhabit environments with invasive mammals, therefore they provide an opportunity to study responses to mammalian predator presence. To test the effects of PFW's effects on *H. crassidens* population abundance and density, I am conducting a spatially explicit capture-recapture experiment and comparing different populations inside and outside the PFW Phase One zone. Two habitat types have been surveyed within and outside the Phase One zone: mature pine plantation (n=2) and mahoe-dominated, regenerating native forest (n=2). Preliminary studies have found that the non-predator free, native regenerating forest contain the highest total abundance of *H. crassidens.* While the exotic pine forest in the same zone has the lowest total abundance. These preliminary results suggest that cohabitation with mammalian predators may not be the only factor influencing population abundance of *H. crassidens*, and other environmental factors such as habitat type may be a strong influence. Therefore, it is possible that stoats, rats, and possums may not negatively impact all native species equally.

Shedding Light on Heteroblasty: Assessing Environmental Influences on Transition Heights in New Zealand Heteroblastic Plants

Miss Irisa Hudson[1], Prof Geotge Perry[1], Prof Cate Macinnis-Ng[1]
[1]University Of Auckland, Auckland, New Zealand

Biography:

Irisa is a Master of Science student studying heteroblastic plants at the University of Auckland, supervised by Prof. George Perry and Prof. Cate Macinnis-Ng. Irisa has a love for New Zealand ecology, specifically our unique plant assemblages and has spent numerous weeks volunteering with the Department of Conservation in remote areas, including being the sole warden on pest-free Te wharawhara (Ulva island), and was recently selected as a BLAKE Freshwater ambassador for 2024.

There has long been a fascination with plants that undergo a substantial and abrupt change during their ontogeny (heteroblastic plants). Nowhere has this fascination been more intense than in New Zealand, where numerous theories have been posed to address the high incidence (c. 170) of heteroblastic species. Many of these theories suggest that this trait evolved as an anti-herbivore defence against extinct moa, where plants are theorised to change to a more palatable state above the browse height of moa. Despite being heuristically attractive, this theory has clear pitfalls, such as the lack of other anti-herbivore defences (spines) and a gross lack of data for many claims. For example, there is no published data on the transition heights of heteroblastic species in the field. As a result of this overfocussing on moa, key stressors such as light availability have likely been overlooked.

This research aims to investigate the role that environmental factors such as light could have on the transition height of heteroblastic species under field conditions. To do this, I am employing three key methods: morphological analysis of leaf shape for herbarium and collected specimens to identify shared heteroblastic trajectories, transitional height/light field analysis to determine if transition heights are related to the ambient light conditions, and finally, physiological leaf trait analysis to determine the shade tolerance differences in juvenile and adult heteroblasts. These results will give insight into the possibility that other drivers, such as light, could have influenced the development of heteroblasty in New Zealand plants.

Bridging Education and Restoration: How School Partnerships Can Support Long-Term Ecosystem Recovery

Dr Spencer Ingley[1], Reagan Owens
[1]Brigham Young University–Hawaii, Devonport, New Zealand

Biography:
Dr. Spencer Ingley is an Associate Professor and Biology Chair at BYU–Hawaii, an Asia/Pacific focused undergraduate university on the North Shore of O'ahu, Hawai'i. Dr. Ingley has a background in evolutionary ecology, primarily with tropical fish, but has recently focused his efforts on invasive species biology and restoration ecology. He is passionate about integrating real-world projects into his teaching and outreach efforts, with particular interest in identifying ways to include traditional ecological knowledge and science practices in his work. He is currently on Sabbatical leave in Auckland.

Island ecosystems worldwide have deteriorated following the colonization of both humans and introduced species, leading to the disruption of native biodiversity and ecosystem functions. Major restoration efforts, led by governments, volunteers, and research organizations, aim to restore these systems. However, sustaining local community investment in these often costly and time-intensive projects remains a significant challenge. Engaging youth is a promising strategy to foster long-term stakeholder involvement. This study presents a case of a university-led ecological restoration project at BYU–Hawaii in collaboration with a local primary school on the Island of Oʻahu, Hawaiʻi. Over the course of a year, we integrated ecological restoration activities into the school's curriculum, aligning with key learning outcomes. Our results demonstrate the success of student-led restoration efforts, including measurable improvements in ecosystem structure, and highlight the educational benefits for the participating students. We also reflect on the practical lessons learned from this collaboration, offering insights into how similar partnerships can enhance community engagement and contribute to lasting ecological restoration.

Advancing ecological knowledge through teaching and outreach on Rēkohu Wharekauri Chatham Island

Dr Travis Ingram[1]
[1]University of Otago, Dunedin, New Zealand

Biography:
Travis Ingram is a Senior Lecturer in the Department of Zoology and Deputy Director of the Ecology Degree Programme at Ōtākou Whakaihu Waka (the University of Otago). His research group works mostly on the food web interactions, life history, and ecological genetics of native freshwater fish. His research and teaching are often focused on the lakes of Rēkohu (Wharekauri, Chatham Island).

Opportunities to align research objectives with educational goals and community outreach are valuable in advancing ecological knowledge. Field-based teaching can give students a first-hand experience of a place while allowing them to carry out authentic research that makes a difference. This talk describes the first two years of a field course based on Rēkohu Chatham Island. Student projects have covered a wide range of ecosystems from rocky shores to forests, and addressed topics of interested to the community including how covenants affect stream health and the implications of different management approaches in kōpi groves. In an under-researched area like Rēkohu, this work can genuinely advance our knowledge of biodiversity and ecological interactions, and provide a baseline for more in-depth study. An essential feature of this course is community engagement, with students communicating their findings back to the wider community to build the relationship year over year.

Palms on the Move: Investigating Niche Conservatism and Invasion Risk of Non-Native Palms in Aotearoa New Zealand

Miss Alisha Keshaw[1]
[1]University Of Auckland, Auckland, New Zealand

Biography:
Alisha Keshaw (She/They) is a current Master of Biosecurity and Conservation student at Waipapa Taumata Rau, University of Auckland. Her master's research investigates the risk of non-native palm species in Aotearoa New Zealand. As the president of the Auckland University Women in Science club, Alisha is dedicated to promoting equity and inclusion in the scientific community. She is passionate about fostering an inclusive environment that supports and uplifts underrepresented voices in STEM. In her spare time, she enjoys doing various arts & crafts projects, doing fun makeup looks and making terrariums.

Understanding the niche dynamics of non-native species is key to predicting potential invasion areas and understanding the mechanisms behind their success. Invasive species pose a major threat to biodiversity and ecosystem functioning by disrupting ecological balance, causing environmental and economic damage, and displacing native species, often within a short time frame.
Palms (Arecaceae) are vital contributors to ecosystems across the globe, yet in Aotearoa New Zealand, only the Nikau palm (*Rhopalostylis sapida*) is native. The increasing presence of introduced palm species has raised concerns, as little is known about their current or potential spread within Aotearoa. My research investigates the invasion risk of forty one non-native palm species, focusing on their environmental preferences and their ability to establish in New Zealand's ecosystems. By employing species distribution modelling, I map potential spread zones and evaluate the adaptability of these palms under both present and future climate conditions. The findings provide valuable insights into how exotic palms may interact with local biodiversity, helping to inform strategies for monitoring, managing, and safeguarding native ecosystems from the potential threats posed by these species.

Native Mammals of the New Zealand Region

Professor Carolyn King[1]
[1] School of Science, University of Waikato, New Zealand

The New Zealand Region includes not only an archipelago of temperate islands, but also the Ross Dependency in Antarctica. It comprises a vast area of pristine coastal and rich ocean waters protected from the rest of the world by great distance and long isolation. Mammalian immigrants, arriving only if they could swim or fly, have evolved into 59 species of native species.
Our fauna of land mammals is limited to four species of short-tailed bats, Mysticinidae (only one still living) and one long-tailed bat (Vespertilionidae), all with relatives in Australia.
By contrast, the New Zealand Region (including Antarctica) is a hot spot for marine mammals: three species of fur seals and one sea lion (Otariidae), five true seals (Phocidae), and 48 species of dolphins and whales (Odontoceti and Mysticeti).
Long isolation protected our marine fauna from human knowledge until after 1280 AD. Tangata whenua harvested some bones and teeth of cetaceans for carving, and pinnipeds for meat. But after James Cook published descriptions of New Zealand's untouched, undefended marine resources in 1769, European and American sealers and whalers arrived in ruthless hordes. Massive exploitation drove fur seals and commercially valued whales to near-extinction. Now all native species are protected, and most are slowly recovering.

King, C. M. (2024). *New Zealand's Native Mammals.* Upstart Press, Auckland.
King, C. M. (2024). *Biogeography and History of the Prehuman Native Mammal Fauna of the New Zealand Region*. *Diversity* 16:45.

New Zealand's Active Sand Dunes: Preliminary Findings from the Dune Systems of National Significance Project

Dr Mike Hilton[1], Dr Teresa Konlechner[1]
[1]School Of Geography|Te Iho Whenua, University of Otago|Ōtākou Whakaihu Waka, Dunedin, New Zealand

Biography:
Teresa Konlechner is a lecturer in Physical Geography in the School of Geography at the University of Otago. She specialises in the dynamics of coastal systems, with a particular interest in the management and conservation of active sand dunes. This work includes understanding how natural processes and human interventions shape coastal landscapes, how nature-based solutions can be applied for managing coastal erosion, techniques for effective habitat restoration in dynamic systems, and the impact of invasive species on dune habitats.

Active sand dunes are dynamic sand dune systems where the physical, ecological and landscape character result from episodic sand transport. Once widespread on the Aotearoa New Zealand coast, the extent of active sand dunes declined by 80% between the 1900s and 2008. Native species associated with sand dune habitats are disproportionately identified as At Risk or Threatened. Many are thriving at only a few sites and their survival is contingent on ongoing conservation action. Our understanding of what remains of this important ecosystem type and associated biodiversity is likely to be out of date. This paper presents preliminary data on the "Dune Systems of National Significance Project" at the University of Otago which seeks, in the first instance, to compile data on the flora of dune systems identified as regionally or nationally significant as the first step toward addressing this knowledge gap. Data was compiled from published flora of dunes and information provided by Regional Councils, NGOs, academics and the Department of Conservation. In total 109 sites are identified as being of National Significance. The criterion for identification varies regionally but collectively these sites have experienced relatively low levels of modification, are strongholds for indigenous dune species, and have a character representative of dune systems in the region. The inventory illustrates that all sites hinge on sustained conservation efforts. It is anticipated that the publication of this inventory will act as a basis for greater recognition of the state of Aotearoa's remaining active sand dune ecosystems.

Comparative Analysis of Genomic Features in Fungal Pathogens Across Different Host Plants in New Zealand

Mr Yongning Li[1]
[1]Auckland Of University, Auckland, New Zealand, [2]Sun Yat-sen University, Guangzhou, China

Biography:
I am a Ph.D. candidate in Ecology at Sun Yat-sen University, currently conducting research at the School of Environment, University of Auckland. My research focuses on the impact of fungal communities on plant species coexistence, with a particular interest in trait-based ecology and spatial distribution patterns. I have published an article on pathogen fungal community assembly in Frontiers in Plant Science and is actively involved in advancing the understanding of plant-microbe interactions and disease ecology.

This study aims to explore the genomic characteristics of pathogenic fungi infecting various seed plants in New Zealand, utilizing data from the Pathogen-Host Interaction Database (PHI) and the compiled database of plant–pathogen association. We focus on key genomic features such as genome size and base pair count, comparing these traits across fungi associated with monocots and eudicots. Preliminary analyses reveal that pathogenic fungi infecting monocots tend to have smaller genomes compared to those infecting eudicots. We also investigate the spatial distribution of these genomic features across different geographic regions in New Zealand and identify potential environmental and host-related factors influencing these patterns. Our findings provide insights into the ecological and evolutionary implications of fungal genome characteristics, potentially guiding strategies for managing plant diseases in diverse ecosystems.

Phenotypic plasticity of invasive hawkweeds under drought conditions in Aotearoa New Zealand's tussock grasslands

Rachael Lockhart[1], Dr Nicola Day[1], Professor Hannah Buckley[2]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]Auckland University of Technology, Auckland, New Zealand

Biography:
Rachael is a master's student at Victoria University of Wellington. Her interests include ecology and research on invasive species – particularly plants.

Phenotypic plasticity is the ability of an individual organism to alter its phenotypic expression of a genotype in response to changes in environmental conditions. The 'plasticity-first hypothesis' suggests that there is greater phenotypic plasticity in novel populations compared to long-established populations; invasive species make excellent case studies to test this hypothesis, but only when colonisation times are known. Invasion by hawkweeds, particularly *Pilosella officinarum* and *Hieracium lepidulum*, has been a concern in New Zealand's grasslands since *c*.1950s. I aimed to assess the plasticity in functional traits of *Pilosella* and *Hieracium* populations in relation to colonisation history (invaded pre-1980, 1990s, or post-2000) and moisture conditions (precipitation). Using permanent long-term grassland sites monitored since the 1980s, I collected and measured functional traits of *Pilosella* (*n* = 17) and *Hieracium* (*n* = 16) populations established at different times, and over a precipitation gradient. To measure plasticity within populations in response to water availability, I set up a common garden experiment using seeds collected from these field populations and grew them under two watering treatments: high-frequency and low-frequency. Plasticity of functional traits varied among populations of both species, but the variation associated with different colonisation histories was confounded with environmental variation, including precipitation. Functional traits of individuals from the common garden experiment showed both species exhibit a high degree of plasticity in response to watering regime. This research helps us to understand the mechanisms underpinning hawkweed trait variation and how this may affect their future spread.

Developing future scenarios for Aotearoa's biodiversity using the IPBES Nature Futures Framework

Dr Carolyn Lundquist[1,2]
[1]University of Auckland, Auckland, New Zealand, [2]National Institute of Water & Atmospheric Research (NIWA), Hamilton, New Zealand

Biography:
Carolyn Lundquist is a Principal Scientist at NIWA in Hamilton and an Associate Professor in the School of Environment at the University of Auckland. She is an interdisciplinary scientist, and collaborates with ecologists, modelers, societal scientists, indigenous knowledge holders, industry, and regional and central government to inform decision-making for the oceans, from coasts and estuaries to the deep sea. She currently serves as a member of the Multidisciplinary Expert Panel for the United Nations International Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

IPBES (International Science-Policy Platform on Biodiversity and Ecosystem Services) has developed a new global biodiversity scenarios framework, building on previous approaches such as climate scenarios. This new framework is designed to catalyse the development of new and transformative biodiversity scenarios that identify management options and opportunities that can reverse the declines in biodiversity and ecosystem services. The Nature Futures Framework (NFF) is underpinned three types of human relationships with nature: 1) instrumental or material benefits of nature (Nature for Society); 2) intrinsic values of nature, including the diversity of species, habitats, and ecosystems that form and sustain the natural world (Nature for Nature), and 3) relational values where humans are an integral part of natural systems, and societies, cultures, traditions and faiths are intricately intertwined with nature (Nature as Culture/One with Nature). In particular, the NFF highlights the role of indigenous knowledge systems in biodiversity conservation and management, and the diversity of non-material benefits of natural systems that have been historically excluded from decision-making based on material values for nature. NFF scenarios can highlight pathways toward sustainable management that bring together conservation, economic benefits, and human well-being, underpinned by principles of whakapapa and kaitiakitanga to ensure positive futures for Aotearoa's biodiversity and people. Here, I highlight developments in the application of the NFF in Aotearoa for diversifying national biodiversity monitoring programmes and associated social, cultural, economic and ecological indicators of biodiversity.

Blue carbon habitats in Aotearoa New Zealand—opportunities for conservation, restoration, and carbon sequestration

Dr Richard Bulmer[1], Dr Phoebe Stewart-Sinclair[2], Dr Orlando Lam-Gordillo[2], Dr Steph Mangan[3], Professor Luitgard Schwendenmann[4], Dr Carolyn Lundquist[2,4]
[1]Tidal Research Ltd., Auckland, New Zealand, [2]National Institute of Water & Atmospheric Research (NIWA), Hamilton , New Zealand, [3]National Institute of Water & Atmospheric Research (NIWA), Christchurch, New Zealand, [4]University of Auckland, Auckland, New Zealand

Biography:
Richard is a marine ecologist, and received his PhD in Marine Science from the University of Auckland. He has spent the last 15 years working in estuarine and coastal environments, studying ecological and functional dynamics. He has a research interest in blue carbon ecosystems, as well as working with iwi and hapu to support the sustainable management of Aotearoa's environment.

Blue Carbon habitats (i.e., mangroves, saltmarshes, and seagrasses) have a high capacity for carbon sequestration and the potential to reduce the effects of greenhouse gas emissions. However, blue carbon habitats have historically decreased as a consequence of land conversion, coastal development, and pollution and are under threat in many locations. Restoration of these habitats can reverse historic losses and generate carbon credits through increased carbon sequestration. Using estimates from satellite remote sensing, we determine that Aotearoa estuaries and coastal areas contain approximately 20,932 ha of saltmarsh, 30,533 ha of mangrove, and 61,340 ha of seagrass, estimated to sequester a total of approximately 57,800 tC/yr. A further 87,861 ha of land was estimated to be potentially suitable for blue carbon projects via tidal restoration, of which 44,149 ha was suitable for saltmarsh restoration (equivalent to 47,239 tC/yr if restored), 17,291 ha was suitable for mangrove restoration (26,455 tC/yr), and 14,087 ha was suitable for seagrass restoration (4790 tC/yr). Both existing extent and restoration opportunity varied throughout the country, with greater opportunity in some regions than others. Nationwide, the total sequestration potential for blue carbon restoration was estimated at 91,680 tC/yr if all potential areas were restored. Carbon credits generated by blue carbon projects could be traded on a carbon market in Aotearoa, generate revenue for landowners, provide an additional pathway to meet domestic and international climate change targets, and result in a diversity of other ecological, social, and cultural co-benefits from coastal restoration.

Courtship and courtship behaviour in eastern white-tailed spiders (*Lampona murina*)

Mr Lewis Luo[1], Dr Anne Wignall[1], Dr Cor Vink[2], Dr Greg Holwell[1]
[1]University Of Auckland, Auckland, New Zealand, [2]Lincoln University, Lincoln, New Zealand

Biography:
Lewis Luo is a recently graduated Master's student at the University of Auckland. His master's research focused on understanding the predatory and social behaviour in white-tailed spiders in the North Island. In his spare time, he enjoys songwriting, hiking, and playing Dungeons and Dragons with friends. He is currently hunting for a job in biosecurity, conservation, consulting, or ecological restoration. Please feel free to approach him during the break if you have anything in mind for him.

Interacting with conspecifics can be dangerous for predatory animals due to the risks of violent conflict and cannibalism. Compared to other predators, araneophagic spiders may be particularly prone to cannibalism due to the degree of similarity shared between themselves and their preferred prey. The evolution of araneophagy may therefore favour mechanisms that minimise aggression toward conspecifics.
The eastern white-tailed spider (*Lampona murina*) is a lamponid ground spider introduced to the North Island from Eastern Australia. The natural diet of *L. murina* consists primarily of other spiders, including both web-building and cursorial spiders. Unlike some other araneophagic spiders (e.g., *Portia*), *L. murina* is a non-visual predator and relies on chemical and vibrational cues for detecting prey and conspecifics. Previously, the intricacies of conflict and courtship behaviour in this species had not been documented and it was unknown what factors predict contest and courtship success. To answer these questions, I conducted behavioural experiments investigating how adult male and female *L. murina* interacted with same-sex and opposite-sex individuals. I found that interactions between all sex combinations (i.e., female-female, female-male, male-male) were distinct, though the behaviours used by both sexes during contests resembled those employed in courtship. Interactions appeared non-injurious, and the cannibalism rate was low during encounters. I found no evidence to suggest that *L. murina* can evaluate the size and power of opponents during contests, nor the size of mates during courtship. It appears that *L. murina* uses tactile cues (possibly chemical) to distinguish between conspecifics and prey.

Preliminary findings of wētā susceptibility to fluralaner, a common anti-parasite treatment for pets

Miss Chloe Mc Menamin[1], Ms Melissa Marsh, Mr Ben Goodwin, Dr Kristie E Cameron, Mr Sean Goodison
[1]Unitec, Auckland, New Zealand

Biography:
Chloe is an emerging researcher dedicated to exploring the effects of commonly used anti-parasitic treatments in companion animals and their environmental repercussions on Aotearoa New Zealand's unique ecosystem. With over a decade of experience in the veterinary industry, Chloe has experience in a variety of veterinary nursing and animal health roles. Currently, a lecturer in applied animal health at Unitec, Chloe's passion for conservation was kindled through their previous work as an exotic and wildlife veterinary nurse. Chloe is a staunch advocate for educating veterinary professionals to consider their crucial role in mitigating biodiversity loss.

Background Antiparasitic treatments for companion animals are approved based on the understanding that their benefits outweigh potential harm. However, when these treatments are administered to large populations of healthy companion animals, the environmental impact of thousands of doses annually may not justify the benefits to Aotearoa New Zealand unique ecosystem. Fluralaner, a commonly used broad spectrum antiparasitic treatment in companion animals, is categorised as an isoxazoline insecticide and acaricide. It is a relatively recent addition to the market, initially approved for use by topical treatment in cats and dogs in 2015 in New Zealand. This study aims to investigate the impact of fluralaner on native invertebrates in Aotearoa New Zealand.
Method The efficacy of fluralaner on native invertebrates endemic to Aotearoa New Zealand was evaluated through topical application to the thorax of *Teleogryllus Commodus* (field crickets) a taxonomically similar species to the New Zealand ground wētā (*hemiandrous spp*). Observations of behavioural changes were made at 1 hour, 24 hours, 48 hours, and 72 hours post-application.
Results Contact exposure to fluralaner did not cause consistent mortality. However, an affect - unable to move away from noxious stimuli but still responsive, on the back but unable to move away from noxious stimuli , hyperextended legs with ability to still upright - was seen at concentrations as low as 2 mg/mL (66% were affected at 24 hours). The LC50 was observed at 14 mg/mL at 24 hours.
Conclusion The environmental impact from runoff or through excretions from the use of commonly used antiparasitic drugs in companion animal species requires further investigation. With concentrations as low as 2 mg/mL causing an effect on Teleogryllus commodus at 24 hours, further investigation is required on pathways to the environment, accumulative effects, the effects of this drug on non-target organism unique to Aotearoa New Zealand and potential hotspot location of environmental contamination.

Conservation implications of exceptional gestation length in Aotearoa's alpine geckos

Dr Jo Monks[1], Dr Marieke Lettink[2], James Chatterton[3], Jim Young[4], Emeritus Prof. Alison Cree[1]
[1]University Of Otago, Dunedin, New Zealand, [2]Fauna Finders, Christchurch, New Zealand, [3]Auckland Zoo, Auckland, New Zealand, [4]Vital Statistics, Christchurch, New Zealand

Biography:
He tangata Tīriti ahau, ā, i tipu ake au i Whakaoriori, i Te Ika-a-Māui. Ka mahi ahau hei pūkenga kei Ōtākou Whakaihu Waka. E rangahau ana ahau mō te tiakitanga o ngā moko māori, o ngā manu māori, o ngā pekapeka māori, o ngā ngārara māori hoki e noho ai i te nuku o te whenua.

I grew up in the North Island and consider myself tangata Tiriti. I'm a lecturer at the University of Otago with a research focus on applied ecology and conservation of native terrestrial animals, with a slight bias towards lizards.

Understanding reproductive output and gestation length is crucial for the conservation of viviparous ectotherms, especially in the face of climate change and increasing predation pressure. Biennial reproduction is increasingly reported for cool-climate lizard species at high latitudes or elevations, but gestation length is not known to exceed 14 months. We evaluated female reproductive cycles of viviparous, nocturnal Cascade geckos (*Mokopirirakau* 'Cascades') at a remote alpine site (44°S, 1300 m a.s.l.) in Aotearoa. We used abdominal palpation to classify adult females into five reproductive stages and validated findings using portable ultrasound on a subset. Using capture-recapture methodology via photo identification, we tracked known females over six summers. We made 160 captures of 100 individual females, of which 36 were recaptured 2 – 6 times. In any given sampling session, we found females in a range of reproductive stages, signalling that their cycle is neither annual nor biennial. Very few were non-reproductive, suggesting that years of skipped reproduction are rare. Gestation length was estimated to be 2.9 years (95% credible interval 2.4 to 3.6) based on modelling of 41 pregnancies among 35 females. We infer that reproduction is triennial or less frequent. Our discovery of exceptional gestation length and extremely low annual reproductive output is significant, particularly given the potential impact of a warming climate and increasing numbers and diversity of invasive mammalian predators in Aotearoa's alpine zone. In combination, our research highlights challenges for conserving alpine biodiversity in Aotearoa.

Carbon and Nitrogen microbial cycling from Aotearoa (NZ) marine methane seeps

Dr Arola Moreras Marti[1], Dr Sarah Seabrook[2], Prof Kathleen Campbell[3], Dr Sebastian Naeher[4]
[1]Aut, Auckland, New Zealand, [2]NIWA, Wellington, New Zealand, [3]University of Auckland , Auckland , New Zealand, [4]GNS, Wellington, New Zealand

Biography:
Arola is from Barcelona, Spain. She did her PhD at St Andrews University in Scotland, UK, studying the carbon and sulfur isotope biosignatures of microorganisms in geothermal systems in Iceland. She was awarded a Research Fellowship at Auckland Uni, and she is now a Lecturer of Earth

Hydrocarbon cold seeps are extensive features along continental margins worldwide, exuding fluids rich in methane (CH_4) and hydrogen sulfide (H_2S) and hosting abundant marine life based on chemosynthesis[1,2]. Substantial amounts of methane and other hydrocarbons are emitted from cold seeps, thus the mineralisation by microorganisms of methane-derived authigenic carbonates is a major sink of carbon and a significant component of the oceanic carbon cycle. Modern seeps are widespread offshore east of New Zealand's North Island, in the active Hikurangi convergent margin[3]. A NZ scientific voyage part of a multidisciplinary project sampled in 2018 the Hikurangi methane seeps over a spatial variation (cm to m) on a km transects.

With the goal to understand the link between geochemical processes and microbial ecosystems functions, I used a multidisciplinary approach by analysing the microbial function, molecular biomarkers, environmental parameters, and C and N isotopes. The first result shows sediment redox gradient and disturbance appear to drive changes in the sediment methane filter and microbial diversity and function. The second and novel result suggest a close link between carbon and nitrogen microbial cycling in these seeps, with the novelty of nitrogen metabolisms playing a central role in the microbial ecosystem function of the seeps.

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Revolutionising small pest mammal control using an innovative drone-delivered bait system

Dr Craig Morley[1]
[1]Toi Ohomai Institute Of Technology, Rotorua, New Zealand

Biography:
Craig Morley is a passionate researcher in wildlife conservation and invasive species management. He joined Waiariki/Toi Ohomai Institute of Technology in 2011, after working with the Department of Conservation (DOC) and the University of the South Pacific (USP). At USP, he initiated research on the impact of mongoose and rats on endangered iguanas and frogs. His recent work includes UAV-based bait deployment systems for pest control and collaborations on global conservation issues. Craig also led community conservation projects in Rotorua and has held leadership roles in international conservation organisations.

Revolutionising small pest mammal control using an innovative drone-delivered bait system
Uncrewed aerial vehicles (UAVs), or drones, are transforming pest management by precisely delivering bait to locations that are difficult to access—offering a significant advantage over traditional helicopter and ground control methods. Moving beyond the limitations of swath bucket broadcasting and manual bait placement, we have developed a cutting-edge drone-mounted system that accurately delivers specific quantities of bait to targeted areas. This advanced precision is vital for navigating diverse vegetation and managing pests in remote regions. Our specially designed biodegradable bait pods are optimised for aerodynamic accuracy and split open upon impact, ensuring maximum bait access for pests while leaving no lasting environmental footprint. This presentation will showcase the promising results from our trials in the Bay of Plenty, Southland, and Hawke's Bay. We will also introduce our upcoming heavy-lift drone, a game-changer in scaling up operations, allowing for more extensive and efficient pest control. We will also discuss the system's advantages and limitations and outline our ambitious goals for enhancing pest management across New Zealand's unique ecosystems.

ESMAX - a spatially explicit model for configuring landscapes to maximise regulating ecosystem services

Dr Richard Morris[1]
[1]Lincoln University, Lincoln, New Zealand

Biography:
Richard Morris is an architect and postdoctoral fellow in the Agriculture and Life Sciences Faculty, Lincoln University. His research involves developing an ecosystem services-based design approach, supported by a spatially explicit modelling tool, ESMAX. Prior to undertaking a PhD, Richard worked for Medecins sans Frontieres in Afghanistan, co-founded a bamboo construction company in Myanmar and was involved in the design of high-end 'eco-resorts' in Southeast Asia. His interest in the ecological impact of these resort developments led directly to his present doctoral research.

CONTEXT:
Understanding relationships between rural and urban systems is central to the unavoidable Anthropocene challenge of reconciling urban development with the biosphere. Utopian approaches such as Garden Cities and Compact Cities don't square with the realities of market forces and the urgent agenda of climate adaptation. Integrative science-based strategies to couple urban development with the protection of critical ecosystem services (ES) are required.

OBJECTIVE:
This research proposes an ES-based design approach applied to the design of a real-world periurban residential development.

METHODS:
The site selected is a contentious large-scale residential development. Public submissions throughout the Resource Consent process are used to determine the three most valued ES associated with the greenfield site - food production, biodiversity and flood control. Literature review and expert opinion are used to quantify 'ES fields' specific to each of these ES. A new GIS-based tool, ESMAX, uses these fields to visualise ES performance of various configurations of natural and built-up land covers.

RESULTS AND CONCLUSIONS:
This process determines spatial configurations of integrated agroecological parcels and built-up areas that maximise the three targeted ES, as well as addressing the demand for housing. ESMAX is set up to allow experts in respective ES fields to easily adjust the 1st and 2nd order effects used by the model, improving its predictive capability. We hope to develop an open online interface to facilitate this input.

SIGNIFICANCE:
The spatially explicit ES-based design paradigm underpins a new framework to re-imagine resilient integrated rural and urban systems. Our model provides a scientifically based tool for designers, land stewards and regulators to comprehend the relationship of landscape configuration and ES.

Landscape context and edge effect impacts on plant community regeneration of restored indigenous forest sites

Mr Henry Morse[1], Associate Professor Stephen Hartley, Dr. Julie Deslippe
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Henry Morse is an Ecology and Biodiversity PhD student at Victoria University of Wellington. His research focuses on informing and improving restoration practices at the landscape scale. Henry serves as the president of Victoria University's Society for Conservation Biology chapter and is a member of Te Pūnaha Matatini, the Aotearoa New Zealand Centre of Research Excellence for complex systems.

The pressing environmental crises of climate change and biodiversity loss necessitate transformative changes in land use and management practices. This research focuses on enhancing the practice and rationale for landscape-scale ecological restoration. As part of my PhD, I investigated the influence of landscape context on vegetation regeneration across 32 restoration sites in urban and rural areas of Taranaki and the southern regions of the North Island, New Zealand. By recording vegetation data for seedlings, saplings, and mature trees at each site, I assessed the effects of surrounding landscapes on plant community composition. The findings reveal insights into how landscape context shapes restoration outcomes, offering guidance for optimizing restoration strategies. This presentation will detail the methodologies employed and discuss the implications of the results for future restoration initiatives.

Modelling hysteresis dynamics in social-ecological knowledge systems

Dr George Perry[1], Dion Pou[2], Phil Lyver[3], Puke Timoti[3], Jason Tylianakis[4]
[1]University of Auckland, [2]Ngā Puhi, [3]Manaaki Whenua, Landcare Research, [4]University of Canterbury,

Biography:
George has broad interests in landscape ecology, including disturbance ecology, long-term ecosystem change, and spatial modelling methods.

Ecological systems can show different states under similar environmental conditions. These are called alternate stable states, and they often involve tipping points where abrupt change occurs after some threshold is crossed; they may also involve hysteresis or 'history-dependent' trajectories that make state changes difficult to reverse. Similar dynamics may occur in social-ecological systems, such as in the retention and transfer of knowledge under social and environmental change. Here we explore the potential tipping point and hysteresis dynamics in knowledge retention using an agent-based model. This model is motivated by the potential transfer of knowledge from native to exotic species after the loss of access to native species through political, social, and/or environmental change. A motivating example is the shifting relationships between people, kererū/kukupa, and poaka (feral pigs) in parts of Aotearoa. Our model results show how different modes of individual and social learning influence the resilience of knowledge systems to changes in the ability of people to interact with an environmental resource and how they can drive hysteresis dynamics. We demonstrate the types of intervention required to interrupt hysteresis and drive recoveries in knowledge systems.

Using eDNA detection devices to monitor a cryptic population of endangered Otago skinks (*Oligosoma otagense*)

Mr Tom Reeves[1], Mr Samuel Purdie[1], Dr Shaun Wilkinson[2], Mr Nathan Whitmore[3]
[1]Southern Lakes Sanctuary, Queenstown, New Zealand, [2]Wilderlab, Wellington, New Zealand, [3]Reproducible, Dunedin, New Zealand

Biography:

Tom Reeves is a passionate wildlife conservation manager specialising in predator-control strategies and threatened species monitoring. He has coordinated various wildlife conservation/research projects and works closely with a plethora of community-led conservation groups. Currently, Tom's many duties entail project coordination and health/safety management for Forest & Bird in Central Otago. Tom has worked in various remote, mountainous ecosystems whilst tirelessly protecting and researching threatened giant wētā, lizards, and some of Aotearoa's most iconic birds.

Samuel Purdie is a budding conservation scientist specialising in herpetology and entomology. He has worked closely with some of Aotearoa's most threatened and enigmatic reptiles, with a strong focus on threatened species surveys, monitoring, and management. Currently, Sam works as a project coordinator for a landscape-scale conservation project — Southern Lakes Sanctuary — in Queenstown. When Sam isn't documenting obscure critters in remote ecosystems, he communicates science through his award-winning wildlife photography and various educational resources.

Shaun Wilkinson is an innovative principal scientist and the founder/CEO of an award-winning environmental DNA (eDNA) testing laboratory — Wilderlab New Zealand Ltd. He has pioneered various new methodologies for identifying coral symbiont genealogies, developed statistical programming software, and advanced ecological monitoring practises in Aotearoa using eDNA. Shaun's eDNA research has dramatically improved our understanding of New Zealand's waterways and allowed people to better connect with these natural ecosystems too.

Nathan Whitmore is an astute conservation scientist, and practitioner, with a wealth of statistical programming experience. He is the data-science cornerstone for various conservation projects throughout Aotearoa, but has also advised wildlife conservation programmes internationally. Some of his other professional interests include evidence-based decision making, sustainable wildlife use, and traditional natural resource management. Currently, Nathan operates a data science consultancy — Reproducible — in Ōtepoti/Dunedin.

Exotic mammalian predators and habitat modification threaten more than 90% of Aotearoa's endemic lizard taxa with extinction. Unfortunately, monitoring lizard populations living in structurally-complex ecosystems — and therefore understanding how they respond to management strategies — can be very challenging. Many of Aotearoa's most secretive and critically threatened lizard species dwell in remote localities where it is often impractical to acquire meaningful population density estimates, or abundance indices. Therefore, alternative population monitoring methods are urgently required. Using an adaptive experimental design, we investigated whether occupancy monitoring, using passive eDNA detection pipes, could be used to monitor a cryptic, Otago skink (*Oligosoma otagense*) population. Additionally, we compared historical occupancy data with our own, to understand if the distribution of an Otago skink population changed over the past 16 years. We found that pear-baited eDNA pipes were an effective tool for monitoring habitat occupancy and that Otago skinks maintained a similar spatial distribution in 2024 to their historic distribution between 2005 and 2007. However, this population appears to occupy less habitat than it did historically (equivalent to an annual decline of c. 2.9%). Our eDNA occupancy method yielded detection probabilities that were 30-50% higher than those acquired using traditional visual occupancy methods. Our findings indicate that eDNA detection devices may be an effective tool for monitoring the occupancy of lizard populations in complex ecosystems, particularly where the species is cryptic, sparse, and saxicolous. However, for eDNA monitoring to be cost-competitive with traditional occupancy methods, eDNA analyses costs need to reduce by c. 28%.

The behavioural ecology of a sympatric population of threatened katipō (*Latrodectus katipo*) and invasive false katipō (*Steatoda capensis*) (Araneae: Theridiidae).

Mr James Roberts[1,2], Professor Dianne Brunton[1], Dr Anne Wignall[1]
[1]University of Auckland, Auckland, New Zealand, [2]Ecology New Zealand Limited, Auckland, New Zealand

Biography:
James Roberts was born and raised in Auckland. He has always loved untangling the intricacies of ecology and conserving our precious species, which is why he decided to pursue a Master of Science in biological science at the University of Auckland. Possibly because of his irrational fear of birds, he chose to study one of the few species in Aotearoa that can actually hurt him—the katipō spider.

Terrestrial invertebrates are crucial for ecosystem functioning, yet they face global threats. The katipō (*Latrodectus katipo*), an endemic widow spider in Aotearoa New Zealand, is in serious decline due to habitat loss and potential competition with the invasive false katipō (*Steatoda capensis*) (Araneae: Theridiidae). My study aimed to support katipō conservation. I focused on a black morph katipō, which has received less research attention than the southern red morph. I conducted monthly surveys over a year, examining phenology and web-sharing behaviour. I conducted lab assays to assess refuge preference and web design in subadult and adult females, as well as locomotor behaviour in adult males. Katipō exhibited seasonal phenology across all age classes except juveniles, likely due to overwintering. In contrast, false katipō displayed mostly non-seasonal phenology except in spiderlings and adult females peaking November and September respectively, occurring a month before katipō. False katipō also produced more egg sacs than katipō. Adult male katipō were less exploratory horizontally compared to false katipō, but both species showed similar exploration vertically, possibly related to habitat use. Both species preferred V-shaped refugia, potential for better protection from predators and climatic conditions. However, no preference was observed for refuge surface or height. Some flexibility in refuge preference may be an adaptation to the dynamic nature of sand dunes. Differences in phenology and web sharing may reduce competition, but the higher reproductive rates and behavioural similarities of false katipō could still threaten katipō. Conservation efforts should consider artificial refugia and habitat restoration for all katipō populations across Aotearoa New Zealand.

Synergistic local adaptation to drought and freezing in a North American willow

Kyle Rosenblad[1], Dr. David Ackerly[1]
[1]University Of California, Berkeley, Berkeley, United States

Biography:
Kyle Rosenblad is a PhD candidate at the University of California, Berkeley. His research explores how biodiversity is responding to climate change and how we can act to modify these responses. He focuses primarily on woody plants, borrowing tools from ecology, physiology, evolutionary biology, and biogeography. He is also interested in developing new statistical methods for analyzing the messy observational data we often rely on to answer these questions. Previously, he spent a year as a Fulbright exchange fellow at the Bio-Protection Research Centre, where he investigated long-term forest vegetation change on Te Pātaka o Rākaihautū – Banks Peninsula.

Adaptive responses to climate change may play an important role in population persistence. It remains unclear which populations will mount the strongest adaptive responses. Some populations may benefit from synergistic adaptations—i.e., alleles conferring increased tolerance to multiple climatic stressors. Populations harboring more of these alleles may be better poised to withstand future climate change.

Using Lemmon's willow (*Salix lemmonii*) in the Sierra Nevada, USA as a case study, we test for local adaptation to summer drought, which is intensifying with climate change, and spring freezes, which are becoming increasingly erratic (and, thus, potentially damaging). We also test for synergy between adaptations to the two stressors. Our approach integrates landscape genomic and common garden data from 184 genotypes spanning 40 provenance sites.

