



Te Tumu Whakaora Taiao Environmental Research Institute

THE UNIVERSITY OF WAIKATO

Annual Report for 2021/2022

academic co-director: Charles Lee / mātauranga co-director: Tim Manukau

Executive Summary

The past twelve months have seen significant changes and activities for ERI. In July 2021, Tim Manukau was appointed as the inaugural ERI mātauranga co-director with support from the Waikato River Authority. Charles Lee succeeded Karin Bryan as the academic co-director in late 2021. Since the new co-directors' appointments, they have been busy with their respective responsibilities and working together closely on a wide diversity of interdisciplinary activities.

During the reporting period, the co-directors have introduced new initiatives, created new collaborations, and made changes where appropriate. The most significant initiative is the creation of the ERI Seed Grant using revenue surplus in 2021 to support the development and preparation of new external research funding proposals that would not otherwise take place. The co-directors have worked together to facilitate new collaborations with naturally aligned end-users (e.g., Waikato Regional Council), between entities that had no prior relationship (e.g., the University Work-Integrated Learning team and the Waikato River Authority), and strategic collaborations with other universities active in freshwater research. Notable changes include a new ingoa Māori for ERI that better reflects ERI's aspirations, improving the discoverability for ERI Reports, and procuring ERI-branded items to support research and outreach. The co-directors have collaborated on diverse activities that strengthen our linkages with mana whenua and stakeholders, including WRA, River iwi, and kura across the Waikato region.

More broadly, ERI researchers are involved in numerous research contracts (totalling more than \$11.5 m) funded since July 2021 by MBIE Endeavour and Marsden funds, and lead or participate in currently pending proposals totalling more than \$38 m. During this period, ERI researchers secured more than \$4.4 m in funding from other national and international sources. Since July 2020, ERI researchers have published 400+ peer-reviewed publications and 24 ERI Reports. Thanks to the solid financial foundation inherited from the previous director, ERI is on track to meet its budgetary goals for 2022 and will likely generate a small financial surplus.

Overall, the Environmental Research Institute has successfully transitioned to a co-leadership structure, producing significant synergies between the two new co-directors. Building on a sound financial foundation, we have started ambitious new initiatives that will likely yield results in the next three to five years to further secure ERI's leadership position.

Notable Activities

Appointments of new co-directors

In July 2021, Tim Manukau was appointed as the new mātauranga co-director of ERI, a position funded by the Waikato River Authority and with a direct line report to the Deputy Vice-Chancellor Māori. The ERI mātauranga co-director position focuses on supporting mātauranga and freshwater research within ERI and across the University as well as promoting the Waikato River Authority, iwi, and the Waikato River Vision and Strategy. Notably, Manukau played an instrumental role in assisting Prof. Bruce Clarkson in establishing ERI, and his mana among freshwater researchers and stakeholders will make critical contributions to ERI activities.

In October 2021, Charles Lee was appointed the academic co-director of ERI, replacing Karin Bryan. Lee's appointment represented a minor but significant change in the role of the ERI academic co-director, building on the foundational work by Bryan to revitalise ERI and set it on a sound financial trajectory. The most notable change is that line-management responsibilities of the ERI academic co-director have been largely devolved to principal investigators of externally funded projects and academic team leaders within the School of Science; this is reflected in a 0.2 FTE appointment for Lee (compared with 0.3 FTE for Bryan). During his three-year appointment, Lee intends to focus on increasing the visibility of ERI within and outside the University and fostering new interdisciplinary research collaborations to address major challenges in environmental science using cutting-edge technology-intensive techniques and incorporating kaupapa Māori.

The composition of the ERI Steering Group was updated in February 2022:

- Andrew Barnes: representing terrestrial ecosystems within BIOEB
- Deniz Özkundakçı: representing aquatic ecosystems within BIOEB
- Craig Cary: representing BIOMO and extreme ecosystems
- Terry Isson: representing CHEMY
- Megan Boston: representing the School of Engineering
- Louis Schipper: representing terrestrial ecosystems within ENVSC
- Jo Ellis: representing marine ecosystems within ENVSC
- Rebecca Lawton: representing the aquaculture team
- Kura Paul-Burke: representing mātauranga and kaupapa Māori research
- John Tyrrell & Anthea Kivell: representing the Research and Enterprise Office
- [Until July 2022] Brendan Hicks: providing advice on ERI Reports and other matters during a transitional period

The ERI Seed Grant

To operationalise the goal of fostering new interdisciplinary research collaborations, co-director Lee worked with PVC HECS to retain \$100,000 of ERI's 2021 revenue surplus in the Research Trust and created the ERI Seed Grant. Its ultimate purpose is to facilitate the preparation of new research proposals for external funding that would not otherwise take place.

Importantly, the ERI Seed Grant operates out of cycle, allowing rapidly developing or time-sensitive research ideas to be nurtured. Such proposals, if successful, will further signify ERI's strategic value and critical functions to the Division and the University. They will also contribute to safeguarding ERI's future financial position, with additional overhead recovery flowing toward Schools that ERI Members are affiliated with. A detailed description of the ERI Seed Grant's purpose and eligibility is attached as [Appendix I: ERI Seed Grant Template](#).

Strengthening linkages with the Waikato River Authority

Co-director Manukau has been working closely with the Waikato River Authority (WRA) on a number of projects that align with the Vision and Strategy for the river and the strategic objectives of the University:

- ERI and WRA partnered to develop a Three Waters Panel discussion as part of 2021 Kiingitanga Day programme. WRA Co-Chair, Hamilton City Council (HCC) Mayor, Taumata Arowai General Manager, and Dr Dan Hikuroa (UoA) participated on the panel.
- ERI funded and co-designed three bespoke internships with Tūwharetoa, Raukawa, and Waikato-Tainui to assist River iwi in achieving the Vision and Strategy and promoting their mātauranga-a-iwi.
- Manukau worked with Assoc. Prof. Peter Sun and Prof. Brad Jackson in WMS to organise and lead the Waikato river tira hoe component of the Community & Enterprise Leadership Foundation programme for emerging leaders, which highlighted the importance of the Waikato River and the role of the WRA and ERI in river restoration.
- Manukau has participated in lecturing and providing support to the Environmental Planning Programme within ALPSS to promote the river Vision and Strategy and the work of WRA, River Iwi, and ERI in river restoration.
- Manukau is a member of the WRA Independent Funding Panel that provides recommendations to the WRA Board on what restoration projects should be funded from an annual budget of \$6M.
- ERI has been a key partner in the development of a Waikato River Dynamic Models project with a number of stakeholders such as WRA, Waikato Regional Council, NIWA, HCC, Watercare, and River Iwi. The model is being developed in conjunction with the Lake Ecosystem Models Smart Ideas project led by Assoc. Prof. Deniz Özkundakçı. Developing student capability will be a key focus of both model projects.
- Manukau is working with Prof. Bruce Clarkson and other partners on the Biodiversity Collective Action project to support and scale up kaitiakitanga and conservation efforts by enhancing biodiversity/conservation action. This project seeks to address the current biodiversity crisis and better connect communities together.
- Manukau is maintaining relationships with NIWA by actively participating in two freshwater-related MBIE-funded research projects that began under Te Waiora Joint Institute for Freshwater Management.

Promoting awareness for the awa and the environment and advancing mātauranga Māori in environmental education

Working with Te Toki Voyaging Trust and the Waikato Regional Council, co-director Manukau has been actively involved in the creation of [Kura Waiti](#), which combines waka tētē with mātauranga Māori kaupapa and targets rangatahi from six kura in the Waikato region. Manukau has supported Kura Waiti through the engagement of an intern from the University, funded by ERI, the University, and WRA. Through Kura Waiti, rangatahi are connected to kōrero of the awa and the environment and learn science mahi while immersed in the tradition of waka tētē. ERI is represented on the Kura Waiti governance board. A working group has been formed between Manukau and Pūhoro Regional Lead Aaron Matenga to work closely together to identify opportunities to support each other's activities with a particular focus on pathway development for Māori students into STEMM. ERI and WRA have assisted with resourcing Pūhoro wānanga with local secondary schools at the University, providing lunches to the students to assist with their learning at the wānanga. Manukau supported the delivery of wānanga and tira hoe with Waahi Pa marae rangatahi on Lake Waahi to enhance their mātauranga māori and historical understanding of the lake and the Waikato River.

A new ingoa Māori for ERI

Co-director Manukau recognised that the previous te reo Māori name for ERI (Te Pūtahi Rangahau Taiao, a literal translation of 'The Environmental Research Institute') lacked impact and connection to mana whenua and took the initiative to seek a new ingoa Māori with Tainui kaumātua Assoc. Prof. Tom Roa: **Te Tumu Whakaora Taiao**. The name translates to "*We are a place, a collective centre of activity, where we encourage others to work together and with us to restore and reinvigorate our environment.*" This name draws inspiration from significant Tainui places: Te Tumu Korero at the residential home of the Kiingitanga (Waahi Pa) and Te Tumu o Tainui, the final resting place of the Tainui waka in Kawhia. This name reflects the fact that ERI Members support caring for our environment through our research, and we also took this opportunity to update the ERI logo to follow the current University guidelines (see cover page).

ERI Reports

ERI Reports are prepared by researchers affiliated with ERI to disseminate findings from externally funded research, typically as a commercial contract. ERI Reports are peer-reviewed and published on the ERI website, making them credible, citable, and available as a public resource. They also serve to illustrate the diversity of research within ERI and the capabilities of ERI researchers. From July 2020 to June 2022 (an annual report for 2020/2021 was not prepared due to staff turnover), 24 ERI Reports were published (listed in [Appendix II: ERI Reports published since July 2020](#)).

Since October 2021, we have made the following changes and improvements to the preparation and dissemination of ERI Reports:

- We employed a PhD student (Siobhan Nuri) to retrospectively categorise all ERI and CBER Reports on the basis of their *ERI Research Theme, relevant habitat, purpose, and mātauranga content*. Where possible, Siobhan verified the categorisation with the lead authors. Categories will be required for all future ERI Reports, and we are currently updating the ERI website so that ERI Reports can be discovered through filtering categories and searches.
- We (Brendan Hicks) liaised with Jess Howie and her team from the Library to explore integrating ERI Reports into bibliometrics and SciVal. We are currently working with the Library to formalise the mechanism for uploading ERI Reports to Research Commons and generating DOIs for them. We have plans to work with the Library on identifying Sustainable Development Goals (SDG) keywords in ERI Reports when Research Commons adds the functionality to discover publications using SDG keywords.
- We revised the guidelines for ERI Report authors and clarified the process for the final sign-off of ERI Reports by one of the ERI co-directors. As of July 2022, the primary point of contact for ERI Reports transitioned from Brendan Hicks to John Tyrrell.