We find that genotypes from drier sites have more wilting-resistant leaves, consistent with local adaptation to drought. Similarly, we find that genotypes from sites with lower minimum spring temperatures are more freeze-tolerant. Our genomic data indicate that alleles favored in sites with colder spring freezes also tend to be favored in drier sites (and vice versa).

Our results indicate that *Salix lemmonii* exhibits synergistic local adaptation to drought and freezing. Consequently, populations in singly stressful sites (e.g., freeze-prone but not drought-prone) may show strong tolerance to both stressors. Populations in doubly stressful sites (i.e., drought-prone and freeze-prone) may be exceptionally tolerant to both drought and freezing due to the apparent synergy between selective processes. These populations may constitute valuable sources for assisted gene flow efforts under climate change.

Testing the thermal squeeze hypothesis: Do temperature and invasive species determine vital rates of New Zealand's forest birds?

Anne Schlesselmann[1], John Innes, Susan Walker, Neil Fitzgerald, Graeme Elliott, Adrian Monks
[1]Manaaki Whenua - Landcare Research, Dunedin, New Zealand

Biography:
Anne Schlesselmann has had the privilege to get up close with many native forest bird species around the country throughout the years. She is now based in Dunedin/Ōtepoti and works as a researcher in Conservation Ecology at Manaaki Whenua - Landcare Research.

Globally, invasive species and climate change are major threats to biodiversity, particularly where species are highly vulnerable. Avian species are declining faster in warmer environments in island biodiversity hotspots, and this pattern is assumed to be driven by greater impacts of invasive species in warmer areas. Here we use demographic data to test the mechanisms that are expected to drive temperature-related declines ('thermal squeeze') across a native forest bird community in New Zealand, where predation by invasive mammals is the principal cause of population declines. We collated data measuring nest and adult survival rates of 26 native forest bird species spanning a wide climatic gradient, plus three levels of conservation management (mammal eradication, predator suppression, no predator management), and classified species as sensitive or resilient to predators according to their past geographic range contractions. We show that, across the bird community, nest survival is reduced by invasive mammal predators, but this effect can be reversed by both predator suppression and mammal eradication. However, there was no effect of temperature on nest survival, nor did we detect the effect of any interactions between temperature, conservation management, and resilience. Neither temperature nor conservation management appeared to influence adult survival in sensitive species. Our results show that although eradication of invasive mammals was more beneficial, predator suppression can also substantially increase nest survival. Combinations of mammal eradication at selected sites and wider-scale predator suppression within nesting periods could both protect current refuges and limit declines of sensitive forest bird species in New Zealand.

To correct or not to correct? Divergent strategies of posture control in three forest tree species.

Dr Damien Sellier[1], Nathan J Gapes[1,2], Dr Thomas Paul[1]
[1]New Zealand Forest Research Institute (Scion), Rotorua, , [2]School of Physical and Chemical Sciences, University of Canterbury, Christchurch, New Zealand

Biography:
Damien Sellier has been a researcher for 20 years. He has degrees in mechanical engineering and wood science. He started his career by modelling the motion of forest trees during wind storm events. His primary interest lies in better understanding the physical processes at work inside trees that drive their growth, their shape and their interaction with the environment.

Trees are sessile organisms that cannot move away from unfavourable environmental conditions or move towards more favourable ones. Because they are also long-lived, they can be subject to large environmental shifts and numerous disturbances during their lifetime. Through adaptive growth mechanisms called tropisms, trees can however change their posture and shape in relation to environmental stimuli to take advantage of their immediate surroundings. Two forms of tropism are important to the development of forest trees: phototropism and gravitropism. The former is the tendency of shoots to grow towards light and increase light availability whereas the latter is their ability to reorient in relation to gravity and improve mechanical stability. We present the results of two experimental studies, documenting the phototropic and gravitropic behaviour of a fast-growing conifer species, Pinus radiata D. Don., and an endemic NZ angiosperm species, Vitex lucens Kirk and the gravitropic behaviour of a representant of an important genus in the Oceanian region, Agathis robusta F.M. Bailey. During the experiments, stem shape was captured by imaging at regular interval and digitized to describe the characteristic kinematics of the response of each species. Observed behaviours were contrasted, ranging from very efficient posture control to unresponsive. A multi-component mathematical model of tropism was fitted to individual responses to estimate the parameters that control the rate and the magnitude of stem reorientation. This model-assisted approach could be generalized to provide a quantitative determination of tropic traits across and within species to include dynamic tree-environment interactions in ecological frameworks.

Surveys and Sensibility: Methods for sensible, standardised invertebrate surveying

Dr Vikki Smith[1]
[1]Wildland Consultants Ltd, Christchurch, New Zealand

Biography:
Vikki is a Senior Invertebrate Ecologist at Wildlands, where she has worked since 2021. She specialises in terrestrial invertebrate ecology and conservation, but also has expertise in pest mammal control. Vikki lives behind a keyboard in Christchurch, with her pet giant centipede, Wriggles.

Invertebrates, as vital components of most ecosystems, need to be considered critical in ecological consulting. However, while many invertebrate survey methods are well-known, they are under-used in consulting and invertebrate surveys are often reduced to incidental observations, or focus on one taxon. My presentation will describe the current state of invertebrate surveying in consulting, and outline my ideas for the basic standards that should be used in surveying and reporting. I hope to stimulate active and ongoing discussion on producing standardised methods for invertebrate surveying, primarily for consultant ecologists, but also of benefit to researchers, conservationists, and many others.

Improving detection and monitoring techniques for Darwin's ants at low density

Miss Ella Speers[1], Professor Rachel Fewster[1], Mr Richard Toft[2], Professor Margaret Stanley[1]
[1]University Of Auckland, Auckland, New Zealand, [2]Entecol, Nelson, New Zealand

Biography:
Ella is a Master's student at the University of Auckland looking at the invasive Darwin's ants. She is particularly interested in how native species may be impacted by introduced species in the future as invasions become more prevalent. She has a background in marine science as well as terrestrial biology and never thought she'd end up working with insects, let alone ants, but has loved her fieldwork on the Hauraki Gulf islands. She hopes to keep working with island ecosystems in the future.

Invasive Darwin's ants (*Doleromyrma darwiniana*) are having adverse ecological impacts in Aotearoa. However, the species has never been a pest outside of their native range before, and literature is sparse. Consequently, we do not have a management program that directly targets the biology of Darwin's ants. Currently, the detection tool developed for Argentine ants (*Linepithema humile*) is used to detect Darwin's ants, which is a protein-based bait placed on the soil surface. This has been successful at detecting the majority of Darwin's ants, but not in detecting the last incipient nests, meaning successful eradication cannot take place. Thus, there is a need to improve the detection and monitoring techniques of Darwin's ants at low density. Anecdotal evidence suggests that Darwin's ants may be foraging further below the soil surface than Argentine ants do, meaning baits placed on the soil surface may not be detecting them. Bait preference testing was carried out on an uncontrolled population of Darwin's ants on Rotoroa Island. Cafeteria experiments revealed that carbohydrate-based baits presented belowground have a higher detection probability of Darwin's ants when compared to the currently used protein-based bait on the soil surface. Results from this project will provide a new best practice for detection of Darwin's ants at low density.

Eradicate everything: Is there a disconnect between pest management strategies and community-based conservation?

Professor Margaret Stanley[1], Dr Marie McEntee[1], Dr Imogen Bassett[2]
[1]University of Auckland, Auckland, [2]Auckland Council, Auckland,

Biography:
Margaret Stanley is an ecologist at the University of Auckland working primarily on urban ecology and invasive species. She works with community partners and other stakeholders to improve biodiversity outcomes and connect people and nature.

Best practice pest management strategies have been developed to prioritise and manage threats cost effectively. Accepted best practice is that high risk pest species which are limited in distribution are suitable targets for eradication as a prevention strategy, while resources for the multitude of widespread pests only exist for suppression at high values sites. Communities in Aotearoa are highly supportive of pest management and many community groups undertake pest management. However, we argue that this community support for pest management has translated into a demand for eradication of widespread species that are highly visible to communities, with no regard to prioritising emerging pests, contrary to best practice pest management. Predator Free New Zealand 2050 has facilitated the eradication of widespread species mindset, raising community expectations of eradication feasibility for many taxa. Environmental agencies have to date successfully employed science communication to enhance community understanding of pest impacts. However, this must shift to using science communication to distil for communities the key principles of best practice pest management and to engage with more participatory approaches to science communication to facilitate partnerships with community pest control groups to develop their capability to undertake best practice management.

Legacies of Past Land Use on the Southern Cumberland Plateau

Kevin Hiers[1], Scott Pokswinski[1], Sarah Sherwood[1], Ken Smith[1], Mx Lily Tidwell[1]
[1]Wildland Consultants Ltd, 4 Mohuia Cresent, Porirua, Wellington

Prior land use and soil legacies related to land use continue to play a significant role in ecosystem structure and functioning in the eastern deciduous forest. On the surface of the southern Cumberland Plateau in Tennessee, abandoned agricultural and home sites are characterized by unusual assemblages of tree species and ground cover, as well as light artifact scatters. To better understand the legacies of past land use on soil properties and forest composition in this region, we intensively sampled three home sites that were abandoned more than 70 y ago and compared them to adjacent forest controls. The home sites had significantly higher concentrations (soil A horizons) for eight of the fourteen elements studied. After examining our plots in ordination space by soil variables, we found that surface soil calcium and phosphorus concentrations were negatively associated to control plots and were the best indicators of intensive human disturbance. Sourwood (*Oxydendrum arboreum*) had the highest importance value in the control forest, and the 23rd highest importance value at the home sites. There were 34 different species encountered at the home sites, including many species usually found at lower elevations in limestone-derived soils (e.g., *Celtis occidentalis*, *Juglans nigra*, *Viburnum rufidulum*, *Fraxinus* spp.). We recovered historic artifacts and charcoal from surface soils at all three sites, and prehistoric artifacts were found at two sites. Abandoned home sites are common throughout the eastern deciduous forest and evidence from this study indicates that land use legacies continue to influence forest dynamics several decades after anthropogenic inputs ceased.

Seasonal dietary resource-switching by North Island Kākā on native and introduced plants – a comparative study using field observations and citizen science

Mr Tirth Vaishnav[1], Dr Rachael Shaw[1], Dr KC Burns[1]
[1]Victoria University Of Wellington, Wellington, New Zealand

Biography:
PhD candidate in Ecology and Biodiversity at Victoria University of Wellington. Currently studying temporal variation in bird behaviour and ecology using a multi-scale approach, investigating biogeographical patterns in seasonality of bird collisions with aircraft, phenology of pollination and seed dispersal mutualisms in a native forest community, influence of introduced species in seasonal dietary resource-switching in Kākā, and the nocturnal activity patterns of Kākā. Past research has included the study of habitat use by a mammalian community in a wildlife corridor in central India.

Island-dwelling birds are generalist foragers to facilitate ecological niche expansion and avoid competition within and among species. Kākā (*Nestor meridionalis*), the endemic forest parrots, consume a variety of food resources, switching sequentially from one resource to another. In this study, we characterized the dietary diversity of North Island Kākā (*N. m. septentrionalis*) in Zealandia, a fenced mainland wildlife reserve, over one calendar year. We also investigated the effect of introduced plants on the seasonal resource-switching behaviour in Kākā. If dietary resource-switching occurs in response to the reproductive phenology of native plants, we hypothesized that Kākā feed on introduced plants aseasonally. In the 492 foraging bouts observed between 2023-2024, Kākā fed primarily on wood-boring invertebrates, flower and fruit resources, sap and pinecones. Using circular statistics, we evaluated the monthly foraging rates and peak foraging seasons for each resource. Preliminary results suggested that wood-boring invertebrates were consumed throughout the year. There were distinct seasonal peaks in the consumption of fruit, flower and sap. However, there was no evidence of seasonality in foraging on the introduced resource, pinecones from *Pinus radiata*, which was consumed evenly throughout the year. We will supplement this analysis with foraging observations from citizen-science databases to gain broader insights on effects of introduced species on seasonal resource-switching by Kākā. With the implementation of fenced mainland sanctuaries and the need to manage decreasing Kākā populations, knowledge of how they interact with their environment will prove crucial for habitat management and future conservation planning.

Boosting predator control with optimised lure strategies

Dr Giorgia Vattiato[1]
[1]Manaaki Whenua - Landcare Research

Invasive predators threaten native biodiversity, and effective control methods are crucial for wildlife management. Trapping is a common approach, but many predators display trap-shyness, reducing capture rates. Lures are used to counter this behaviour, but uncertainty remains about the extent of trap-shyness in wild populations and the optimal timing for lure deployment.
We used a Bayesian approach to estimate the degree of trap-shyness in a population of brushtail possums in a New Zealand forest. These estimates informed a stochastic, individual-based model to simulate the effects of different luring strategies. Our analysis revealed two distinct groups within the population: a smaller, highly trappable group and a larger, trap-shy group with a low mean nightly probability of trap interaction.
Our findings demonstrate that using a combination of different lures throughout a kill-trap operation achieves better population knock-down than relying on a single lure or switching between lures mid-operation. This research provides valuable insights for wildlife managers aiming to enhance invasive predator control and improve eradication efforts.

Genomics helps unravel the evolutionary history of the Southern Alps geckos

Miss Sarah Walters[1], Euan Brook[2], Rod Hitchmough[3], Mary Morgan-Richards[4], Graham McCulloch[1], Tania King[1], Joanne M. Monks[1], Bruce C. Robertson[1], Ludovic Dutoit[1]
[1]University of Otago, Dunedin, New Zealand, [2]Independent, , New Zealand, [3]Retired, , New Zealand, [4]Massey University, Palmerston North, New Zealand

Biography:
Sarah Walters is a PhD candidate in Zoology at the University of Otago, specialising in evolutionary genomics. Her research involves the genomic investigation of various New Zealand gecko species, with a focus on species complexes and hybrid zones, assembling the first genome for any New Zealand lizard, and uncovering sex determination systems in New Zealand geckos. With a background in forensics and a growing interest in coding, Sarah uses cutting-edge genomic techniques to explore evolutionary processes and species diversity. Her work aims to provide new insights into the biology and conservation of New Zealand's unique gecko species.

Lack of knowledge remains a major barrier to the conservation of biodiversity worldwide. The complexity of species interactions and evolutionary history can further complicate conservation efforts. This is especially true for species complexes, where cryptic diversity and unclear boundaries make it difficult to assess risk and implement effective conservation strategies. Genomic analyses can provide deeper insights into these species complexes, offering a more comprehensive understanding of their population dynamics and evolutionary processes. The Southern Alps gecko (*Woodworthia* 'Southern Alps') is found along the eastern slopes of the Southern Alps and is known to form two distinct clades. Previous mitochondrial analyses indicated that there may be some gene flow between the two clades along a narrow contact zone located in the upper Rakaia River valley. To investigate whether the two clades were hybridising and the extent of their differentiation, DNA was extracted from 59 tail tips collected across the putative hybrid zone, and sequenced using genotyping-by-sequencing to obtain 11,032 markers. Our results indicate two potential scenarios: one where the two Southern Alps clades are mixing along a narrow hybrid zone, and another suggesting introgression into both clades from a third, unsampled population, originating from the Canterbury Plains, with very little gene flow between the two clades themselves. Applying population genomics to Aotearoa geckos for the first time, this research highlights the value of genomic analyses in uncovering hidden evolutionary processes and unravelling species complexes, revealing complex population dynamics such as species distributions, boundaries, and gene flow between populations.

Establishing frugivory by kōrero geckos of a native shrub

Mx Elliot Weir[1], Dr Stephanie Godfrey, Dr Janice Lord
[1]University Of Otago, Dunedin, New Zealand

Biography:
Elliot Weir is a master's student in Ecology at the University of Otago, studying frugivory and seed dispersal of geckos in Otago. They are also on the Otago Regional Council, elected in 2022.

While birds and mammals dominate seed dispersal literature globally, geckos and skinks have been identified as potential seed dispersers for New Zealand flora since 1984, and more recent studies have estimated frugivory rates of endemic shrubs by geckos through exclusion experiments. My research aims to quantify the impact of kōrero gecko (*Woodworthia "Otago/Southland large"*) presence on fruit removal rates of mingimingi (*Coprosma propinqua*) in a rocky grassland site in the Strath-Taieri valley of Otago. An exclusion experiment was used to establish fruit removal rates across four treatments of varying levels of access, similar to past literature but with the addition of an insect-only access treatment that could be compared to the lizard (and insect) access to identify the impact of lizards alone.The proportions of fruit removed in the total exclusion, insect access, lizard access, and open access treatments were 0.009, 0.657, 0.827, and 0.876 respectively. These results suggest both insects and lizards can consume significant amounts of mingimingi fruit when given the opportunity. Trail cameras were positioned to estimate the relative visitation rates of geckos and common skink species and monitor the experiment. The vast majority of shrub visitation by lizards on trail cameras were kōrero geckos, despite the abundance of skinks at the site, supporting the assumption kōrero geckos are responsible for most of the lizard frugivory detected. This research shows that insect frugivory should not be ignored when establishing fruit removal rates, and that kōrero geckos are a significant frugivore of mingimingi.

Reimagining, reclaiming and reconnecting indigenous voices in urbanism – a review of indigenous approaches for urban ecological restoration

Ms Mahuru Wilcox[1], Dr Erana Walker[2], Dr Shaun Awatere[1]
[1]Manaaki Whenua Landcare Research, Hamilton, New Zealand, [2]University of Waikato, Hamilton, New Zealand

Biography:
Mahuru (Ngāti Awa, Ngāti Ranginui) is passionate about supporting iwi and hapū to engage in research that supports wellbeing of communities and their taiao. Her background is in freshwater and wetland ecology (MSc), and she now works within a Māori research team at Manaaki Whenua Landcare Research looking at restoring health of land and waterways grounded in mātauranga a iwi and hapū.

Urban spaces serve as both a tool for assimilating indigenous communities into Western society and as important sites for indigenous peoples to reconnect with their culture and rights. However, globally, these areas have not fully allowed indigenous people to exercise their rights and traditional knowledge within urban settings, often due to the perception that indigenous peoples are primarily associated with rural areas. This limits the opportunity to include indigenous perspectives in transforming urban spaces. Indigenous communities are engaging with urbanism to restore connections to ecology, culture, spirit, and knowledge. They advocate for inclusive cities shaped by Indigenous Peoples. The use of indigenous knowledge in urban ecological restoration is limited and there are calls to integrate it more.
We carried out a review of indigenous knowledge from Aotearoa, New Zealand, and beyond that showcases the value of Indigenous approaches to ecological restoration. We explore developing challenges for urban areas and nature access and share some insights into the implications of restoration approaches. Importantly, we focus on the indigenous experiences of the Māori people (the indigenous people of Aotearoa, New Zealand) to discuss both the challenges and opportunities for urban transformation and ecological restoration. We will present key insights into how **indigenous approaches to ecology can shape urban spaces,** including restoring urban nature through collaborative processes between Māori and local authorities to create equitably and enriching solutions for urban challenges and engaging in ecological restoration that not only restores nature, but also restores people back to their rich cultural knowledge and practices.

Assessing wilding risk of *Pinus radiata* and *Pinus attenuata* hybrids: could it be the right tree in the right place?

Dr Sarah Wyse[1]
[1]University Of Canterbury, Christchurch, New Zealand

Biography:
Sarah is a forest ecologist in the School of Forestry, University of Canterbury. Her research interests include indigenous forest ecology, seed ecology and conservation, restoration, and plant invasions - particularly wilding conifers.

Pinus radiata × *attenuata* is a hybrid taxon that has been trialled for forestry suitability in New Zealand. The taxon performs favourably compared to *Pinus radiata* at higher elevation sites due to its greater cold tolerance, and as such is now beginning to be planted by the forestry industry at sites that are typically unsuitable for *P. radiata* afforestation. It has been assumed that the likelihood of invasive spread by *P. radiata* × *attenuata* from areas of afforestation is low, however this has not been formally assessed. Here, we undertook assessments of *P. radiata* × *attenuata* cone production, cone opening, seed viability, seed dispersal, seedling establishment, and sapling survival. In addition, we undertook analogous assessments of *P. radiata* to provide a baseline for comparison. Our results indicate that while cone production and seedling survival are higher for *P. radiata* × *attenuata* than *P. radiata* at high elevation sites, cone opening requires significantly higher temperatures. On average, only 3.6% of ripe cones on mature (26-year-old) trees opened on the *P. radiata* × *attenuata* trees in field conditions suggesting that the strong cone serotiny may present a barrier to invasion for this taxon. Based on our current data, we suggest that the spread risk from *P. radiata* × *attenuata* is likely to be lower than that from *P. radiata*. Future work should examine the longevity of *P. radiata* × *attenuata* seed in aerial seed banks and should undertake field surveys to assess for wilding spread from mature *P. radiata* × *attenuata* stands.

Bridging Knowledge Gaps: Enhancing Community Awareness of Pekapeka and Conservation Efforts in South Auckland

Dr Natasha Bansal[1], Isabel Gil[2], Rewa Narsana[2], Isabella Dee[2]
[1]Ecoquest Centre for Indigeneity, Ecology And Creativity, Whakatiwai, New Zealand, [2]University of New Hampshire, Durham, United States of America

Biography:
Natasha Bansal is a researcher at EcoQuest Centre for Indigeneity, Ecology and Creativity. She is a Wildlife Biologist and has an interest in behavioral ecology and empowering communities for conservation research. Natasha is a Pekapeka person and co-leads the Finding Franklin Bats research project.

Effective communication between scientists and local communities is crucial for successful conservation, especially in the context of critically endangered species. In New Zealand's Franklin District, the Finding Franklin Bats (FFB) project highlights the necessity of local engagement in bat conservation, specifically for the long-tailed bat (pekapeka tou roa, *Chalinolobus tuberculatus*). To assess the community's knowledge about FFB and pekapeka, we conducted a series of street-style and in-depth interviews with Franklin District residents. Despite ongoing research, our study revealed significant gaps in community knowledge about both the FFB project and pekapeka, and a strong need for enhanced public education.
To address these gaps, we proposed a diverse set of science communication strategies, including building a digital presence, collaborating with local organizations like Predator Free Franklin to advertise pekapeka, creating educational resources for schools, developing library programs, and designing informative pamphlets.
By implementing these strategies, we aim to enhance community understanding, support FFB volunteers, and foster a more engaged and informed public. This approach not only advances local conservation efforts but also contributes to broader environmental goals by translating scientific knowledge into meaningful action.

Factors driving insectivorous avian communities within indigenous and exotic forests

Ms Victoria Brosnahan[1], Ms Alanah Grassick[1], Dr Kristal Cain[1], Professor James Russell[1]
[1]University of Auckland, Waipapa Taumata Rau, New Zealand

Biography:
Victoria Brosnahan is a Master's student at the University of Auckland. Her research is focused on understanding the factors that drive avian communities in exotic pine plantation. She is passionate about the conservation of Aotearoa's avifauna and hopes that the findings from her research will help develop forestry management to increase biodiversity.

Aotearoa's forest bird populations have faced significant declines and extirpations due to forest cover loss and the introduction of mammalian predators such as ship rats (*Rattus rattus*). Exotic pine plantation makes up c. 18% of Aotearoa's forest cover. Pine forest habitat frequently supports viable populations of endemic insectivorous avian species at similar or higher abundances to indigenous forest, however the factors driving these populations are not well understood. Kaingaroa Forest is a large, well-studied pine plantation in the Bay of Plenty and Whirinaki Te Pua-a-Tāne Conservation Park is an old-growth lowland podocarp forest located directly east of Kaingaroa Forest. Here, we investigate factors regulating the abundance of insectivorous avian species between indigenous and exotic forests. The relative abundance of avian species was assessed using five-minute bird counts, and the abundance of mammalian predators was quantified using trail cameras. We found that whiteheads (*Mohoua albicilla*) were observed in higher abundances within pine plantation, and North Island robins (*Petroica longipes*) were found at similar abundances between both forest types. We also observed differences in mammal communities between sites, where ship rats were not detected in the pine forest. The lack of detection of ship rats may indicate reduced predation pressure within pine forest habitat, allowing it to provide habitat for avian species where they can have increased breeding and fledgling success. Findings from this research will further understanding of avian communities in pine plantations to assist in providing recommendations for future forestry management to maximise endemic avian diversity and abundance.

Rotoehu Ecological Trust: a North Island kōkako success story, Bay of Plenty, Aotearoa New Zealand

Dr Chris Bycroft[1], Jane Bird[1], Margaret Dick[1], Emma Radford[1], Roger Bawden[1]
[1]Rotoehu Ecological Trust, Rotorua, New Zealand

Biography:
Chris Bycroft is currently chair of the Rotoehu Ecological Trust. He works professionally as a Senior Ecologist with Wildland Consultants based in Rotorua. He is currently Treasurer of the New Zealand Ecological Society and is a past President of the Society. He specialises in botany and avifauna surveys. Chris studied tussock grasslands in southern Aotearoa New Zealand in 1990s for his PhD. Since moving to Rotorua in 2000 Chris has taken a particular interest in geothermal systems. He enjoys visiting wild and remote places, particularly tramping and trail running.

Rotoehu Forest contains one of the largest contiguous and one of the largest relic populations of North Island kōkako (*Callaeas wilsoni*) remaining. Kōkako are an endemic threatened bird species whose numbers have declined markedly due to predation particularly by rats and possums . Rotoehu Forest and its kōkako are within the rohe of Ngati Makino. Management and research of this population has been undertaken since the mid-1990s. Rotoehu Ecological Trust (RET) was formed in 2013 to assist the Department of Conservation (DOC) with managing this population. The combination of the work the Trust and DOC undertake has proven to be highly successful in increasing the kōkako population. The Trust undertakes ground based pest animal control, primarily focusing on rats. The trust currently undertakes animal control in 1493 hectares of forest, with the potential to expand to *c.*2,500 hectares when resources allow. DOC currently undertakes an aerial 1080 operation every three years with the most recent being in 2023 covering >3,000 hectares. Prior to the Trusts involvement (between 1995 and 2013), the population slowly increased from 17 to 50 pairs. The last two censuses (2019 and 2023) found the population had increased from 157 to 289 pairs (including singles 592 birds). Of these, 471 kōkako were within areas with pest control by RET. Birds have also been translocated from Rotoehu Forest to other locations with the aim to help establish and/or improve the genetic diversity of other populations.

Deep-learning based classification of southern beech (Nothofagaceae) species using high-resolution UAV colour imagery

Ms Binyao Yang[1], Assoc. Prof. Bradley Case[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Binyao is a PhD student at the Auckland University of Technology. She arrived in New Zealand in 2023 after completing a BSc(Honours) degree at the University of Queensland in Brisbane.

Brad is an Associate Professor in the School of Science at the Auckland University of Technology and has been teaching environmental science, ecology, GIS, and remote sensing at universities since 2005. His research focuses on understanding pattern-process relationships across spatial and temporal scales and spans a range of study systems including forests, treeline ecotones, and agroecoystems. Brad has a keen interest in the application of spatial data collection and analysis tools and statistical techniques for solving multi-disciplinary spatial problems.

Southern beech forest (Nothofagaceae) is the most abundant native forest type in New Zealand, comprising up to five species (and their hybrids) in mixtures that vary in environmental preferences and tolerances. However, we currently do not have a landcover classification of beech forest resolved at the species level. In this study, we explored the development of a deep learning classifier for southern beech species using UAV-collected RGB imagery for a beech forests area in the Lewis Pass area of New Zealand's South Island. We hypothesised that different leaf properties with different crown and tree branch structures will result in different spatial patterns and spectral reflectance properties in imagery that can form the basis for training a deep learning classifier. We used aerial and UAV imagery combined with field measurements to compile a potential training datasets of delineated tree crowns and species labels. We then divided the dataset into training (80%) and testing (20%) datasets and applied the deep learning model DetectTree2 on 2-cm resolution RGB UAV imagery. The validation was performed on the testing dataset. We showed the potential of deep learning on classifying the close related species from optical only image with an automatic process. The overall performance of the model with overlapping threshold of 50% between validation data and predicted results is around 80%, and detection is more effective over larger tree crowns. From the diagnosis of learning curve, we found the performance can be further improved by providing more directed and extensive training samples.

How far down can we go? Exploring multilayered insights into diadromous fish life histories through eye lenses

Mr Alexandre Che[1,2], Dr Simon Stewart[2], Dr Amandine Sabadel[1,3]
[1]Auckland University of Technology, Auckland, New Zealand, [2]Cawthron Institute, Nelson, New Zealand, [3]NIWA, Wellington, New Zealand

Biography:
Alexandre Che is a PhD student at Auckland University of Technology. His doctoral research focuses on the mysterious ocean migrations of eels from Aotearoa – New Zealand. He is developing and using indirect methods such as stable isotope analysis and environmental DNA/RNA to track the movement of these enigmatic creatures.

Analysing tissues acting as biogeochemical archives can be a valuable tool when it comes to tracing the life history of fish at various developmental stages. In the case of diadromous fish presenting a complex life cycle such as eels, stable isotope analysis (SIA) can reveal key insights into their ontogenetic movements across different water systems and related diet changes. Various inert tissues –including otoliths, scales, or bone – have been utilised to understand these shifts, given their ability to retain specific environmental information from their time of formation. However, each tissue type has its inherent limitations (e.g. organic matter content, time resolution). A recent technique using fish eye lenses' layers as biochemical archives shows promise in advancing research on life-history traits with enhanced precision and may be used as a complementary tool to more traditional tissues analysis. In this work, we propose a detailed investigation of the fish eye lens delamination method, examining multiple layers with the objectives of: (**i**) determining the amount of material required for SIA of different elements; (**ii**) identifying the optimal element based on the research question when looking at diadromous fish; (**iii**) getting insights in the developmental stages of an endemic and endangered eel species, the Aotearoa New Zealand Longfin eel (*Anguilla dieffenbachii*).

First Investigations of Diet and Habitat Niche Overlap in Three Deep-Sea Flying Squid Species

Mr Samuel Clough[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Originally from the UK, I became interested in cephalopod biology while doing my undergraduate degree at Glasgow University. The AUT laboratory for Cephalopod Ecology & Systematics (ALCES) has a worldwide reputation for their research on the biology of these animals, prompting me to work with them. Currently my PhD research is focused on the ontogenetic trophic dynamics of three poorly understood flying squid species residing in Aotearoa New Zealand's waters.

Marine taonga ('treasure' in Te Reo Māori) species like toroa and hoki depend on deep-sea habitats yet these habitats are subject to rising exploitation. Effective conservation should ensure that taonga will endure but much ecological information that could support effective conservation practices remains unknown. Deep-sea squid food-web ecology is one poorly studied topic and their role is set to substantially increase as global squid populations fill the void left behind by over harvested fish. My research focuses on the dietary ecology of 4 poorly described deep-sea squid species sampled from local waters: the Angolan flying squid, the southern flying squid, and two large warty hooked squids. To achieve this, I am analysing the squids' gut contents via morphological prey identification and DNA barcoding of prey tissues, yet this only provides a snapshot of the squids' most recent meals, but longer-term comparative data can be obtained through stable isotope analysis. Squid beaks are chitinous structures formed in layers over their lives and stable isotope values of carbon and nitrogen are indices for habitat and food ladder placement. By sub-sampling the beaks and measuring their stable isotope values, we can quantify habitat and dietary changes throughout their lives. Multivariate analysis of variance of identified prey items and stable isotope data will provide further insight into how prey influence the movement of nutrients in Aotearoa New Zealand's waters. My poster aims to showcase that multiple, complementary methods can robustly model the dietary and habitat niches of these understudied yet increasingly important species.

Nature in the City: a Hamilton city urban restoration programme

Toni Cornes[1], Rodrigo Teodoro[1], Hannah Rogers[1,2]
[1]Hamilton City Council, Hamilton, New Zealand, [2]University of Waikato, Hamilton, New Zealand

Biography:
Toni started as biodiversity planner in Hamilton city council parks and recreation unit in 2023. Working previously at the University of Waikato assisting urban restoration research and plant sciences since 2007.

Hamilton City Council adopted the Nature in the City strategy in 2020 with the goal of establishing 10% native dominant canopy cover by 2050. Key expected outcomes for the programme include improving indigenous biodiversity, increasing native fauna populations, improving public access to natural areas, and enhanced mana whenua involvement.
With input from technical experts, the programme is currently obtaining baseline measurements to monitor expected outcomes, which are robust and financially viable for re-measurements up to 2050. This information will be used to report progress and highlight focal areas of future work. Citywide surveys completed to date include: canopy cover, priority weed cover, a vegetation permanent plot network, annual bat autumn passes, triennial bird counts, and gully stream eDNA for Giant kookopu.
A comprehensive index is now being developed to capture information on the ecological, community and cultural aspects of the different natural areas across the city. This should provide an accessible visual score card for the community to follow progress. Overall, the programme is seeking ways to incorporate urban research and best practise to improve outcomes for the city's biodiversity.

Moss traits mediate invasive hawkweed germination and early seedling growth

Paul Bell-Butler[1], Dr Nicola Day[1], Professor Hannah L Buckley[2]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]Auckland University of Technology, Auckland, New Zealand

Biography:
Nicola's research broadly focuses on the ecological impacts of global change on plants and soil fungi, including plant-soil interactions. Topics include resilience after fire and impacts of invasive plants. Nicola leads the plant and soil ecology group at Victoria University of Wellington.

Water availability is a crucial factor for the germination and growth of vascular plant seedlings. Mosses are thought to impact water availability to vascular plants in the habitats where they co-occur. We aimed to understand how variation in functional traits of mosses along environmental gradients in South Island tussock grasslands influences their role in the germination of an invasive vascular plant. We measured morphological and functional traits of specimens of 11 common moss species from 26 grassland sites throughout Canterbury and Otago, focussing on traits important for water relations. We then experimentally tested the germination and growth of the exotic pest plant, *Pilosella officinarum*, using seven of the moss species as substrates, comparing with bare soil. There were distinct differences in functional trait values among moss species and groups of species delimited by life form. The *P. officinarum* early growth rate was higher on bare soil compared to on any moss species. However, moss traits played a role in variation in *P. officinarum* germination success; smaller, shallower moss colonies were better substrates for seeds than deep turfs, although one large species was nearly as good a substrate as soil. Our results show that mosses can affect the growth and germination rates of vascular plants, and that these effects are mediated by quantifiable functional traits. This shows that mosses vary in their ecological functions, and that their presence or absence likely affects vascular plant success.

Bay of Plenty Regional Council Biodiversity Programme

Miss Shay Dean[1]
[1]Bay of Plenty Regional Council, Whakatane, New Zealand

Biography:
Shay Dean has worked as an Environmental Scientist at Bay of Plenty Regional since 2015. Shay's work is focused on terrestrial ecology.

An overview of the Bay of Plenty Regional Council's (BOPRC) initiatives for managing and monitoring terrestrial and wetland biodiversity, with a particular focus on Priority Biodiversity Sites (PBSs) identified in partnership with the Department of Conservation (DOC). The BOPRC actively supports landowners and community groups in safeguarding and enhancing these sites, having invested approximately $2 million in the 2023/24 fiscal year. This work is integral to the Long-Term Plan (LTP) 2024-34, which seeks to uphold the health of the region's diverse ecosystems and to incrementally increase the percentage of actively managed PBSs by at least 1% annually. In addition, the BOPRC conducts outcome and state of the environment monitoring, assessing the condition and extent of terrestrial and wetland ecosystems and ensuring compliance with wetland regulations. These efforts illustrate the role regional councils can play in protecting natural ecosystems for future generations.

Investigating connectivity between current and future conservation priorities for deep-sea corals.

Mr Calum Doughty[1], Dr Carolyn Lundquist[1,2]
[1]University of Auckland, AUCKLAND, New Zealand, [2]NIWA, Hamilton, New Zealand

Biography:
Calum Doughty is a Masters' student at the University of Auckland with an interest in marine ecology, modelling, and conservation. His Masters' research focuses on incorporating connectivity into deep-sea coral habitat suitability models to fill gaps for conservation priorities in a future climate. Calum also completed his undergraduate studies at the University of Auckland with a degree in Computer Science and Biological Sciences. In his spare time, he enjoys cooking, playing board games, and exploring intertidal pools. Please feel free to approach Calum and talk about any of his topics of interest or projects in the same area.

Deep-sea corals are expected to be significantly impacted by climate change, particularly via temperature increases and ocean acidification. Prior model predictions of habitat suitability for twelve protected deep-sea corals common to New Zealand's Exclusive Economic Zone (EEZ) suggest changes in suitability, with reductions in suitability of some existing areas, but also new areas that may become suitable. Here, we quantify how well current coral distributions are covered within existing management zones (Benthic Protected Areas and Seamount Reserves) and show that the relative protection is likely to decrease in future for some corals as suitable areas shift outside these protected zones into areas that are subject to bottom trawling. Priority areas for filling gaps are then identified using the spatial planning software Zonation for both current and future coral distributions. In addition, we assess conservation priorities including connectivity options that integrate whether predicted habitats are within viable dispersal ranges from present day coral distributions. National and global data on larval dispersal and genetic connectivity of deep-sea corals were used to parameterise Zonation connectivity algorithms to identify disconnected areas, as well as prioritise areas that could serve as stepping stone populations, connecting current and future distributions. These results can inform conservation priorities for deep-sea corals in the face of climate change.

Evaluating mice and cat responses to urban predator control strategies in Wellington, Aotearoa New Zealand.

Mrs Tamara Encina[1], Mr Stephen Marsland[1], Mr Stephen Hartley[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
I am a veterinarian from Chile, living in New Zealand since 2010. From a young age, I have been deeply interested in animals and their interactions with the environment, fostering a strong sense of care for their well-being. This passion led me to earn a Veterinary Medicine degree in Chile. During my studies, I understood and discovered that community and population dynamics were the subjects I was more looking for. This realization motivated me to pursue a Graduate Diploma in Ecology and Biodiversity at Victoria University of Wellington. Currently, as a doctoral candidate there, I am researching the population dynamics of introduced mammalian predators and their disease impacts.

Introduced mammalian are primarily responsible for the loss and extinction of Aotearoa's native and endemic species. To address this issue, Aotearoa's primary management strategy involves the targeted control of rats, mustelids, and possums, while excluding other significant invasive species like mice and cats. These strategies might unintentionally impact trophic dynamics and community organisation, potentially leading to negative consequences such as the mesopredator release of mouse populations, exacerbating damage to native and endemic species. This study aims to investigate the effects of various predator control strategies on introduced mammals in Wellington's urban habitats. It will specifically examine how mouse populations respond to different control regimes and their subsequent impacts on ecological processes. The research will be conducted at three sites - Zealandia, Miramar, and Karori – each with distinct predator profiles and management strategies. To accurately measure mouse, rat, and cat populations, we will use spatially explicit capture-recapture (SECR) techniques using live trapping grids and camera trap monitoring. This approach will help quantify capture probabilities g_0, home ranges σ, and demographic parameters to assess population dynamics over time and space. Additionally, behavioural tests will evaluate mouse spatial exploration and boldness, while blood samples will determine the prevalence of *Toxoplasma gondii*, to understand the effects of competitors, predators, and disease on mouse behaviour. This study aims to clarify interactions between competitor and predator species, their behaviour, and disease prevalence, offering insight into the broader ecological impacts of predator management strategies in urban environments.

Fostering Belonging in STEM: The Role of Indigenous Knowledge in Ecosystem Restoration Education

Melanie Ercoli[1], Joshua Costales[1], Teri Fifita[1], Tyler Stephens[1], Jemima Ferguson[1], Ellie Garrett[1], Claire Westcott[1], Spencer Ingley[1]
[1]Brigham Young University Hawaii, Laie, United States

Biography:
Melanie Ercoli is from Tahiti, French Polynesia, and is a Senior attending Brigham Young University Hawaii, majoring in Biology. She is working for two professors as a Research Assistant on coral and native plant restoration projects. She also worked as a Teaching Assistant for Biology classes such as Natural Resource Management and others. She is currently a Senior and hopes to further her education in environmental science and ecology.

Dr. Spencer Ingley is an Associate Professor and Biology Chair at BYU–Hawaii, an Asia/Pacific focused undergraduate university on the North Shore of O'ahu, Hawai'i. Dr. Ingley has a background in evolutionary ecology, primarily with tropical fish, but has recently focused his efforts on invasive species biology and restoration ecology. He is passionate about integrating real-world projects into his teaching and outreach efforts, with particular interest in identifying ways to include traditional ecological knowledge and science practices in his work. He is currently on Sabbatical leave in Auckland.

Underrepresentation of Indigenous peoples in science, technology, engineering and mathematics (STEM) can lead to both social inequality and a lack of diversity in scientific thinking. This underrepresentation can also contribute to a loss of cultural and traditional knowledge within STEM. In the United States, Native Hawaiians and Pacific Islanders (NHPI) are proportionally represented in STEM at the undergraduate level but are underrepresented in graduate programs and beyond—a phenomenon known as the "leaky pipeline." Some have proposed that this underrepresentation results, in part, from a fundamental difference between science and Indigenous Pacific worldviews, leading NHPI students to feel that they don't belong in STEM fields. Therefore, potential approaches to recruiting and retaining NHPI students in STEM include efforts to promote belonging by identifying areas of intersection between science and Indigenous knowledge. We have begun to test this by conducting controlled educational tours of an ecosystem restoration project on the campus of Brigham Young University–Hawaii. These tours focused on the benefits of ecosystem restoration, and either took an exclusively scientific look at these benefits, or one that integrated science and Native Hawaiian knowledge and values with respect to plants and the ecosystems they help form. We surveyed 270 undergraduate students from a diversity of backgrounds to evaluate the impact of tour content on various environmental attitudes and metrics for belonging and science identity. Here, we present results that highlight the urgent need to acknowledge and embrace Indigenous practices and worldviews in the effort to restore our imperiled ecosystems.

Investigating seed physiology of podocarp species to inform ecological restoration including direct seeding by drone to advance large-scale projects

Ms Sarah Goldberg[1], Dr Danielle Shanahan[1,2], Dr Karin van der Walt[1,3]
[1]Victoria University - Te Herenga Waka , Wellington, New Zealand, [2]Zealandia Te Māra a Tāne, Karori , New Zealand, [3]Ōtari Native Botanic Garden - Taketake o Ōtari me te Puihi Rāhui o Wilton, Wellington City Council, Wilton, New Zealand

Biography:
Sarah is a master's student in the School of Biological Sciences at Te Herenga Waka Victoria University in Wellington. She is working towards a degree in Ecology & Biodiversity with a particular interest in native forest restoration and the seed biology required to inform large-scale efforts.

Knowledge of seed physiology of native species including variables such as viability, short-term storage behaviour, and germination requirements is fundamental for effective restoration. Prior to human settlement, Podocarp species like kahikatea, tōtara, rimu, mataī and miro were common canopy trees throughout forests of Aotearoa. Reestablishing these species mostly depends on manual planting of nursery stock or direct seeding. Knowing the seed biology of target species could increase successful reintroduction. The objectives of my research are to fill important knowledge gaps for Podocarpaceae, specifically:
a) assess the viability of fresh seed
b) establish short-term seed storage behaviours
c) determine germination requirements to inform restoration

To achieve this, fresh mature seeds from miro, mataī, kahikatea and tōtara were collected in Autumn 2024 from Wellington and Upper Hutt. Baseline viability, moisture content, and germination tests were established for fresh seeds. Four short-term seed storage conditions were tested including cold/dry, cold/moist, room temperature/dry, and room temperature/moist. Seed viability using tetrazolium stain and germination potential are assessed at 3-month intervals for one year. This method may also determine if cold/moist stratification enhances germination. Research on miro, which is known to take 2 to 7 years to germinate, is focused on determining dormancy type and investigating strategies to alleviate seed dormancy. Lab experiments are being carried out at the Lions-Ōtari Plant Conservation Laboratory and a direct seeding trial has been established at Zealandia Te Māra a Tāne Ecosanctuary. Results from this research will be openly shared to assist both nursery propagation and direct seeding operations.

Effect of calcium carbonate precipitation on phosphorus cycle

Wei Huang[1], Kaining Chen
[1]Nanjing Institute of Geography and Limnology, Chinese Academy of Science, Nanjing, China

Biography:
I am mainly engaged in the research of physiology and ecology of large aquatic plants and aquatic ecological restoration.

Potamogeton crispus was used to investigate different calcium concentrations, alkalinity, phosphorus concentrations, and temperatures on the ability of *P. crispus* to cut water body phosphorus and the difference on the production of $CaCO_3$-P co-precipitation. The experiments verified that the natural water body phosphorus concentration has less difference on the production of $CaCO_3$-P co-precipitation in the leaves of *P. crispus*, and the co-precipitation was highest at the medium temperature level (17°C), with an average of 16.61 mg co-precipitation per *P. crispus* per day, which indicates that there is not much difference in the production of co-precipitation by *P. crispus* at the appropriate temperatures. The above results indicate that alkalinity has a greater effect on the amount of $CaCO_3$-P co-precipitation in *P. crispus* compared to phosphorus concentration and temperature. Under the same water environment factors, the calcium carbonate saturation indices (calcite and aragonite saturation indices) of the control group without *P. crispus* were greater than 0, indicating a crystallisation tendency, but no precipitation was produced during the experimental period, whereas the treatment group with added *P. crispus* produced unequal amounts of $CaCO_3$-P co-precipitation, which suggests that submerged macrophytes can also reduce the phosphorus loading of the water body by co-precipitation.

Assessing the Ecological Impact of Pelargonium capitatum (rose-scented geranium) in Northern New Zealand Sand Dunes

Jimmy Daamen[1], Ralf Ohlemüller[1], Dr Teresa Konlechner[1], Dr Mike Hilton[1]
[1]School Of Geography|Te Iho Whenua, University of Otago|Ōtākou Whakaihu Waka, Dunedin, New Zealand

Biography:
Teresa Konlechner is a lecturer in Physical Geography in the School of Geography at the University of Otago. She specialises in the dynamics of coastal systems, with a particular interest in the management and conservation of active sand dunes. This work includes understanding how natural processes and human interventions shape coastal landscapes, how nature-based solutions can be applied for managing coastal erosion, techniques for effective habitat restoration in dynamic systems, and the impact of invasive species on dune habitats.

Environmental weeds cause major modifications to indigenous biodiversity and ecosystem function. Management is more cost effective in the early stages of weed invasion, yet new environmental weeds can be well established before their adverse effects are recognised. This paper reports on new observations and potential ecological impacts of *Pelargonium capitatum* (rose-scented geranium) in coastal dune habitats in northern Aotearoa - New Zealand. Native to South Africa, *P. capitatum* is a known invasive environmental weed of sand dunes in Western and Southern Australia, California and the Mediterranean Basin, but is not yet identified as an environmental weed in Aotearoa. Observations in Northland indicate rapid and recent spread of this species in active sand dunes, resulting in dense infestations in sand habitats inland of the foredune. Ecological impacts documented elsewhere in its introduced range suggest that *P. capitatum* poses a significant threat to dune integrity and function. It forms dense stands that can dominate large areas converting open dune habitats to vegetated environs, reduces native species extent and richness, alters plant community structure, promotes geomorphic stability, and is associated with a loss of basking space for reptiles. This research highlights the need for early detection and management to prevent widespread ecological damage. The findings underscore the importance of proactive biosecurity measures and cross-agency collaboration to safeguard sand dune systems from invasive species that may not yet be officially recognised as threats but have the potential to cause significant harm.

Bryophyte-Angiosperm interactions: biotic filtering of tree fern epiphytes

Miss Yiting Lei[1]
[1]University of Auckland, Auckland, New Zealand

Biography:
Kia ora! My name is Yiting Lei. I am from China and a master of ecology in SBS (School of Biological Sciences), a member of James Brock's team at the University of Auckland. My research area is terrestrial ecosystem, specifically the interactions between bryophytes and angiosperms.

Tree ferns are a dominant feature of New Zealand forests and provide a significant establishment surface for hemi-epiphytic canopy and shrub species; up to 60% of canopy trees may establish epiphytically on tree ferns. Tree fern trunk also support communities of bryophytes, and many terrestrial bryophytes have been shown to affect the germination and development of native woody plant species through the release of secondary metabolites (allelopathy). I investigate whether a common epiphytic moss of tree fern trunks suppresses or promotes the germination and growth of woody epiphytes. In this study, I selected five species of woody plant (*Pterophylla sylvicola*, *Pseudopanax arboreus*, *Melicytus ramiflorus*, *Hedycarya arborea*, *Geniostoma ligustrufolium*) and a common epiphytic moss species: *Calomnion complanatum*. To test whether bryophytes affect seedling germination and plant growth I am running two experiments; (1) Growth: I add a 5% solution of moss extract (BWSE) weekly to saplings in the treatment group (and the same volume of distilled water to the control group), and will compare above-and below-ground plant biomass, stem diameter, and plant height before and after the five month treatment period to determine whether *Calomnion complanatum* promotes or inhibits the growth of tree fern epiphytes.(2) Germination: Using the same treatments on seed of the same species, I monitor germination and development to establish whether the BWSE inhibits seed germination and radicle development. I will present my initial results demonstrating how bryophyte and angiosperm epiphytes interact with consequent effects on forest structure and composition.

Agricultural soil amendments affect decomposition

Mrs Deshaun Martin-Clarke, Professor Hannah Buckley, Associate Professor Bradley Case, Lecturer Syrie Hermans
[1]Auckland University of Technology, Auckland CBD, New Zealand

Biography:
Deshaun is a Jamaican Manaaki Scholar that is pursuing her A Ph.D. in Environmental Sciences at the Auckland University of Technology. She was a lecturer in Environmental Sciences, Programme coordinator for Agricultural Sciences and Project writer/manager at the Northern Caribbean University where she contributed to the development of sustainable agricultural and environmental projects for her students and the community. She is a mother of three with a passion for innovation and creative problem-solving that is geared towards more sustainable practices for environmental conservation and preservation.

Agricultural practices have significant impacts on the ecology of soil organisms and on soil physicochemical properties. These changes therefore affect belowground ecosystem processes, such as decomposition. This study experimentally investigates the effects of soil amendments on decomposition rate and soil chemistry using the standard teabag decomposition method in ex-farmland soils. Six replicates of three treatments and a control were applied in 1-m^2 plots along a 50-m strip of land adjoining the Pourewa community garden in Auckland, New Zealand. The three treatments applied were: Agrisea, Blood and Bone, and Compost Tea. Teabags were buried and subsequently recovered during autumn and winter in each plot. Soil chemistry, respiration and moisture were assessed at the end of each season. Results showed a weak positive relationship between soil moisture and soil respiration over the two seasons. Blood and bone treatment showed slightly higher soil moisture and respiration than the other treatments, however, there were no striking differences between the treatments and control overall. Rate of stabilization was highest in Blood and bone over the two seasons but not significantly higher than the control. Decomposition rates in comparison were marginally higher in the controls especially for the winter season with lower variability within each treatment set. This study will improve our understanding of agricultural applications on soil ecosystem processes and inform us of the impact that treatment applications may potentially have on soil ecosystems.

Multi-domain ecosystem typologies – towards a unified approach in Aotearoa New Zealand

Dr James McCarthy[1], Dr Susan Wiser[1], Dr Rowan Sprague[1], Dr Olivia Burge[1], Dr Carolyn Lundquist[2], Dr Doug Booker[2], Dr Paul Franklin[2], Dr Karen Houghton[3], Dr Louise Weaver[4], Dr Annette Bolton[4], Dr Susie Wood[5]
[1]Manaaki Whenua – Landcare Research, , New Zealand, [2]NIWA, , New Zealand, [3]GNS, , New Zealand, [4]ESR, , New Zealand, [5]Cawthron Institute, , New Zealand

Biography:
James is a plant 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 important ecosystem functions and make predictions for how these will be affected by events such as storm damage, disease outbreak, and 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 in 2017.

Ecosystem typologies are frameworks to classify ecosystems into groups and can be used to describe the degree of similarity between ecosystem types. They form fundamental infrastructure for biodiversity protection, monitoring, management and research. They can be used to manage land use and development, guide natural area protection, inform conservation planning, monitor environments, and support ecological research and understanding across domains. While some environments (e.g. rivers, terrestrial habitats) in Aotearoa New Zealand have existing typologies, there is not a unifying typology that brings these together in a conceptual framework. The Ministry for the Environment (MfE) commissioned Manaaki Whenua – Landcare Research (MWLR), in collaboration with NIWA, Cawthron, ESR, and GNS, to investigate a unifying ecosystem typology for Aotearoa New Zealand. This project covers six domains (environments): Groundwater, Lakes, Marine and Estuarine, Rivers, Terrestrial, and Wetlands. As part of this project, we investigated international unifying typologies and undertook an in-depth analysis of the International Union for Conservation of Nature Global Ecosystem Typology (IUCN GET) and its potential to fit with local typologies being applied in Aotearoa New Zealand. We also developed a roadmap for each domain that outlines the steps required to achieve a revised ecosystem typology which meets principles defined by end-users, and which nests under the IUCN GET. This poster will summarise our recommended approach for a unifying framework.

Developing technology-enhanced biodiversity indicators for agroecosystems in Aotearoa New Zealand

Ms Samaneh Mosaferi[1], Dr. Craig Bishop[1], Dr. Hannah L. Buckley[1], Dr. Syrie M. Hermans[1], Dr. Bradley S. Case[1]
[1]School of Science, Auckland University of Technology, Auckland, New Zealand

Biography:
Samaneh Mosaferi is a PhD student in Environmental Science at AUT. Her previous major was botany. She has done some research projects about invasive plants and their genetic diversity.

Seventeen percent of the remaining native forests in New Zealand are embedded within agroecosystems in the form of woody patches of different sizes, compositions, and histories. Woody patches on farms have a high potential to contribute to the conservation of native biodiversity in these modified landscapes. Effective conservation and management of these patches for biodiversity values require data on resident species, habitat condition, and possible ongoing threats. However, there is a paucity of data regarding the nature and state of biodiversity in these woody elements in agroecosystems. Further, data availability will remain poor due to the lack of practical and cost-effective methods for developing relevant indicators of biodiversity and condition. In this project, we aim to develop a standardized methodology for biodiversity assessment that can be easily applied to forest patches, to quantify spatial variation in biodiversity within these human-modified landscapes, and to explore the potential and limitations of these methods to assess biodiversity rapidly. To carry out this research, firstly, available biodiversity datasets pre-collected for the Auckland Region will be used to find the spatial and temporal variation in biodiversity. After that, we will develop metrics from technology-based methods including environmental DNA metabarcoding, passive acoustic monitoring, and LiDAR data deployed in a sample of patches to determine how effectively technology-based metrics can be used to predict ground-truthed biodiversity values. The implications of our findings will be extensive, covering a range of spatial scales from site-specific assessments to land-cover mapping.

Assessing the impact of pine forest plantations on soil microbial communities

Mrs Nilukshi Muthuthanthrige[1], Professor Hannah Buckley[1], Associate Professor Bradley Case[1], Professor Gavin Lear[2], Dr Syrie Hermans[1]
[1]School of Science, Auckland University of Technology, 34 St. Paul Street, New Zealand, [2]School of Biological Sciences, University of Auckland, 3A Symonds Street,, New Zealand

Biography:
I am a microbial ecologist dedicated to exploring microbial communities within ecological systems and understanding their responses in an ecological context. Currently, I am focused on uncovering the composition and functions of microbes in exotic forests and investigating how forestry management strategies influence soil biology.

Land use conversion poses a significant threat to soil biodiversity and cause long term effects on soil ecosystems. Although pine plantations are rapidly expanding in New Zealand, the effects of transforming land into plantations on soil microbial communities and their ecological functions both within the pine forest and on neighbouring ecosystems, is not well understood. Here we focus on the Kaingaroa Forest, the oldest and largest pine plantation in Aotearoa, to determine the edge effects in different neighbouring land uses. It will compare the composition of microbial taxa and functional genes in the Kaingaroa pine forest with those of neighbouring native forest, and pasture ecosystems. Soil samples will be collected along 200m transects at varying intervals, running perpendicular to the land use border. The bacterial and fungal communities will be characterized using 16S rRNA gene and ITS gene amplicon sequencing respectively. Further, to assess the functional potential of these microbial communities, shotgun sequencing will be conducted. It is expected that microbial diversity and functional profiles will be more distinct in areas farther from the border, with notable shifts observed across different ecosystems. Overall, the study will broaden our understanding of belowground communities in forestry ecosystems, and the impacts these forest systems have on neighboring environments. The outcomes will contribute to sustainable forest health and help with soil biodiversity conservation efforts in Aotearoa.

Spatial and Temporal Patterns of Soil Erosion in the Gisborne Region, New Zealand.

Mr Oghenemaro Elijah Ogwara, Associate Professor Loic Le De, Associate Professor Bradley Case
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
I am a lecturer and researcher at the Delta State University of Science and Technology, Ozoro, I have both a bachelor's degree and a master's degree in Geography and Environmental Management from the Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria. I have a paper published in the Global Journal of Advanced Engineering Technology and Sciences. I am fully a member of the Association of Nigeria Geographers (ANG), I presented a portion of my thesis paper at the 60th Annual Conference of the Association of Nigeria Geographers (ANG) held at Kaduna State University (KASU) on 12th -18th October 2019. I am studying for my PhD at the Auckland University of Science and Technology, Auckland, New Zealand. My career goal is to contribute to sustainable land management and environmental conservation. I aim to develop innovative mapping and modelling techniques that enhance our understanding of landscape dynamics and soil interactions, ultimately guiding policymakers and communities in making informed decisions about land use, disaster risk reduction, and ecosystem restoration. My master's research thesis has contributed to the resilience and sustainability of communities along the Nun River, ultimately enhancing their quality of life in the face of climate change and environmental challenges. My current research focuses on characterising and modelling spatial and temporal patterns of soil erosion in the Gisborne Region, New Zealand. I am particularly interested in understanding the underlying causes of soil erosion and exploring its consequences on disaster risk. By utilising Geographic Information Systems (GIS), Remote Sensing (RS) Data and advanced modelling techniques, I aim to uncover the complex dynamics of soil erosion processes over time and space. This research is crucial for identifying vulnerable areas, assessing potential risks, and developing strategies to mitigate the impacts of soil erosion-induced disasters in the region.

Soil erosion is a major environmental problem that significantly affects agricultural productivity and s ustainability in regions like Gisborne, New Zealand. The Gisborne region's diverse topography and climate make it vulnerable to several forms of soil erosion, which can have catastrophic consequences for the land's yield potential and the ecology's general stability. Despite the importance of understanding soil erosion's underlying forces, a more thorough study of the variations in the spatial-temporal patterns of soil erosion in this area is lacking in research. This study aims to compare historical and present geospatial data to examine the spatial and temporal patterns of soil erosion over forty years in the Gisborne region of New Zealand, by integrating satellite data and ground truth points. This research will uncover how soil erosion has evolved in this region. The study will use advanced GIS tools, to identify hot spots of erosion and analyse changes in the type and distribution of erosion. The research will prove beneficial as it will provide additional insights into the characteristics of soil erosion in Gisborne and identify potential triggers, enabling more informed and effective soil conservation measures to be put into place.

Effects of the long-term ecological restoration in the eutrophic plateau shallow lake — A case study of Dabokou, Lake Dianchi

Professor Jizheng Pan[1]
[1]Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, Nanjing, China

Biography:
Prof. Jizheng Pan works in Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences. He has more than 20 years experience in ecological restoration and constructed wetland. He is accomplished in the research on technology of ecological restoration in eutrophic lakes and treatment wastewater by constructed wetland with artificial aeration. He is interested in the study on ecological change of polluted lakes and the mechanism of oxygen transfer in constructed wetland now.

Dabokou is located in the south of Caohai, Lake Dianchi, with an area of 0.52 km2 and an average water depth of about 2 m. As a typical severely eutrophic lake, Dabokou has carried out two phases of ecological restoration project in 2015 and 2019 respectively. The results showed after treatment, CODCr, TP and Chl.a from A1 to A4 area decreased stably. CODCr reduced by 18.65, 27.96, 25.26, 40.92 mg/L; TP reduced by 0.11, 0.10, 0.11, 0.14 mg/L; Chl.a reduced by 0.037, 0.068, 0.067, 0.106 mg/L, respectively. SS showed strong seasonal fluctuations, and TN showed a continuous decreasing trend only in A4 area, the southeastern part of Dabokou, with a decrease of 0.68 mg/L. The correlation analysis showed that CODCr and TP had the strongest correlation with Chl.a, which might be the key factors affecting the growth of algae. Water diversion and exchange project decreased nutrient concentration and accelerated water circulation, and micro-filter purification and algae removal project reduced algae biomass and reduce the risk of algae-derived pollution. And through the purification functions of submerged macrophytes, plants restoration project provided conditions for the formation of the macrophyte-dominated state lake. It is considered that plants restoration project is the most direct, economical and long-term measure in the above projects. Overall, part of Dabokou area, as a case of successful restoration of the severe eutrophic algae-stable state lake, it's experiences have important reference value for the further ecological environment restoration of Dabokou itself, Caohai and even the whole Lake Dianchi.

Exploring fungal diversity: the puāwaitanga of restored Wairarapa wetlands?

Miss Teremoana Porter-rawiri[1], Dr Julie Deslippe[1], Dr Sara Belcher[1], Dr Ocean Mercier[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Tere Porter-Rawiri is a proud descendant of Te Ātiawa iwi and a master's student in Ecology at Victoria University of Wellington, passionate about applying mātauranga Māori in science to support Māori aspirations for their whenua.

Wairarapa Wetlands in Aotearoa New Zealand, like many worldwide, face degradation, prompting restoration efforts. Although fungi play a vital role in ecosystem health, they are often overlooked as insufficient data makes their role in wetland ecology unclear. While Māori connections to wetlands are well-documented, the relationship between Māori and fungi remains limited to traditional uses often framed in the past. In this era of nurturing the evolution of mātauranga Māori (Māori knowledge), we have the opportunity to gain new insights into ecological restoration, particularly in understanding the role of fungi within these processes. By aligning mātauranga Māori with scientific methods, I hope to gain a holistic understanding of how fungal communities in Wairarapa wetland forests respond to restoration efforts. I have interviewed Māori raised in Wairarapa to explore Indigenous ties to place and how fungi fit into their environmental aspirations for wetlands. I have also characterised fungal communities in wetland soil samples by sequencing ITS genes. My sampling focused on Wairarapa wetlands of various ecological states; pastoral, restored, and conserved wetland forest sites. Ultimately, this work seeks to contribute to improved wetland restoration outcomes that align with te ao Māori (a Māori worldview).

Wood You Believe It? Native and Exotic Ambrosia Beetles Unearthed

Mr Andrew Pugh[1]
[1]Scion Research, Rotorua, New Zealand

Biography:
Andrew Pugh is the Entomology Team Lead at Scion Research, with over a decade of research experience. He has a broad interest in ecology, basic and applied research, as well as invasive species management. Specific interests include improved and novel pest detection methods.

Globally, ambrosia beetles are increasing in their prevalence and impacts, likely due to changing climate patterns and weather severity causing tree stress. We have several native and invasive ambrosia beetles present in Aotearoa New Zealand, and many more of biosecurity concern should they become established. Recent ambrosia beetle outbreaks and new incursions, combined with renewed interest in indigenous forestry means there are many concerns about how these beetles may respond to newly established native tree systems.

Developing an automated process for counting birds flying into roost

Dr Kathryn Ross[1]
[1]Toi Ohomai Institute of Technology, Rotorua, New Zealand

Biography:
Kathryn teaches on the Environmental Management and Master of Applied Science (Biodiversity Management) programmes at Toi Ohomai, based in Rotorua. Kathryn completed her PhD at Bournemouth University, UK, on individual-based modelling of a coastal shorebird population. Her current research interests broadly include ornithology, monitoring and biosecurity.

In the context of bird monitoring, automated image analysis often involves counting a large number of individuals from a small number of images (e.g. seabird colony counts). A less-well explored application is automated counting of sparsely distributed individuals from a large number of images. In the latter case, increased counting efficiency is created through batch-processing a large number of images, and removing the requirement for time-consuming and error-prone manual counting of individuals from still images. In this poster, we discuss the process of using an image-analysis software (*ImageJ*) for counting birds and discuss the technical challenges in developing a fully automated counting procedure to estimate the number of birds flying over a fixed-point camera. The benefits and weaknesses of this method in monitoring a problematic non-native bird roost at the predator-free fenced site at Rotopiko are considered.

Broadscale Spatial Prioritisation for Marine Biodiversity Conservation using Marxan in Aotearoa New Zealand

Mr Naif Rushdi[1], Associate Professor Bradley Case[1], Dr Dan Breen[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Naif Rushdi is a marine conservation scientist from the Maldives, currently pursuing a PhD at Auckland University of Technology (AUT). His research focuses on spatial prioritisation for marine biodiversity conservation, using geographic information systems and spatial prioritisation tools.

In New Zealand's Territorial Sea (within 12 nautical miles of the coast and islands), the majority of habitats and species are poorly represented in existing MPAs. We applied the spatial prioritisation tool, Marxan, to identify important areas to include in an efficient and ecologically representative MPA network in New Zealand's Territorial Sea. Broad categories of primarily physically derived factors intersected in a Geographic Information System were used as surrogate habitats for biodiversity in each mesoscale (hundreds of kilometres) marine bioregion. We aimed to include 30% of every habitat in each of the 14 marine bioregions in protected areas while minimising impacts on commercial and recreational fisheries.

With existing MPAs included as a mandatory part of potential MPA networks, Marxan was able to identify networks of sites that achieved all 30% targets while including only 38% of the total area, 13% of commercial fishing effort and 9% of recreational fishing effort. If existing MPAs are not mandatory in solutions, only 35% of the total area, 12% of commercial fishing effort and 7% of recreational fishing was included in MPA networks.

The study demonstrates the potential of marine spatial planning tools for nationwide marine conservation planning. We present results as a starting point to explore alternative models, data for marine species, socioeconomic costs and benefits, and participatory planning. The models help identify gaps in proposed MPA networks and can guide and inform the interactive design of single and multiple-use zoning for conservation and sustainable use.

Investigating the Effect of Ecological Restoration on Nitrogen Partitioning in Wetland Ecosystems.

Miss Pearl Ruston[1,2], Dr Sarah Herbert[1,2], Dr Sarah Bury[3], Dr Julie Deslippe[1,2]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]Bioprotection Aotearoa, Christchurch, New Zealand, [3]NIWA - National Institute of Water and Atmospheric Research, Wellington, New Zealand

Biography:
Pearl Ruston completed her Bachelor's degree in Environmental Science, Ecology & Biodiversity, and Physical Geography in 2022. She is now working towards completing her Master in Ecological Restoration at Victoria University of Wellington – Te Herenga Waka.

Nitrogen (N) is essential for plant growth, but excessive inputs from fertilizers, livestock waste, and non-native N-fixing plants can overwhelm ecosystems. Wetlands help absorb excess N, but over 90% of Aotearoa New Zealand's wetlands have been lost or degraded. Our understanding of how wetland condition affects N-cycling is limited, hindering effective restoration. Our research aims to address this knowledge gap by examining the impact of ecological restoration on N partitioning among plant and soil pools across three different wetland states; pastoral, restored, and conserved sites. We assessed nitrogen pools in plant leaves, roots, and soils from 18 wetlands in the Wairarapa. We analysed the samples for total nitrogen, mineral nitrogen and δ^{15}N values. We hypothesise that soil nitrogen pools will be highest in unrestored wetlands, followed by restored, and lowest in remnant, due to reduced plant functional diversity and lower above-ground biomass in disturbed, early successional ecosystems. We also predict that plant tissue nitrogen pools will be greatest in remnant wetlands, followed by restored and unrestored wetlands, as a result of higher plant functional diversity in mature successional ecosystems because each species differs in their sources and tissue concentrations of N. Preliminary data indicate that pastoral wetlands have 4.8 times more mineral N (NH_4^+, NO_3^-) than conserved wetlands, with twice the variation. An improved understanding of N cycling in wetlands of different ecological states will enhance our ability to create and restore wetlands with maximum capacities to remove excess nitrogen, ultimately improving environmental management practices and informing land-use decisions.

Determining the trophic discrimination factor for two hypercarnivores: stoat (*Mustela erminea*) and weasel (*Mustela nivalis*) to support stable isotope-based diet studies

Ms Amandine J M Sabadel[1,2,3], Mr Andrew Sides[1], Ms Juliet Saul[1], Ms Leigh J Ellmers[4], Ms Jenny Dent[5], Ms Sarah J Bury[3], Ms Julie Brown[3,8], Ms Josette Delgado[3], Mr Jamie McAulay[5], Ms Kerry Borkin[6]

[1]Department of Zoology, University of Otago, Dunedin , New Zealand, [2]School of Science, Auckland University of Technology, Auckland, New Zealand, [3]National Institute for Water and Atmospheric Research, Wellington , , [4]Manaaki Whenua Landcare Research, , Lincoln, [5]Zero Invasive Predator, Christchurch, , [6]Department of Conservation, Te Anau , , [7]Department of Conservation, Taupō, , [8]Department of Earth Sciences, University College London, London, The United Kingdom

Biography:

Juliet's research reflects her commitment to restoring ecosystem health in Aotearoa. Her postgraduate work centres on wildlife management, with a particular focus on using stable isotopes as biochemical tracers. By applying isotope analysis, she aims to unlock insights into the complex interactions between species and their environments, both past and present. This method allows her to address critical questions about ecosystem dynamics, species movements, and the long-term impacts of environmental change, contributing to a deeper understanding of Aotearoa's unique ecological landscape.

The introduction of non-native small carnivores, such as stoats (*Mustela erminea*) and weasels (*Mustela nivalis*), has caused considerable harm to native wildlife in Aotearoa New Zealand. Understanding the dietary habits and ecological impacts of these invasive predators is crucial for effective conservation management. However, traditional methods, like stomach content analysis, are often impractical and imprecise. Stable isotope analysis offers a robust alternative, providing insights into dietary patterns, habitat use, and trophic interactions across various timeframes. Accurate interpretation of carbon and nitrogen stable isotope values in diet studies requires precise knowledge of the trophic discrimination factors (TDFs) – the extent to which stable isotope values change from prey to predator. TDFs vary by species, tissue type, and diet and are unknown for both weasels and stoats. This study determined the carbon and nitrogen TDFs for these species across various tissues, including muscle, liver and claw. Particular focus was given to claw tissues as they provide a record of dietary shift over the growth period, thus additional measurements were made to determine claw growth rates. Overall, the average TDFs were significantly higher than the universal values in both species' tissue types with weasel TDF_N = 5.16±0.36‰, TDF_C = 2.28±0.81‰ and stoat TDF_N = 4.80±0.46‰, TDF_C = 2.68±0.75‰ which was attributed to the fast metabolism of mustelids. The similarity in TDFs between both mustelids suggest that weasels and stoats metabolise their diets similarly, despite being different species. Tissue-specific TDFs and claw growth rates will be further detailed during this talk.

Understanding the biodiversity of New Zealand's freshwater ecosystems through eDNA analysis

Mr Judah Shantapriyan[1], Ms Indira Venkatraman[2]
[1]Kings High School, Dunedin, New Zealand, [2]University of Canterbury, Christchurch, New Zealand

Biography:
Judah Shantapriyan is a year 9 student at Kings High School Dunedin. He has an interest in fishing and by extension in freshwater ecology and explores it through eDNA and case study method. He is keen to find solutions to the issues that threaten biodiversity in New Zealand's freshwater ecosystems.

He has a marine biology badge from Science Awards Trust NZ. And is certified in Cell Biology: Mitochondria, a course through Harvard University; achieving a grade of 94%. He is keen to work on this research in parallel to his school work and is looking forward to networking and collaborating with other researchers.

In this paper we delve into New Zealand's freshwater ecosystems by exploring the distinct biodiversity of organisms within these ecosystems. We use eDNA analysis methods to uncover the variety of life forms, from unique fish species to endemic plants, that can thrive in New Zealand's freshwater. By understanding the intricate web of interactions and adaptations within these ecosystems, we can gain valuable insights into the preservation and protection of such environments. We approach this by conducting a literature review on New Zealand's freshwater ecosystems, followed by fieldwork-based investigation of the factors that contribute to the diversity and abundance of organisms in these habitats. The field-work sites we have chosen to explore are the Waimakariri River and the Clutha River. We will compare our results between both case sites. eDNA stands for environmental DNA. This is the DNA that organisms leave behind in the environment that they live in. eDNA analysis involves a systematic framework of extracting information from eDNA naturally present in the environment, analyzing it, and coding it to understand and monitor the biodiversity in a sample ecosystem. This research will focus on their adaptations to the specific environmental conditions found in New Zealand's rivers, lakes and wetlands. We aim to find alternative options in countering the threats that are affecting our local freshwater ecosystems. Our findings will enhance knowledge of New Zealand's biodiversity and contribute to broader understanding of freshwater ecosystems worldwide.

Testing the long-term effectiveness of common restoration & monitoring techniques in a wetland restoration project

Mr Charlie Tustin[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Charlie Tustin: BSc in Ecology and Biodiversity & Environmental Science. Studying for MSc in Ecological Restoration. I have experience involving lizard translocations and handling, plant monitoring, pest trapping and pest plant control. I have a particular interest in native plants and the application of technology in ecology.

A key issue in restoration ecology is establishing the effectiveness of restoration and monitoring techniques. Despite their widespread use, rigorous research on the efficacy of these techniques is lacking, particularly in the context of New Zealand wetlands. This study aims to address these gaps by identifying: (1) how a combination of environmental factors and restoration techniques impact plant survival and success, (2) whether there is an intraspecific relationship between size-related plant attributes, allowing drones to infer size parameters that they cannot directly measure, (3) whether AI-integrated GIS analysis of drone imagery corresponds with more established field methods for vegetation monitoring. To address these aims, I will: (1) take field measurements of plant size attributes and survival, then test for a correlation between these values and the degree/presence of flooding, topsoil scraping and nurse trees, (2) test for an intraspecific relationship between these size attributes for 8 native tree species, (3) compare values from field measurements to those derived from drone imagery, which will be analysed using ArcGIS integrated with a spatial classification AI package. This study will serve to inform restoration practitioners of the effectiveness of common restoration and monitoring techniques in a New Zealand wetland ecosystem, as current evidence is largely anecdotal.

A conceptual framework for NbS selection and planning to enhance climate change resilience in agricultural landscapes

Mr Thanh van Nguyen[1], Professor Hannah Buckley[1], Dr Craig Bishop[1], Associate Professor Bradley Case[1]
[1]School of Science, Auckland University of Technology, Auckland, New Zealand

Biography:
I am a lecturer and researcher at the University of Agriculture and Forestry, Vietnam. I graduated with a Master's in Sustainable Agriculture from Kasetsart University, Thailand, in 2015. Currently, I am a first-year PhD student in Environmental Science at Auckland University of Technology, New Zealand. My current research interests relate to the governance of natural resources, biodiversity conservation, and climate change resilience and adaptation in agroecosystems. Here, I focus on nature-based solutions to address biodiversity loss and resilience in agricultural landscapes, as well as the role of informal and formal institutions and actor interactions in natural resource governance.

The loss of biodiversity and the impacts of climate change have significantly affected ecosystems and human livelihoods globally, undermining access to essential resources, increasing the risk of natural disasters, and negatively impacting public health. In this context, nature-based solutions (NbS) have been recognized as a sustainable approach to addressing these global challenges. While substantial efforts have been made to develop NbS frameworks, particularly in urban environments, there remains a notable lack of research in agricultural landscapes. Specifically, the absence of a comprehensive framework to guide decision-makers and practitioners in planning and selecting context-specific NbS represents a gap in this field. This study seeks to bridge this gap by proposing an integrated conceptual framework, drawing from a review of relevant literature and stakeholder input, to guide the planning and selection of the most appropriate NbS based on specific intervention objectives and the socio-ecological context of the area. The framework is structured as follows: (1) identifying the societal challenges to be addressed; (2) determining the stakeholders involved in the NbS selection and planning process; (3) identifying the specific environmental context in which the intervention must be implemented; and (4) selecting and planning NbS interventions tailored to address the identified societal challenges in agricultural landscapes. By following this approach, the framework guides users in identifying a portfolio of NbS interventions specifically tailored to the unique needs of each agroecosystem.

Plant trait moderated priority effects on community-level carbon cycling

Ms Janelle Veenendaal[1], Dr Julie Deslippe[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:

Janelle Veenendaal is a research assistant in Dr. Julie Deslippe's lab at Victoria University of Wellington. She holds a BSc from the University of Lethbridge, Canada and has a background in agricultural science. She completed her MSc at Victoria University of Wellington in 2022, where her research focused on the impact of plant traits on grassland ecosystem productivity. Currently, Janelle is part of the WaRM project, investigating carbon cycling in response to warming and plant community shifts in natural environments.

Plant community assembly profoundly affects ecosystem carbon (C) cycling. Timing is important because early established species can generate priority effects on newcomers. The recruitment and growth of a newcomer is affected both by its own traits and those of the recipient community. Ecological theory predicts that positive priority effects, where niche complementarity enables the newcomer to be facilitated by the recipient community, should maximise biodiversity and ecosystem function. Conversely, negative priority effects, whereby the recipient community suppresses the newcomer should reduce both parameters. We tested the hypothesis that a greater difference between community weighted plant traits and the traits of the late arrival species would increase ecosystem productivity. Given that plant traits can affect above and belowground components of C-cycling directly and indirectly via the soil microbial community, we explored trait effects on productivity under three soil treatments: unaltered, sterilised, and reinoculated. We assessed above and belowground plant biomass and ecosystem carbon flux (net ecosystem exchange-NEE; gross primary productivity-GPP; and ecosystem respiration-ER) in response to plant and soil treatments. Late arrival species had strong effects on community biomass, with some species reducing it by -11.5% compared to controls, however these effects had no significant effects on C fluxes. Soil sterilisation reduced plant community biomass by as much as 13.9% but increased NEE by 18.0% and decreased ER by 22.4%. These results suggest that species-specific priority effects on community C-cycling are moderated through changes in soil communities.

Can olfactory and acoustic lures attract invasive predators in a wetland environment?

Miss Jessica Wagner[1], Stephen Hartley[1], Stephen Marsland[1], Patrick Garvey[2], Al Glen[2]
[1]Victoria University Of Wellington, Kelburn, New Zealand, [2]Manaaki Whenua Landcare Research, , New Zealand

Biography:

Jessica Wagner is currently studying for her Master's in Ecology and Biodiversity at Victoria University of Wellington. She has broad ecological interests with a passion for conservation, particularly of New Zealand wildlife. She has previously researched the efficiency of acoustic lures for possums with the Taranaki Mounga project. She is currently a research assistant conducting tree and ecological monitoring on restoration planting sites for the Tonganui corridors project in the Wairarapa.