ERI Seminars

We thanked Andrew Barnes and Chrissie Painting for their work as co-organisers of ERI Seminars since 2018, and we welcomed Rebecca Lawton and Yifan Yang as the new co-organisers from March 2022. Rebecca (based at the Coastal Marine Station) and Yifan (School of Engineering) offer broadened perspectives for ERI Seminars, and, despite ongoing challenges presented by COVID-19, they have organised monthly ERI Seminars since May 2022 and have speakers lined up for the rest of 2022 with an aim to transition to fortnightly seminars. Notably, we are increasing interactions with the Artificial Intelligence Institute through ERI Seminars, with two speakers from the AII scheduled later in 2022. As part of our effort to increase the visibility of ERI through branding (see details below), we started giving out ERI-branded waka stern whakairo (see picture on the right) to ERI Seminar speakers as tokens of appreciation.



We are currently working with the University marketing team to record and disseminate ERI Seminars through University social media channels as well as updating the ERI website to make ERI Seminar recordings perpetually available.

Sponsorships and ERI-branded Promotional Items

Although there have been limited opportunities to sponsor in-person workshops and conferences, we have made commitments to sponsor some upcoming events taking place at the University. We have pledged \$3,000 for the [SMBE Regional Meeting on The Role of the](#)

[Genome in Biological Invasion](#), co-organised by Ang McGaughran and Manpreet Dhami (MWLR), to be held at the University in November 2022. We have also pledged direct and in-kind support for the International Large River Restoration Symposium scheduled for February 2023 (see New Collaborations for details).

To promote the visibility of ERI inside and outside the University, we designed and purchased a number of ERI-branded items:

- High-visibility vests (provided free of charge to ERI Members)
- T-shirts and polo shirts (offered to ERI Steering Group members and other key individuals as well as made available for purchase from Waikato Print)
- Magnetic signage for vehicles and vessels
- We are currently working on sourcing ERI-branded giveaway items that reflect the values and characteristics of ERI, and we anticipate having them ready by Q4 2022 for outreach and public engagement events.



Website and Social Media

Joshua Sargent (PhD student in Karin Bryan's group) has done excellent work as the ERI Outreach Coordinator and webmaster and will continue through at least 2023. During the past twelve months, Joshua has worked on the following initiatives:

- Revamped the ERI institutional LinkedIn account, which is now followed by almost 150 people (>50% growth since October 2021)
- Revamped the ERI homepage around kōrero for the new ingoa Māori
- Maintained a high level of high-quality interactions on the ERI Twitter account, which is now followed by more than 350 people (>100% growth since October 2021)
- Proactively reached out to ERI Members to create or improve their ERI website profile

A new award from the Human Frontiers Science Program

Prof. Craig Cary was invited to join a newly assembled team (Morgan Beeby, Imperial College London; Georg Hochberg, Max Planck Institute for Terrestrial Microbiology - Marburg; and Francesco Pedaci, CNRS - Montpellier), which was awarded funding in 2021 by the prestigious Human Frontiers Science Program administered by the International Human Frontier Science Program Organization (HFSP) in Strasbourg, France. This study will combine breakthroughs in metagenomics, evolutionary biology, structural biology, and single-molecule biophysics to provide a description of the evolutionary path of one of nature's smallest molecular

machines: the flagellum. Using hundreds of thousands of publicly available environmental metagenome datasets, we will discover novel lineages of Epsilonproteobacteria and determine when modifications in the motor occurred and the impact they had on the motor efficiency aided by metagenomics-informed environmental sampling of uncultured microbial diversity. The Epsilonproteobacteria have a rich diversity of flagella, making them an ideal candidate for this type of work. Prof. Cary's contributions provide the critical link to the geothermal environment that has effectively driven many radical changes in flagellum structure over time.

New Collaborations

Developing a Pan-University Alliance on Catchment Recovery

Through conversations with senior leaders within the University and ERI researchers, regaining the University's leadership position in freshwater science was identified as a key objective and opportunity for ERI. This is an ambitious goal, but with the recent appointment of Deniz Özkundakçı as Toihuarewa Waimāori - BoPRC Chair in Lake and Freshwater Science and strategic appointments of Frank Burdon (freshwater ecologist) and Luke Harrington (climate scientist), ERI and the School of Science are on a credible trajectory toward this goal.

Recognising that systematic changes and disruptions are likely to follow the implementation of Te Ara Paerangi, co-director Lee spearheaded an initiative to develop a pan-university alliance on catchment recovery involving the Waterways Centre for Freshwater Management (University of Canterbury and Lincoln University) and Catchments Otago (University of Otago). To date, Lee and Özkundakçı have had several in-person and Zoom meetings with key researchers from those two institutions and reached an agreement on high-level strategic directions and a timeline. Meanwhile, co-director Manukau has been providing critical insight from his experience working with MfE and Taumata Arowai, which has guided and contextualised this initiative; he has also been working with WRA, River iwi, and the Ngāi Tahu Research Centre to facilitate strategic alignment. Our three-person team has been effectively leveraging our diverse background and expertise and collaborating synergistically.

The distinguishing feature of this alliance will be a central focus on national capability building that produces a Te Tiriti-informed research-capable workforce equipped with the knowledge and tools required to facilitate sustainable management and recovery of catchments. This alliance will not be business-as-usual and instead be informed by empirical evidence (leveraging technology-intensive methodologies) and wider socioeconomic needs, and the ultimate goal of this alliance is to present itself as a natural entity to coordinate a national Priority (as defined in Te Ara Paerangi) on freshwater environments and ecosystems.