Invasive mammalian species threaten global biodiversity, prompting initiatives like New Zealand's Predator-Free 2050 that aims to eradicate possums, mustelids, and rats. To achieve this goal, more effective eradication strategies are essential. This study investigates the efficacy of acoustic lure devices, a relatively novel technology, in attracting mammalian predators, compared to olfactory lures. Acoustic lures have the advantage of remaining effective over longer periods and greater distances, unlike olfactory baits, which degrade quickly. Seven treatments, including three scent stimuli, three acoustic stimuli, and a control, were individually tested across ten sites in the Wairio wetland, Wairarapa. Trail cameras monitored how often the lures were approached to determine the effectiveness of each treatment. Possums approached lures significantly more than any other species and were most active between 9 pm to 12 am, 1-3 nights after lures were placed or removed. Over two weeks, peanut butter and cat noise were the scents and sounds most approached by possums, with 88 approaches to peanut butter, and 83 approaches to cat sounds, both significantly higher than the 37 approaches recorded for the control. Possums' attraction to predator sound reveals the complex interactions among invasive species and the value of novel lures. Trial two is yet to be conducted which will aim to identify if a combined olfactory and acoustic lure has a synergistic effect on attractiveness.

The spatial and temporal patterns of forest succession following landslide disturbance in the Aotea and Coromandel regions

Ms Elizabeth Williams[1], Dr George Perry[1], Dr Thomas Dowling[1], Dr Bruce Burns[1], Dr James Brock[1]
[1]University Of Auckland, Auckland, New Zealand

Biography:
Elizabeth Williams is a PhD candidate at the University of Auckland, working under the supervision of George Perry, Thomas Dowling, Bruce Burns and James Brock. Her doctoral research explores the spatial and temporal patterns of forest succession following landslide disturbance in the Aotea and Coromandel regions using remote sensing and field-based approaches.

Common globally in mountainous regions and often driven by rainfall or seismic events, landslides trigger the process of primary succession by removing existing vegetation and topsoil. While early landslide succession research exclusively used field studies to monitor forest changes, modern approaches have increasingly integrated remote sensing and predictive modelling methods. In New Zealand, however, research on post-landslide forest recovery has been limited and exclusively involved the use of vegetation surveys. Our research aims to address this gap by assessing the temporal and spatial patterns of landslide recovery in the Aotea and Coromandel regions, using methods novel to this area. Canopy recovery will be monitored using spectral identification models across all landslides detected using freely-available satellite and aerial imagery from the 1940s to present. Field surveys and seed bank analyses will be conducted in a select chronosequence of landslides and the surrounding undisturbed forests to assess the timeline for recovery and relative changes in species diversity, functional traits, and invasive species prevalence. By integrating remote sensing and field-based methods, this research aims to provide an enhanced understanding of local landslide-recovery processes and insight into potential community shifts that further landslide events could cause. With a projected increase in landslide frequency due to climate change and land use intensification, the community effects of this disturbance method will continue to be of importance for local conservation and ecosystem management efforts.

Te Mana o Rangitāhua: Transforming Aotearoa's environmental stewardship and leadership through an indigenous-led research programme for Rangitāhua

Dr Sarah Withers

Biography:

Dr Josie Galbraith is Curator of Land Vertebrates at Auckland Museum, Tāmaki Paenga Hira. She is an ecologist with a research focus on urban avian ecology. Her research interests encompass invasive species, conservation, urban impacts, animal behaviour, epidemiology, and human–wildlife interactions. Josie is a Research Aim Leader on Te Mana o Rangitāhua where she is responsible for co-leading numerous project outputs associated with public engagement and project representation.

Dr Sarah Withers is the Associate Curator of Land Vertebrates at Auckland Museum, Tāmaki Paenga Hira. She is a behavioural ecologist, with a particular interest in the evolution of communication traits in native bird species and drivers of variation across and within avian populations. Sarah is the Programme Lead for Te Mana o Rangitāhua, responsible for programme activity oversight and research alignment.

Rangitāhua includes internationally significant terrestrial nature reserves and hosts Aotearoa's largest marine reserve – scientifically identified as one of the most pristine marine ecosystems on Earth. Our project, Te Mana o Rangitāhua, aims to transform Aotearoa's environmental stewardship and leadership through an indigenous-led research programme for Rangitāhua – a large, pristine, globally significant, yet critically understudied part of Aotearoa's Exclusive Economic Zone.
Te Mana o Rangitāhua as a research project recognises all tangible and intangible links between people, the environment and taonga. Multiple viewpoints are considered within the project that reflect our expertise and the overall research position and vision. Our programme has two fundamental research questions: 1) What are the main contributors to Rangitāhua's ecosystem wellbeing and thrivability? and 2) How can knowledge from indigenous and scientific research paradigms be applied to meet future environmental challenges and secure environmental justice?
By completion, our research programme will have reconnected, reidentified and restoryed Rangitāhua for Ngāti Kuri and Aotearoa. A large-scale mātauranga framework is being enabled through pūrākau, Pūpuri mauhanga and a conservation management plan, all informed by the largest taonga stocktake ever completed within Aotearoa's Exclusive Economic Zone.
In this poster, we would like to present the vision for Te Mana o Rangitāhua, and an overview of our Aims, Intentions, and Critical Steps as a pathway to realising that vision. We are excited about the opportunity to engage with the ecological community on this transformational approach to ecosystem wellbeing.

Testing of mistletoe propagation techniques and assessment of the state of loranthaceous mistletoes in Wellington

Benjamin Wright[1]
[1]Victoria University Of Wellington, Wellington, New Zealand

Biography:
My name is Benjamin wright, I am currently undertaking my master's in ecology and biodiversity at Victoria University. I have had a love of the natural world since I was a young child. I'm especially interested in freshwater ecology and native plants. I really enjoy contributing to restoration projects and am interested in hearing about any volunteer opportunities in the Wellington region, especially involving rare species.

Native mistletoes have under gone large declines across most of New Zealand, including local extinctions over large areas. This is due to a combination of habitat destruction, mammal browse and pollinator/disperser loss. The reintroduction of mistletoes to areas where they have been lost is greatly complicated by their hemiparasitic nature which prevents the use of normal propagation methods. Whilst there is colloquial knowledge on how best to reestablish these species using seed in situ, Little formal research to empirically base best practice has been conducted in New Zealand. This study focuses on two main aspects, firstly the propagation of mistletoe's (specifically *Tupeia antarctica* and *Ileostylus micranthus*). Building upon the limited published work by quantifying the effects of host branch size, seed position, height and distance from the host trees trunk, on seed establishment. As well as "planting" on the same host species as the mother plant. And secondly surveying populations of these species and other Loranthaceae in the greater Wellington region, in order to ascertain the current regional state of these species. This research will better inform best practice for propagation of these mistletoes and therefore their conservation management and reintroductions going forward.

Preliminary study on the contribution model of wind wave disturbance to the rise of total phosphorus in Meiliang Bay of Taihu Lake

Mr Gu Xiaozhi[1]
[1]Nanjing Institute of Geography and Limnology, Chinese Academy Of Sciences, Nanjing, China

Biography:
Associate Professor, Nanjing Institute of Geography and Lakes, Chinese Science. Research Areas: Research on habitat restoration mechanisms and techniques for lake and river water bodies; wetland ecological engineering; environmental geochemical cycling of nitrogen and phosphorus at the wetland plant-sediment environmental interface.

In this paper, the disturbance device is used to simulate and characterize the phenomenon of wind wave disturbance. Based on the dynamic variations of physicochemical parameters in water and sediment under different wind wave disturbance modes, the contribution of wind wave disturbance to the rise of total phosphorus in water of Lake Taihu was explored. The results show that the wind wave disturbance significantly increases the concentrations of suspended solids in water, and the small wind group and strong wind group increase by 80.9% and 360.8%, respectively. The effect of wind wave disturbance will be weakened with the extension of disturbance period. Different wind wave disturbance intensities have obvious effects on total phosphorus (TP) in water. Under the condition of small wind, the TP concentrations in water shows a decrease trend, while the values of TP in water performs an increase trend under the condition of strong wind. The mean values of TP in the control group, small wind group and strong wind group were 0.15±0.03 mg/L, 0.13±0.04 mg/L and 0.20±0.08 mg/L, respectively. The contents of TP in the surface sediments within 0~4 cm experience an increase slightly due to wind wave disturbance. The main explanation is that the redox conditions on the sediment surface is changed. With the increase of disturbance intensity, the soluble active phosphorus concentrations in pore water does not increase or decrease

Seabird plastic ingestion: species-specific patterns?

Mr Timothy Yang[1], Dr Ariel-Micaiah Heswall[1], Dr Anne Gaskett[1]
[1]University Of Auckland, Auckland, New Zealand

Biography:
Timothy is currently a Master's student at the University of Auckland, an avid wildlife photographer, and a recipient of the University of Auckland Sustainability Network Research Award. His research focuses on the impact of plastic pollution on seabirds in the Auckland, Hauraki Gulf, and Northland regions. He aims to complete his Master's degree in February 2025.

Timothy has experience working with various community conservation groups and has also gained professional experience in the ecological consulting space.

Plastic pollution is a major global issue affecting many species. Annual global production of plastics has increased nearly 200-fold since 1950. Seabirds are highly vulnerable to global plastic pollution and ingestion of plastics, with threatened seabird species appearing disproportionately affected. The effects of ingestion include starvation, internal injuries, false satiation, and reduced fitness. Current research primarily focuses on exposure risk, i.e., the quantity of plastic in their typical habitat or distribution. However, even species in the same areas can vary in plastic ingestion, suggesting other factors at play.

Tāmaki Makaurau/Auckland and the Hauraki Gulf region is a globally critical seabird hotspot, used by 88 seabird species, representing 23% of the world's species of this very at-risk group, with five species breeding nowhere else. This location enabled us to compare specimens from a wide range of species, which is not feasible in many other regions.

Here, we report on plastic ingestion incidence from a preliminary dataset of approximately 15 species from 12 genera of seabirds. We investigated this by dissecting dead seabirds, examining their proventriculus and gizzard for plastics, recording the amount, mass, colour, types, and sizes of plastics, and noting body morphometrics, sex, body condition, and dehydration. We predict that species-specific differences in plastic ingestion may be explained by the diversity of morphological, ecological, and sensory traits across seabird species.

This study can provide crucial insights into plastic pollution, seabird health, and the factors contributing to plastic ingestion, ultimately leading to more informed conservation initiatives.

Using infrared spectroscopy to determine the chemical composition of kauri leaf litter in kauri forests affected by dieback.

Miss Siqi Yang[1], Marijke Struijk[2], Luitgard Schwendenmann[1]
[1]The University of Auckland, Auckland city, New Zealand, [2]EcoQuest Centre, Whakatiwai , New Zealand

Biography:
Siqi Yang is a PhD student at the University of Auckland, pursuing a degree in Environmental Science. With a strong interest in forest ecology, she has focused her research on the kauri ecosystem. After graduation, she hopes to continue working in the field of forest pathology.

Pathogen infection and subsequent tree dieback may indirectly affect leaf chemistry and litter decomposition. Phytophthora *agathidicida* (PA) is a pathogen causing kauri (*Agathis australis*) dieback. The objective of this study was to determine whether the chemical composition of kauri leaf litter changes in response to PA infection. Kauri leaf litter across three sites (Cascades, Piha, Huia) within the Waitākere Ranges Regional Park were selected. The kauri leaf litter was dried and ground into powder followed by Fourier-transform infrared (FTIR) spectroscopy. This method allows for the detection of a wide range of chemical bonds and can be used to identify the presence of different functional groups (e.g., carbohydrates, lignin) in plant material.
We found a significantly lower absorbance intensity of the peak at wavenumber 842 cm^{-1} (i.e., carbohydrate) in spectra of kauri leaf litter collected from locations where *P. agathidicida* was detected. Pathogen detection status did not have a significant effect on the absorbance intensity in the 1000-1700 cm^{-1} region (i.e., lignin, cellulose). We also found significant differences in FTIR spectra of kauri leaf litter from different sites. For example, the absorbance intensity in the 1000-1700 cm^{-1} region was lowest at Huia. Differences in the chemical composition of kauri leaf litter between sites might be related to differences in soil available nutrients and/or water, tree age, and litter decomposition stage. Thus, both pathogen presence and environmental conditions influence the observed differences in kauri leaf litter chemical characteristics.

Te Ukaipo o Hinemoana. A spatial tool to support ocean decision making in Aotearoa New Zealand

Miss Nidhi Yogesh[1], Dr Laura Jordan-Smith[1], Dr Katie Cook[1], Miss Eva Leunissen[1], Dr Tom Brough[1], Dr Matt Bennion[1], Dr Carolyn Lundquist[1,2]
[1]National Institute Of Water And Atmospheric Research (NIWA), Auckland, New Zealand, [2]School of Environment, University of Auckland, New Zealand, Auckland, New Zealand

Biography:
Nidhi Yogesh has a master's degree in Marine Conservation from the University of Auckland, and is currently working for the Marine Ecology and Communications teams at the National Institute of Water and Atmospheric Research (NIWA). Her passion lies in science communication and she has produced many scientific graphics and geospatial tools to support diverse projects, from the Sustainable Seas National Science Challenge, to NIWA spatial planning research, to central government research toward identifying key ecological areas in marine ecosystems.

Coastal ecosystems are subject to a multitude of anthropogenic stressors which can fragment the seascape and overlap to cause cumulate effects with increased environmental impacts. *Te Ukaipo o Hinemoana* is a national scale online tool for Aotearoa New Zealand's coastal marine area, which assists in visualising multiple stressors to better understand how stressors overlap with each other, and with the distributions of marine organisms, habitats and ecosystems. The tool includes layers in the following four categories for ecosystems: 1) Management areas (e.g., administrative boundaries, regionally significant and protected areas); 2) Stressors from marine and land-based sources (e.g., aquaculture, fishing, freshwater nutrient and sediment inputs, adjacent land use); 3) Biodiversity data (e.g., modelled species distributions, subtidal habitats); 4) Environmental data (e.g., sea surface temperature). Data sources include the National Institute of Water and Atmospheric Research (NIWA), Department of Conservation (DOC), Fisheries New Zealand (FNZ), Ministry for the Environment (MfE), Land Information New Zealand (LINZ), NZ Petroleum and Minerals (NZPAM), and regional authorities. Detailed data descriptions and metadata provide links to access data, and outline limitations and uncertainties of each dataset. *Te Ukaipo o Hinemoana* supports an ecosystem-based management approach and visually demonstrates ki uta ki tai, the interconnections from the mountains to the sea.

Colour changing flowers and pollinator vision

Miss Angie Zhu[1], Dr Anne Gaskett[1], Mrs Leah Barnfather-Wu[1]
[1]School of Biological Sciences, University of Auckland, Auckland, New Zealand

Biography:
Angie Zhu is a third-year undergraduate student at The University of Auckland, pursuing a Bachelor's degree in Biological Sciences. She is currently working on a research project in Dr Anne Gaskett's lab, exploring visual signals in flowering plants, with a focus on how changes in the floral colour of Lantanas impact pollinator perception. Angie is also keenly interested in behavioural ecology and the role of biodiversity in shaping ecological interactions.

Flowers often use colours to attract animals for pollination and signal a nectar reward. Animal perception of colours varies depending on their types of photoreceptors and how they are tuned to different colour wavelengths, but also the surrounding colours and backgrounds . The invasive plant species *Lantana camara* has flowers that change colour with age, leading to various colours within each inflorescence. This could be a strategy to improve pollinator efficiency by directing insects to flowers that have not yet been pollinated. Studies have suggested that pollinators of *L. camara* are more attracted to unpollinated yellow flowers, and that only yellow flowers have nectar. However, instead of directing animals to specific flowers, could floral colour change enhance the detectability of the entire flower cluster by creating a target shape against the leaves?

To test this, I have measured the nectar, morphological features and spectral reflectances of *L. camara* flowers from plants that have three colours (new yellow flowers, older orange flowers and the oldest red flowers) and modelled them into the vision systems of bees and butterflies, two main pollinators of *L. camara*. I test for pollinator ability to detect flower colours at close range (using chromatic contrast) and from a distance (achromatic contrast). Interestingly, all flowers had nectar. This study will help enhance our understanding of how floral colour changes impact the detectability of flower clusters, the importance of considering achromatic aspects of visual signalling, and the different pollination strategies used by flowering plants.

Distributions and ecology of alpine skinks and geckos in the Kahurangi National Park

Ms Anna Zrinyi-Morgan[1], Dr Jo Monks[1]
[1]University Of Otago, Dunedin, New Zealand

Biography:
Anna Zrinyi-Morgan is a Master of Science student studying through the University of Otago investigating the distributions and ecology of alpine lizards in the Kahurangi National Park.

Alpine zones in Aotearoa New Zealand are home to a number of lizard species, and these species are often understudied compared to their lower elevation relatives. The inaccessibility of many alpine zones can greatly restrict survey effort, impacting ecological knowledge and delaying appropriate conservation management for threatened and at risk species. The Kahurangi National Park (north-west South Island) is known to have several alpine lizard species, namely the Kahurangi gecko *Woodworthia* "Mt Arthur'', black-eyed gecko *Mokopirirakau kahutarae*, Newman's speckled skink *Oligosoma newmani*, and the more recently described and "Nationally Critical" Kahurangi skink *Oligosoma kahurangi*. However, to date there has been limited survey effort in the alpine Kahurangi. We aimed to improve understanding of current distributions and habitat usage of these species. Systematic surveying was undertaken over two summer periods primarily on the eastern and north-western ranges. We resurveyed areas with historical records and habitat between known locations. We collected data on lizard species and habitat characteristics in both sites where lizards were detected and randomised absence sites within search areas. Kahurangi geckos were well distributed across the eastern ranges, speckled skinks in isolated populations of various sizes across both western and eastern ranges and Kahurangi skinks in two sites on the Douglas Range. We documented range extensions and found new populations, adding to distribution Information important for conservation status assessments. The comparison of habitats types allows us to identify key features and differences in geology, plant community and refugia availability improving our understanding of the potential drivers of lizard distributions.

Impacts of Cyclone Gabrielle on Aotearoa New Zealand ecosanctuaries

Dr Warwick Allen[1], Dr Sarah Richardson[1]
[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand

Biography:
Warwick Allen (Manaaki Whenua – Landcare Research) is a community ecologist based in Ōtautahi Christchurch. His research interests are wide-ranging but coalesce around a desire to understand and mitigate the impacts of global change on indigenous ecosystems and species.

Tropical cyclones inflict widespread and severe destruction to natural ecosystems. As well as direct effects, cyclones can also have indirect effects via their impacts on conservation infrastructure and activities. Cyclone Gabrielle was a Category 3 tropical cyclone that affected Aotearoa New Zealand between 12-14 February 2023. In this presentation, we profile the impacts of Cyclone Gabrielle on 65 North Island ecosanctuaries. Specifically, we describe 1) the frequency of different types of cyclone damage experienced by ecosanctuaries, 2) the range of impacts on conservation infrastructure and activities, and 3) recommendations to help ecosanctuaries prepare for future extreme weather events. Damage from wind (91% of ecosanctuaries) and erosion (85%) was widespread, followed by inundation (47%) and sediment deposition (32%). Sixty-five percent of ecosanctuaries suffered multiple types of impacts on conservation infrastructure or activities. Impacts on infrastructure (e.g., predator-proof fences, buildings, roads, trails) were most widely reported and often paired with disruption to conservation activities such as pest control, restoration plantings, and native species monitoring. Perhaps most crucially, 40% of ecosanctuaries that maintain a predator-proof fence reported that their fence was compromised. Cyclone damage can also lead to longer term problems, including ongoing management of pest incursions, loss of access to management areas, reduced capacity of the paid and volunteer conservation workforce, and opportunity costs associated with recovery instead of progress. We conclude with several management recommendations focussed on planning and preparation, rapid response, and recovery.

Impacts of Cyclone Gabrielle on shorebird populations and riverbed habitats on Hawke's Bay's braided rivers

Ms Annabel Beattie, Mr Nikki McArthur[1], Warwick Allen[2], Sarah Richardson[2]
[1]Independent Ecologist, Blenheim, New Zealand, [2]Manaaki Whenua Landcare Research, Christchurch, New Zealand, [3]Hawke's Bay Regional Council, Napier, New Zealand

Biography:
Nikki is an independent ecologist who has spent fifteen years working in New Zealand's local government sector, helping to design and deliver biodiversity research and monitoring programmes in terrestrial and freshwater ecosystems throughout New Zealand. Nikki has had a particular interest in monitoring the indigenous shorebird populations of the lower North Island.

In the coming decades, human-induced climate change is predicted to cause an increase in the strength and intensity of ex-tropical cyclones tracking over the North Island of New Zealand. Cyclone Gabrielle was one such ex-tropical cyclone that struck the North Island in February 2023, bringing heavy rainfall and record flooding to Hawke's Bay. The braided rivers of Hawke's Bay support internationally and nationally significant breeding populations of indigenous shorebirds, including several species that have been seriously impacted by flooding associated with Cyclone Gabrielle. Shorebird census counts carried out since 2019 have found that the number of pohowera / banded breeding on Hawke's Bay rivers declined by 15% following Cyclone Gabrielle, and black-fronted dotterel numbers declined by 30%. The number of poaka / pied stilts declined by 16% and tōrea / SI pied oystercatcher numbers declined by 43%. Following the cyclone, riverbed vegetation cover declined along 96% of river sections that were surveyed, and large increases in the percent cover of fine substrates was also recorded. Local shorebird densities had an inverse relationship with riverbed vegetation cover, but relationships between shorebird densities and substrate composition were less clear. These results provide some of the first quantitative evidence that extreme weather events exacerbated by human-induced climate change can lead to catchment- and regional-scale declines in populations of indigenous riverbed-nesting shorebirds in New Zealand.

Overview of cyclone ecology in New Zealand and globally

Dr Peter Bellingham[1], Dr Sarah Richardson[1], Dr Warwick Allen[1]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand

Biography:
Peter Bellingham is a forest ecologist who has worked on cyclone disturbances and their long-term consequences in tropical and temperate forests.

Tropical cyclones are evolutionary pressures that shape the structure, composition, and function of ecosystems in the latitudes where they occur frequently. New Zealand is outside the zone of frequent cyclone disturbance so that we are apt to treat the effects of any given cyclone as catastrophic. Here, we review the effects of historic cyclones on New Zealand's ecosystems, especially its natural forests, and show that these infrequent disturbances have been important agents of regeneration. Reconstruction of past events is only so helpful given today's multiple components of global change. Climate change and warmer oceans are taking cyclones of unprecedented intensity to higher latitudes, including New Zealand, where a new disturbance regime could transform ecosystems. Effects of cyclones on New Zealand ecosystems have already shown interactions with anthropogenic pressures. The viability of fragmented ecosystems to cyclone disturbance is unknown, especially in interactions with surrounding land uses that often have poor cyclone resilience. After cyclones, the resilience of ecosystems dominated by native species may be undermined by input of nutrient-rich sediment, weed invasions, effects of browsing mammals, and other interactive effects that could promote subsequent disturbances like fire and further erosion. The resilience of native forests to future cyclones could be similarly undermined by logging of snapped and uprooted trees. To predict effects of a future cyclone disturbance regime on our ecosystems we need to learn from our own history of cyclones, to learn from cyclone studies internationally, and to expect interactive effects with biological invasions and other kinds of disturbance.

Wetland resilience and services

Mrs Jess Copsey, Ms Annabel Beattie[1]
[1]Hawke's Bay Regional Council, Napier, New Zealand

Biography:
Annabel is the Biodiversity Team Leader at Hawke's Bay Regional Council, but previously worked with Jess as a Senior Terrestrial Ecologist helping to run the State of the Environment wetland monitoring programme. Her work in this area now focuses on leading a team working with landowners to protect and restore wetlands and other ecosystems, which benefits hugely from the insights our monitoring programme provides.

Jess is in charge of running the Council's wetland State of the Environment monitoring programme which includes vegetation, soil, bird, condition and water level monitoring across a range of wetland types throughout the region. She also is responsible for working with other parts of Council to provide technical advice around wetland delineation, monitoring and restoration, particularly to our Consents and Compliance teams.

Widespread inundation and sedimentation associated with Cyclone Gabrielle in February 2023 had significant impacts on wetland ecosystems in Hawke's Bay. In collaboration with Manaaki Whenua-Landcare Research, 22 wetlands in the Hawke's Bay Regional Council State of the Environment monitoring programme were revisited in the months after the cyclone to collect data on ecological impacts and allow comparison with baseline data. Monitoring results have shown an overall decline in wetland condition, driven largely by ecosystem intactness and physico-chemical parameters. Results do also show the resilience of wetland ecosystems to extreme weather events and their provision of ecosystem services. This role is being further quantified through a modelling project to investigate how wetlands and other nature-based solutions may change runoff coefficients and the impact of this on peak flows. The cyclone has also led to new challenges in wetland management, with questions arising over consenting requirements for silt removal and disposal, and changes in wetland extents as a result of the cyclone. This presentation shares some of our experiences and learnings around the impact of this devastating event on our region's wetland ecosystems and their associated resilience and ecosystem services.

A spatial assessment of damage to native ecosystems from Cyclone Gabrielle

Dr James McCarthy[1], Dr Warwick Allen[1], Dr Sarah Richardson[1]
[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand

Biography:
James is a plant 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 important ecosystem functions and make predictions for how these will be affected by events such as storm damage, disease outbreak, and 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 in 2017.

Cyclone Gabrielle was a tropical cyclone that occurred between 12 and 14 February 2023 which caused severe damage to a substantial proportion of the east coast of the North Island. Evidence suggests that with climate change the strength, and possibly frequency, of these extreme weather events is likely to increase. Ecosystem damage from Cyclone Gabrielle was primarily caused by flooding and inundation, deposition of material, and the direct effect of wind on forest canopies. We assessed the extent of these impacts across various native ecosystems using spatial data sets that quantified cyclone damage based on satellite imagery captured before and after the event. Impacts to (primarily) native ecosystems were derived from existing spatial maps including the Land Cover Database (LCDB), Ecosat Forests, the Protected Areas of New Zealand, the Freshwater Ecosystems of New Zealand (wetlands layer), a map of wetlands from Hawke's Bay Regional Council, QEII National Trust Covenants, and the River Ecosystem Classification. Our results showed that damage overall was low (but with isolated patches of far greater damage) in areas where native ecosystems were present, in comparison to the widespread damage reported for production systems like exotic pasture. Damage was greater in flatter areas which are more prone to flooding and sediment deposition, in areas closer to waterways, and in earlier successional forest types. These results highlight the crucial services provided by mature native forests in maintaining landscape-level resilience to large-scale extreme weather events.

Impacts of Cyclone Gabrielle on freshwater and coastal ecosystems

Becky Shanahan[1]
[1]Hawke's Bay Regional Council, Napier, New Zealand

Biography:
Becky is a coastal ecologist who has worked as a technician at University of Canterbury and Victoria University of Wellington ultimately getting her PhD. She found her interest in applied coastal ecology during her time on the marine ecosystems team at DOC and has been working at the Hawke's Bay Regional Council as a coastal scientist and now team leader of the freshwater and marine science teams.

Cyclone Gabrielle unleashed up to 501mm of rain in Hawke's Bay in 24 hours causing substantial flooding impacting life, property, infrastructure, and the natural environment. Vast amounts of sediment were washed into rivers and deposited in nearshore coastal waters. Receding floodwaters left silt not only on floodplains, but also in rivers, streams, lakes, estuaries and the coast. Silt was resuspended each time it rained meaning both river and coastal waters were turbid for months following the Cyclone. While significantly fewer macroinvertebrates were left in rivers and streams after the event, sensitive species remained at many sites at lower abundances. Using eDNA to detect fish presence, responses to the cyclone were variable across sites and species with substantial impacts observed at some sites and minimal impacts at others. In Lake Tūtira, sediment cores showed ~60cm of Cyclone Gabrielle sediment, like that deposited during Cyclone Bola. Mud content and organic matter content was variable across estuary sites but were similar within sites highlighting the varied impacts across estuaries. At some sites, sediment was continuing to accumulate over one year after the Cyclone. Patterns of estuary infauna abundance were also variable with some sites showing decreasing richness and others no discernible trend. However, sites with the highest mud count also had the lowest richness. Continual monitoring of both rivers, streams, lakes, and coastal ecosystems will help us understand the extent ecological functioning was disrupted and the how long recovery of these systems takes.

Perception and Reality: Building iwi momentum for 1080 and deer culling consent

Ms Ora Barlow[1], Mr Wiremu Wharepapa[1]
[1]Raukumara Pae Maunga / Save the Kiwi/ Te Whanau-a-Apanui, te kaha, New Zealand

Biography:
Ora Barlow and Wiremu Wharepapa have been instrumental in building the momentum for iwi consent in the 1080 operation for Raukūmara Forest - the largest 1080 programme in the North Island of 116,000 hectares.

Ora is one of the Te Whanau-a-Apanui Governors for Raukumara Pae Maunga and works for Save the Kiwi in national engagement with Iwi/hapū. Wiremu works for Raukumara Pae Maunga and Save the Kiwi as a pou tangata - supporting iwi/whānau to connect with their taiao.

The Raukūmara Forest is the last of the largest contiguous landscapes from the Mountain to the Sea and part of the backbone of mountain ranges through the north island. It was also forgotten and had had no largescale pest control up until 2022. Raukumara Pae Maunga now operates the largest deer culling programme in the north island and the largest 1080 programme in the north island. This korero takes people on the journey of how this happened - the engagement, the political influences, the deep wananga and discussions with their people to distinguish between perception and reality and what it takes to connect our people to heal our forests.

Providing a trusted platform for conversations and information in a post-truth world

Professor Amanda Black
[1]Bioprotection Aotearoa, Lincoln, New Zealand

Biography:
Amanda Black is a professor of environmental soil chemistry and biochemistry at Lincoln University. She is also co-director of Bioprotection Aotearoa – a national centre of research excellence that conducts research framed by Māori values to improve the resilience of our ecosystems.

Her research explores the relationship between gene expression and soil productivity, including carbon storage, halting kauri dieback, and biosecurity and climate change issues that are of concern to Maori and indigenous communities.

She has a strong background incorporating mātauranga Māori into research and has recently held Ministerial appointments with DOC, MFE, MoE, and MPI.

It is becoming increasingly difficult for communities, stakeholders, and rights-holders to know what information is meaningful and trustworthy. How can researchers contribute to the arena of 'ideas' and support healthy conversations about new information?
In recent research, my co-authors and I discussed the merits of teaching Indigenous knowledge in the classroom and Indigenous data sovereignty. We aimed to re-open contentious conversations within the peer review system as, although flawed, peer review is still our most robust measure of quality. We highlighted an overlooked and ongoing historical issue that Indigenous communities and those working with them face when trying to exert data sovereignty.
The reactions to these conversations were both predictable and unpredictable. Predicable in that some were unmoved in their assertion that we were discrediting one or the other form of knowledge generation. Unpredictable as we received more public interest and engagement from Māori media than from the research community. This highlights how researchers often celebrate the acquisition of new knowledge, while people outside of research celebrate information that reaffirms their values. Here I'll discuss how we as researchers get our work to our intended audiences.
How do we continue to have inclusive conversations? Researchers need to recognise those challenges, and not be afraid to make mistakes in articulating information to audiences they are not used to speaking with. Not everyone gets it right the first time and feedback can be harsh. But taking turns at being the messenger can help share the load and normalise research in everyday conversations.

Who is really to blame for wilding conifers?

Dr Thomas Carlin
[1]Scion Research

Wilding conifers are some of Aotearoa's worst weeds. They affect high- and low-country and invade multiple land types affecting their productivity and conservation value. Conifers were originally introduced into Aotearoa in the 19th century to support a growing forestry industry and were widely planted throughout the country as amenity trees, in shelterbelts, to stabilise eroding soils, and as timber plantations. Of the species introduced, 19 species became significant invaders recognised by the National Wildling Conifer Control Programme—spending over $160 million since 2016 on their management. So, are early foresters to blame for this epidemic? Or perhaps farmers and land managers who helped spread trees across the country? What role does the government (both past and current) hold in this? As usual, the truth is murky. In this talk I'll explore some of the drivers of wilding pine introduction and spread in Aotearoa—including the roles of the present-day forestry industry, historical plantations, and their subsequent spread. The drivers of wilding conifer spread are species-specific, with some being actively planted to this day and others prohibited under the biosecurity act. With this, I hope to clear up common misconceptions and highlight areas where ecologists can greatly contribute to the wider management of these species under a changing climate.

Are natural forests really 40 times better than plantations for fighting climate change?

Dr Steve Wakelin[1]
[1]Scion, Wellington, New Zealand

Biography:
Dr Steve Wakelin is part of the Silviculture and Forest Carbon team at Scion, and is an expert in carbon sequestration, forest management, and land use planning. A large component of his research is around the greenhouse gas emissions and sequestration of forestry in New Zealand, including the development of carbon accounting models.

There is heightened interest in New Zealand in the relative merits of alternative land uses and the role of forests in climate change mitigation. Policymakers faced with evaluating the complex environmental, cultural, social and economic trade-offs need objective evidence to inform their decisions; advocates for a particular outcome do not. Scientists tasked with providing objective evidence are only human - they can also become advocates out of personal beliefs or economic necessity. From decisions on what to research, to decisions about how to frame the research findings and disseminate the results, scientists shape how the debate plays out, whether consciously or sub-consciously. Intermediaries between scientists and policymakers can have a greater impact, including research grant assessors, journal reviewers, editors and publishers, research organisation managers and communications staff, media representatives, advocacy groups, the public and politicians. A well-run campaign can make implementation of research findings politically impossible, or inevitable. This presentation traces some public contributions to the land use debate in New Zealand back to the source material, to identify points at which information may have strayed into misinformation.

How do we have community conversations about contested environmental issues?

Dr Marie McEntee, Associate Professor Fabien Medvecky[2], Dr Vicki MacKnight[3]
[1]University of Auckland, Auckland, New Zealand, [2]The Australian National University, Canberra, Australia, [3]University of Otago, Dunedin, New Zealand

Biography:
Marie is a social scientist in the School of Environment with teaching and research interests in science / society interactions particularly relating to complex socio-environmental issues. Her research principally focuses on public engagement in science, science communication, and science and technology studies.

Before joining the University of Auckland, she worked in the public and commercial health sectors. After graduating with a BA, she became a qualified nurse before moving into the pharmaceutical industry and advancing over eight years to national sales management. During this time she developed a strong interest in science communication.

The potential use of genetic technologies to support New Zealand's natural environment, while complicated and contentious, is an area that requires citizen engagement to support responsible decision making. This is made more pertinent given the coalition government's recent move to review and reset regulations surrounding gene technology's use in New Zealand. Complex conversations such as those on genetic technologies, must provide opportunities to involve, listen to, and understand a diverse range of perspectives. Underpinning dialogue of controversial technologies is a recognition that innovation is not just technology but is driven by people's values and their visions for the type of world they wish to live in.

In this setting we held a broad national dialogue with New Zealanders about gene technology's use for environmental purposes. Such a dialogue, required a careful methodological approach to foster open, honest, thoughtful and respectful conversations. Here we present the methodology we developed for this large scale national dialogue. Our three phase method: Explore, Refine and Deliberate (ERD) acted as an iterative process that was responsive to both public perspectives and realistic ecological and technological possibilities. The paper presents the ERD method, and examines how it enabled people to engage in inclusive and informed discussions about current and future genetic technologies. We argue this process is well suited to other dialogues and deliberations of socially contentious science and technology issues.

Potential uses of gene editing in ecology, public engagement and regulatory challenges

Dr Glenn Thorlby[1]
[1]Scion, Rotorua, New Zealand

Biography:
Glenn completed a PhD in Plant Molecular Biology at the University of Birmingham, UK, and pursued research and teaching across several UK universities. Since joining Scion in 2009, he has led biotechnology research that has focused on enhancing the productivity, resilience, and sustainability of New Zealand's planted forests. This has included developing gene editing technologies for conifer species, including projects to develop sterile trees as a possible tool to prevent wilding spread. He actively engages in the national conversation on gene technologies, working with stakeholders to promote the responsible advancement of biotechnology in New Zealand.

In the past decade, gene editing technologies, such as CRISPR, have been increasingly used in plant breeding, resulting in several consumer products now on the market. This growth has been driven by global regulators increasingly treating gene-edited plants in the same way as those developed by traditional breeding, easing their path to adoption and considerably lowering costs. Recently, the New Zealand government announced plans to introduce legislation to deregulate certain gene editing applications, enabling broader use, including potential environmental benefits.
Research underway at Scion that aims to develop sterile exotic conifers that could be planted without the risk of generating new wildings, exemplifies this potential. The use of sterile trees will require both enabling regulations and societal acceptance. Recent public engagement suggests whilst there is support for such innovations, many New Zealanders feel uninformed about gene editing technology, highlighting the need for continued and wide public engagement.

Community Outrage and Risk Estimation. Why 1080 is scary and how best to dispel myths and misinformation?

Mr Dale Williams[1]
[1]Bay Of Plenty Regional Council, Rotorua, New Zealand, [2]Kaharoa Kokako Trust, Rotorua, New Zealand

Biography:
Most of his career has been in or around the native forests of the Central North Island. In 1980 he started as a Technician with FRI and later Manaaki Whenua, working on indigenous forest ecology, threatened species and pest management.

From 1993 to 2010 he worked for DOC, on pest animal management, a national training programme, DOCs Pesticides Advisory Group, and he project managed the eradication of cats, kiore and Norway rats from Tūhua (Major Island)

Currently a Biosecurity Officer with the Bay of Plenty Regional Council and the Wallaby Management Team (Tipu Matoro). Dale volunteers for the Kaharoa Kōkako Trust.

Peter Sandman's book "*Responding to Community Outrage: Strategies for Effective Risk Communication*", delves into the issue of industrial pollution, where some industries profit while potentially harming the environment, the community believe that they carry the risk, while they see the government regulators as being ineffective or in the industry's 'back pocket'.
In New Zealand the 1080 story is worse, because some members of the community see the government as the polluter and the regulator.
Sandman points out that when "Community Outrage" is low, people underestimate risk. This is why governments try to increase outrage about issues such as drink driving and smoking, so that people take these risks seriously.
When "Community Outrage" is high people overestimate risk. This is why many people find 1080 scary.
Sandman lists 10 components that influence outrage. In this presentation the author relates these components to the 1080 situation, then investigates how involving the community in the management of pest control operations is probably the only way to dispel myths and misinformation about 1080.
The author uses the Kōkako Recovery Programme as an example of where community groups, through highly successful pest control, including the use of 1080, has shifted the threat status of this species and exceeded the national recovery target of 2000 pairs of kōkako.

Supported by:

Changes in the Ecological Integrity of urban forest remnants in Auckland City 2009 - 2023

Dr Craig Bishop[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Craig is currently a lecturer at AUT - Auckland University of Technology where he contributes to teaching in plant taxonomy, environmental science and ecology. He has been in that role for the last five years. Prior to AUT, Craig has had a varied career working as an ecologist & terrestrial biodiversity specialist for several different environmental consultants, Auckland City Council and Auckland Council. The data he is presenting today relates to his time as the Forest Biodiversity monitoring specialist at Auckland Council

Auckland has a rich diversity of urban forest ecosystems within the city limits. These include examples of at least twelve different regional ecosystem types encompassing over 1,000 ha of indigenous scrub, shrubland and forest. Unsurprisingly, these remnants have been highly impacted by habitat loss and fragmentation, and the depredations of invasive weeds, pests and pathogens over the past few hundred years. This paper presents change data over the 2009 – 2023 period from a network of c. forty 20m x 20m vegetation plots established in urban forest remnants within the Auckland Metro Area by Auckland Council Biodiversity Staff and contractors. All plots are within indigenous urban forest remnants on public land and provide a representative sample of locations across the Auckland Metro area. Plots were established using methods the closely followed the 'standard' 20m x 20m approaches & comprise basal area measures, stem, and sapling & seedling counts. We provide data on the species richness, diversity, basal area, structure and weediness/ naturalness of Auckland's urban forest, and how these have changed between the baseline and 10-year re-measures. We also compare the ecological integrity of Auckland's urban forest remnants with large tracts of indigenous forest in other locations within the Auckland Region (e.g. Waitakere and Hunua Ranges).

Bridging the Gap: Priorities, concerns, and compromises amongst urban forest stakeholders

Dr Thomas Carlin[1]
[1]Scion, Christchurch, New Zealand

Biography:
Tom Carlin is an invasion ecologist based at Scion. His main research focuses on understanding the circumstances facilitating reinvasion of invasive conifers in Aotearoa, but is also involved in modelling the spread of pests, pathogens, and weeds under climate change. Recently Tom began developing an urban forest research programme within Scion and was the lead organiser of the successful Urban Forest Futures New Zealand event in April 2024. Tom is also the New Zealand Ecological Society Newsletter Editor as well as contributing to the society's social media presence.

Aotearoa is globally heralded for its clean, green, iconic land- and city-scapes, but it faces its own challenges in establishing and maintaining effective urban forests. Following the inaugural *Urban Forest Futures New Zealand* symposium, this talk summarises both the successes and the issues raised by attendees. This first of its kind event in New Zealand brought together 110 researchers, arborists, council workers, indigenous peoples, and urban planners for two days in April 2024. All sharing a common-goal, these stakeholders aim to improve our urban forest initiatives, but face hurdles when integrating across disciplines and being stone-walled by existing policy, or the absence of effective policies. Here we aimed to understand the 1) priorities, 2) challenges, and 3) suggestions for improving urban forests in the future from each stakeholder group. We find that stakeholder groups tend to have distinct priorities, but still acknowledge and care for the initiatives of other stakeholder groups. Despite these differences in priorities, the challenges that slow progress towards establishing thriving urban forests are often similar, including: a lack of funding, lack of political will, lack of understanding on the benefits of trees, missing key information, and more. We synthesise the learnings from these stakeholders and propose a framework to improve urban forests for the betterment of Aotearoa. This proposed framework suggests collecting new information, developing efficient (not bureaucratic) policies to support tree establishment/maintenance, engaging with urban foresters and mana whenua from project fruition, and developing resources to share information across stakeholders and the general public.

Empowering communities as the foundation for effective citizen science

Ms Abigail Cunninghame[1]
[1]Pest Free Howick Ward, Howick, New Zealand

Biography:
Abigail is the Project Manager for Pest Free Howick Ward (PFHW), an environmental organisation based in Tāmaki Makaurau. Abi's recent Master's Thesis evaluating Greenspaces in Primary Schools has proved invaluable in her role with PFHW and their many projects working with schools and communities. She is a vocal advocate for collaboration and effective communication in science so that more than just scientists can work together to improve the natural environment across Aotearoa.

Urban ecology is about more than just the natural environment within our cities—it's about the people who live there and their connection to the land. Citizen science plays a crucial role in expanding ecological efforts beyond professional scientists by involving everyday people in conservation. At Pest Free Howick Ward, empowering our community is the first step in ecological management through citizen science.

At PFHW, the foundation of our mission to restore and protect urban biodiversity begins with empowering our community. By fostering commitment and passion, we create the essential groundwork for effective citizen science, enabling precise data collection and its replication across different projects.

Our programs, including the Moth Plant Pod Competition, Native Trees for Native Birds, and Threatened Species Projects, are not about gathering data—they're about engaging and empowering the Howick community to take meaningful action. These initiatives equip residents, particularly younger students, with the tools and knowledge needed to understand the impact of invasive species and the importance of native biodiversity.

The success of Pest Free Howick Ward's initiatives underscores that the real power of citizen science lies not just in data collection, but in the empowerment of the community. By nurturing commitment and passion, we are laying the groundwork for robust, effective citizen science that can be replicated and scaled. As we look to the future, continued community empowerment will be key to sustaining and expanding our conservation successes across Aotearoa.

Bat Box Monitoring: Testing the Efficacy of eDNA and Other Contemporary Methods

Ms Fiona Davies
Ecology Practice Lead, AECOM NZ

The native long-tailed bat (*Chalinolobus tuberculatus*) is a threatened ('Nationally Critical') species with known populations in Hamilton, New Zealand. Eighty bat boxes were installed on trees by Hamilton City Council (HCC) as part of their bat management approach for the Southern Links Project in South Hamilton. One of the biggest challenges in deploying the bat boxes was showing that the boxes were being utilised by bats for roosting, thereby ensuring successful mitigation of the local bat population.

Various survey methods to monitor the bat boxes were employed including visual assessment, endoscope surveys and thermal imaging. The innovative approach of eDNA sampling was also used where the entrances of bat boxes were swabbed. In NZ, eDNA is most commonly used in the freshwater environment to detect fish species and hasn't been used in this way before to detect long-tailed bat DNA. The results of the survey showed that the eDNA method was the most effective monitoring method and long-tailed bat DNA was detected at 34% of the boxes sampled and confirmed they were using the boxes. At boxes where eDNA was detected, 80% of the boxes were also consistently confirmed by other survey methods. This demonstrates that the false positive/negative occupancy detection rates are likely minimal. Studies like this are essential for confirming the effectiveness of bat boxes as a tool for mitigation and are integral for the ongoing protection of this iconic native species.

Do cats still play when the rats are away? The impact of selected predator control on invasive mammalian predators in an urban environment.

Angela Knight[1], Professor Yolanda van Heezik[1], Dr Jo Carpenter[2]
[1]University Of Otago, Dunedin, New Zealand, [2]Manaaki Whenua Landcare Research, Dunedin, New Zealand

Biography:
Ange Knight is a final year MSc (Ecology) student at the University of Otago. She has a passion for New Zealand's native wildlife and a desire to contribute to the conservation of our indigenous species through applied research. Her research interests include urban ecology, rewilding, reintroductions and restoration within a broad overarching umbrella of wildlife and conservation ecology. She also has a (not very secret) passion for wild felids and although no such native animal exists in New Zealand, hopes to have the opportunity to undertake conservation work that benefits them overseas at least once in her career.

The control of invasive species is a common tool utilised in indigenous wildlife conservation in natural and urban areas. Urban ecosystems are complex, and it is not often clear how the interactions between invasive species and native fauna might change when some, but not all, invasive predators are controlled in our cities. Under rat suppression, domestic cats, for example, may suppress house mice that might otherwise increase in the absence of rats, or they may prey switch to more native taxa. I examined how controlling rats and possums in Dunedin affected non-target mammalian predators. I studied the predation and ranging of domestic cats before and after rat control and reviewed three years of monitoring data for rats, mice and hedgehogs in areas with and without rat and possum control. Cat predation and ranging did not change following rat control. Analysis of the three years of monitoring data indicated that the relative abundance of rats decreased when and where rat control occurred, but mice and hedgehogs remained unchanged. My findings suggest that the suppression-only regime in Dunedin, common across New Zealand's urban areas, is making little difference to the number of, and interactions between, cats, mice, rats, and hedgehogs in urban centres. In cities with a similarly low density of rats as Dunedin, rat control may have little effect on non-target predators or native wildlife.

Analysing trends in lizard mitigation translocation methodology across New Zealand

Ms Diana Methner[1], Dr Christopher Woolley[1,2], Professor Nicola Nelson[1]
[1]Victoria University Of Wellington, New Zealand, [2]Zealandia Te Māra a Tāne, , New Zealand

Biography:
Diana is a PhD student at Te Herenga Waka - Victoria University of Wellington where her thesis is focused on the conservation of lizard biodiversity and improving the outcomes of mitigation translocations. She obtained her Master's working with threatened freshwater turtles in the United States before moving to New Zealand. Diana is passionate about the conservation of at-risk reptiles and hopes to continue working with these valuable species further into her career. You can find her thriving on a rainy day with a book and cinnamon roll in hand.

Over 100 endemic species of lizards (skinks and geckos) inhabit New Zealand, though many are threatened by habitat destruction that occurs due to land use changes, often related to urban development. A common method used to mitigate the impact of habitat destruction or disturbance on lizards involves salvage and translocation: moving lizards to suitable habitat where they can establish viable populations. The Department of Conservation (DOC) has identified key principles for encouraging translocation success which includes preparing release sites using habitat enhancements and control of mammalian predators. However, these guidelines are subjective, and field methodology and preferences likely vary among ecologists. Using records of completed translocations obtained from DOC, I analysed trends in mitigation translocation methodology across New Zealand to determine where translocations are taking place and what methods are currently employed. Since 2012, approximately 75% of lizard translocations have occurred in three New Zealand regions with almost half of translocations occurring in just three districts. Of 77 completed translocations, mammalian predator control was planned in approximately 70%, release site planting enhancements in 50%, rock pile enhancements in 35%, and log pile enhancements in 25%. However, the specific design for each of these methods varies across projects. This variability provides a research opportunity to develop an evidence base that could contribute to best practice for lizard mitigation translocations. Standardisation of best practices will facilitate nationwide comparisons of translocations and ensure efficiency of methods since salvages often occur on tight timelines, leaving little time for planning and release site preparation.

Urban gateways: the role of cities in invasive species risk and response

Dr Nicolas Meurisse[1]
[1]Scion (NZ Forest Research Institute), Rotorua, New Zealand

Biography:
Nicolas Meurisse leads the Forest Ecology and Management team at Scion (NZ Forest Research Institute). He is also a long-term member of the science management Committee of the Better Border Biosecurity (B3) research collaboration.

Nicolas expertise areas are in pest invasion ecology and forest entomology, with 15 years of expertise in forest biosecurity and spatial risk modelling. At Scion, he played a key role in implementing the Forest Biosecurity Surveillance (FBS) system, a key nationwide surveillance network supporting the Government Industry Agreement (GIA).

Cities act as critical entry points for invasive species due to the large influx of imported goods and the constant flow of international travellers passing through ports, airports, and surrounding urban and peri-urban areas. Once introduced, many invasive species find favourable conditions in urbanised environments, where diverse hosts, microclimates, and other habitat features enable their population growth and spread.

With global change, it is anticipated that invasive species from warmer, tropical regions will increasingly thrive, due to the growing variety of available host species and other factors such as intensifying urban heat islands. Introductions of new pests and diseases into urban and peri-urban forests presents three main challenges: (i) a reduced ability to deliver essential ecosystem services, which impacts human well-being and other socio-economic consequences; (ii) risks to public safety from weakened trees or branches falling due to infestations, and direct health hazards posed by other species such as stinging insects and disease vectors; and (iii) the potential spread of highly damaging insects and pathogens into adjacent agricultural lands, forests, and natural ecosystems.

In this presentation, we explore the biosecurity risks facing urban forests and assess our current strategies for preventing and managing future biological invasions. Key solutions include enhancing our surveillance systems for early detection, developing comprehensive incursion response and eradication plans, and implementing long-term management strategies. Enhancing resilience in urban forests may involve selecting well-adapted species for planting and promoting diversity to strengthen resistance to both abiotic and biotic disturbances.

Biodiverse residential spaces in a densifying city: policy challenges and a biodiversity assessment tool

Miss Jacqueline Theis, Professor Yolanda van Heezik[1], Dr Chris Woolley[3], Professor Claire Freeman[2], Dr Danielle Shanahan[3], Associate professor Maibritt Pedersen Zari[4]
[1]University of Otago, Dunedin, New Zealand, [2]Victoria University of Wellington, Wellington, New Zealand, [3]Zealandia Te Māra a Tāne, Karori, New Zealand, [4]Auckland University of Technology, Auckland, New Zealand

Biography:

Yolanda is a professor in the Zoology Department at the University of Otago in New Zealand, where she has taught conservation biology and wildlife management. Her research interests include urban ecology, biodiversity of private gardens, residential developments, urban green spaces, and people's interactions with nature. She is also involved in research on mammalian invasive species, and marine bird ecology with a focus on penguins.

Jacqui is a PhD Ecology student at the University of Otago, dedicated to understanding how urban environments can enhance biodiversity and improve urban living. Her research focuses on developing biodiversity assessment tools and studying invertebrate colonisation in urban areas to inform urban planning and conservation efforts.

Chris is interested in reptile conservation and the relationship between people and wildlife living in cities. His research investigates where different lizard species live in New Zealand cities and what can be done to promote populations. He is also investigating the potential for 'backyard' lizard monitoring, both to aid the conservation of urban-dwelling lizards and as a way to engage urbanites in conservation.

Claire's main research interests are in the field of Environmental Planning, in particular, planning for and with children and young people, planning and diversity, sustainable communities and places, and conservation planning with a focus on urban biodiversity. Her work is interdisciplinary, working with colleagues from zoology, ecology, education, geography, landscape architecture, architecture, development studies and other disciplines. Her research focuses mainly on the Pacific Realm with several projects working with Pacific Island colleagues in New Zealand and Samoa.

Dr Danielle Shanahan is a conservation researcher and practitioner, having made significant advances in both generating on-ground outcomes for biodiversity, and also in quantifying the benefits of improvements in nature for people's social, physical and mental wellbeing. Danielle is currently Chief Executive at Zealandia Te Māra a Tāne (a 225ha ecosanctuary), and Adjunct Professor at Te Herenga Waka Victoria University of Wellington. Danielle led Zealandia's restoration efforts for many years, and now has been growing Zealandia's efforts to support businesses to take action for the places where they live and work.

Maibritt's research seeks to redefine sustainable architecture and urban design through mimicking ecosystems, changing the goals from sustainable to regenerative development, and integrating complex social factors into sustainable architectural design. Her current research explores how understanding ecosystem services can be used to define tangible ecology-based metrics for sustainability assessment or design goals in the urban built environment with particular regard to how climate change and continued loss of global biodiversity will affect architecture and communities.

Residential areas make up about three-quarters of the built area of NZ's cities, and in traditional-style suburbs, around 46% of the residential area comprises vegetated garden areas: these gardens make a significant contribution to biodiversity across the urban area. However, the National Policy Statement on Urban Development (2020) heralded a move towards higher-density urban living (medium-density), both "up" and "out" across NZ cities, with significant consequences for urban biodiversity as garden size is substantially reduced. Here we describe several case-studies which explore the consequences for biodiversity of the move to medium-density development, and the extent to which policy currently supports the protection and enhancement of biodiversity in residential areas. We describe a biodiversity assessment tool (The New Zealand Biodiversity Factor) which we have developed to educate and incentivise developers, urban planning and design professionals on strategies to support and enhance biodiversity, which we hope will support a national accreditation for biodiversity in urban developments.

People, Cities & Nature: a future-thinking programme in urban ecological restoration research

Dr Kiri Wallace[1], Dr Shaun Awatere[2], Professor Yolanda Van Heezik[3], Associate Professor Martin Breed[4], Associate Professor Stephen Hartley[5], Professor Bruce D. Clarkson[1]
[1]Te Whare Wānanga O Waikato - University of Waikato, Hamilton, New Zealand, [2]Manaaki Whenua Landcare Research, Hamilton, New Zealand, [3]Ōtākou Whakaihu Waka - University of Otago, Dunedin, New Zealand, [4]Flinders University, Adelaide, Australia, [5]He Herenga Waka - Victoria University of Wellington, Wellington, New Zealand

Biography:
I am generally interested in biodiversity and restoration ecology in research, technology and business. I am passionate about restoration of native ecosystems, whatever the context. In tandem I like to restore people's connection with nature, helping them enjoy and benefit from it! I enjoy urban restoration ecology and am a researcher in the MBIE-funded programme People, Cities & Nature. In this thread of work I explore aboveground urban forest planting and its impacts on belowground soil life. We are investigating the soil and air microbiomes of reconstructed urban forests and how they impact the wildlife and humans who spend time in them. For more: https://www.peoplecitiesnature.co.nz/
I am also co-founder and co-director of Eco-index. In this mahi I lead a team focused on guiding biodiversity investment in Aotearoa New Zealand using digital technology. We provide products to some of the major land management groups (e.g., industry, iwi, government) to aid their exploration of best investment options in biodiversity. This kaupapa leans on artificial intelligence and remote sensing for a landscape-scale approach. For more: https://eco-index.nz/

This presentation will give an overview of the People, Cities & Nature research programme. The programme was established in 2016 through MBIE Endeavour and other funding, and harnesses expertise from Aotearoa New Zealand and Australia to enhance restoration of indigenous biodiversity in cities.

Urban areas are home to 87% of the NZ population and 56% of the human population worldwide. Cities are disproportionately affected by ecological challenges and are critical entry points for non-native species. Despite this, cities are a key part of the solution to the global biodiversity crisis, improved human health and harmonious cultural interface. Currently, information on making urban restoration successful and cost-effective is limited.

People, Cities & Nature researchers are working in 10 cities across Aotearoa New Zealand. Our programme has developed and refined best practices and foundational knowledge required for efficient urban restoration. We have cultivated robust relationships with end-users to ensure effective information transfer to local government and community. We believe that restoring nature in urban environments is critical for sustainable, functioning ecosystems, and for human health and wellbeing, and we are working hard to make urban restoration targets clear achievable.

Come along to hear about People, Cities & Nature's four focus areas:

1. Residential design for biodiversity
2. Retain and restore urban wildlife
3. Restoring health-promoting soil biodiversity
4. Whanake rākau, whakatipu mātauranga, poipoia te tangata: Growing trees, enhancing knowledge, nurturing people

Exploiting fear for non-lethal cat management

Dr Sze Wing Yiu[1], Dr Justin Suraci[2], Dr Grant Norbury[1], Dr Patrick Garvey[1]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Conservation Science Partners, Truckee, USA

Biography:
Sze-Wing, Grant and Patrick are researchers from the Wildlife Ecology and Management Team at Manaaki Whenua - Landcare Research. Their research focus on the management of invasive mammalian predators. In this project, they team up with Justin from Conservation Science Partner in the US to develop a non-lethal tool for urban cat management through manipulating cat behaviour using sensory cues.

Cats are invasive predators that pose a great threat to native biodiversity. Yet, cat management is challenging in urban environments where cats are valued as companion animals; lethal control is not feasible while keeping cats indoor receives low public support. We aimed to develop a non-lethal deterrent for cats to repel them from ecologically sensitive areas through manipulating the landscape of fear. We conducted playback experiments to test the effectiveness of using auditory cues from predators (humans) and competitors (cats and dogs) to manipulate perceived risks and trigger fear behaviour in feral and urban domestic cats (*Felis catus*). Human sounds protected the most food lures and resulted in the greatest fleeing responses of cats, least time spent feeding, lowest frequencies of return to food and least duration of stay in the treatment areas. These effects were similar between feral and urban domestic cats. Cat and dog sounds were effective in protecting food patches but induced fewer responses. Playbacks were more effective deterrents in open than in structurally complex areas. Our study demonstrated the efficacy of using audio playbacks as cat deterrents which could be applied in the field to discourage cats from staying in areas where they are unwanted.

Edge effects influence soil microbial community structure and function under small tree patches in pastoral landscapes

Kara Allen[1], Ziva Louisson[1], Kate Orwin[1], Manpreet Dhami[1], Sam McNally[1]
[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand

Biography:
Dr. Allen is an Ecosystems Scientist at Manaaki Whenua-Landcare Research. She has a strong background in plant-soil interactions with a keen interest in incorporating soil biology into process-based ecosystem models. She has worked in a variety of systems, from productive to natural landscapes, tropical to temperate biomes, and across ecosystems undergoing human and biotic disturbances.

Though habitat fragmentation often leads to reduced diversity and functioning in natural ecosystems, the integration of small tree patches (<1 hectare) across more uniform, pastoral landscapes can have the opposite effect via increasing habitat complexity. The stark contrast between the tree patch and pasture habitats results in strong ecological differences at the tree-pasture boundary, driving "edge effects" or changes in abiotic and biotic conditions in this zone. It is well documented that edge effects at tree-pasture boundaries can increase growth, productivity, and nutrient return in the aboveground vegetative community. However, little is known about how edge effects impact soil communities and the important belowground functions they support, such as nutrient regulation and carbon storage. Using data collected along a series of tree-pasture boundaries in New Zealand pastoral systems, we explore how edge effects shape soil microbial communities, as well as how changes in these communities could influence the turnover of carbon and nutrients. Preliminary results suggest that microbial communities at the edge differ from those found within the tree patch and pasture habitats, with much of this change related to shifts in nutrient availability. Differences in these communities also contribute to the protection of carbon in soils at the tree-pasture boundary, with important implications on the carbon sequestration potential associated with establishing small tree patches in pastoral landscapes.

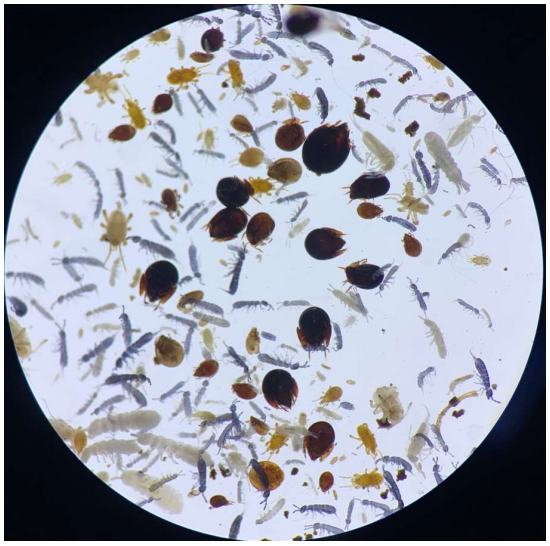
Using metabolic theory to assess the restoration trajectory of body size structure in trees and soil fauna

Dr Andrew Barnes, Miss Joaquina Romera[1], Kiri Joy Wallace, James K. McCarthy, Bibishan Rai, Grace Mitchell, Nico Eisenhauer, Christopher H. Lusk
[1]University of Waikato, Gold Coast, Australia

Biography:

I'm a recent MSc (Research) graduate in Environmental Sciences with a specialization in energetic constraints and energy flow in ecosystems. My master's research focused on how these factors shape plant and soil animal communities in forests. In addition to urban restoration, I am passionate about community ecology, metabolic theory, terrestrial ecology, and soil fluxes. I am dedicated to advancing the conservation and restoration of Aotearoa's green spaces and am enthusiastic about contributing to projects in these areas. I am now taking a much-needed break, traveling the world, starting in Australia!

The widely observed negative scaling relationship between organism size and abundance is predicted to have a universal –0.75 scaling exponent across all life forms. This relationship is governed by energetic constraints on organisms that result in many small and few large organisms in ecosystems. This scaling relationship is thought to arise from increasing metabolic demands with organism body size (i.e., with a predicted, positive 0.75 exponent). However, factors influencing frequently observed deviations from the negative size–density exponent, such as ecosystem succession and organism traits, remain poorly understood. We explored the dependence of size–density scaling on ecosystem succession and organism traits by analysing size–density relationships in trees and soil invertebrates across 183 temperate forest plots comprising urban secondary forests, urban old–growth forests, and non–urban natural forests. Exponents of scaling relationships in urban tree and invertebrate communities progressively steepened with increasing restored (planted) forest stand age as small organisms increased in abundance. In contrast, non–urban tree scaling relationships flattened during succession with exponents veering away from –0.75, whereas urban tree and soil invertebrate communities converged towards this prediction in later successional stages. Our results shed light on how the body size structure of tree and soil invertebrate communities spanning multiple trophic levels shift over successional time as the relative abundances of large versus small–bodied organisms increase. This study emphasises the fundamental influence of organismal traits and ecosystem succession on shaping community body size structure and the energetic constraints on forest ecosystems.



Aotearoa New Zealand urban forest soil invertebrate sample viewed through a stereo microscope lens from. Photo Credit: Poppy Joaquina Romera.

Exploring drivers of soil microbial community assembly in urban restored forests

Miss Stella Brachmann[1]
[1]University Of Waikato, Hamilton, New Zealand

Biography:
Stella is a PhD student at the University of Waikato and is interested in the links between aboveground and belowground biodiversity. She studied molecular biology and microbial ecology in Germany and came to Aotearoa New Zealand to research soil microbial communities in the context of urban forest restoration.

Ecosystem restoration is one of the most effective measures to mitigate global pressing issues like climate change, ecosystem degradation, and biodiversity shifts. Urban centres are particularly of interest to restoration research, with the goal to enhance biodiversity and ecosystem services (e.g., supporting human health and wellbeing) within cities where human population densities are the highest. The complex interplay between plant, animal, and microbial communities is responsible for crucial ecosystem functions (e.g., climate regulation, nutrient cycling, and detoxification), many of which are carried out belowground. However, the impact of ecosystem restoration planting on soil biodiversity, especially the soil microbiome, is poorly understood. If we want to restore belowground ecosystems, we need to improve our understanding of soil microbial assembly mechanisms, which ultimately govern the trajectory of biodiversity recovery over time.
To address this knowledge gap, we sampled and analysed the taxonomic and functional profiles of soil microbiomes across a ~60 year urban forest restoration chronosequence spanning 80 study sites in nine cities across Aotearoa New Zealand. Using metagenomics, we investigated the effects of abiotic (e.g., soil nutrients, climate) and biotic properties (e.g., vegetation, forest age) on soil microbial community assembly and identified major drivers of stochastic versus deterministic assembly processes. This study could aid restoration practices to facilitate diverse soil microbiomes that provide multiple ecosystem services, including benefits to human, plant, and animal health.

The effect of land management on arbuscular mycorrhizal fungal communities in New Zealand

Ms Fionnuala Bulman[1,2], Prof Eirian Jones[1,2], Dr Amanda Black[1,2], Dr Steve Wakelin[2,3], Prof Leo Condron[1,2]
[1]Lincoln University, Christchurch, New Zealand, [2]Bioprotection Aotearoa, Christchurch, New Zealand, [3]Scion, Christchurch, New Zealand

Biography:
Fionnuala Bulman is in her final year of a PhD in microbial ecology at Lincoln University. With a background in biomedical sciences, Fionnuala's passion for the outdoors led her to pursue a PhD investigating the effect of land management on belowground biodiversity. During her time at Lincoln University she has represented New Zealand on the Australasian Mycological Society and as a delegate to Chile with the Winds of Change organisation. After attending NZES conference in 2022 and an NZES regional event in 2023, Fionnuala is excited to be back to share findings from her PhD research.

Arbuscular mycorrhizal fungi (AMF) are symbionts that colonise plant roots and can exchange soil nutrients for plant-provided carbon. Due to this relationship and their ability to form extensive hyphal networks in soil, AMF can play an important role in plant-soil ecosystems. Given this role, understanding how land management practices affect AMF diversity allows insight into potential impacts on ecosystem functioning. By examining the effects of differing land management on AMF communities, this research contributes to our understanding of how anthropogenic activity impacts AMF diversity.
Over two years, we conducted seasonal sampling across agricultural and native forest ecosystems in Te Kaha, located on the East Cape of the North Island. We assessed AMF abundance and diversity at these sites using fatty acid analysis and DNA metabarcoding, alongside analysis of soil physiochemical properties.
DNA metabarcoding from environmental samples allowed identification of 72 taxa down to the species level. Of these, 37 taxa were common across all three systems, with 6 taxa conditionally present in kiwifruit orchards, 12 conditionally present in maize fields and 17 conditionally present in native forest. The mean relative abundance of the genus *Paraglomus* was significantly higher in kiwifruit orchards, while *Acaulospora* was significantly higher in native forest. Soil samples from maize fields were found to have significantly higher species richness and evenness compared to those from kiwifruit orchards and native forest. Results presented at NZES 2024 will further explore the comparison of AMF communities between ecosystems including spatiotemporal effects on community structure and correlation with soil physiochemical properties.

Plant invasion down under: Exploring below-ground impacts of invasive plants on the Central Plateau of New Zealand

Dr Andrea Clavijo Mccormick[1,2], Dr Evans Effah[2], Mr Benjamin Pearson[3], Prof Alastair Robertson[1], A Prof Maria Minor[1]
[1]Massey University, Palmerston North, New Zealand, [2]Ministry for Primary Industries, Wellington, New Zealand, [3]Taranaki Regional Council, New Plymouth, New Zealand

Biography:
Andrea Clavijo McCormick is the Plant Risk Manager at Biosecurity New Zealand (Ministry for Primary Industries) and she also holds an Adjunct Senior Research Officer Role at Massey University. She is interested in understanding the impact of exotic invasive species and environmental change on species interactions. Her work at MPI supports the NZ biosecurity system by providing evidence-based advice to inform decision-making.

Invasive plants affect their invaded ecosystems by altering plant, animal and microbial communities and the chemical and physical properties of their surrounding environment. Impacts are often assessed above-ground and reported to be negative. However, our growing understanding of invasive plant ecology suggest that invasive plants' ecological impacts are far from uniform, being complex, species-specific and context dependant. This presentation includes the results of two separate studies exploring below-ground interactions at the Central Plateau of North Island (New Zealand), home to the Tongariro National Park, recognised as a dual UNESCO heritage site for its cultural and natural value. The first study reports the impacts of root extracts of two invasive species heather (*Calluna vulgaris*) and Scotch broom (*Cytisus scoparius*) on seed germination and seedling growth of the native mānuka tree (*Leptospermum scoparium*) when compared to conspecific root extracts and those from another native (red tussock, *Chionochloa rubra*). The results show that invasive plants' root extracts display stronger allelopathic activity on the germination and seedling growth of mānuka than extracts of another native or conspecifics. The second study explores the soil properties and arthropod communities (micro and mesofauna) associated with each of these four plants under field conditions. In this case, soil properties and soil fauna assemblages did not cluster by plant invasive status. In fact, there was higher similarity between mānuka and broom, and between red tussock and heather. These results evidence the ecological complexity of below-ground interactions involving invasive plants and provide grounding for future studies to inform management decisions.

How does fire impact plant-soil feedbacks and soil fungal communities in New Zealand's tussock grasslands?

Nicola Day[1]
[1]Victoria University of Wellington, Wellington, New Zealand

Biography:
Nicola's research broadly focuses on the ecological impacts of global change on plants and soil fungi, including plant-soil interactions. Topics include resilience after fire and impacts of invasive plants. Nicola leads the plant and soil ecology group at Victoria University of Wellington.

Climate change is intensifying fire severity and frequency, raising questions about how fire-induced changes in soil biota will impact plant-soil feedbacks, plant invasions, and wider biodiversity. Fire activity increased in Aotearoa New Zealand when humans arrived ~700 years ago, causing substantial vegetation change. Biota in native ecosystems may therefore be poorly-adapted to fires. I will present case studies where impacts of fire on soil fungi and plant-soil feedbacks in Aotearoa New Zealand grasslands have been assessed through observational and empirical studies from recent fires and experiments. Results suggest recent fires have had little impact on community structure of soil fungi and plants in Aotearoa New Zealand grasslands. In an experimental study, mycorrhizal fungal communities and plant-soil feedbacks of invasive hawkweeds (Asteraceae) were not altered by simulated fire. Overall, these studies suggest that recent large wildfires in Aotearoa New Zealand grasslands have not significantly impacted soil fungal communities or disrupted plant-soil feedbacks. However, this resilience may be eroded as fires increase in severity and frequency due to climate change.

Climatic drivers of oomycete communities at plant and community scales

Professor Ian Dickie[1], Dr. John Ramana[2], Dr. Kate Orwin[2]
[1]University Of Canterbury, Christchurch, New Zealand, [2]Manaaki Whenua | Landcare Research, Lincoln, New Zealand

Biography:
Ian Dickie is a professor at the University of Canterbury. His research focusses on understanding the role of fungi, oomycetes, and other cryptic biota as drivers of ecosystem level outcomes. He is a project co-leader within BioProtection Aotearoa, investigating the drivers of plant and ecosystem health.

Terrestrial oomycetes, exemplified by Kauri dieback and potato blight, are important parasites of plants both above and belowground, as well as animal parasites and saprotrophs. Given the potential for oomycetes to cause widespread ecosystem impacts, it is critically important to understand how communities of these micro-Eukaryotes respond to climate. We used DNA meta-barcoding to quantify oomycetes communities across an elevation gradient from 27 to 650 m asl, and a precipitation gradient from 735 mm to 1905 mm / yr in stands of the early-successional Myrtaceae tree, *Kunzea ericoides* (Kānuka), across Horomaka / Banks Peninsula. We sampled at community and focal-tree scales, including both above (community leaves, focal-tree leaves) and belowground (community soil, focal-tree roots). Communities were dominated by *Aplanopsis, Globisporangium, Peronospora, Phytophthora* and *Pythium* with very strong differentiation between above- and below-ground substrates. Numerous oomycetes could not be well identified based on DNA, including the dominant taxon found on *Kunzea* leaves. Oomycete detection and species richness declined with elevation in community-scale samples, but not in focal-tree samples; while precipitation had smaller impacts. The effect of elevation on oomycete communities suggests a high sensitivity to climate change, with differing effects at the community versus focal-tree scale. Our results provide critical baseline data on natural oomycete communities, and the risk of climate change for increasing disease risk.

Temperature responses of soil food-webs along geothermal gradients in New Zealand

Ms Estela Folch Chaos[1], Prof Andrew Barnes[1], Prof Louis Schipper[1], Prof Charlotte Alster
[1]University of Waikato, Hamilton, New Zealand

Biography:

I'm a PhD student at the University of Waikato. I work with the EcoDiv Lab team leaded by Andrew Barnes, and my research project is about the effects of temperature in soil food webs structure and energetics, taking advantage of geothermal gradients of New Zealand. I have a Master's in Terrestrial Ecology and I'm very interested in the effects of climate change drivers in soil communities in general, and particularly invertebrates.

Global warming is exerting significant impacts on ecosystems worldwide. Rising temperatures are expected to accelerate metabolic rates in organisms, potentially altering species interactions, and the structure and energetics of food webs. Very few studies have investigated the effects of warming on soil food webs and have mostly focused on shifts in community composition, biomass, or biodiversity of specific invertebrate groups or trophic levels, using short-term warming experiments. I sampled soil food webs long a natural temperature gradient (18°C to 50°C) near geothermal surface features around Rotorua, New Zealand. I then identified soil organisms to morphospecies and classified them into trophic groups to assess how temperature influences community composition and population densities across trophic levels. Preliminary results indicate that temperature, alongside other environmental covariates such as pH, water content, and carbon-nitrogen ratios, is a major driver of species composition within the soil community. Distinct species assemblages were associated with elevated temperatures, both across the entire community and within decomposer and predator groups when analyzed separately. Overall community abundance increased significantly with temperature, with certain species becoming more dominant, leading to reduced species evenness. This pattern was largely driven by decomposers, the most abundant trophic group of the soil food web. In contrast, predator abundance remained consistent across temperature treatments, although species richness within this group declined as temperatures increased.

Urbanization reduces the importance of microbial effects on native plant community productivity in a fragmented landscape

Dr. Kasey N. Kiesewetter[1], Dr. Leydiana Otano[2], Dr. Michelle E. Afkhami[2]
[1]University of Waikato, Hamilton, New Zealand, [2] University of Miami, Department of Biology, Coral Gables, USA

Biography:
I am a postdoctoral researcher at the University of Waikato for the People, Cities, and Nature Programme. I earned my PhD at the University of Miami where I studied how habitat fragmentation impacted soil microbiomes and their interactions with native plants in urban forests. My work in Aotearoa New Zealand has continued to focus on urban soil microbiomes. Throughout my postdoc I have been working to characterize microbial communities and functions across a chronosequence of restored urban forests to better understand how soil ecosystems change with aboveground restoration.

Habitat fragmentation – the breaking up of natural landscapes – is a pervasive threat to biodiversity that introduces novel, non-natural matrix habitat into landscapes worldwide. Despite the importance of the matrix, we have limited knowledge of how it influences microbiomes on remnant habitats and even less on how matrix-driven changes to microbiomes scale up to influence plant community productivity. Using field collections, microbiome sequencing, and manipulative mesocosms in the imperiled Pine Rocklands ecosystem, we (1) investigated how microbial diversity and composition differed between 15 native rocklands fragments and adjacent urban matrix, (2) compared how the strength of fragmentation and matrix features explained variation within these two habitat types, and (3) tested whether urbanization-driven changes in microbiomes affected plant community productivity and composition.

Microbial diversity and composition significantly differed between native habitat and urban matrix, including an ~80% increase in symbiotrophs in native habitats and a >300% pathotroph increase in urban matrix. Further, patch attributes explained significant variation in microbial diversity of native, pine rockland fragments but not of the adjacent urban matrix habitats. Importantly, native habitat microbiomes, increased overall plant community productivity by ~300%, while urban microbiomes did not affect productivity, indicating that native plant communities showed diminished reliance on urban microbiomes. Our study not only documented matrix-driven changes in microbial diversity and composition, but also demonstrated native microbiomes persisting in fragmented landscapes are imperative to plant community productivity, highlighting preservation of native microbiomes as critical for native plants in remnant fragments.

Can’t see the microbes for the trees: pine microbiota invasion allies and buffers to change

Dr. Joanna Green[1]
[1]Lincoln University, Lincoln, New Zealand

Biography:
I am a microbial ecologist. I like to say that I appreciate the small thing in life. I’ve pursued this interest all over the world, from the Amazon River plume to the Alaskan tundra. My current area of research is in the connection between trees (specifically Radiata pine) and their associated microbial community. This work aims to better understand the microbial impact in increasing tree drought resilience to improve tree health in changing environments where drought is becoming more prevalent.

Plants foster distinct microbial communities in their roots that are influenced by the biotic and abiotic environment at the root-soil interface. The soil acts as a reservoir for the microbes which can remain after the plant has gone, referred to as the plants’ legacy, and can affect dynamics of future plants grown in this soil. Here we discuss these legacy effects in soil and how this can affect future plant communities in terms of wilding pine invasion and restoration post-invasion, as well as a peek into current forestry research of drought resilience associated with the soil microbiome.

Global analysis of soil microbial responses to experimental warming and plant species removal in alpine ecosystems

Dr Natascha Lewe[1,2], Dr Julie R Deslippe[1,2]
[1]School of Biological Sciences, Victoria University of Wellington, New Zealand, [2]Centre for Biodiversity and Restoration Ecology, Victoria University of Wellington, New Zealand

Biography:
Natascha Lewe is a postdoctoral researcher in Dr. Julie Deslippe's lab at the School of Biological Sciences, Te Herenga Waka - Victoria University of Wellington. Her research focuses on the responses of soil microbial communities to global change factors in alpine environments. Natascha has a particular interest in plant-mycorrhizal interactions and their stability under climate change.

Globally, alpine ecosystems are experiencing rapid change due to warming and shifts in plant species composition. Alpine soil microbes drive nutrient cycling and moderate plant production but our understanding of their responses to global change remains poor, partly because previous studies have been limited to single or few sites. Here, we utilize a global network of field experiments - Warming and Removals in Mountains (WaRM), which applies a 2×2 factorial combination of warming (W) and dominant species removal (R) at high (HE) and low elevation (LE) sites on mountains in nine countries (18 sites). We explore the response of soil microbes to WaRM treatments using metabarcoding of fungal ITS and bacterial 16S genes and quantify microbial phospho- and neutral lipids (PLFA/NLFA) to gain insight to their total and functional group biomasses. While edaphic factors were the dominant drivers of soil microbial composition globally, our analysis reveal stronger responses of fungi than bacteria to WaRM treatments. Total fungal and bacterial abundances were most strongly altered by W, followed by R, with WxR interactions dampening warming responses. These changes were associated with shifts in the absolute abundances of fungal guilds. W reduced fungal litter saprotrophs, while R led to weaker reductions in soil saprotrophs. Total microbial biomass was generally stable with treatments, although it increased with W at LE Canada. Likewise arbuscular mycorrhizal fungal biomass was generally stable but increased with W at LE Australia. This highlights the potential for microbial functional shifts that may alter soil decomposition in future alpine ecosystems.