To build toward this goal, we have identified and are working on intermediate steps to establish a network of expertise across universities (see 'International Symposium for Large River Restoration' below), a framework for delivering effective training across disciplines and institutions (see 'Developing a Pan-University Freshwater Winter School' below), and a virtual centre to facilitate knowledge exchange, sharing of best practices, and data management (e.g., the UK River Restoration Centre, <https://www.therrc.co.uk>). These are critical components for facilitating systematic catchment restoration, which has relatively uncontroversial support across public and private sectors, but they will also form a framework for evidence-based and mātauranga-informed advice for climate change adaptation (e.g., managed retreat) for the longer term. Once these intermediate steps are on track, we will then focus on increasing our visibility to demonstrate critical mass within the New Zealand science system and attract aligned researchers in other institutions.

International Symposium for Large River Restoration

Co-director Manukau has been working with Deniz Özkundakçı and various stakeholders to put together a symposium for large river restoration. The purpose of this symposium is to bring together national and international experts on the restoration of large rivers so they can assist to answer key strategic timeline questions of the WRA:

- When should we expect to see the benefits of our restoration actions?
- Are there critical points where we might expect to see step changes?
- How might we increase the rate of improvement?

The symposium is scheduled to take place during the week of 20 February 2023. To date, Manukau has recruited key members of the organising committee for the symposium, including Waikato-Tainui kaumātua Assoc. Prof. Tom Roa, Dr Dan Hikuroa (UoA), Dr Marama Muru-Lanning (UoA), Whetu Taukamo (DVC Māori Office), and Dr Mike Scarsbrook (WRC). Siobhan Nuri (a PhD student from River iwi) has agreed to be the symposium coordinator. Several organisations have made financial commitments in principle to support the symposium, including WRA, the Office of DVC Māori, WRC, and ERI, and there are ongoing discussions with other entities for direct or in-kind support. Potential outputs and legacies from the symposium include the following:

- A Waikato-Waipā Restoration Timelines Framework Report
- Paper from symposium presenters to be published in peer-reviewed journals
- A synthesis paper on a Waikato-Waipā Restoration Timelines framework
- A themed special issue in a scientific journal from all contributors of the symposium

Developing a Pan-University Freshwater Winter School

We are working toward an annual winter school, jointly and simultaneously held at the University of Otago (by Catchments Otago), the University of Waikato (by ERI), and the University of Canterbury (by the Waterways Centre for Freshwater Management) to provide a systematic overview of the current and future regulatory landscape, challenges and opportunities for land users and territorial authorities, and solutions offered by freshwater research. Students will attend in person at the Dunedin, Hamilton, and Christchurch campuses, and the lectures will all be in-person (broadcast via Zoom to the other two campuses). Each university will focus on its research strength and the major freshwater issues for its home region (e.g., restoration of the Waikato River for UoW, flood risks for UC, and wetlands in Southland for UO) while identifying elements that can be generalised for a national scale. In other words, the students will learn about the heterogeneous challenges across the motu as well as the solutions offered by freshwater research that are nationally relevant.

The course material will build on our understanding (and ability to project changes) of the physical environments associated with freshwater ecosystems, overlaid with biological and ecological context to highlight connectivity and ecosystem functionality. The students will also gain an appreciation of climate change impact, response, and adaptation in a freshwater context. The goal is to provide students with a transdisciplinary understanding of freshwater ecosystems as well as the knowledge gaps and the research required to address them.

Importantly, this will also highlight freshwater research capabilities across the three universities and the transferability of research conducted at a regional scale to the national level.

Initially, this winter school will offer only micro-credentials (e.g., certificates of completion), but we will develop it with the aspiration of eventually creating a credit-granting paper harmonised across the three Universities (noting that UO has 18-point papers). Ultimately, we hope to have a collection of harmonised papers that can underpin an Erasmus-style joint MSc degree (taught and research). We are currently working with Catchments Otago on developing a prospectus for the proposed winter school for potential sponsors and end-users.

Exploring Work-Integrated Learning Opportunities with the WRA

Recognising aligned opportunities between the WRA River Vision & Strategy and WIL within the School of Science, co-director Lee organised a meeting between the WIL team (Karsten Zegwaard & Clare Hewins), co-director Manukau (as the WRA Liaison to the University), and members of the freshwater research team (Deniz Özkundakçı and Frank Burdon) in March 2022. During the meeting, we identified how SCIEN301 (Capstone Projects), SCIEN371 (BSc[Tech] Work Placements), and SCIEN303/313 (Undergraduate Research Projects) map to WIL opportunities with WRA and clarified expectations from the WIL team for WRA.

We are currently scoping out potential projects using UoW resources (including ERI) and trialling them with suitable students. For example, Burdon has been working with the WIL team on a Capstone project with a practical component. The project will begin in the B trimester of 2022, and there are already seven students enrolled (potentially more), and its theme is 'Rewilding Rivers'. This project will involve something akin to a pilot study where the students sample restored stream reaches using functional indicators.

Our goal is to eventually present a proposal to WRA for how these projects fit into the River Vision & Strategy and how they can be resourced by WRA in the long term to ensure relevance to the Strategy. WRA has expressed a strong interest in this collaboration and provided examples of WRA-funded river restoration projects and associated contact information. The Dean of Science, DVC Research, and DVC Māori have all expressed strong support for this developing initiative, and we are currently working with WRA to identify suitable opportunities.