Elevated carbon dioxide alters soil nitrogen cycling genes in a grazed grassland

Ms Freya Newton[1], Dr Shengjing Shi, Ms Faith Mtandavari, Dr Julie Deslippe
[1]Victoria University/ Agresearch, Wellington, New Zealand

Biography:
I completed my undergraduate and master degrees (biology and microbiology respectively) at Idaho State University. I was born and raised in Te Papaioea, Palmerston North and now live and work in Te Whanganui a tara as a PhD student at Te herenga waka – VUW.

Biological nitrogen (N) cycling is essential to sustaining pasture production as climate changes. Elevated atmospheric CO_2 (eCO_2) and grazing by livestock both have the potential to alter nutrient cycling in soil ecosystems, but their interactive effects are poorly understood. We monitored the abundance of N-cycling functional genes in a globally unique long-term Free Air CO_2 Enrichment (FACE) experiment, with in situ grazing by livestock. We use quantitative polymerase chain reaction (qPCR) to characterise genes involved in nitrification (bacterial and archaeal *amoA*), denitrification (*nirK, nirS*), and N_2O-reducers (*nosZI, nosZII*) under treatments.
We show that eCO_2 increased *nirK, nirS gene abundance,* and decreased in *nosZI,* while grazing activities significantly increased both archaeal and bacterial *amoA*, particularly in the excrement return treatment. Additionally, grazing and excrement return significantly altered the abundance of *nirK, nirS* under eCO_2 and increased total 16S genes, which was accompanied by a significant decrease the ratio of fungi to bacteria. These results suggest increased microbial denitrification activity under eCO_2 and increased microbial nitrification activity under grazing. Furthermore, the combined effects of grazing and excrement return appear to offset the increased denitrification associated with eCO_2, potentially helping to maintain sustainable levels of nitrogen availability in the forms of nitrate and ammonium.
Our study highlights the significant impacts of eCO_2 and grazing on soil microbial communities and nitrogen cycling processes, suggesting that integrated management strategies such as rotational grazing or intensity management are necessary for maintaining soil health and productivity in pastoral systems, particularly in the face of global change.

The threat of a major tree pathogen to forest soil mesofauna food webs and ecosystem functioning

Marijke Struijk[1,2,*], Jamie R. Stavert[3], Rebecca J. Le Grice, Luitgard Schwendenmann, Poppy Joaquina Romera, Grace Mitchell, Marie Sünnemann, Jaynie Yang, Fredrik Hjelm, Andrew D. Barnes.

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[2] School of Environment, The University of Auckland, Auckland, Aotearoa
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[4] Canterbury Museum, Christchurch, Aotearoa
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[*] Present address: EcoQuest Centre for Indigeneity, Ecology, and Creativity, Whakatiwai, Pokeno, Aotearoa

Biography:
Marijke is an environmental scientist specialised in soil biogeochemistry. She is intrigued by soil because it harbours the majority of terrestrial carbon, contains more than 25% of the earth's biodiversity, and is foundational to ecosystem health. After a PhD on decomposition in agricultural soils in the UK, she ended up in Aotearoa and spent over a year researching soil mesofauna food webs in the kauri forests of the Waitākere Ranges as part of a larger project on the ecosystem impacts of kauri dieback. Marijke currently works as a lecturer and research supervisor at EcoQuest.

Pathogens threaten the survival of many forest tree species worldwide. However, there is limited knowledge of how dieback of tree species may threaten other components of forest ecosystems, such as soil biodiversity and associated ecosystem functions. Kauri (*Agathis australis*), threatened by the root-borne pathogen *Phytophthora agathidicida*, are culturally and ecologically significant tree species that exert great influence on soil properties.
We characterised soil mesofauna community structure and energy fluxes in kauri forest in the Waitākere Ranges Regional Park, Aotearoa – New Zealand, and assessed the potential threat that *P. agathidicida* poses to belowground ecosystems. We constructed soil mesofauna food webs associated with kauri and broadleaf trees and identified differences between food webs associated with kauri versus broadleaf trees. We also quantified the effect of *P. agathidicida* on density, biomass, mean body mass, and energy fluxes of mesofauna taxonomic and trophic groups.
Our findings suggest that kauri support soil mesofauna food webs that are distinctly different from those found under broadleaf trees in the same habitat, which could be explained by differences in soil C:N and forest floor depth. We also found omnivore body mass to be greater when *P. agathidicida* was detected compared to where the pathogen was not detected. With increasingly advanced stages of kauri dieback, a decreased dominance of kauri and altered C and nutrient fluxes may drive future changes in soil mesofauna food webs which could be associated with further changes in ecosystem function.

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Kea pine for an exotic home?

Ms Jodanne Aitken[1], Dr Adrain Paterson[1], Dr James Ross[1], Dr Laura Young[2,3], Tamsin Orr-Walker[2]
[1]Department of Pest-Management and Conservation at Lincoln University, Lincoln, New Zealand, [2]Kea Conservation Trust, Queenstown, New Zealand, [3]Department of Conservation, Nelson, New Zealand

Biography:
I hold a degree in ecology and conservation from Lincoln University. Since 2018, I have been involved with the Kea Conservation Trust (KCT), assisting with administration, advocacy, and fieldwork. In 2020/21, I conducted research with KCT and OneFortyOne on kea use of plantation forests in Nelson-Tasman. I enjoyed collaborating with the forestry sector and look forward to more conservation work in this area. Currently, I am a PhD candidate at Lincoln University, focusing on GPS tracking and movement ecology of kea.

Our preliminary study documented kea habitat use and movements in Nelson/Tasman plantations and neighbouring native forests. GPS-VHF units were used to track kea movements, whilst feeding observations and faecal analysis were used to determine kea diet in this habitat. All birds tracked in this study spent a notable proportion of their time in plantation forests (> 65% fixes in plantation forest), which included feeding, roosting, and nesting. Pinus radiata seeds were commonly observed being eaten by kea (36% total feeding time), as was cambium tissue stripped off newly harvested *Pseudotsuga menziesii* logs (20% total feeding time). This study suggests the value of extending research to cover at least a full calendar year to record seasonal patterns in kea diet, habitat use, movements and source-sink dynamics in the plantation habitat type.

Continuous Cover Forestry as a potential response to challenges facing New Zealand

Dr Yvette Dickinson[1], Dr Tim Payn, Sebastian Klinger, dr Serajis Salekin
[1]Scion (New Zealand Forest Research Institute), Rotorua, New Zealand

Biography:
Yvette Dickinson's research applies forest ecology principles to the sustainable management of our forests for a variety of benefits including carbon sequestration, climate change adaption, mitigating hazardous wildfires, protection of soil and water, healthy forests, conservation and biodiversity, aesthetics and recreation, and wood production. She has over twenty years of experience working in forestry, science and academia; and, has worked in a wide variety of forest ecosystems, including native forests and exotic forest plantations of New Zealand, mixed-hardwoods in eastern United States, and the conifer forests of the Southern Rockies.

Production forestry in New Zealand is undergoing a shift in the face of numerous challenges, especially from the impact of extreme events due to climate change; erosion, sedimentation and slash movement following clearfell harvest on highly erodible soils; declining global biodiversity; risks of pest and disease outbreaks in monocultures; and, increased societal expectations and poor social licence to operate. Technological developments such as the use of automation and precision forestry, A.I. and big data are presenting opportunities for forestry that will allow us to respond to these challenges in ways not tried before in New Zealand.

One proposed response to these challenges and opportunities is the development of Continuous Cover Forestry (CCF) systems for the New Zealand context. CCF is a suite of forestry systems aimed at providing multiple benefits by maintaining a cloak of forest over the land in the long term, while still allowing for some timber harvest. CCF may provide multiple products and services, with a lower environmental impact than conventional forestry systems. While it has been successfully applied in the northern hemisphere for some time, CCF will require adapting for our local needs, species, and environment if it is to be successful. This presentation will explore what CCF is, the role of ecological sciences in CCF, the benefits and opportunities it may bring to New Zealand, and the challenges we face in developing and applying it.

Ecological management of natural areas in Tarawera Plantation Forest, Bay of Plenty

Sarah Beadel[1], Angela McQuillan[1], Dr Christopher Bycroft[1], William Shaw[1], Colin Maunder[2], Les Russell[3]
[1]Wildland Consultants, Rotorua, New Zealand, [2]Timberlands Limited, Rotorua, New Zealand, [3]Māori Investments Limited, Kawerau, New Zealand

Biography:
Angela has a wide range of consultant ecology experience, including vegetation monitoring (e.g. permanent vegetation plots, transects, and photopoints), ecological assessments, restoration management plans, and work with threatened species. She has been involved in the Tarawera Forest natural area management project since joining Wildlands in 2015. Angela has a BSc (Tech) and MSc in Biological Science from the University of Waikato.

Timberlands Ltd is working collaboratively with the landowners of Tarawera Forest (Māori Investments Limited) to maintain and enhance the ecological values of key natural areas within Tarawera Forest. Located between Kawerau and Lake Tarawera, Bay of Plenty, Tarawera Forest covers 29,000 hectares comprising *c.*23,300 hectares (80%) of plantation forest and *c.*5,700 hectares (20%) natural areas. While the natural areas are not part of the Forestry Right, Timberlands has an agreement with the landowners to manage these areas to meet their FSC obligations. Since 2014, ecological management of natural areas has been undertaken within Tarawera Forest, with a long-term focus on indigenous biodiversity restoration, returning original ecosystems and species that have been lost, while restoring mauri and ecological integrity. Here we highlight achievements and challenges from the past 10 years of natural area management at Tarawera Forest. Focus tasks have included wilding pine control on the northeastern slopes of Tarawera maunga, pest plant control in wetlands, inventory surveys and monitoring of important indicator species (including wetland birds and pōhutukawa × northern rātā forest), and establishing new populations of a nationally threatened shrub (*Pimelea tomentosa*) on the alluvial terraces beside the awa. International FSC auditors have given the project high praise. Key components of the success that are a lesson for further work are the ongoing commitment and collaboration between the landowners and managers; well-defined, high-level aspirational vision with a series of targeted goals and measurable, time-bound outcomes; and dedication to on-the ground high-quality work and progress while adapting to challenges.

The use of black soldier fly for bioconversion of organic waste in Aotearoa-New Zealand: a new sustainable approach

Dr Adriana Jeannette Najar Rodriguez[1], Dr Marian McKenzie[2], dr Jay Liu[2], Mr Federico Fabisik[2]
[1]Plant And Food Research, Lincoln, New Zealand, [2]Plant And Food Research, Palmerston North, New Zealand

Biography:
I am a Senior Scientist working for Plant & Food Research in Applied Entomology. I have a Biologist with a MSc and PhD in Entomology and more than 25 years of experience in plant health research related to invertebrates and in particular insects and biosecurity-related issues involving invasive insect species. My experience includes working in Colombia, Australia, Europe (Switzerland and Germany) and NZ. My investigations have addressed invasive insect pests (lepidopterans, aphids and thrips), native insects and invasive weeds, and I have concentrated on major agricultural markets, including potatoes (Colombia), cotton (Australia), vegetables and summer and stonefruit (Switzerland), and the NZ forestry and agricultural industry. Topics covered by my research have included insect behaviour and ecology, multitrophic interactions (plant-herbivore-parasitoid), biological control, chemical ecology, effects of climate change on agricultural systems and associated herbivores and natural enemies, behavioural genetics, and insect communication (mediated by sound and chemistry).

Insect-based bioconversion is gradually being used worldwide to treat biowaste because it is a novel, affordable, and environmentally friendly way to deal with the organic waste disposal problem faced by modern societies. At the NZ Institute for Plant and Food Research, we have established a commercial facility to investigate the potential of using insects for bioconversion and to create a circular economy model focusing on the black soldier fly (*Hermetia illucens* L.). This tropical species is found throughout the world and is present in Aotearoa-New Zealand. In our NZ-based facility, we are working to maximize insect production, from egg laying to pre-pupae self-harvesting methods, as well as to understand the physiological constraints/strengths of insects for bioconversion. There is a growing global interest in using insects to bioconvert organic waste into useful added-value products, including high fat and protein for fish, swine, poultry, and pet feed and soil amendments to use for regenerative farming. Thus, in this presentation, we will introduce the concept of insect bioconversion and outline our recently built capability and long-term research aims, which aim to contribute to solving the environmental problem posed by organic waste from NZ-based horticultural industries.

Using ecological knowledge to support transitions from low to high diversity pasture

Dr Kate Orwin[1], Dr Kara Allen[1], Dr Norman Mason[1], Dr Paul Mudge[1], Dr Sandra Lavorel[1,2], Dr Gwen Grelet[1]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Université Grenoble Alpes - CNRS, Grenoble, France

Biography:
Kate Orwin is an ecologist with more than 20 years' experience in studying plant-soil interactions. She currently works at Manaaki Whenua - Landcare Research, and conducts research on a range of topics including soil C dynamics, invasive plant species, ecosystem health, and incorporating diversity into agricultural ecosystems.

Current pasture-based systems are designed to maximise productivity, but now need to also be much more resilient and have a low environmental footprint. One potential solution to achieve this is to shift from the traditional low diversity pasture to high diversity pasture. This solution is partly based on the results from biodiversity-ecosystem function experiments, where grasslands with higher diversity have been found to be more resource-use efficient, productive and resilient than low diversity grasslands. However, there is some variation in how successful the establishment and functioning of diverse pasture is in New Zealand systems. Some farmers aim to improve diverse pasture performance by using a diverse annual "primer crop" to facilitate the transition from low to high diversity pasture, on the basis that diverse annual plants could improve soil structure, increase soil nutrient cycling rates, and reduce the impact of soil pathogens. Although grounded in theory, the value of this approach has not been scientifically tested. We tested how primer crops affect diverse pasture establishment and functioning on 5 paddocks distributed across 3 sheep and beef farms in Canterbury. Results showed that the use of primer crops enhances the establishment of legumes in diverse pastures and improves plant nutrient access. This effect was largely driven by changes in soil biology. This suggests that manipulating plant-soil feedbacks before transitioning to high diversity pasture could improve diverse pasture performance, at least in the short-term.

Plantation forestry and biodiversity: how many beetle species can an exotic plantation forest support?

Carl Wardhaugh[1], Taiāwhio Bryers, Samuel Aguilar

[1]Scion Research

Exotic plantations are in general considered to support very little biodiversity compared to natural indigenous forest. However, there exists sporadic evidence that exotic pine plantations in New Zealand can support a wide variety of indigenous forest species. In this study we examined the entire beetle community collected from canopy and ground-based traps to quantify the role exotic pine plantations can play in supporting biodiversity compared to native forest. Furthermore, by examining a chronosequence of 2nd and 3rd rotation stands, we examined whether diversity is declining over time in plantations. Overall, we collected 9,338 beetles from 557 species across 15 pine and native forest sites. While beetle diversity was highest in native forest, we found that exotic pine plantations supported ~65-70% of the number of beetle species from native forest sites. The vast majority of beetle species and individuals collected were endemic, with only 34/557 beetle species confirmed as introduced across all forest types, and there was no difference between exotic plantations and native forest in the proportions of native and exotic beetle species or individuals. Interestingly, we did not find any decline in beetle diversity or abundance between 2nd and 3rd rotation pine stands, indicating that the beetle community is able to quickly recolonise these sites as the new plantation matures. Our data refute the widespread generalisation that all exotic plantations are incapable of supporting many indigenous species, and show that those in New Zealand at least, could play a substantial role in supporting biodiversity and associated ecosystem functions as they undoubtedly support more indigenous biodiversity than any other production crop.

Supported by:

Development of an automated detection tool for incursions of invasive submerged weeds

Dr Daniel Clements[1], Dr Deborah Hofstra[1], Mr Gareth Preston[2], Dr Leigh Tait[2]
[1]National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand, [2]National Institute of Water and Atmospheric Research (NIWA), Christchurch, New Zealand

Biography:
Dr Daniel Clements is an aquatic plant scientist for NIWA's Freshwater Biosecurity group. His current research focus is the ecology of invasive aquatic plants, their impacts on aquatic ecosystems, and their management. He leads research projects developing improved detection and control techniques for invasive aquatic weeds in New Zealand and evaluating the effectiveness of control activities and eradication programmes.

Early detection of an invasive species enables early intervention, and along with prevention, early detection provides the best (most cost-effective) opportunity to successfully manage invasive species that pose a biosecurity risk. Typically, freshwater aquatic weed invasions that go unnoticed or are overlooked, or where management interventions are delayed, become problematic resulting in a decline in the values and functions of aquatic ecosystems. When aquatic weeds establish and are left to proliferate, they compete with, and displace native species. This can cause significant habitat alteration, impact adversely on recreation and cultural values, hydroelectric generation, and compromise agricultural productivity by impeding water delivery. Surveillance methods that can be efficiently deployed are required to detect and locate incursions at an early stage of invasion, so that control strategies can be implemented. NIWA researchers have developed a method for remote detection of invasive aquatic weeds utilising advances in remote sensing, recognition software and machine learning, initially targeting two of New Zealand's worst submerged aquatic weeds, lagarosiphon (*Lagarosiphon major*) and hornwort (*Ceratophyllum demersum*). This presentation outlines the development of NIWA's prototype invasive species detector module, that can be deployed from manned or unmanned surface vessels (USVs) and remotely operated submersible vehicles (ROVs). Whilst the project has primarily developed a detection tool to target invasive submerged weeds in New Zealand waterways, in principle, the system could be used for recognising other relevant target species including pest fish, invertebrates and native species (e.g., taonga species, kōura and kākahi), and is also applicable in the marine environment.

Temporally-indexed multi-species density impact functions: Quantifying timing and impact of invasive predators on seabird breeding success

Mr Michael Fox[1], Dr Todd Landers[1,2], Dr Brendon Dunphy[1], Dr James Russell[1]
[1]University of Auckland, Waipapa Taumata Rau, School of Biological Sciences, Auckland, New Zealand, [2]Auckland Council, Environmental Evaluation & Monitoring Unit, Auckland, New Zealand

Biography:
Michael has recently submitted his PhD thesis, "An integrative approach to ōi/grey-faced petrel restoration in the Waitākere Ranges" he is an aspiring transdisciplinary scientist and will share his ecological research findings on how we can restore burrowing seabirds in the face of invasive predators.

Conserving threatened bird species requires effective predator suppression strategies, particularly on islands where introduced predators pose significant threats. However, to be effective, predator suppression requires an understanding of the nature and timing of predator impacts, often within the context of a multi-predator assemblage that requires simultaneous management. Density-impact functions provide a framework to quantify the relationships between predator abundance and impact but are currently limited to a single species with constant impact. Here, we expand density impact functions to a multi-species assemblage with temporally varying impacts, applying them to a case study of rat (*Rattus* spp.) and mustelid (*Mustela* spp.) predation on a burrowing seabird species. We calibrate these impact functions using data collected over two years and across fourteen grey-faced petrel (*Pterodroma gouldi*) colonies in northwestern New Zealand. We found that nest failure is predicted by increased abundance of Norway rat (*Rattus norvegicus*) and stoat (*Mustela erminea*) during the early chick rearing stage. Surprisingly, we found no relationship during the egg-laying and late chick rearing stages. Our temporally-indexed multi-species density-impact functions allow us to identify key predators and management periods in the breeding cycle, thereby recommending an effective strategy for restoring and conserving a threatened species. Our results provide empirical evidence that vulnerable procellariid species can be successfully conserved in invaded ecosystems, highlighting a valuable conservation strategy for several globally threatened procellariids on such islands.

The Bay of Plenty New to Region Pest Plants Programme

Dr Jo McQueen-Watton[1], Dr Chris Bycroft[1], Ms Sarah Beadel[1]
[1]Wildland Consultants Ltd, Rotorua, New Zealand

Biography:
Jo is a consultant Principal Ecologist with Wildland Consultants based in Rotorua, where she manages teams of ecologists, large projects and procurement. Jo has worked on the topic of weed invasions since completing her Master's thesis on Acacia longifolia, and has authored a number of reports on weed issues. Jo has managed the Bay of Plenty Regional Council New to Region Pest Plant project since its inception in 2018.

The impacts of pest plants on New Zealand's indigenous biodiversity and primary production industries are immense. A potential gap in the management of pest species in New Zealand is identifying species that are either in a lag phase (naturalised but not yet invasive) or have already established in one part of the country but are absent from others. To this end, the new to region pest plant programme was initiated by Bay of Plenty Council in 2018. A region wide surveillance program for emerging pest plants was initiated, with survey undertaken at predetermined high-risk points of entry. In 2018, some 131 new to region pest plants were identified, and some subsequently controlled. A re-survey of the same areas five years later (2023-24) found 44 new to region pest plants, and six new species were found in different areas identified as transport routes. Almost all the new species found exist within gardens in the Bay of Plenty, and have spread from gardens either though seed disbursement (birds or wind), or through illegal dumping of green waste (including aquarium waste). Only a few species are likely to have come into the region through transport routes. A number of species have now been included in the Regional Pest Management Plan as a result of this survey and a number of species have been submitted to the National Pest Plant Accord process. This program provides a unique opportunity to target control of potentially highly invasive pest plants before they become a large and expensive problem in the Bay of Plenty.

Alteration of ecosystem services by invasive species

Dr Leigh Tait[1]
[1]Niwa, Christchurch, New Zealand

Biography:
Leigh Tait is a marine ecologist specialising in the application of remote sampling techniques that enable a broadscale understanding of marine ecosystems. To overcome bottlenecks in ecological information Leigh has been developing multi-scaled remote-sensing techniques that include underwater remote operated vehicles (ROVs), aerial drones and earth-oriented satellites. He has developed techniques and protocols for detecting key habitat-forming seaweeds using enhanced spectral imaging, real-time computer vision algorithms for detecting invasive marine pests such as exotic Caulerpa, and protocols for remote mapping of the Antarctic seafloor.

Invasions of novel pest species can have a broad spectrum of impacts to the environments they inhabit. While some of the direct impacts of invaders can be immediately obvious (e.g., predation, competition), other impacts are diffuse and difficult to anticipate and quantify. Where key ecosystem services are interrupted or modified, cascading consequences to ecosystems may occur. Here we discuss the implications of several notable invasions on marine ecosystems. This includes the implications of the Mediterranean fanworm (*Sabella spallanzanii*) on nutrient processing and the potential consequences of the invasive seaweed *Caulerpa parvifolia/brachypus* on seafloor ecosystems. We present the outcomes of several experiments and ecological monitoring performed over several years and extrapolate the large-scale consequences of these invasions to whole ecosystems.

A molecular investigation of the evolutionary ecology of *Bonamia* shellfish parasites

Dr Felix Vaux[1], Amber Brooks[1], Lisa Smith[1], Dr Jaret Bilewitch[1], Dr Henry Lane[1]
[1]NIWA, Wellington, New Zealand

Biography:
Felix is a marine biosecurity scientist at NIWA who specialises in evolutionary ecology and genomics. Since completing his PhD at Massey in 2017, he has worked in both the research and industry sectors investigating a broad diversity of organisms.

Outbreaks of haplosporidian *Bonamia* parasites frequently result in high mortality and substantially reduced recruitment for oyster populations – presenting a critical threat to the worldwide shellfish industry. *Bonamia ostreae* is an invasive species that was first detected in Aotearoa New Zealand in 2015, whereas *B. exitiosa* is native parasite and the principal driver of the bluff oyster *Ostrea chilensis* fishery. Biosecurity responses across the globe have struggled to contain *B. ostreae* and the biological mechanisms for its remarkable persistence in the marine environment remain elusive. I summarise the long-term surveillance of both species in Aotearoa and discuss findings involving coinfections and host-parasite coevolution. I present progress on new research to sequence the nuclear genomes of both species, and I explain plans to investigate spore formation and the life cycle of *B. ostreae* using whole-genome sequencing and transcriptomics. *Bonamia* infections provide an exciting model system for ecological, evolutionary, and parasitological research that stands to improve marine biosecurity and responses to future biological invasions.

The current state of play for mustelid eradication

Dr Andrew Veale[1]
[1]Manaaki Whenua, Lincoln, New Zealand

Biography:
Dr Veale has worked at Manaaki Whenua Landcare Research since 2019, primarily focusing on ways that genomics can contribute to addressing wildlife management problems. He has a particular interest in mustelid ecology, and he hopes to be reincarnated as music, or a stoat, or some form of quantum being that combines these two forces.

Mustelid eradication at large landscape scales, or indeed nation-wide in Aotearoa, presents a colossal challenge given the varied ecologies and behaviours of stoats (*Mustela erminea*), ferrets (*Mustela putoruis furo*), and weasels (*Mustela nivalis*). While significant progress has been made in locally suppressing these invasive species, the potential for their complete eradication remains an open question. This presentation will examine both local and international eradication programs, highlighting successes, obstacles, and the broader implications for conservation efforts. Stoats are by far the best researched both in their ecological effects in Aotearoa, and in the methods used to suppress and eradicate them. While small islands have had successful eradication campaigns using trapping, eradicating stoats at scales greater than 1,200 ha has yet to be achieved without significant toxin use. With current technology it appears toxin use is required for large landscape scale elimination of stoats. While ferret eradication has received less attention, there are reasons to believe it could be achieved with current technologist at far larger scales. Ferrets were present across all counties in the UK in the early 19th Century, but through intensive persecution by game keepers from 1850 to 1900 they were eliminated from the entire of England and Scotland (an area larger than the ferret's range in Aotearoa). Potentially ferret free regions (e.g. Northland, North Auckland, Coromandel) are realistic goals. Weasels are the least known, and considerable research on their ecology and control is required. The only successful weasel eradications have come through secondary poisoning using rodents as vectors.

Local restoration genetics of Syzygium maire, a critically threatened New Zealand Myrtaceae: from species range to habitat patch

Mr Colan Balkwill[1], Dr David Chagné[2,3], AProf Peter Ritchie[1,3], Dr Julie Deslippe[1]
[1]Victoria University Wellington, Wellington, New Zealand, [2]Plant and Food Research, Palmerston North, New Zealand, [3]Genomics Aotearoa, Dunedin, New Zealand

Biography:
I am a PhD student at Victoria University of Wellington with an interest in facilitating restoration and resilience of ecosystems in the face global change. My research interest centers around population genetics with a focus on conservation and restoration ecology and how this can be used to manage species into the future and in human dominated landscapes. Throughout my PhD studies, I have learned about and participated in the unique environment that is conservation in Aotearoa New Zealand. This has included developing and managing relationships with diverse stakeholders, both crown entities, private and mana whenua. I am committed to supporting Māori goals and values, and my work with iwi has enabled me to recognize the importance of cultural and spiritual connection to the land.

Wetlands are essential to ecosystem service and habitat provision and are taonga (sacred) to Māori. With over 90% lost across Aotearoa New Zealand, the restoration of wetland habitat is vital for the recovery of biodiversity and cultural values. Incorporating genetic information into restoration projects is key to safeguarding species resilience to novel pathogens and environmental change. Studies on endemic trees in Aotearoa have described regional-scale genetic conservation units, but most genetic degradation in fragmented landscapes occurs at a much smaller scale. How to ensure genetic robustness and adaptive potential at local scale in Aotearoa has not been explored. We assessed the genetic legacy and effects of natural and artificial habitat fragmentation on maire tawake (*Syzygium maire*), a critically threatened swampland tree, in the Greater Wellington Region. We identify evidence of pre-fragmentation genetic homogeneity in extensive swampland. This evidence implies that there is still time to capture a large proportion of the remaining regional diversity by focusing on seed sourcing from mature trees. Spatial analyses and close kin relationships in micro-habitats, however, indicate that patches of trees separated by only a few kilometres may be genetically isolated. Concurrently, small but significant differences in the diversity of adults and seedlings suggests that current levels of fragmentation are resulting in genetic degradation of the species. We advise that restoration and conservation improve population connectivity of *S. maire* remnants and aim to conserve as many genotypes as possible within regional clusters to protect adaptive potential.

Monitoring is essential for integrated disease management and the relevance of research, lessons from a myrtle rust case study

Dr Michael Bartlett[1], Dr Stuart Fraser[1]
[1]Scion, Rotorua, New Zealand

Biography:
Michael Bartlett is scientist in the Pathogen Ecology and Control team at Scion, based in Rotorua, New Zealand. Michael was a co-lead for RA1 of the Beyond Myrtle Rust programme, focused on the impact and adaptive potential of the myrtle rust pathogen Austropuccinia psidii. He has contributed to several other collaborative myrtle rust projects, including leading aspects of a Ngā Rākau Taketake funded project investigating the impacts on Lophomyrtus reproduction, looking at natural enemies of myrtle rust, surveying nurseries about their use of fungicide, testing fungicide rotations, and using hyperspectral and thermal imaging to identify pre-visual myrtle rust symptom development.

Managing the impact of pathogens affecting natural forests is challenging and requires an integrated approach. Monitoring data is crucial for making management decisions and forms the basis of integrated pest management programmes. While monitoring data required to make management decisions may differ from research objectives, there are some key learnings we can take away from systematic myrtle rust monitoring conducted for research.

Austropuccinia psidii was first detected on mainland Aotearoa in May 2017 and is now present throughout its climatically suitable range. This pathogen threatens our most vulnerable Myrtaceae, including species of *Lophomyrtus* and *Syzygium maire*, with localised extinction. Monitoring sites were established at nine locations in three regions of Te Ika-a-Māui o Aotearoa (New Zealand's North Island) in 2019 and 2020 that enabled (1) tracking disease incidence and severity overtime on different hosts, (2) investigation of the pathogen's life-cycle, and (3) opportunistically recording and collecting of natural enemies.

Our data, collected over four spring-summer periods (between October and April) to 2023, have improved understanding of the behaviour of *A. psidii* in New Zealand, the seasonality and impact of the disease. We found that sexual spores were uncommon but produced in most populations, and genotyping of 379 single pustules revealed evidence supporting the occurrence of frequent recombination, likely driven by sexual reproduction. Opportunistic records of natural enemies improved our understanding of the distribution of fly larvae feeding on rust spores and presence of mycoparasitic fungi antagonistic to *A. psidii* in New Zealand.

E heke e Heka! E piki e Pia!

Get down, rust! Rise, young sapling!

Mr Taiawhio Bryers[1], Katerina Pihera-Ridge[1], Michael Bartlett[1]
[1]Scion Research Institute, Rotorua, New Zealand

Biography:
Born and raised in Ngāmotu (New Plymouth), Taiāwhio Bryers is a descendant of Te Uri o Hua, Rereahu, Ngā Rauru and Ngāi Tāhu. is a Research Assistant of the Te Ao Māori research group at Scion Research Institute. In his role, he is positioned to support Kaupapa Māori research pathways and projects involving indigenous species. Taiāwhio has worked with scientists monitoring myrtle rust in the field. His experience has been valuable through the creation of "E heke, e heka", a reo-rua (bilingual) application supported by Unlocking curious minds funding. His presentation at NZES will share highlights from the app and its development.

Kahika (native Myrtaceae species) are an essential component of our native forests.
Preserving vitality in Te-Wao-nui-ā-Tāne, they heal the land in times of intensity/extremity and preserve the sanctity/integrity of the forest. The arrival of Austropuccinia psidii to our shores has significantly impacted our ngahere. This plant pathogen affects the Myrtaceae family, including our native Kahika species, causing the symptoms of what we see as 'Myrtle rust'.

Myrtle rust research in New Zealand has broadened our understanding of how each of our native Kahika are affected by the disease. From low impact in Mānuka and Kānuka, to high impact in Ramarama and Rōhutu (Lophomyrtus spp.), the high impact of disease for some species is concerning for future succession of Kahika in Aotearoa. We currently lack solutions that can efficiently control or prevent myrtle rust infection long term. With the persistence of ongoing seasonal impacts of Myrtle rust and limited collective knowledge, it becomes imperative to raise awareness beyond science communities.

Supported with Unlocking Curious Minds funding, a Scion team led by a Te Ao Māori approach, have developed digital tools that presents science knowledge about Kahika and how they are affected by Myrtle rust. With rangatahi Māori in mind, two bilingual applications; “E heke e Heka!” and “Mātaihia te heka”, were created. This presentation will share key highlights of our journey to develop this virtual ngahere tool and the distinct impacts we hope these tools will have for inspiring the next generation of Kaimātai Taiao (Explorers of the environment).

A virulent soil pathogen reshapes rain forest understorey sapling population dynamics and successional trajectories.

Mr Toby Elliott[1], Dr George Perry[3], Dr Peter Bellingham[2], Dr Bruce Burns[1]
[1]School of Biological Sciences, Faculty of Science, The University of Auckland, Auckland, New Zealand, [2]Manaaki Whenua Landcare Research, Lincoln, New Zealand, [3]School of Environment, Faculty of Science, The University of Auckland, Auckland, New Zealand

Biography:
Toby is a PhD student at the University of Auckland that is interested in forest ecology, population demography, and spatial ecology. He did his undergraduate degree in 2015 at Auckland university before completing an internship in Costa Rica. After that he completed a PgDipSci and a Master's Degree at Auckland University, focussing on plant ecology. He is currently completing a PhD at Auckland University that is focussing on the population dynamics of kauri and the impacts of Phytophthora agathidicida on the dynamics and long-term stability of kauri populations.

Forest tree pathogens can affect the population dynamics of canopy or emergent (overstorey) tree species, likely impacting co-occurring understory sapling populations. The regeneration potential of infected susceptible species populations and competing resistant allospecifics will depend on the direct impacts of the disease on sapling populations and the changes associated with the declining overstorey. We aimed to assess the likely impacts of a soil-borne pathogen *Phytophthora agathidicida* (PTA), on the sapling population dynamics of the disease-susceptible, locally dominant canopy tree, the conifer kauri (*Agathis australis*), and of likely resistant allospecific trees, split by their shade tolerances. We conducted this analysis in four kauri-dominated permanent plots in warm temperate New Zealand rain forests, two of which had adult kauri showing intense visual PTA symptoms. We examined the association between kauri adults and saplings using point–pattern analysis and the relationship between the level of crowding around kauri saplings and their growth and survival rates. We also compared the growth and survival rates of kauri and allospecifics, split by their shade tolerances as saplings, between these sites. Kauri forms sapling banks under conspecific adults that reduce in number as the forest matures and through infection by PTA. The sapling growth rates, however, of kauri and light-demanding allospecifics were higher in symptomatic stands, with more minor differences for more shade–tolerant species. PTA changes the impact of kauri-dominated canopies on co-occurring saplings, and understanding these effects can help us understand the population-level implications of PTA on kauri and how it affects infected forest stands.

Searching for a pathogen in a needle-stack: screening historical specimens for Phytophthora podocarpi, a recently described pathogen of tōtara

Rebecca McDougal[1], Selwyn Insley[1], Taiāwhio Bryers[1], Bethan Parry[1], Katie Daley[1], Kiryn Dobbie[1], Judy Gardner[1], Stuart Fraser[1]
[1]Scion, Rotorua, New Zealand

Biography:
Stuart is a Forest Pathologist and Research Group Leader, Ecology and Environment at Scion Research, Rotorua. His research focuses on the ecology, epidemiology, and management of forest diseases. He leads and contributes to interdisciplinary projects that aim to improve the resilience of both exotic and native forests. His research has focused on foliar diseases, including those caused by ascomycetes, rusts, and phytophthoras. From 2017-2023 he led research projects that aimed to enhance the resilience of radiata pine forests to needle diseases, including research on growth impacts of diseases, disease epidemiology, forest resilience, control options, and autonomous forest health monitoring. From 2018-now he led research projects on myrtle rust, including research on pathogen adaptability, disease ecology and control, host susceptibility, disease impacts, and natural enemies. Prior to joining Scion in 2017, Stuart undertook a Postdoctoral Fellowship at the Forestry and Agricultural Biotechnology Institute (FABI), South Africa focused on forest rust epidemiology and life cycles. He gained a PhD at the University of Aberdeen, Scotland in 2015 working on host resistance to Dothistroma needle blight.

Phytophthora podocarpi, cause of tōtara blight, was first discovered in 2011 in remnant stands of tōtara (*Podocarpus totara*) within commercial pine forests in New Zealand. Since then, the pathogen has been found sporadically on tōtara, and to a lesser extent on mountain tōtara (*Podocarpus laetus*), across the North Island. As observed with other aerial phytophthoras, detections have often been linked to extended periods of wet weather. The pathogen was officially described as a new species in 2022. Due to the recent discovery and description of this pathogen, very little is known about its biology or potential impact. To investigate the historical status of *P. podocarpi* in New Zealand, as a basis to understand its potential threat to tōtara in natural forests and plantations we are: (1) analysing historical collections for the presence of the pathogen; and (2) collecting cultures of the pathogen to be used in population genetics analysis. Dry specimens of tōtara from Scion's National Forest Fungarium (NZFRIM) were visually examined and those with potential symptoms of tōtara blight selected for analysis. Specimens span a wide geographic and temporal range, with the oldest from the 1950s. Engagement with respective mana whenua is now underway to allow analysis and to source fresh specimens. A qPCR assay for the detection of *P. podocarpi* has been developed that will allow analysis of these samples and support other projects and routine diagnostics. This year the pathogen was detected from within a large contiguous native forest and from a seedling for the first time.

Identifying suitable and accessible refugia to mitigate myrtle rust impacts on maire tawake in wetland forests

Dr Sarah Herbert[1,2], Dr Stephanie Tomscha[1,2,3], Dr Hao Ran Lai[2,4], Dr Rubianca Benavidez[5], Mr Colan Balkwill[1], Miss Pearl Ruston[1,2], Dr Bethanna Jackson[5], Dr Julie Deslippe[1,2]
[1]Centre for Biodiversity and Restoration Ecology and School of Biological Sciences, Victoria University of Wellington, Wellington, New Zealand, [2]BioProtection Aotearoa Centre for Research Excellence, Lincoln, New Zealand, [3]Te Uru Rākau - New Zealand Forest Service, Ministry for Primary Industries, Wellington, New Zealand, [4]Centre for Integrative Ecology, School of Biological Sciences, University of Canterbury, Christchurch, New Zealand, [5]BEEA Ltd., Wellington, New Zealand

Biography:
Sarah Herbert is a postdoctoral research fellow in Julie Deslippe's lab group at Victoria University of Wellington. Her current research is focused on spatial prioritization of conservation efforts for indigenous plants that are threatened by myrtle rust. More generally, her research interests lie in the investigation and development of strategies for biodiversity conservation, ecological restoration and reconciliation, and resource management. She is happiest when occupied with some combination of herpetofauna, infectious diseases, plants, and statistics.

Myrtle rust is an emerging pathogen in Aotearoa New Zealand that represents a grave threat to our iconic indigenous Myrtaceous plant species, including the endangered and culturally important tree maire tawake (*Syzygium maire* / swamp maire). We urgently need to identify refugia from myrtle rust in accessible locations to enable hands-on conservation and restoration management of maire tawake. We employed a novel combination of high-resolution hydrological modeling and integrated species distribution modeling using point process models to identify refugia for maire tawake in the Greater Wellington Region. We mapped myrtle rust infection risk throughout the region to identify areas of lower disease risk and used distance to road as a proxy for human accessibility to maire tawake habitats. We identify 5,216 km^2 of suitably waterlogged soils for maire tawake in the region, of which 369 km^2 are considered highest priority sites because they are predicted to support maire tawake abundances that are higher than the regional average, are accessible, and offer lower risk of myrtle rust infection. Finally, we show that protecting only existing trees in these refugia is unlikely to be sufficient to maintain the regional population size as the myrtle rust pandemic proceeds. We highlight the advantages of a highly local approach to refugia modeling for an endangered tree species and recommend leveraging the power of people to create, expand, and protect habitat for rare species in a rapidly changing world.