Developing a Collaboration with WRC on Bat Research

Recognising bottlenecks and resourcing challenges related to ecological and ecophysiological research on bats, co-director Lee facilitated a meeting with Mike Scarsbrook (WRC Science Manager) and his team to explore opportunities for collaboration and sharing of resources. During the meeting, we identified strongly aligned interests that are directly relevant to the Waikato Bat Strategy Alliance and its developing strategy document. Specifically, we highlighted the need and shared desire to better understand the spatial distribution and metapopulation structure of urban and suburban bats to enable evidence-based management and planning. We identified that a combination of acoustics and eDNA-based techniques would effectively complement conventional catch-and-release approaches to address those needs. Following the meeting, Lee submitted a proposal to WRC that would fund 0.2 FTE for an ERI

Member (Grant Tempero), a number of postgraduate students, and associated operational expenses for an initial duration of four years.

Developing Collaborations with Auckland Council

Co-directors Lee and Manukau met with scientists and managers from the Auckland Council in June 2022 to explore opportunities and synergies for collaboration. The discussions focused around generating spatially explicit projections under climate change scenarios on top of the baseline information currently available in the AC Freshwater Management Tool, developing an integrated understanding (including biological connectivity) across the ten watersheds in the Auckland region, predicting ecosystem and human health outcomes under climate change, and exploring adaptations to climate change (including leveraging work on ecosystem restoration with ERI to understand and define reference states). We identified that there is particular strength within ERI to contribute to a holistic understanding of ecosystem health, which includes biological connectivity and identified values of mana whenua and tangata whenua. Particularly relevant tools and research areas include spatially explicit ecosystem modelling (e.g., process-based modelling), eDNA-based biological monitoring, and attributing climate change outcomes. We also identified that the School of Science is particularly well-placed to build freshwater research capacity in postgraduate students and train graduates who can effectively communicate and implement climate change adaptation policies through the Bachelor of Climate Change programme.

External Revenue Generation

The lists below include research contracted since July 2021 or is currently pending. Unless otherwise indicated, the University of Waikato is the lead institution.

The Marsden Fund and MBIE Endeavour Fund

- Shari Gallop (Principle Investigator). *Exploring the utility of stable state theory in real-world environmental problems*, Marsden Fast-Start (\$300,000)
- Bruce Clarkson (Science Leader), Kiri Wallace, and Andrew Barnes. *Restoring urban nature*, MBIE Endeavour Research Programme (\$10,070,000)
- Deniz Özkundakçı (Science Leader). *An ecosystem modelling platform to assist New Zealand lake management*, MBIE Endeavour Smart Ideas (\$1,000,000)
- Rebecca Lawton, Marie Magnusson, and Chris Glasson (Researchers). *Ngā Punga o Te Moana: Anchoring our Open Ocean Aquaculture Future*, MBIE Endeavour Research Programme (awarded to Cawthron) (\$450,000)
- [Pending] Chris Battershill (Science Leader) & Jenni Stanley. *Toka ākau toitu Kaitiakitanga - building a sustainable future for coastal reef ecosystems*, MBIE Endeavour Research Programme (\$8,800,000)
- [Pending] Kura Paul-Burke (Science Leader). *Pou rāhui, pou tikanga, pou oranga reigniting the mauri of Tikapa Moana and Te Moananui-ā-Toi*, MBIE Endeavour Research Programme (\$13,950,000)
- [Pending] Karin Bryan (Key Researcher). *Te Ao Hurihuri: Te Ao Hao - Our Changing Coast*, MBIE Endeavour Research Programme (led by GNS) (\$15,000,000)
- [Pending] Deniz Özkundakçı (Key Researcher). *Our lakes' health safeguarded for future generation - Te Mana o Te Wai, Te Mauri o Te Wai*, MBIE Endeavour Research Programme (led by Cawthron) (\$637,000)
- [Pending] Charles Lee & Kura Paul-Burke (Co-Science Leaders). *Weaving Conservation and Kaitiakitanga Values for Comprehensive Ecosystem Protection in Antarctica*, MBIE Endeavour Smart Ideas (\$1,000,000)

Other funding sources

- Craig Cary (Co-Principal Investigator). *Darwin rwinDa: rewinding and rerunning evolution to study innovation in action*, Human Frontier Science Program (25% of US\$2,250,000)
- Rebecca Lawton & Marie Magnusson (Principal Investigators). *Ecklonia* (Envirostrat/Seaweed Innovations/AgriSea/UoW), MBIE Special Strategic Initiative Fund (\$1,200,000)
- Marie Magnusson & Chris Glasson (Principal Investigators). *Ulva land-based diffuse bioremediation* (UoW/AgriSea), MBIE Special Strategic Initiative Fund (\$438,000)
- Jo Ellis (Program Leader). *Scale and Ecosystem-Based Management*, Sustainable Seas National Science Challenge (\$400,000)

- Phil Ross (Program Leader) & Kura Paul-Burke. *Thinking outside the can: engineering a sustain future for toheroa aquaculture*, Sustainable Seas National Science Challenge (\$250,000)
- Kura Paul-Burke (Associate Investigator). *Patangaroa hua rau*, Sustainable Seas National Science Challenge (\$67,000)
- Shari Gallop (Lead Investigator). *Co-developing with hapū to plan for the impacts of sea level rise on coastal marae and infrastructure*, Resilience to Nature Science Challenge (Ākina Te Tū – Kaupapa Māori Research Support Fund) (\$20,000)
- Louis Schipper (Principal Investigator). *MethaneSAT Research Programme*, MBIE Catalyst Fund (awarded to NIWA) (\$320,000)
- Nick Ling & Kura Paul-Burke (Principal Investigators). *Whakaari/White Island seafood safety research*, Ministry of Primary Industries. (\$580,000)
- Louis Schipper (Principal Investigator). *Developing a National scale soil carbon monitoring system*, Ministry of Primary Industries (awarded to Manaaki Whenua–Landcare Research) (\$25,000)
- Karin Bryan (Principal Investigator). *Ohiwa Harbour Sediment Study*, Bay of Plenty Regional Council (\$94,000)
- Louis Schipper (student support). New Zealand Agricultural Greenhouse Gas Research Centre (\$60,000)
- Andrew LaCroix (Principal Investigator). *Integrating western science with Māori knowledge to understand changes in sedimentation and water quality in Ōhiwa Harbour, Aotearoa New Zealand*, Association for the Sciences of Limnology and Oceanography (US\$2,500)
- [Pending] Louis Schipper (Principal Investigator). *Mitigation practices to maintain soil carbon and reduce nitrous oxide emissions at paddock scales*, New Zealand Agricultural Greenhouse Gas Research Centre. (\$320,000)

Budget Report

Overall, ERI is on track to make a small surplus in 2022. In 2021, an external research income target of \$4.5M was set for ERI for the 2022 financial year. Due to challenges in getting some of the larger MBIE programmes fully staffed, as of 30 June 2022, we are slightly behind in revenue generation. These positions, however, have either recently been filled or are being advertised with new staff expected to come on board this year.

Research Degree Completion

The lists below are likely incomplete but offer a useful overview of the diversity of ERI-aligned postgraduate research projects.

MSc and MSc (Research)

- Ashlee Cooper, MSc(Res): Locating Whitebait (*Galaxias argenteus*) Eggs via Canine Scent Detection
- Renee Denby, MSc(Res): Canine (*Canis familiaris*) Scent Detection of Invasive Brown Bullhead Catfish (*Ameiurus nebulosus*) in Water Samples, and the Effects of Sample Preservation
- Catherine Dennis, MSc: Dogs (*Canis familiaris*) prove the concept; giant kōkopu (*Galaxias argenteus*) eggs are detectable and distinguishable by canine olfaction using a scent line-up
- Kelsey Ferris, MSc(Res): eDNA-based monitoring of freshwater mussel populations
- Sean Georgeson, MSc(Res): The Influence of Group Size on Learning and Problem-solving in New Zealand Spotted Wrasse (*Notolabrus celidotus*)
- Lauren Little, MSc(Res): Fish Finding Fidos; Can Domestic Dogs (*Canis familiaris*) Offer a Solution for Detecting an Invasive Freshwater Catfish (*Ameiurus nebulosus*)
- Nicola Wilson, MSc(Res): Flows of water and nutrients to Lake Tarawera and connected lakes
- Alicia van de Laar, MSc(Res): Changes in temperature dependence of soil respiration along a geothermal gradient
- Kristyn Numa, MSc(Res): The temperature response of soil respiration from labile and stable carbon. (Sir Theodore Rigg Award from the New Zealand Society of Soil Science for the best masterate thesis)

PhD

- Shelly Brandt (chief supervisor: Craig Cary): The effects of ocean acidification on microbial nutrient cycling and productivity in coastal marine sediments
- Thomas Corbett (chief supervisor: Louis Schipper): Improved Determination of Nitrate Concentrations and Flow Rates in Freshwater using 'Diffusive Gradients in Thin-films'
- Jasmine Robinson (chief supervisor: Louis Schipper): Measuring the temperature response of soil respiration from two distinct carbon pools in soil
- Aaron Wall (chief supervisor: Louis Schipper): Does increasing supplement feed import to dairy farms result in increases in soil carbon?
- Anne Wecking (chief supervisor: Louis Schipper): Paddock scale nitrous oxide emissions from grazed pastures: quantification and mitigation

Details of Publications

From July 2020 to June 2022 (an annual report for 2020/2021 was not prepared due to staff turnover), ERI members published more than 400 articles in peer-reviewed journals (listed in [Appendix III: Select Publications by ERI Members](#)). Particularly noteworthy articles are listed below with a short description of their significance:

- **Barnes, A.D.**, Scherber, C., Brose, U., Borer, E.T., Ebeling, A., Gauzens, B., Giling, D.P., Hines, J., Isbell, F., Ristok, C., Tilman, D., Weisser, W.W., and Eisenhauer, N., 2020. Biodiversity enhances the multitrophic control of arthropod herbivory. *Science Advances*. doi:10.1126/sciadv.abb6603
 - This study synthesises data from two long-running biodiversity experiments and uses an ecosystem energetics approach to demonstrate that increasing grassland plant diversity enhances the multitrophic control of arthropod herbivory, thus reducing the net impacts of herbivores on plants.
- **Hicks, B.J.**, Smith, D.R., **Pingram M.A.**, Kelly, D.J., Fraley, K.M. 2021. Conservation of freshwater eels in food-web studies: Non-lethal stable isotope analyses substitute fin for muscle tissue with lipid correction. *Ecology of Freshwater Fish*. doi.org/10.1111/eff.12647
 - The use of stable isotopes has generally required sacrifice of animals to gain tissue samples for isotope analysis. Fin tissue, which can be collected without lethal sampling, can be substituted for muscle tissue provided that the isotopic relationship of muscle to fin tissue is accurately known.
- Vopel, K., **Marshall, A.**, Brandt, S., **Hartland, A.**, **Lee, C.K.**, **Cary, S.C.**, and **Pilditch, C.A.** 2021. Biogeochemical feedbacks to ocean acidification in a cohesive photosynthetic sediment. *Scientific Reports*. doi:10.1038/s41598-021-02314-y
 - This publication presented findings from the first-ever systematic experiment to holistically assess the effect of ocean acidification on the biogeochemical cycling functions of marine sediment microbial communities.
- **Isson, T.T.**, Zhang, S., Lau, K.V., Rauzi, S., Tosca, N.J., Penman, D.E., and Planavsky, N.J. 2022. Marine siliceous ecosystem decline led to sustained anomalous Early Triassic warmth. *Nature Communications*. doi:10.1038/s41467-022-31128-3
 - This study demonstrates for the first time that siliceous organisms play a key role in regulating climate on Earth.
- **Yang, Y.**, Xiong, X., Melville, B.W., Sturm, T., 2021. Dynamic morphology in a bridge-contracted compound channel during extreme floods: effects of abutments, bed-forms and scour countermeasures. *Journal of Hydrology*. doi:10.1016/j.jhydrol.2020.125930
 - This study for the first time demonstrates the dynamic sediment processes in a natural river channel during extreme floods, particularly from an engineering perspective, and presents new criteria to assess scour that may put bridge infrastructure in significant risks.