Evaluating the effects of two newly emerging plant pathogens on northern Aotearoa-New Zealand forests using an individual-based model

Dr Craig Simpkins[1], Dr Peter Bellingham[2], Dr Kiri Reihana[3], Dr James Brock[4], Prof George Perry[4]
[1]Auckland Council, Auckland, New Zealand, [2]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [3]Taiao Ora Solutions, New Zealand, [4]University of Auckland, Auckland, New Zealand

Biography:
Craig is a Senior Bioinformatics Analyst at Auckland Council, where they work on applying spatial data analytics to inform environmental management and decision-making processes. He completed his PhD at the University of Auckland, focusing on landscape connectivity modelling. Their research interests include spatial modelling, land-use and land cover change modelling, and community and population dynamics.

Globally, forest ecosystems face many threats to their resilience. In Aoteaora-New Zealand (Aotearoa-NZ) these threats include the direct and indirect effects of climate change, shifting disturbance regimes, and newly emerging plant pathogens. During the last 20 years, two plant pathogens have become of widespread concern in Aotearoa-NZ: kauri dieback (a soil-borne disease caused by *Phytophthora agathidicida* and affecting *Agathis australis*) and Myrtle rust (a wind-borne disease caused by *Austropuccinia psidii* and affecting members of the Myrtaceae). The long-term consequences of these pathogens are unclear, but they could drive significant changes in forest composition and ecosystem function. Here we present refinements to an individual-based forest model for northern Aotearoa-NZ that enables us to explore these stressors. The model is used to explore how Myrtle rust and kauri dieback might affect forest dynamics under a range of scenarios. Myrtle rust may speed the decline of the two early successional species considered in the model but has less effect on Carbon storage. On the other hand, kauri dieback may lead to the stand-level loss of all kauri and a significant decline in aboveground live Carbon storage compared to healthy stands. As with other efforts to model NZ's forest ecosystems the model struggles to capture regeneration dynamics of very long-lived species and this, along with including a broader pool of species, is where future model developments should focus.

Risk based surveillance of the pathogen *Phytophthora agathidicida* across the Kaimai Conservation Park

Ms Roanne Sutherland[1]
[1]Department Of Conservation, Tauranga, New Zealand

Biography:
Roanne Sutherland has worked across entomology and pathology biosecurity issues from monitoring the impacts of myrtle rust in the native forests to investigating the phenology and trapping techniques for the Granulate Ambrosia Beetle. She also discovered a new to science gall midge Mycodiplosis constricta from observing the minute larvae feeding on the rust fungus Austropuccinia psidii. Roanne is a Plant Pathogen Technical Advisor for the Department of Conservation based in Tauranga.

Kauri trees once covered 1.2 million ha of land from the far North of the North Island to the Bay of Plenty, however extensive logging in the 1800s saw the number of kauri quickly dimmish with around 2% of the old growth forest remaining. The Kaimai Mamaku Conservation Park covers an area of around 37,000 hectares which is home to the southernmost kauri. *Phytophthora agathidicida* (PA) now threatens the survival of this iconic species and understanding the distribution of kauri and PA helps determine the necessary management actions to protect this long-lived species. Using risk-based surveillance reduces the amount of sampling that needs to occur to detect the pathogen. This talk will look at the development and implementation of a widescale surveillance across the southern most kauri population.

Surveillance tools for mapping the distribution of Kauri and *Phytophthora agathidicida*

Dr. Lauren Waller
[1]Lincoln University, Lincoln, New Zealand

Biography:
Lauren is a terrestrial ecologist, with a particular interest in the dynamic interactions that occur at the root-soil interface. She employs a range of approaches in her research to understand how factors such as invasion by exotic species, habitat fragmentation and other anthropogenic disturbances influence plant and microbial function.

The Kauri tree is a national treasure of Aotearoa and the third largest conifer in the world. Māori see the health of Kauri as an indicator of the wellbeing of the forest and the people, so their protection is of critical importance. However, Kauri are being threatened by the soil-borne *Phytophthora agathidicida*, leading to the fatal Kauri dieback disease. There is a general understanding that PA has spread across the distribution of Kauri, yet we have not performed the landscape-scale, systematic surveillance required to confirm the pathogen's distribution. This talk will cover the surveillance work done to date and the new approaches planned in Kauri forests, highlighting the unique rewards and challenges in this space.

Kauri Survival and Growth in response to Co-Planting and Timing-of-Arrival treatments in Waipoua Forest, Northland

Ms Su Min Yeoh[1,2], Dr Monica Gerth[1,3,4], Dr Lisa Woods[5], Mr Ashley Davenport[6], Mr Conrad Marsh[6], Mr Hone Hohaia[6], Dr Julie Deslippe[1,2,4]
[1]School of Biological Sciences, Victoria University Of Wellington, , New Zealand, [2]Centre for Biodiversity and Restoration Ecology, School of Biological Sciences, Victoria University Of Wellington, , New Zealand, [3]Centre for Biodiscovery, School of Biological Sciences, Victoria University of Wellington, , New Zealand, [4]BioProtection Aotearoa Research Centre, Lincoln University, Lincoln, New Zealand, [5]School of Mathematics and Statistics, Victoria University of Wellington, , New Zealand, [6]Te Roroa Kauri Ora Ranger Team, P.O. Box 6, New Zealand

Biography:
Su Min is currently a final-year PhD candidate in Deslippe lab, VUW. Her research interests lie in plant-microbial interactions.

Global forest decline poses significant threats to ecosystems worldwide, including Aotearoa New Zealand's kauri (*Agathis australis*) forests, which are threatened by dieback disease caused by *Phytophthora agathidicida*. Forest restoration often seeks to leverage facilitative interactions among plant species to combat disease or enhance successional processes, but these strategies remain unexplored in kauri forests. We conducted a two-year field trial to assess the effects of companion planting and time-of-arrival on kauri survival and growth at four sites in Waipoua Forest. The companion plants karamū (K, *Coprosma robusta*) and māpou (M, *Myrsine australis*) were selected based on mātauranga Māori (Māori knowledge) and *in vitro* confirmation of their anti-*Phytophthora* activities. Kauri saplings were planted as two cohorts: one concurrently with companion plants in July 2021, and the other as late-arrival kauri a year later. Site conditions played a crucial role in determining the effects of companion planting treatments on kauri relative growth rates (RGR). In absolute terms, kauri planted in the K and KM treatments grew significantly taller (with 5.2 cm/year and 4.2 cm/year growth respectively) in the site with the highest survival. Likewise, late-arrival saplings generally achieved significantly higher RGR than those concurrently planted (up to absolute rate of 21.4 cm/year in late-arrival treatments as compared to 9.3 cm/year in concurrent batch). Our results highlight the need for site-specific kauri replanting strategies and point to potential benefits of pre-planting with native species prior to planting kauri into certain environments.

Supported by:

Carbon sequestration in Aotearoa NZ's planted native forests

Dr Jacqui Aimers
Tāne's Tree Trust

This presentation is based on a publication authored by biometrician Mark Kimberley, Dr David Bergin, and Prof Warwick Silvester - https://pureadvantage.org/carbon-sequestration-by-native-forest-setting-the-record-straight/

The Emission Trading Scheme Look-up table for native forest is based on data from naturally regenerating shrublands, which have considerably less carbon storage potential than planted native forest. Unfortunately, the Look-up tables are often quoted by people wanting to dismiss the potential carbon sequestration by planted native trees and the call for planting more indigenous forest.

Tāne's Tree Trust (TTT) has comprehensive data on planted native forest, based on four decades of measurements from permanent sampling plots. This Indigenous Plantation Database demonstrates a much greater capacity for carbon storage than the Look-up table for native species would suggest. While native forest is slower to 'take off' than radiata pine (which is 'quick out of the blocks' and peaks relatively early), once established, carbon sequestration in native forest steadily increases.

This database constitutes the largest and best available information on growth rates of planted native trees that we have in NZ with over 10,000 measured native trees and shrubs. TTT has produced its Carbon Calculator for Planted Native Forest based on this database. This research is a first for planted native forest using methodology comparable to that used for planted radiata pine in NZ. Look-up Tables for the ETS should include the option for planted native forest as well as regenerating native forest.

Native Afforestation Programme: Feasibility Study of Establishing a Network of Native Tall Tree Seed Orchards vs. Seed Islands

Dr Stanislav Garbuz[1], Maggie Olsen[2], Dr Jacqui Aimers[3], Dr David Bergin[3], Oliver Coutts[2], Ted Ries[2], Bronwyn Douglas[2]
[1]Ministry For Primary Industries, Te Uru Rākau ¬- New Zealand Forest Service, Wellington, New Zealand, [2]Mānuka Farming New Zealand Ltd., [3]Tane's Tree Trust

Biography:
Stanislav Garbuz completed a PhD in Ecology at Massey University and has been involved in several restoration projects in New Zealand. Currently, he lead the Native Afforestation Research Programme at MPI Te Uru Rākau - New Zealand Forest Service. Stanislav's work focuses on advancing native afforestation efforts and addressing ecological challenges to support sustainable land management.

Aotearoa has lost three-quarters of its native forests since human settlement, mainly due to clearing for agriculture and timber harvesting. The remaining native forests are slow-growing and difficult to re-establish on a large scale. Despite government-supported afforestation programs, an ongoing issue has been ensuring a sufficient seed supply to meet the growing demand for native seedlings and support regeneration.
This research compared seed orchards and seed islands as strategies to address this challenge. Seed orchards are managed plantations that produce genetically improved seeds, offering long-term benefits for ecological restoration and potential commercial use. They serve as genetic archives, particularly when local habitats are under threat, such as in Northland with Kauri dieback. While seed orchards can support future timber markets and protect at-risk genetics, their economic feasibility remains uncertain due to the long-term investment required.
Alternatively, seed islands are small, strategically planted areas designed for natural regeneration. They are easier and less costly to establish, using naturally regenerating groves to disperse seeds across degraded landscapes, promoting biodiversity and ecological restoration with minimal human intervention.
Both approaches hold merit in advancing New Zealand's native afforestation goals, enhancing ecosystem services, and promoting cultural values sustainably. It is crucial for decision-makers to understand the value of each approach to adopt the most suitable strategy for their needs.

Efficient Biomass Estimation in Natural Forests with SLAM Laser Scanning and Deep Learning in Large Plots

Dr David Pont[1], Dr Dejan Firm[1], Dr Thomas Paul[1]
[1]New Zealand Forest Research Institute (Scion), Rotorua, New Zealand

Biography:
Dr. David Pont is a leading scientist at Scion, specializing in the use of LiDAR technology to characterize forests and individual trees. His expertise lies in applying advanced LiDAR techniques to enhance forest measurement, structure analysis, and biomass estimation. Dr. Pont has pioneered methods for accurately assessing forest dynamics and tree attributes using LiDAR, significantly advancing the field of remote sensing in forestry. His work plays a crucial role in sustainable forest management and ecological research, providing valuable insights into forest health and productivity. Dr. Pont's contributions are instrumental in leveraging LiDAR technology to improve our understanding of forest ecosystems.

Accurate assessment of forest structure, stem volume, and biomass is crucial for global forest monitoring. Terrestrial laser scanning (TLS) has emerged as a promising tool for this purpose, particularly when applied to large-scale plots in diverse forest ecosystems. In this study, we evaluated a Simultaneous Localization and Mapping (SLAM) LiDAR system, used as a backpack-mounted scanner, to characterize above-ground biomass in two 1.5-hectare plots within an old-growth temperate rainforest. Point clouds from the scans were processed using novel semi-automated and automated methods to detect trees and estimate diameter at breast height.

The SLAM system proved time-efficient, providing comprehensive coverage of the dense, multi-layered vegetation. Semi-automated tree detection achieved an accuracy of 94% for trees with diameters greater than 0.8 meters and 87% for those between 0.4 and 0.8 meters. A deep learning model (YOLOX-tiny) for fully automated detection reached over 80% accuracy for trees above 0.4 meters in diameter, which were the primary contributors to live biomass. Diameter estimation methods revealed that while conventional circle-fitting was inadequate, the most effective method was nearly unbiased (-0.7%) with an R-squared of 0.99.

These results demonstrate that the SLAM-based approach provides robust, efficient, and accurate data for forest structure analysis in heterogeneous stands, despite using a lower resolution scanner compared to other TLS studies. This methodology offers significant potential for improving forest biomass estimates and supports the development of large-scale, accurate forest monitoring from airborne and satellite platforms.

Small patches of trees make critical contributions to Aotearoa-New Zealand

Dr Daniel Richards[1], Kara Allen[1], Scott Graham[1], Nikki Harcourt[2], Nick Kirk[1], Sandra Lavorel[1,3], Sam McNally[1], Maksym Polyakov[4], David Whitehead[1]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Manaaki Whenua - Landcare Research, Hamilton, New Zealand, [3]Laboratoire d'Ecologie Alpine, Université Grenoble Alpes - CNRS – Université Savoie Mont Blanc, Grenoble, France, [4]Manaaki Whenua - Landcare Research, Auckland, New Zealand

Biography:
Dan Richards is a researcher at Manaaki Whenua – Landcare Research. His work looks at how ecosystems provide benefits to people, particularly regarding climate change adaptation. He has worked previously in Europe and Southeast Asia, and has published over 60 peer-reviewed papers.

Small patches of trees add heterogeneity to grassland landscapes, and provide many benefits. Economic pressures have driven the management of grasslands either towards removing tree cover to enhance agricultural productivity, or large-scale conversion of grassland to production forests. Protecting existing small patches of trees, and encouraging their establishment across grassland landscapes is challenging since the current extent and benefits of these patches is not known. This study demonstrates the critical contributions of small tree patches (those less than one hectare in area) in Aotearoa-New Zealand's (A-NZ) grassland landscapes.
Using a high-resolution tree cover dataset, we mapped 1,639,015 small tree patches in grasslands across A-NZ, encompassing a total land area of 190,270 hectares. We used a probabilistic simulation approach to estimate carbon stocks and annual sequestration, revealing a potential aboveground carbon stock between 11.8 and 32.4 million tonnes (Mt) and an annual sequestration of 0.28 to 0.88 Mt. Despite their current exclusion from the national carbon emissions market, economic valuation suggests a liability of between $NZ 2.7 billion and $NZ 7.3 billion if the small tree patches were felled, and a market value of between $NZ 62.5 million and $NZ 196.6 million annually for sequestration. In addition to carbon, small patches of trees provide co-benefits including shade provision for livestock, soil erosion control, and importance within Te Ao Māori. This research contributes to a more holistic understanding of these benefits in the framework of the Trees in Landscapes, *Te Kapunipunitanga a Tāne Mahuta* programme.

Impacts of introduced browsers on forest carbon stocks measured over four decades: A Maximising Forest Carbon Programme case study from Rakiura/Stewart Island

Dr Micah Noel Scholer[1], Dr Alex Fergus[2], Narkis Morales[2], Chris Stowe[3], Kiri Pullen[3], Dr Renee Johansen[4], Dr Sarah Richardson[2]
[1]Te Uru Rakau - New Zealand Forest Service, Rotorua, New Zealand, [2]Manaaki Whenua - Landcare Research, Rīkona / Lincoln, New Zealand, [3]Urtica Ecology, Aparima / Riverton, New Zealand, [4]Te Papa Atawhai - Department of Conservation, Ōtautahi / Christchurch, New Zealand

Biography:
I am an ecologist and conservation biologist by training. My research focus began with monitoring populations of forest birds in North and South America and expanded to include overall biodiversity. I am now part of a team of researchers at Te Uru Rākau working to improve how we measure and manage carbon in New Zealand's exotic and natural forest ecosystems.

Natural disturbances, impacts from introduced species, and management interventions can all drive changes in forest carbon stocks. Consistent, repeated measurements from natural forests over decadal time frames provide a critical information source for understanding how these multiple drivers interact to determine long term dynamics in forest carbon stocks.
This joint agency study involved the remeasurement of 66 permanent forest plots on Rakiura / Stewart Island. These plots were selected because they sample forests where carbon stocks are dominated by palatable tree species such as kāmahi and measurements span up to 48 years. Plots sampled included a mix of offshore islands where deer and possums have never occurred (Bench Island), plots on islands where they have been eradicated (Ulva Island), plots on mainland Rakiura where deer are excluded (exclosure plots), and plots in unmanaged areas with ambient animal densities. This unrivalled experimental design permits analyses of deer and possum impacts. Forest carbon stocks, tree species richness, and tree demographic rates were estimated from data collected using the DOC Inventory and Monitoring standard 20 x 20 m methods. The relative abundances of deer and possums were measured on a representative subset of 38 plots using faecal pellet counts and chew cards, respectively. During this talk, we will highlight the value of long-term forest plot networks for biodiversity and carbon monitoring and the need for their regular measurement. We will also present preliminary findings and discuss implications of introduced animal management interventions for carbon stocks in natural forests.

Using Global Navigation Satellite System technology to improve location accuracy for applied ecological research within indigenous forests

Dr Alex Fergus[1], Dr James Shepherd[2]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Manaaki Whenua - Landcare Research, Palmerston North, New Zealand

Biography:
Dr Alex Fergus is a field botanist, field ecologist and field team leader, with significant experience across multiple agencies working in different ecosystem types throughout Aotearoa New Zealand. Quantitative ecology background with expert knowledge of forest permanent plot methodologies, including relocating and remeasuring historical vegetation plots in native forests. Demonstrated experience managing the delivery of large and complex projects for both the Department of Conservation and Manaaki Whenua – Landcare Research.

Dr James Shepherd applies remote sensing and image analysis approaches to a range of vegetation and land monitoring and measurement challenges. He has over 25 years in developing new approaches to mapping land cover from satellite imagery. He has led the delivery of national maps in support of MfE's Kyoto reporting and the ETS as well as the national LCDB and other vegetation analysis. Diverse projects include mapping possum habitat and impacts of kauri die-back, and mapping landslides and other storm damage to support emergency response and recovery.

Manaaki Whenua – Landcare Research are using existing Global Navigation Satellite System (GNSS) technology to improve location accuracy for applied ecological research within indigenous forests. Spatial accuracy is critical for ground-truthing remotely sensed data and enabling its application to ecological or environmental measurement and monitoring. For example, highly accurate ground-based spatial data could be used to leverage that derived from remote sensing to calculate carbon storage estimates for extrapolation to landscape scales across different ecosystem types. However, achieving high spatial accuracy in forested environments has several challenges. GNSS signals travelling through forest canopies are subject to blockage, attenuation, and reflection, irregular topography can also block signals for some locations and atmospheric conditions can affect signal propagation. The use of survey grade GNSS receivers and differential correction techniques can significantly improve accuracy. Light Detection and Ranging (LiDAR) also has the potential for directly measuring above ground forest carbon over large areas, and with regional LiDAR data it may be possible to produce national maps of forest carbon permitting better management of emissions and sequestration. Working with DOC and mana whenua we have begun the roll-out of a national network of hectare plots that will be used as test sites for developing relationships between regional LiDAR and above ground forest carbon. In this talk we discuss methods and assess the effectiveness of the technology by comparing individual tree positions and sizes between ground-based physical measurements and digital forest twins generated using high resolution LiDAR.

Investigating the use of Carbonyl Sulfide as a tracer for Gross Primary Production of New Zealand indigenous forests

Miss Kararaina Te Puni[1], Dr Peter Sperlich[1], Gordon W. Brailsford[1], Dr Haeyoung Lee[1], Rowena C. Moss[1], Molly Leitch[1], John McGregor, Dr Sara Mikaloff-Fletcher[1], Sylvia Nichol[1], Abby Vincent[1], Dr Julie Deslippe[2]

[1]National Institute Of Water And Atmospheric Research, Wellington, New Zealand, [2]Te Herenga Waka - Victoria University Of Wellington, Wellington, New Zealand

Biography:
Kararaina Te Puni (Ngāti Porou, Ngai Te Rangi, Ngāti Raukawa ki te Tonga, Rangitāne o Manawatū) is a PhD student completing research in a partnership between NIWA and VUW under the CarbonWatch-NZ project. Her research looks to investigate the contribution that native ngāhere have to the carbon budget of Aotearoa. She has a passion for protecting te taiao and particulalry native ngahere.

She is a member of the Māori Women Welfare league Rangitāne peka, is a trustee for the Rangitāne o Manawatū culutural trust.

Understanding present-day CO_2 fluxes is vital for robust predictions of the atmospheric CO_2 load. Carbonyl sulphide (COS) can serve as an independent tracer for gross primary production (GPP), because similar size and structure of COS and CO_2 allows their simultaneous uptake during photosynthesis. However, unlike CO_2, which can be reemitted through respiration, COS remains fixed in plant tissues after uptake. This makes changes in atmospheric COS concentrations a potentially useful proxy for GPP at ecosystem scales.
We present a novel method for simultaneous measurement of COS and CO_2 in discrete air samples. We use a continuous flow coupled to a custom-built sample inlet system, allowing concurrent analysis of multiple flask samples. We achieve measurement precisions for COS, CO_2 and CO of around 1 ppt, 0.1 ppm and 0.1 ppb, which is sufficient to enable investigations at the ecosystem scale. Our sampling approach involves collection of air samples upwind and downwind of the forest. Upwind sites are selected where air is coming off the ocean and downwind sites are chosen so that the air is representative of forest-atmosphere interactions. The differences in COS between are used to infer CO_2 uptake of a New Zealand indigenous forest. Preliminary results from sampling sites show differences in COS between measurement sites (> 6ppt), suggesting a spatial GPP gradient of >4 ppm CO_2.
Our method is currently applied to the Raukūmara forest in the East Cape of New Zealand. We aim to assess the contribution of New Zealand Indigenous forests to the national carbon budget.

Review of current research on native forest establishment on extremely eroded land

Dr Sandra Velarde Pajares[1,2], Kyle Wills[1], Lisa Arnold[1]
[1]WSP, Rotorua, New Zealand, [2]Te Pūnaha Matatini, New Zealand

Biography:
Dr Sandra Velarde Pajares is a Registered Forestry Consultant at WSP and Principal Investigator at Te Pūnaha Matatini, Centre of Research Excellence for complex systems. Her international and national experience in forestry and transdisciplinary expertise in research and policy expands 20 years, including the World Agroforestry Centre, the International Center for International Tropical Agriculture, the United Nations Food and Agriculture Organization (FAO), Scion (New Zealand Forest Research Institute Ltd.) and the Climate Change Commission. Recently, Sandra was the Technical lead for four literature reviews on native afforestation for Te Uru Rākau-New Zealand Forest Service at the Ministry for Primary Industries. Formerly, as senior analyst at the Climate Change Commission, Sandra led the synthesis of the evidence base on forestry that led to key recommendations for Ināia tonu nei Ināia tonu nei: a low emissions future for Aotearoa. Sandra holds a diploma on Te reo Māori level 5 and has strong cultural capabilities built for the last 10 years working with different iwi around Aotearoa New Zealand. Sandra brings a deep understanding of the interactions between forestry and farming, rural, local and multicultural communities.

Establishing native plants on steep land poses a number of challenges including access, health and safety, and unsuitable environmental and soil conditions. A variety of techniques are being used to establish trees on erodible land both in New Zealand and internationally. We reviewed the available information on techniques used for recent native tree establishment projects within New Zealand, and techniques used internationally for erosion control, including bioengineering.
Our review highlights that plant root systems provide the primary mechanism of reinforcing soil and control erosion, however the spread and depth of rooting systems is highly variable between native species. While mānuka is the most common native species used as a nurse crop when planting areas of steep, erodible land, other non-woody species in native forest succession such as ferns and mosses should be investigated. Restoration approaches that assist natural regeneration, either by attracting birds that eat certain species, or planting seed islands, are significantly more cost effective than planting out bare or pastoral areas in forest. We reviewed techniques that are being used or trialled in New Zealand (e.g. Geotextile coverings, seed islands, drone seeding, space planting), and others are used internationally and could be applicable to New Zealand (e.g. live staking, live fascine, brush layering). The use of nurse crops is also discussed, with a particular focus on those non-native shrub species that could provide erosion control. We identified knowledge gaps and recommendations for targeted future research to support native forest establishment projects on highly erodible land in New Zealand.

Bridging Knowledge Gaps: Enhancing Collaborative Knowledge of Pekapeka and Conservation Efforts in South Auckland

Dr Natasha Bansal[1], Ben Paris[2], Kelly Wootton[2], Zion Flavell[1,3], Sky Flavell[3]
[1]Ecoquest Centre For Indigeneity, Ecology And Creativity, Whakatiwai, New Zealand, [2]Environmental Services, Auckland Council, Auckland, New Zealand, [3]Ngaati Te Ata Waiohua, Waiuku, New Zealand

Biography:
Ben Paris is a senior conservation advisor for Auckland Council and more famously known as Batman. He embarked on his professional journey at the Waikato Regional Council, where Ben's fascination with New Zealand's native bats began, leading him to co-lead the establishment of Project Echo.

Transitioning to Auckland Council, Ben continues to contribute significantly to launching a bat awareness movement throughout Tamaki Makarau. Ben is a Pekapeka Person, and co-leads the Finding Franklin Bats project with other stakeholders.

Zion Flavell of Ngaati Te Ata Waiohua was inspired to step into Te Taiao by his koro, George Flavell. This gave him the connections he needed to step into the Kaitiaki Ranger role for the pekapeka mahi. Since then, he is a Pekapeka person and has been involved in Finding Franklin Bats.

Natasha Bansal is a researcher at EcoQuest Centre for Indigeneity, Ecology and Creativity. She is a Wildlife Biologist and has an interest in behavioral ecology and empowering communities for conservation research. Natasha is a Pekapeka person and co-leads the Finding Franklin Bats research project.

Finding Franklin Bats, a collaborative project between Auckland Council, scientists from EcoQuest, local community groups, mana whenua and landowners carried out their first pekapeka trap and track season in November 2023. The project was co-led by kaitiaki from Ngaati Te Ata Waiohua and utilised more than 700+ volunteer hours which is a testament to collective effort of the community and kaitiakitanga. Individual bats were caught and tracked using radio transmitters for two weeks, and additionally, by using night tracking and triangulation, we were able to gain our first insight into the habitat use by female long-tailed bats during the breeding season in a fragmented landscape like Franklin. We believe predator control in Franklin may have an important role in the choice of foraging and roosting sites. We conclude that the distinct variety of vegetation in the fragmented forests supporting an abundance of food sources could be decreasing the range and increasing colony size of these long tailed bat populations.
Following our presentation, Sky Flavell, a Kaitiaki Ranger from Ngāti Te Ata, will share her personal journey as a Pekapeka Kaitiaki. Experience the profound connection she and her iwi have forged with these remarkable bats and gain insight into the cultural and personal transformations that arise from this stewardship.

Effect of traffic noise playback on bat behaviour and vocalisations

Miss Alisha Hart, Dr Patrick Monari[1], Dr Kerry Borkin[2], Dr Kristal Cain[1], Tim Prebble[3], Dr Ellen Cieraad[4], Dr David Pattemore[1,5]
[1]University Of Auckland, Auckland, New Zealand, [2]Department of Conservation, Taupō, New Zealand, [3]Department of Conservation, Wellington, New Zealand, [4]Department of Conservation, Nelson, New Zealand, [5]The New Zealand Institute for Plant and Food Research Limited, Hamilton, New Zealand, [6]Bioresearches, Auckland, New Zealand

Biography:
Alisha Hart worked on a project funded by the Department of Conservation for her MSc degree, investigating the effects of traffic noise playback on bats in Pureora Forest Park. She spent a month and a half living in Pureora during this trial, where she had the joy of experiencing Aotearoa's bats in native old-growth forest and exploring the area in her spare time. Since completing her degree, Alisha has started a position as an Ecologist with Bioresearches, where she is conducting bat surveys and providing guidance to clients around design and mitigation strategies, while also preparing publications from her MSc.

Anthropogenic sound is increasingly recognised as a prevalent pollutant with broad effects on wildlife. Transportation networks often cross otherwise relatively undisturbed habitats, and the noise generated is typically chronic and high intensity. The way that this noise interferes with how animals relay and receive acoustic signals that drive their behaviour remains largely unknown. Bats (order Chiroptera) are the second most diverse mammalian group but have received limited attention in anthropogenic noise studies, despite strong acoustic reliance amongst echolocating bats. Here we use a 'phantom road' paradigm to experimentally isolate and assess the effect of traffic sound playback on the avoidance and mitigation behaviour of the two extant bat species in Aotearoa New Zealand. We also investigate whether bats alter their call structures in response to sound playback, to begin to understand which strategies, if any, bat species use to cope with a noisy environment. We found an approximate 50% reduction in the mean number of passes per night of both bat species during sound playback, suggesting that bats are avoiding noisy areas, but this effect reduced quickly with distance. We also found that call structure appeared to be altered when bats were present during traffic playback. As avoidance of areas reduces the amount of quality habitat accessible, chronic noise may impose fitness costs on declining native bat species. With increasing areas of natural habitat exposed to anthropogenic noise, untangling the effects of high sound levels is therefore crucial for conservation of bats and the ecosystem services they provide.

Time to re-think Auckland's bat scene? - Surprising results from year-round monitoring in the North-West suggests it is.

Mr Neil Henderson[1]
[1]Kaipatiki Project, Auckland, New Zealand

Biography:
Neil Henderson has been working with the Kaipatiki Project since 2018, undertaking environmental restoration programs on Auckland's North Shore, as well as exploring biodiversity monitoring as a way to advance citizen science with local volunteers and university interns from NZ and overseas. Coming from a wide zoological and botanical background that has included work with DOC in Pureora Forest tracking kaka, through to over a decade assisting community organisations and landowners remove invasive weeds in the Waitakere Ranges in Auckland ,Neil is passionate about ecosystem health and how we measure the results of our actions in trying to advance it.

Kaipatiki Project and Community Waitakere are Community based organisations supported by Auckland Council to undertake surveying and monitoring of pekapeka tu roa in The Waitakere Ranges, the Kumeu/Taupaki fragmented rural landscape and into both Riverhead and Woodhill plantation pine forests. The two latter areas having recently been returned to Iwi ownership.
Best practise in the Auckland Region revolves around a limited Season between December and February (the bat maternity period) and March-May, (the bat mating season). Widespread adherence to these protocols has resulted in little if any monitoring done in the Auckland Region outside of the season. This is despite most of the data in support of these protocols, coming from well South of Auckland and in some cases as far away as Fiordland.
Our two organisations have undertaken acoustic monitoring using ABM on a year round basis, between 2021 and the present, amassing over 80,000 recorded bat passes from three sites in the Waitakere Ranges Cascades and over 30,000 passes at a single site in the heart of Riverhead pine forest. Although our data is sporadic through some months because of constraints around access to equipment, man power and funding, we have discovered consistently high levels of bat activity at all these sites throughout the year, in some instances equalling and even exceeding seasonal months, leading us to suspect there may be important elements of bat ecology and behaviour in the Auckland region that we are simply missing out on.

Assessing the risk of wind farms on pekapeka-tou-roa (long-tailed bats, (*Chalinolobus tuberculatus*)) and applying a suitable effects management regime

Mr Gerry Kessels[1]
[1]Bluewattle Ecology, Hamilton, New Zealand

Biography:
Mr Kessels is an experienced ecologist and independent hearing commissioner. He has project managed, peer reviewed, and been involved in effect assessments on bats throughout New Zealand since 1998. In 2011, Mr Kessels presented the findings of his three-year research programme on assessing and predicting avian bird strike risk to the first Wildlife and Wind Farm Conference in Norway on behalf of the NZ Ecological Society. Mr Kessels is currently acting as an independent peer reviewer of the monitoring programme on the consented and operational Waipipi (Waverly) Wind Farm and the consented Kaiwaikawe (aka Omamari) Wind Farm.

Dr Ian Davidson-Watts has been researching bats since 1993. In the UK he has led a range of research and development related projects involving advanced techniques for the survey and assessment of bats, Including major infrastructure. Ian's PhD investigated the ecological differences between the common and soprano pipistrelle bats (the smallest European bat species) and he has undertaken research into bat swarming sites and the ecology of barbastelle, Bechstein's and greater horseshoe bats. In New Zealand Ian has been undertaking survey and assessments for long-tailed bats on the West Coast, Southland, Otago, Waikato and Auckland Regions.

From 2000 onwards, it has been estimated that 35% of all global multiple bat mortality events were due to collisions with wind turbines. Since bat species have low reproduction rates outside the tropics, the potential losses caused by wind turbines must be considered as a mortality factor relevant to the population of a species at a landscape level.
No publicly accessible studies have investigated the impacts of wind farms on either of New Zealand's native bat species. Therefore, it is not clear what kind of behaviour either species exhibit toward wind turbines. Given long-tailed bats are the most widely distributed of NZs two extant species, it is likely most at risk of being adversely affected by the construction and operation of wind farms. Overseas research shows that wind farms can adversely impact non-migratory, insectivorous bats and their habitat requirements in the following ways:

- Direct collision mortality or injury, barotrauma and other injuries;
- Loss and/or fragmentation of roosting, commuting and foraging habitat; and
- Displacement of individuals or populations.

Long-tailed bats are non-migratory, edge/gap-foraging, aerial hawking bats with moderate manoeuvrability, which international research indicates that they are at risk of direct impact with turbine blades, or via barotrauma.
There are a number of proposed wind farms in the pipeline in Aotearoa, many of which will likely be processed through the new fast track legislation. Given the potential risk wind farms pose to long-tailed bats, combined with the time constraints a fast track consent application regime will place on the ability to undertake robust site specific studies, there is a urgent need to undertake research and investigate the efficacy of effects management measures, such as turbine blade curtailment and deterrent technology.

Whispers of the Night: Where could we broadcast ultrasound to repel pest moths from crops without affecting pekapeka?

Mr Jarod McTaggart[1], Dr David Pattemore[1,4], Dr Kerry Borkin[2], Dr Flore Mas[3], Dr Adriana Najar-Rodriguez[3]
[1]University of Auckland , Auckland, New Zealand, [2]Department of Conservation, Taupō, New Zealand, [3]The NZ Institute for Plant and Food Research, Lincoln, New Zealand, [4]The NZ Institute for Plant and Food Research, Ruakura, New Zealand

Biography:
Jarod is a postgraduate student at the University of Auckland, currently completing his Master's in Biosecurity and Conservation. His project is in collaboration with Plant and Food Research, considering the implications of ultrasonic emitters as a pest control method, in this case, the behavioural impact on pest moths and native bats.

Broadcasting ultrasonic frequencies has been proposed as a tool to repel pest moth species from agricultural systems. Field trials in Japan have shown the efficacy of this technology, however, before we consider its use in agroecosystems in Aotearoa, understanding the potential non-target effects on native species is vital. Potential impacts on pekapeka must be considered, given they are culturally significant taonga species with already vulnerable populations. Part of understanding these impacts and ensuring safe implementation is mapping the distribution of pekapeka in Aotearoa, notably in relation to agricultural areas. Using data made available by the Department of Conservation (DOC), we assessed the coverage of reported surveys and records of bat presence. Our results show patchy survey coverage throughout Aotearoa, particularly on the South Island's east coast, an area that is heavily used for agriculture. Furthermore, the literature suggests that native old-growth forests have historically been prioritised for bat monitoring, while more contemporary studies have found that pekapeka use a wider variety of land cover types. Our research indicates that bat surveys should be conducted in a wider range of land cover types, especially when considering the use of technology that may affect pekapeka.

Progress towards recovering New Zealand's threatened bat populations; What have we learnt and what's next?

Colin O'Donnell[1]
[1]Department of Conservation, Christchurch 8140, New Zealand

Biography:
Colin O'Donnell is a Principal Science Advisor in the Department of Conservation's Fauna Science Unit. He leads DOC's Threatened Species Research Workstream, which prioritises, commissions and oversees new research on threatened species across all domains. He has studied pekapeka/NZ bats for >30 years, investigating all manner of aspects of their ecology, genetics, social structure and threats and has tested and applied management approaches for their conservation. He has been a member, and past leader, of the NZ Bat Recovery Group since its inception.

The range and numbers of the five bat taxa in Aotearoa New Zealand have declined significantly and extant taxa are classed as Threatened or At-Risk. The Department of Conservation has led an active recovery programme for bats since 1995 aimed at securing key populations from extinction that represent the full genetic and distributional range. Intensive studies have described habitat preferences and use, home range and roosting requirements, population structure, breeding behaviour and conservation genetics. A wide range of threats to bat populations include predation and competition from exotic pests, habitat degradation and loss, and disturbance. Intensive ecological studies elucidated the importance of these threats and have led to the development of specific predator control prescriptions for implementation at priority sites for bat conservation. Management includes using legal mechanisms for protection, general advocacy and education, developing community-based conservation initiatives, control of exotic pests, particularly introduced predators, active protection of roosts sites, protection of aquatic and terrestrial foraging habitats and a raft of habitat restoration techniques. Translocations to predator free habitats have been trialled. Intensive predator control tailored to protecting bat populations has commenced at 35 priority sites covering >600,000 ha of bat habitat. However, although there are several examples of pest control reversing declines, these initiatives have not been running long enough to determine overall if management is being effective at reversing declines. Recently, a Climate Change Vulnerability Assessment indicated that extant bat taxa demonstrated High Latent Risk profiles under the carbon dioxide concentration scenario RCP4.5 2040 indicating they should be monitored closely to determine if the projected changes in climate happen earlier than 2090. All taxa were categorised as Highly Vulnerable by RCP8.5 2090. There is still much to learn about the ecology of bats to aid development of effective conservation management practices. Research and management priorities for the immediate future include developing effective pest control to recover bat populations in Aotearoa's warm forests, understanding emerging pressures such as those associated with collisions with wind turbines, effects of fragmentation of foraging and roosting habitats as a result of urbanisation and infrastructure projects (e.g., solar farms, roading), emerging biosecurity risks and understanding indirect effects such as noise and lighting.

How prey abundance and weather influence long-tailed bat (*Chalinolobus tuberculatus*) activity in a fragmented agricultural landscape.

Mr Jode Page-Corney[1,2], Dr. David Pattemore[2,3], Dr. Kerry Borkin[4], Dr. David Seldon[2]
[1]Wildland Consultants Ltd., Auckland, New Zealand, [2]University of Auckland, Auckland, New Zealand, [3]The New Zealand Institute for Plant and Food Research Ltd., Hamilton, New Zealand, [4]Department of Conservation, Taupō, New Zealand

Biography:
Jode Page-Corney is a passionate field ecologist at Wildland Consultants Ltd. Over the course of the last five years, Jode has journeyed from hands-on roles in the ecological restoration space to his current position as a field ecologist specializing in bat ecology and botany. Jode recently completed his Master's degree in Biological Sciences at the University of Auckland. This project helped him refine his passion for bat ecology and conservation, while teaching him a plethora of research skills.

Understanding bat habitat selection in Aotearoa-New Zealand, particularly for the critically endangered long-tailed bat (*Chalinolobus tuberculatus*), is challenging. Previous research on long-tailed bats has largely focused on their ecology in intact forested ecosystems. However, recent survey efforts have revealed use of a much wider variety of modified landscapes and land cover types; amongst these, fragmented agricultural landscapes. Understanding what drives use of fragmented agricultural landscapes by long-tailed bats is key to ensuring their persistence in this largely overlooked landscape type. The objective of our research was to investigate how insect prey availability, weather and moonlight intensity predicted bat activity in fragmented agricultural landscapes with an emphasis on comparing activity along forest edges and in pasture. We monitored bat activity using acoustic detectors at 20 sites across five localities, and collected concurrent data on prey availability, moonlight and weather. Statistical models were then created to assess the relative importance of these variables in predicting habitat use by long-tailed bats. Contrary to what was hypothesized, the biomass of small insect prey (<5 mm body length) was positively associated with bat activity in pastoral areas. Furthermore, this selective use of pasture, based on prey availability, coincided with increases in bat activity on warmer nights and decreased activity on nights with greater moonlight intensity. These findings enhance our understanding of habitat selection by long-tailed bats and highlight the need for further research into their role as potential biological control agents in agricultural landscapes.

No Pulse Left Behind: opportunities for automated radio monitoring and tracking of bats

Dr David Pattemore[1,2,3]
[1]University Of Auckland, Auckland, New Zealand, [2]Bushcast Limited, Tauwhare, New Zealand, [3]The New Zealand Institute for Plant and Food Research Limited, Hamilton, New Zealand

Biography:
Dr David Pattemore has worked as a pollination biologist and ecologist at Plant and Food Research for 13 years, since finishing his PhD at Princeton University in the USA. He holds a joint appointment at the School of Biological Sciences, University of Auckland, and just this year has started his own radio telemetry company, Bushcast. David has a passion for ensuring that his research makes a difference for people, communities, and ecosystems, whether that's his work in crop pollination, or his venture in bringing new radio telemetry technology to the region.

The use of radio-frequency transmitters to monitor and track wildlife has delivered significant benefits for the conservation of threatened species. The technology has been used successfully in Aotearoa-New Zealand to locate roost sites of both extant bat species and understand their movements and behaviour. The use of radio transmitters on bats is limited by concerns about the impact of the capture and attachment of the transmitters on individual bats and their populations, the labour available to track the transmitters, the adhesion of the transmitter to the bat, the battery life of the transmitters, and the cost of the transmitters. Given these constraints, maximising data capture from these transmitters when used with bats is an important goal. Automated monitoring can continue to monitor signals from transmitters continuously to complement more periodic data collection by manual tracking. Here I will discuss and critique a range of options available for automated monitoring of bats fitted with radio transmitters, based on initial trials as well as experience with other species, showing that automated monitoring can provide insights into activity patterns and social interactions. I will also outline some scenarios of how automated tracking of bat movement could be achieved.

Do bats cross the road? Behavioural monitoring of long-tailed bats (*Chalinolobus tuberculatus*) along the Waikato Expressway

Hannah Robinson[1], Dr Lisa Denmead[2]
[1]WSP, Hamilton, New Zealand, [2]WSP, Nelson, New Zealand

Biography:
Hannah is an ecologist at WSP specialising in the management and monitoring of bats in a variety of projects throughout the North Island. Most notably, she undertakes annual long-term monitoring of long-tailed bats along the Waikato Expressway with a team of ecologists enthusiastic about bat conservation. Hannah completed her MSc at the University of Waikato, researching the uptake of artificial roosts by long-tailed bats in Hamilton City. She is committed to furthering her knowledge about bats in New Zealand and strives to gain more expertise in this area.

Research suggests roads impede bat foraging and commuting via behavioural avoidance or direct mortality. The Hamilton Section of the Waikato Expressway was built through known long-tailed bat (*Chalinolobus tuberculatus*) habitat. To determine if the construction and operation of the Hamilton Section has resulted in long-tailed bat behavioural changes, NZTA engaged WSP to undertake behavioural monitoring using thermal imaging technology at five commuting routes crossing the Expressway. Monitoring began during the construction period and will continue for the first five years after the road becomes operational (2023-2027). Monitoring is completed annually for five nights at each site. Analysis focuses on if the proportion of four flight behaviours are changing between survey years, and if bats crossing the road are doing so at a safe height (>5 m above road corridor). Initial analysis, after the first five years (2019-2023) of monitoring, suggests the proportion of bats crossing the road has declined over time, which could be indicative of the road causing disruptions to bats. However, there were no significant changes in the proportion of behaviours that could indicate avoidance of the road (e.g. reversal). Only 0.9% of the 424 bats detected crossing the road to date have crossed at an unsafe height. However, when the road was first fully operational in 2023, only 0.2% of crossings occurred at an unsafe height. When complete, this monitoring may provide insights into long-term effects of roads on long-tailed bat behaviour and inform the suitability of thermal imaging as a tool for mitigation monitoring.

Dietary turnover time and diet-faeces trophic discrimination factor of an Aotearoa New Zealand bat determined through controlled feeding experiments

Miss Lola Nomblot[1], Dr Kerry Borkin[2], Dr Sarah Bury[3], Dr Amandine Sabadel[1,3,4]
[1]Zoology Department, University of Otago, Dunedin, New Zealand, [2]Department of Conservation, Taupō, New Zealand, [3]National Institute for Water and Atmospheric Research, Wellington, New Zealand, [4]Auckland University of Technology, Auckland, New Zealand

Biography:
I am a chemist, ecologist, and environmental scientist. I work across all ecosystems, ki uta ki tai, and as such my approach to research is very holistic and finds its strength in its interdisciplinarity.

I have mastered analytical chemistry and the state-of-the-art compound-specific stable isotope analysis techniques, and have become an expert in reconstructing energy links between organisms, and between organisms and their environment(s).

Studying the diets of bats is challenging due to their rarity, cryptic nature, nocturnal habits, and protected status. Stable isotopes analysis of bat faeces offers a promising non-invasive and non-lethal method to understand their trophic interactions. However, it requires knowledge of the isotopic difference between food items and resulting faeces, known as the trophic discrimination factor (TDF). Accurate TDF calculations require a precise knowledge of the diet obtained through controlled feeding experiments. In this study, we used the opportunity of a rare feeding trial conducted on a rehabilitating *Chalinolobus tuberculatus*, a threatened Aotearoa New Zealand bat (pekapeka) species, to determine its diet-faeces TDF. We also employed DNA metabarcoding to estimate the turnover time (ingestion to excretion) of specific food items. We calculated TDFs values for carbon and nitrogen as 0.61 ± 1.47‰ and -0.94 ± 1.40‰, respectively, with neither significantly different from zero. These measured diet-faeces TDF values will enable more reliable estimates of bat food sources from stable isotope analyses of bat faecal samples. The food turnover rate was between 3 to 4 hours, thus indicating the dietary timeframe that a faecal pellet represents. This combined diet-faeces TDFs and food turnover rate information will significantly advance future studies of bat trophic ecology, particularly within the genus *Chalinolobus*.

Does white light and blue wavelength-filtered light influence the activity of light-naïve long-tailed pekapeka?

Titia Schamhart[1], Kerry Borkin[2], Nicholas Ling[1], Clare Browne[1], David Pattemore[3], Grant Tempero[1]
[1]School of Science, University Of Waikato, Hamilton, New Zealand, [2]Fauna Science, Terrestrial Biodiversity Unit, Department of Conservation, , New Zealand, [3]School of Biological Sciences, University of Auckland , Auckland, New Zealand

Biography:
Grant Tempero is a freshwater and behavioural ecologist at the University of Waikato.

Artificial light at night (ALAN) has negatively impacted many bat species, by altering diurnal rhythms through physiological disruption and effective exclusion from foraging areas. In New Zealand, recent research suggests long-tailed pekapeka (*Chalinolobus tuberculatus*) activity is both reduced and delayed in the presence of white light (4000K). However, there has been little research into the effects of different ALAN wavelengths on pekapeka.
White light is one of the most common illumination sources and is partially composed of blue wavelengths which have been demonstrated to negatively impact some nocturnal animals. The response of light-naïve long-tailed pekapeka to reduced blue light wavelengths was investigated by comparing the relative effect of white LED light (4000K) to phosphor converted (PC) amber LEDs (2700K) which were coupled with a blue cut filter to further reduced the proportion of blue wavelength light. Two rural sites were individually lit with asynchronous alternating 4-day periods of either white, PC amber or no light, over 6 weeks, a third unlit site was used as a control. Pekapeka nightly activity rates were lower when sites were lit with white light compared to both PC amber and unlit periods ($p < 0.01$). Pekapeka activity rates were also lower under PC amber compared to unlit periods ($p < 0.05$), but mean difference was compared to white light. Our results indicate that both white and PC amber ALAN negatively affect localised activity of light-naïve long-tailed pekapeka and support previous findings of negative impacts from white light on long-tailed pekapeka activity.

Ecophysiology of heteroblastic plants along a climate gradient

Professor Cate Macinnis-ng[2], Professor Kasey Barton[1]
[1]University Of Hawaii At Manoa, Honolulu, United States, [2]University of Auckland, ,

Biography:
Dr. Kasey Barton is a Professor in the School of Life Sciences, at the University of Hawaii at Manoa. She is a plant functional ecologist whose research investigates island plants, their evolutionary and functional ecology, and how plants shift in form and function as they develop through ontogeny.

Plant functional strategies shift dramatically as plants develop from the juvenile to adult stages, and such ontogenetic variation is expected to enhance plant performance across variable environments as plants grow up. In heteroblastic species, ontogenetic variation can be particularly apparent and abrupt. While most heteroblastic species have been well characterized with respect to morphological variation between juvenile and adult plants, there is less known about the associated physiological trait variation. Because climate has been implicated in the evolution of at least some heteroblastic species, an ecophysiological approach is essential for a mechanistic understanding of how plant function differs between juvenile and adult stages. Moreover, for widespread species that span climate gradients, it remains unclear how climate relates to the magnitude of heteroblastic trait variation. In this field study, we characterized a suite of physiological (photosynthesis, stomatal conductance, transpiration, and leaf water potential) and associated anatomical (stomatal density and pore size) and morphological (leaf mass per area and thickness) traits of juvenile and adult plants within 4 heteroblastic species: *Pseudopanax crassifolius*, *Pseudopanax ferox, Streblus heterophyllus,* and *Parsonsia heterophylla*. Sampling traits across 3 regions that vary in climate, we investigated population differences in the magnitude of heteroblastic variation across traits. Overall, traits were highly variable, differing among species, between heteroblastic stages, and across the bioclimatic regions. Moreover, patterns differed among traits, revealing complex shifts in plant function across heteroblastic stages. Implications of this ecophysiological variability for plant persistence under a changing climate will be discussed.

Rainforest canopy trees are functionally and demographically distinct

Jennifer Bufford[1], Narkis Morales[1], Sarah Richardson[1], Peter Bellingham[1]
[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand

Biography:
Jennifer is a plant ecologist at Manaaki Whenua - Landcare Research, based in Ōtautahi, Christchurch. Her primary research area is understanding the dynamics and consequences of plant invasions. She also has broad interests in plant community and population ecology, particularly the impacts of global change, such as disturbance and non-native herbivores, and recruitment dynamics. Jennifer also loves exploring the New Zealand outdoors and is always up for a field work adventure!

Rainforests of northern New Zealand are diverse and multilayered, with different microclimates and selective pressures for trees that reach the canopy compared to those that spend their entire lifecycle in the understorey. As a result, we expect that species which become canopy trees will have different functional traits than understorey tree species and may show different demographic rates. However, demographic rates of species in our northern rainforests are poorly known. Long-term plots at Puketī Forest provide a unique opportunity to address these questions and establish baseline information about the demographic rates of many important native trees. We used these data to assess the relationship between canopy status, functional traits and demographic rates, while accounting for topography. Canopy species in Puketītī had lower specific leaf area, lower leaf nitrogen content, higher seed mass and greater wood density than understorey species. Canopy species also had lower recruitment and mortality rates. By contrast, growth rates did not differ between canopy and understorey species and were instead driven by topography. Baseline demographic rates and the differences between understorey and canopy species provide essential context for understanding forest dynamics and forest response to disturbance and climate change. Understorey species show high turnover, with greater mortality and recruitment, but canopy species naturally show little change over time. Drivers that increase mortality of canopy trees are therefore likely to have greater implications for persistence of those species and the structure of the forest.

An initial assessment of growth rates of native tree species and restoration plantings in Aotearoa New Zealand: implications for policy and practice

Assoc. Prof. Bradley Case[1], Professor Hannah Buckley[1]
[1]Auckland University of Technology, Auckland, New Zealand

Biography:
Brad is an Associate Professor in the School of Science at the Auckland University of Technology and has been teaching environmental science, ecology, GIS, and remote sensing at universities since 2005. His research focuses on understanding pattern-process relationships across spatial and temporal scales and spans a range of study systems including forests, treeline ecotones, and agroecoystems. Brad has a keen interest in the application of spatial data collection and analysis tools and statistical techniques for solving multi-disciplinary spatial problems. With colleagues Professor Hannah Buckley and Dr David Hall, he is the co-leader of the AUT Living Laboratories long-term native forest restoration project which uses designed experiments to understand how to accelerate the restoration of native forest on farmland soils.

Efforts to restore and enhance indigenous biodiversity in farm landscapes, through native tree planting, has gained momentum in recent years in Aotearoa New Zealand. This is particularly critical as the country's lowland areas are increasingly at risk from extreme flooding, drought, and erosion events as climate change related effects accelerate. However, despite many government- and community-funded native forest restoration efforts over several decades, there remain fundamental data gaps regarding species-specific tree growth rates and mean growth rates of mixed-species native restoration plantings. These data gaps make it difficult to properly evaluate, for example, the pros and cons of using native tree species for climate mitigation efforts, including for carbon sequestration. This is particularly problematic as we continue to observe an increased conversion of farmland to more lucrative pine forests. Here we present a first compilation and analysis of data extracted from published literature on native tree growth rates; we analyse this dataset to understand the factors that explain variability in tree growth rates across the country. We also present an analysis of LiDAR data to estimate growth rates for a range of restoration plantings in the Auckland Region. Finally, we consider the relevance of these analyses and results to enhancing current understanding of the benefits of indigenous trees in the context of policy and practice.

Phenology and distributions of Aotearoa/New Zealand orchids in a changing climate

Mr Joe Dillon[1]
[1]Victoria University, Wellington, New Zealand

Biography:
I am an early career ecologist whose focusses largely lie in botany and plant ecology. After spending my early years involved in conservation in the Waikato, I moved to Wellington for a bachelors of ecology and biodiversity. Currently I am undertaking a master's with thesis, focussed on climate change and its impacts on orchids in Aotearoa/New Zealand. My interests are in plant ecology and conservation, but as a young person, I am highly motivated by the impacts of climate change and broader global change ecology.

Climate change poses significant changes to plant conservation in Aotearoa/New Zealand. In coming decades, existing pressures on many populations will worsen, and new pressures will emerge. Despite this, few studies have focused on the impacts of climate change on our native species. In my thesis, I use herbarium specimens and iNaturalist observations to investigate changes in phenology and distributions in response to climate change in 21 orchid species. Flowering time changes are observable in 13 (62%) of these since 1920, with accelerated changes in recent decades associated with an increased rate of warming. Many orchid species depend on a single pollinator species, which could make them vulnerable to disruption if changes in flowering and pollinator activity times are asymmetrical. Species distribution models (SDMs) indicate that climate change will have diverse impacts on distributions of the study species. Southern and high elevation species are likely to experience range contractions, while more potential habitat may become available to Northern and low elevation species. Unsurprisingly, the most severe climate change scenarios are associated with greater distributional changes.

Winter dormancy release in Kauri (*Agathis australis*) in a warming world

Dr Dejan Firm[1], Dr Damien Sellier[1], Dr Gancho Slavov[2]
[1]Scion (New Zealand Forest Research Institute), Rotorua, New Zealand, [2]Aberystwyth University, Aberystwyth, United Kingdom

Biography:
Dejan is an ecologist, forester, and conservationist. His research focuses on understanding how forests function and change over time, and how this knowledge can be applied to improve forest ecosystem management in ways that benefit both nature and people. He is committed to promoting sustainable practices that help humans coexist with the rest of the living world.

Understanding how a warming climate will affect tree growth is key to predicting the resilience and future distribution of forest ecosystems. Recent research, particularly in temperate and boreal regions, has documented that rising temperatures are leading to significant shifts in phenological patterns across various tree species. However, there is considerable variability in the magnitude and direction of these phenological changes, with most species experiencing earlier dormancy release and bud burst, while a smaller number of species have shown delayed development. Moreover, the degree of uncertainty around the effects of warming on future phenological shifts in species originating from regions with mild temperate or subtropical climates is even greater. This study examined the responses of multiple *Agathis australis* populations to changing temperature regimes, focusing on the environmental triggers for dormancy release. We conducted a glasshouse experiment involving seedlings from five *Agathis australis* populations, applying chilling and forcing treatments to simulate future climate conditions characterized by shorter and milder winters. The development of the apical meristem and the timing of bud burst were closely monitored, alongside continuous recording of radial growth using automatic high-precision dendrometers. Our results highlight the variation within and among populations in their chilling requirements. They also reveal a decoupling between the timing of apical bud burst and cambial reactivation in spring. These findings have important implications for forest conservation and restoration efforts, offering insights for the development of climate adaptation strategies that ensure the resilience of *Agathis australis* under future climate scenarios.

Interaction between weather cues and plant resources in mast seeding plants

Professor Dave Kelly[1], Prof Jakub Szymkowiac[2], Prof Andrew Hacket-Pain[3], Prof Michal Bogdziewicz[2]
[1]University of Canterbury, Christchurch, New Zealand, [2]Adam Mickiewicz University, Poznan, Poland, [3]University of Liverpool, Liverpool, United Kingdom

Biography:
Dave Kelly was born in Wellington just after his parents had emigrated from Northern Ireland. He studied at Massey and at Cambridge University UK, then got a job at the University of Canterbury in 1985 and never left. He retired at the end of 2021 but is still working on research, mainly on mast seeding. He started working on masting in 1987 but somehow still keeps finding bits of the topic he hasn't figured out yet.

Predictions of when mast-seeding years will occur are important for conservation. The ΔT weather cue is a useful predictor because it does not require information about plant resources. But ΔT might be just a proxy for previous summer temperatures (T1) and plant internal resources (R1), and a recent review proposed that both cues and resources would normally affect masting. Here we used long datasets for Chionochloa pallens (snow tussock) and Fagus sylvatica (European beech) to explore interactions among temperature cues and plant resources. Both species previously showed good fits to ΔT models, which should make separate information on T1, T2 (temperatures two summers ago) and R1 superfluous. But field observations on Chionochloa suggested that with increasing time after the last mast year, some plants flowered even following low ΔT cues. Our analysis found that both Chionochloa and Fagus were best fitted by complex models including temperatures, plant-level resources, and their interactions. For both species, the best ΔT models included an interaction with resources. The best models overall included T1 x R1 plus either T2 (for Fagus) or T1 x T2 (Chionochloa). This suggests that temperatures two summers ago (T2) do more than just affect resources, and that the flowering response to any given T1 (or ΔT) cue becomes larger as plant resources accumulate. We consider the size of these interaction effects, and whether they could be included to potentially improve the accuracy of predictions without requiring detailed plant- or site-level data on resources.

Community and leaf-level controls of carbon fluxes in an invaded NZ alpine tussock grassland

Ms Indira Leon Garcia[1], Dr Julie Deslippe[1], Dr Aimée Classen[2]
[1]Victoria University of Wellington, Wellington, New Zealand, [2]University of Michigan, Ann Arbor, United States of America

Biography:
I'm a biologist from Colombia with a Master's in Biological Sciences and currently a PhD Candidate at Victoria University of Wellington. I'm passionate about plant eco-physiology, particularly on the effects of climate change on alpine plant stress and ecosystem processes related to community and leaf-level carbon fluxes.

Rapid warming in mountains can result in newly available niches for invasive species to colonize, altering alpine community composition and local carbon (C) balance. We conducted a warming and plant removal experiment in an invaded alpine tussock grassland in Tongariro National Park to evaluate the impacts of warming and invader removal (*C. vulgaris*; CV) on community-level C-fluxes (net ecosystem exchange-NEE; gross primary productivity-GPP; and ecosystem respiration-ER); and to assess community controls on C-balance. We applied six treatments: two ambient-control (with/without CV: AC/A), two ambient-removal (CV/dominant-native: AR/ADR), and two warming (with/without CV: WC/WR). Following nine years of treatment we measured: C-fluxes, plant community composition and greenness (NDVI), community weighted means of leaf traits, and leaf-level C-fluxes. We found net zero C-balance (NEE) across all but two treatments. High T_{air} and CWM-R_d (leaf respiration) in the WR treatment led to net C-loss from the ecosystem due to greater ER but no change in GPP. The main controls on C-fluxes were the positive effects of T_{air} and richness, and CWM-L_{th} (leaf thickness) which reduced ER and GPP. High GPP was associated with high NDVI and CV abundance. However, the A treatment with naturally coldest T_{air} but high NDVI, showed significant net C-uptake, suggesting positive net C-balance in the community when the invader is inherently absent. These findings support the importance of abiotic factors and species richness in driving alpine communities C-fluxes in the face of plant invasion, as well as identifying key community leaf traits that drive these underlying effects.

Drought-deciduous response in the southern conifer New Zealand kauri under natural and simulated drought

Professor Cate Macinnis-ng[1], Xi Chen[1], Dr Ben Cranston[1], Dr Julia Kaplick[1], Toby Ellliott[1], Dr Xiuhua Zhao[1]
[1]University of Auckland Waipapa Taumata Rau, Auckland, New Zealand

Biography:
Cate Macinnis-Ng is Professor in the School of Biological Sciences at Waipapa Taumata Rau, the University of Auckland. She is interested in plant-climate interactions and fluxes of carbon and water in forest systems. Cate is Senior Editor with the Journal of Applied Ecology and Council Member for the Royal Society Te Apārangi. In 2023, Cate was awarded the Miriam Dell Award for Mentoring.

In temperate systems deciduous phenology is commonly associated with cold avoidance rather than drought avoidance. However, we have previously identified phenological reduction of leaf area in kauri (*Agathis australis*) as a strategy to reduce water requirements during dry periods.
Using a ten-year dataset of litterfall from Huapai Scientific Reserve, we explored thresholds of soil moisture and drought index triggering the drought-deciduous response. During the study, two natural droughts occurred (in 2013 and 2020). We also conducted a throughfall exclusion experiment for three years in the same forest. We explored relationships between litterfall biomass and environmental drivers.
Our results show litterfall increased when soil moisture deficit increased. The New Zealand Drought Index (NZDI), combines indicators of precipitation, soil moisture and evaporation. NZDI values exceeded 2 (defined as extreme drought) in 2013 and 2020 and in both these years, litterfall was significantly higher than in all other years. Other climatic factors such as wind speed, rainfall and storm events did not have measurable effects on litterfall volumes. Therefore, we conclude kauri is a brevi-deciduous species with an annual maximum NZDI threshold of 1.9 (i.e. when maximum NZDI exceeded 1.9 during a year, a drought deciduous response occurred). Drought-treated trees under throughfall exclusion had reduced litterfall (compared to control trees) due to other hydraulic adjustments.
As droughts increase in frequency and severity, the carbon cost of leaf area reduction during dry periods will increase. Ongoing research is exploring the contribution of increased litterfall under drought to annual forest carbon budgets.

Exploring Hidden Drivers of Tree Range Shifts with a Novel Machine Learning Approach

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Biography:
I am working on the cusp of machine learning and ecology. I am interested in building predictive models and identifying climate change induced patterns for the state of New Zealand's forests. My raw materials are the data from the National Vegetation Survey, which consists of tens of thousands of botanical surveys in plots nationwide over the last 50 years and traits collected from species within. I am looking for patterns of range shifts in widespread species in these plots using climate and topographical data.

However, rather than going with the classical ecological approach of fitting regression models through the data, I analyse it through a machine learning lens. These trained models are then probed with explainable AI techniques (XAI) to explain the model's predictions rather than the data. Explainable AI has many advantages over classical statistics, such as predicting where and why certain covariates are important. Additionally, the non-linearity of machine learning models allows the capture of non-linear patterns and species-specific threshold effects.

Knowing how the composition of forest species changes (and even being able to predict it) would mean that we can identify species at risk of extinction or large-range contractions. This, in turn, allows us to dedicate conservation resources more efficiently.

My PhD came late in life, and my previous careers always revolved around entrepreneurial pursuits in the IT sector. In my free time, I continued this ambition and founded EffortlessAcademic.com . On this platform, I offer courses and webinars for academics who want to become more efficient through the use of tools, AI, and note-taking techniques.

Climate change has driven extensive reorganisation of plant communities as species adjust their ranges in response to changing conditions. Observational data often contradicts the expected trend of upslope and poleward migration, highlighting the need to include often-overlooked biotic and abiotic factors like precipitation, soil properties, and herbivores and their interactions with temperature and one another. With few exceptions, studies of range shifts document range boundaries, neglecting preceding changes in abundance within the range. This results in an incomplete and often contradictory understanding of species range shifts, limiting our ability to accurately predict ecological responses to climate change. Here, we introduce the Abundance Trend Indicator (ATI), a novel machine-learning approach that explains where and why plant species change in abundance based on 37 predictor variables, including climatic, topographic, edaphic and biological factors.
We train and validate the algorithm on New Zealand's forest inventory data of 77 woody species across 2821 sites, collectively covering 75% of forest canopy. Mapping the predicted ATI values over a species' range reveals range shift directions locally at the resolution of the predictor variables (1px = 100m for our data). Our results confirm the average trend of abundance shifts along temperature and elevation gradients but additionally reveal unique responses driven by unrelated factors (e.g., grazing, soil pH). ATI suggests that stress avoidance and tolerance strategies are primarily responsible for determining range shift directions, readily identifies areas where species persist but do not reproduce (extinction debt) and explains anomalous and hitherto unexplained species shifts.

Shoot flammability varies throughout the year in some species, and is related to plant water relations and leaf size

Dr Niger Sultana[1], Dr Tim Curran[1], Dr Cate Macinnis-Ng[2], Dr Jon Sullivan[1]
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Biography:
Niger Sultana is a multidisciplinary forest ecologist. She broadly trained and endeavors to combine tree physiology and ecophysiology to better understand forest ecology and species-specific response to climate change. She worked with tropical and sub-humid temperate ecosystems and tree species. She earned PhD in Ecology from Lincoln University, New Zealand.

Evaluation of plant flammability is becoming increasingly important to help manage fires and understand fire behaviour in the wildland-urban interface. However, flammability can vary within individuals and species throughout the year, for instance due to biotic and environmental factors associated with changing seasons. Documenting variability of flammability across the year will provide better information to improve fire behaviour models and better guide fire management decisions.
We measured shoot flammability and plant traits for ten species from mixed regenerating rainforest / shrubland four times across a year on the same individuals, to test for changes in flammability and to determine the relationship between flammability and several physiological and morphological traits. We found that flammability changed throughout the year in several, but not all, of our species. For instance, three species (*Pseudopanax crassifolius*, *Pseudopanax colensoi* and *Griselinia littoralis*) had consistently low flammability across all sampling times and all flammability variables. Two highly flammable species, *Kunzea robusta* and *Ulex europeaus*, generally maintained high flammability throughout the year, although there were significant differences between sampling times for some flammability variables. One species, *Melicytus ramiflorus,* varied significantly throughout the year for all flammability variables, shifting from very low flammability in April and July, to high flammability in October and February.
Flammability variables were negatively correlated with three plant water relations traits, and two leaf size traits, suggesting that highly flammable species had low leaf moisture content, leaf relative water content, *stem water potential*, and high leaf dry matter content with small leaves.

Artistic and culturally-focused activities result in more positive community attitudes towards a rare, cryptic species: pekapeka

Dr Kerry Borkin[1], Israel Maxwell[2], Kylie McKay[2], Tania Bagley[2], Priscilla Wehi[3,4], Ellen Cieraad[5], Sophie Doyle[6,7], Tom Roa[4,7,8,9]
[1]Department Of Conservation, Te Papa Atawhai, Taupō, New Zealand, [2]Pekapekarau School, Te Awamutu, New Zealand, [3]University of Otago, Ōtakou Whakaihu Waka, , New Zealand, [4]Te Pūnaha Matatini, Auckland, New Zealand, [5]Department of Conservation, Te Papa Atawhai, Nelson, New Zealand, [6]Ngāti Kahu, Te Rarawa , [7]University of Waikato, Te Pua Wananga ki te Ao, Hamilton, New Zealand, [8]Taarewaanga Marae, Ōtorohanga, New Zealand, [9]Waikato-Maniapoto, ,

Biography:
Kerry Borkin grew up in the shelter of Te Aroha mountain, and alongside the winding Waihou River. She is Tangata Tiriti. Kerry works for Te Papa Atawhai – the Department of Conservation as a Science Advisor, and is based in Taupō. Her research has a focus on how threatened and other native species are influenced by people, and how people are influenced by threatened species. She aims for a work-life balance by hanging a surfboard in her shed.

Ecologists often help design engagement activities so that species they care for will be liked more. However, the appeal of these activities may be limited, perhaps because activities take place away from communities, and effectiveness is rarely measured. We trialled a different approach.
When Pekapekarau School (‘multitudes of bats’ in te reo Māori) realigned their school name, together we created community activities focused on pekapeka/bats: a naming ceremony centring Māori protocols, and art exhibition. School staff led design and facilitated activities; researchers designed a survey to examine whether participation in activities resulted in more positive attitudes towards pekapeka.
Activities, built knowledge, but were focused on celebrating community connections with pekapeka and depicting them artistically. We found attitudes towards pekapeka were more positive after activities than previously. Participants with higher awareness that pekapeka were present in their area had greatest gains in positive attitudes post-activities.
School staff knew both community and students well, so could deliver culturally relevant, appealing events appropriate for their students and community, who often do not participate in typical conservation or ecological restoration activities usually led by government agencies. These activities aimed to engage people with a culturally significant species, in a place where participants were less likely to feel excluded – their children’s school. When activities are led by people within the community, as ours were, positive outcomes are even more likely. This type of partnership is therefore more likely to be effective in achieving change in attitudes towards species, ecosystems, and environmental issues.

Te Haumanu Taiao: Restoring the natural environment in Tāmaki Makaurau'

Mr Gavin Anderson, Mr Adrian Pettit, Mr Paul Duffy[1]
[1]Te Kaunihera o Tāmaki Makaurau / Auckland Council, Auckland, New Zealand

Biography:
Paul Duffy is the Team Manger Specialist Advice for Te Kaunihera o Tāmaki Makaurau | Auckland Council, Natural Environment Specialist Services Team and has over 20 years of experience in indigenous forest restoration and protection. Paul was a key kaimahi supporting the partnered development of Te Haumanu Taiao | Restoring the natural environment in Tāmaki Makaurau with Ngā Iwi Mana Whenua o Tāmaki Makaurau.

Gavin Anderson: My name is Gavin Anderson and am here today as representative of the working group for Te Haumanu Taiao. I contract to Ngaati Whanaunga Incorporated Society one of the thirteen iwi in Taamaki Makaurau .It is a privilege to have led and participated in the development of this resource working in partnership with Iwi and Auckland Council. Understanding the role of kaitiaki and kaitiakitanga in Taamaki is fundamental to Te Haumanu Taiao.The kaupapa is to restore the natural environment of New Zealand's largest city to good health. We can all play a role as people in sharing our knowledge, skills and experience. In conclusion, it is important to acknowledge the iwi and individuals who participated and are named in Te Haumanu Taiao for their important contributions.

Adrian Pettit: Kaitiaki for Te Ākitai Waiohua, Adrian Pettit has a background in architecture, and is part of the I&ES Mana Whenua Kaitiaki Regional Forum that has played an essential role in providing mātauranga (knowledge) and direction to Auckland Council's Infrastructure & Environmental Service Directorate. The Mana Whenua Forum has ensured that the holistic values of both people and place are embedded into the Directorate's daily business as a matter of course, and that Mana Whenua are duly relfected in both strategic and operational realms. With MWF input, the I&ES Directorate continues to crystallise outcomes that are not only indigenous and contemporary but wholly reflective of Auckland's unique point of difference – namely, Ngā Mana Whenua o Tāmaki Makaurau; Outcomes representing the historic and cultural ties that bind Mana Whenua iwi to Tāmaki Makaurau.

Te Haumanu Taiao is a foundational ecological restoration guide created to achieve best practice ecological restoration goals and the recovery of indigenous biodiversity in Tāmaki Makaurau. Ngā Iwi Mana Whenua o Tāmaki Makaurau who have partnered with Te Kaunihera o Tāmaki Makaurau | Auckland Council in the development of the guide and invite your participation.
In the design of Te Haumanu Taiao individual iwi perspectives and tikanga are taken into consideration in a way that gives effect to Te Tiriti o Waitangi. The guide highlights mana whenua priorities as it relates to their rohe (tribal boundaries) to ensure that restoration practices are carried out respectfully applying their values. It serves as a comprehensive resource, providing practical guidance on maximizing and measuring ecological outcomes for the ecosystems of Tāmaki Makaurau/ Auckland.
The publication includes detailed, ecosystem-specific strategies for terrestrial, wetland, and riparian restoration. Te Haumanu Taiao also offers valuable insights into engaging with iwi, facilitating culturally respectful and effective restoration practices. This collaborative approach provides a model for future projects aimed at harmonising environmental and cultural objectives.

Making scientific journals a better home for Mātauranga Māori

Thomas Etherington[1]
[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand

Biography:
Tom is a senior researcher at Manaaki Whenua – Landcare Research. He is an interdisciplinary researcher, using theories and methods from geography, ecology, and data science. Tom also has a strong interest in the development and adoption of open science principles to maximise the potential use and impact of research that he is involved with, and is currently Editor-in-Chief for the New Zealand Journal of Ecology.

Scientific journals represent the major mechanism by which knowledge is currently archived, shared, and verified in New Zealand and through which scientists and scientific institutions develop scientific reputation. However, today's system of scientific journals is largely still a result of decisions made in 17th century Europe, and this does not necessarily align well with the needs of New Zealand in the 21st century. In particular, it is worth considering how scientific publishing as a system currently meets the needs of Māori worldviews. There are a number of hot topics relating to scientific publishing, such as copyright transfer, open access requirements, publication language, and editorial representation, that require our attention as a science community if we are to ensure that scientific journals are a better home for Mātauranga Māori. These hot topics are introduced in the hope of initiating greater attention, discussion, and collaboration, and where possible some potential options for future solutions are suggested. However, many of the issues raised here do not appear to have easy or obvious solutions. Therefore, journals are encouraged to at least be flexible and open in their requirements to allow better practices to be demonstrated by authors in the hope that solutions may emerge. For scientific journals to do nothing and remain anchored to the founding principles from 17th century Europe risks excluding Mātauranga Māori from scientific journals and Māori scientists from the scientific community.

Cultural Value of Urban Forest - Lessons for Urban Ecological Restoration

Dr Erana Walker[1]
[1]The University Of Waikato, Hamilton, New Zealand

Biography:
Dr Erana Walker (Te Parawhau, Ngāti Ruamahue, Ngāti Porou, Ngāi te Rangi) is a postdoctoral fellow at the University of Waikato. Her research interest are in the intersection between Mātauranga Māori and Ecological science. Her most recent work examined kaitiakitanga in urban areas across Aotearoa. She is currently part of the People, Cities and Nature programme exploring the use of Mātauranga Māori in urban restoration in Aotearoa.

Relationships of Indigenous people to nature intertwine knowledge and practices related to their locale, worldview and lineage. These components are important for maintaining obligations to nature, ancestors and future generations of the tribe. Forest spaces are integral for the collection of resources, the undertaking of cultural practices as well as support the overall well-being of indigenous communities. Similarly, Māori communities rely on these spaces for physical, spiritual and cultural sustenance and therefore, forest protection is critical for the well-being of current and future generations.
Cultural practices within nature are becoming more challenged with rapid loss of biodiversity, increased climate change impacts as well as the encroachment of urban areas upon traditional landscapes. Cities present new barriers for Māori to maintain connections with the natural world and the expression of cultural practices and knowledge. Pressingly, access to forest sites within and on the peripheries of urban areas also add to these challenges for the longevity of cultural practice and knowledge. Understanding the cultural values of these forest spaces may develop news ways for their protection, especially in urban areas.
This presentation shares research on the challenges and opportunities for Māori communities and urban forest. Through survey data, this presentation details the ways that urban Māori communities use urban forest and the barriers for their effective use. The presentation will share the importance for this research in not only supporting urban forest restoration but also the opportunity for Māori to maintain important cultural knowledge and practice in cities of Aotearoa.

Ahakoa he iti he pounamu; Although small, it is precious:

Exploring how mātauranga can inform and support the conservation of pekapeka (bats of Aotearoa)

Miss Jade Watkin[1,2], Dr Stephanie Godfrey[1], Associate Professor Priscilla Wehi[2,3], Dr Kerry Borkin[4], Professor Tom Roa[3,5]
[1]Department of Zoology, University of Otago, Dunedin, New Zealand, [2]Centre for Sustainability, University of Otago, Dunedin, New Zealand, [3]Te Pūnaha Matatini, Centre of Research Excellence, Auckland, New Zealand, [4]Department of Conservation, Taupō, , New Zealand, [5]Ngāti Maniapoto, Waikato, Ngāti Apakura, Te Pua Wananga ki te Ao - Faculty of Māori and Indigenous Studies, University of Waikato, New Zealand

Biography:
Jade Watkin is a master's student at the University of Otago who recently submitted her thesis exploring mātauranga surrounding pekapeka, bats of Aotearoa. Jade holds a Bachelor's degree in Zoology and Psychology and will soon earn a Master of Science. Her passion for pekapeka began during her undergraduate studies, where she researched pekapeka with the Department of Conservation, assessing the risks of predator traps for the species. This experience inspired her Master's research, initially focused on pekapeka behaviour, which later evolved to explore the connection between pekapeka and Māori, as guided by her love for pekapeka and her whakapapa roots.

Despite the presence of pekapeka in Māori narratives, wider knowledge of the mātauranga held around these threatened taonga remains limited. Given pekapeka are threatened and considered taonga by some, it is crucial to explore how Māori are connected to pekapeka, how Māori wish to strengthen this connection, and explore how ecological sciences and mātauranga around pekapeka can walk-side-by-side. To explore the connection between pekapeka and Māori, we conducted interviews and wānanga with Māori community members and pekapeka researchers to illustrate diverse perspectives, aspirations and knowledge types. We first analysed participants' aspirations for the research; these aspirations focused our second phase, evaluating insights and knowledge shared by participants. Both groups expressed a strong desire to benefit pekapeka through increased understanding of mātauranga anticipated from our research. Despite a historically frayed connection, contemporary kōrero (discussions) revealed a profound connection between Māori and pekapeka. Pekapeka were consistently referred to as a ‘taonga’, and participants voiced growing interests to deepen their connection to pekapeka. Participants shared thoughts around what tikanga should be considered when working with pekapeka, and we highlight this tikanga to guide future restoration efforts. Our findings highlight the importance of fostering relationships between researchers and mana whenua to create comprehensive goals for restoration, and the importance of ongoing opportunities to share kōrero to enhance and maintain mātauranga around species with cultural significance. We emphasise shared values/aspirations for pekapeka found amongst researchers and Māori community members as a step forward in addressing the complex challenges that arise around species restoration.

Biocultural diversity and the nature of evidence

Priscilla Wehi[1,2]
[1]University of Otago, Dunedin, New Zealand, [2]Te Pūnaha Matatini

Biography:
Priscilla is a conservation biologist and co-director of Te Pūnaha Matatini Centre of Research Excellence in complex systems. She works in the liminal spaces of ecology, language and biocultural diversity, as well as using stable isotopes and other tools to explore terrestrial and historical ecology questions

Language connects cultural and biological diversity. Over the last 20 years our group has examined ecological information embedded in Māori oral tradition, and particularly in whakataukī. Here I reflect on this work, what we have been able to contribute to a better understanding of human connections to the rest of nature since Māori arrival, and the wider context of cultural and language revitalisation that matters in this kind of work. I also consider how this work fits within the wider discipline of historical ecology, and discuss the other kinds of data that can be examined, both innovative and traditional, from place names through to bones and written archives. I reflect on the questions what is evidence, and to whom? and how we can use different forms of evidence to have confidence in our findings.