- Smith, P., Soussana, J-F., Angers, D., **Schipper**, L.A., Chenu, C., Rasse, D.P., Batjes, N.H., van Egmond, F., McNeill, S., Kuhnert, M., Arias-Navaro, C., Olesen, J.E., Chirinda, N., Fornara, D., Wollenberg, L., Álvaro-Fuentes, J., Sanz-Cobena, A., Klumpp, K. 2020. How to measure, report and verify soil carbon change to realise the potential of soil carbon sequestration for atmospheric greenhouse gas removal. *Global Change Biology*. 26:219–241.
 - This publication pulled together the world experts to overview a general approach for measuring, monitoring, and verifying changes in national scale soil carbon stocks for greenhouse gas inventory reporting, attracting over 200 citations to date (Google scholar).
- Rullens, V., Townsend, M., Lohrer, A., Stephenson, F., and **Pilditch, C.** 2021. Who is contributing where? Predicting ecosystem service multifunctionality for shellfish species through ecological principles. DOI: [10.1016/j.scitotenv.2021.152147](https://doi.org/10.1016/j.scitotenv.2021.152147)
 - This paper applied mechanistic models to link ecological processes with ecosystem functions and services. Understanding service contributions can assist with how to manage multiple services simultaneously to ensure efficient and sustainable use of the environment and its resources.
- Duffy, K.A., Schwalm, C.R., Arcus, V.L., Koch, G.W., Liang, L.L., and **Schipper, L.A.** 2021. How close are we to the temperature tipping point of the terrestrial biosphere?. *Science Advances*. doi:10.1126/sciadv.aay1052
 - This study used data from 1500 site-years drawn from the largest continuous carbon flux monitoring network to construct temperature response curves for global land carbon uptake. We demonstrated that under business-as-usual greenhouse gas emissions, there will be a near halving of the land sink strength as early as 2040, revealing a truly troublesome global tipping point. This publication has received an altmetric score of over 1,000 after being picked up by 59 news outlets around the world including a video explainer by the SciShow YouTube channel (<https://www.youtube.com/watch?v=1NBQZkySDY0>) that has been viewed over **165,000 times**.
- Nepper-Davidsen, J., **Magnusson, M., Glasson, C.R.K., Ross, P.M., and Lawton, R.J.** (2021). Implications of Genetic Structure for Aquaculture and Cultivar Translocation of the Kelp *Ecklonia radiata* in Northern New Zealand. *Frontiers in Marine Science*. doi:10.3389/fmars.2021.749154
 - This publication assessed the genetic structure of the kelp *Ecklonia radiata*, a target for seaweed aquaculture in New Zealand, to determine suitable regions for translocation of broodstock for aquaculture that will prevent the spread of non-local genes to natural populations.
- **Puke, W.T.** Conception, construction and the cultural significance of Te Parapara Garden in Hamilton, Aotearoa New Zealand. *Journal of New Zealand & Pacific Studies*. Volume 9 Number 2. doi:10.1386/nzps_00071_1
 - This publication by a former ERI member, Wiremu Puke (Ngāti Wairere, Ngāti Porou), described the creation and significance of 'Te Parapara Garden' within the Hamilton Gardens. 'Te Parapara Garden' is the only complete pre-European-style Māori horticultural garden in the world.

Popular Media Coverage

ERI members contributed to numerous events to disseminate their research findings and the associated environmental and policy implications during the reporting period. A selection of events are included below:

- Mainstream Media
 - [Cary, S.C.] **Radio New Zealand**: *Interview for the Saturday Morning podcast, exploring extreme bacteria in Antarctica. 21/5/2022*
 - [Gallop, S.L.] **Radio Kahungunu AM**: *Interview with Rahina Huata on rip current safety and research on rip current education using photographs. 27/01/2021*
 - [Gallop, S.L.] **Te Hiku Media Ngā Take o te Taitokerau (Northland Regional Māori News)**: *Interview with Whaea Girlie Clarke AMResearch on rip current education using photographs. 21/01/2021*
 - [Bailey-Winiata, A. & Gallop, S.L.] **New Zealand Herald**: *Kāhu ki Rotorua: Te manu kai i te mātauranga nōna te āo - A star for his work ethic and commitment. 10/12/2021*
 - [Gallop, S.L.] **Te Puke Times**: *Researchers share results: Learn about the impact of the Kaituna river rediversion on the estuary. 21/10/2021*
 - [Bailey-Winiata, A. & Gallop, S.L.] Interview for the **Newshub** 6 pm news: *Māori cultural sites among most vulnerable to climate change, rising sea levels. 08/05/2022*
 - [Bailey-Winiata, A. & Gallop, S.L.] **New Zealand Geographic**: *A map of the future. May-Jun 2022*
 - [Bailey-Winiata, A. & Gallop, S.L.] **Radio New Zealand**: *Interview for the Our Changing World podcast, Getting ready for our warmer future. 07/04/2022*
 - [Bailey-Winiata, A. & Gallop, S.L.] **The University of Waikato News**: *coastal marae and sea level rise research as well as being a young Māori researcher 08/04/2022*
 - [Bailey-Winiata, A. & Gallop, S.L.] Article in **Kahu Ki Rotorua, NZ Herald**: *Showcasing professionals from Rotorua, New Zealand. 11/12/2021*
 - [Magnusson, M. & Lawton, R.] **Radio New Zealand**: *Interview for the Our Changing World podcast: Multi-talented macroalgae. 17/02/2022*
 - [Magnusson, M. & Lawton, R.] **Sunlive**: *Seaweed farming trials in Hauraki Gulf and BOP. 13/12/2021*
 -
- Specialist Media
 - [Gallop, S.L.] **Henry Magazine** (Summer 2021): *Turn on the water works: Bay of Plenty's Shari Gallop's estuary outreach*
 - [Gallop, S.L.] **The Coast2Cast Podcast**: <https://www.podbean.com/media/share/pb-bdr2k-10a0ce9> July 2021
 - [Gallop, S.L.] **Build Magazine** (Winter 2021): *Our changing coastline*
 - [Gallop, S.L.] **Shepherdess Magazine** (Autumn 2021): *Nā te Wāhine, Mō te Whenua. From the Women, for the Land, Restoring Maketū Estuary (Waea Ngahere, Bush Telegraph section).*

- [Gallop, S.L.] **Thrive Magazine** (Summer 2021): *Our Estuaries, our kaitiakitanga.*
- [Bailey-Winiata, A. & Gallop, S.L.] Online talk in Te Ao Rangahau Climate Conversation, **Engineering New Zealand: The lessons we can learn from Te Ao Māori and Mātauranga Māori to combat climate change.** May 2022
- [Magnusson, M. & Lawton, R.] **The Fish Site: GreenWave inspires \$5 million kelp farming pilot in NZ.** December 2021
- Public Seminars, Webinars, and Workshops
 - [Ellis, J.] **Te Au o Te Moana Webinar Series: Improved Decision-making for the Moana.** March 2022
 - [Ellis, J.] **Te Au o Te Moana Webinar Series: Healthy Seas.** March 2022
 - [Ellis, J.] Panellist member, **UN Ocean Decade Laboratory Virtual Webinar: Ecosystem based management in Aotearoa New Zealand.** March 2022
 - [Gallop, S.L.] **Coast2Coast Webinars: The science of returning freshwater to estuaries and positioning as a scientist.** May 2021
 - [Gallop, S.L.] Invited speaker, **Global Biodiversity Festival, 2021 Virtual Weekend Festival: The science of returning freshwater to estuaries.**
 - [Gallop, S.L.] Invited presenter, **Te Rarawa Mahi Tahi: Working together on Climate Change.** November 2021
 - [Gallop, S.L.] invited speaker and panellist, **Good Green Gatherings: Caring for our diverse environments: Terrestrial and marine.** 06 May 2021
 - [Gallop, S.L.] Invited speaker, **Cafe Scientifique: The science of restoring estuaries and what about climate change?** March 2021
 - [Gallop, S.L.] **Sunlive: Panel to inspire chance comes to Tauranga.** May 2021
 - [Bailey-Winiata, A. & Gallop, S.L.] Online presentation, **Australasian Coasts and Ports Conference: Coastal marae and urupā: What about sea level rise.** 12/04/2022

Appendix I: ERI Seed Grant Template

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Description and Application Template for Te Tumu Whakaora Taiao - The Environmental Research Institute Seed Grant

Purpose

The ERI Seed Grant is an out-of-cycle (i.e., open all year round) funding mechanism to support **novel interdisciplinary** research ideas that are time-sensitive and have clear potential to attract **new external research funding**. 'Novel' is defined in the sense that the proposed research has not been previously attempted by the project team and would likely not happen without this support. This definition excludes continuation and expansion of ongoing research, and interdisciplinarity is implicitly a part of this definition. A good indication that a research idea is 'novel' is that the project team has not previously worked or published together, and a good (but not the only) indication of 'interdisciplinarity' is that project researchers come from different academic teams (within a School), different Schools, or different Divisions. Research ideas that *sincerely and tangibly* integrate empirical scientific investigation with mātauranga Māori and/or kaupapa Māori are also considered interdisciplinary and highly encouraged.

By offering an out-of-cycle funding mechanism, the ERI Seed Grant aims to increase the agility of ERI Members to respond to rapidly developing challenges and opportunities. Consequently, the ERI Seed Grant is meant for research opportunities that other UoW internal funding mechanisms (e.g., RTCF, SRF, Marsden Support Grants, strategic CapEx within individual Schools) cannot effectively support due to their rigid timelines.

At the strategic level, the ERI Seed Grant is used to foster new proposals for external research funding that would not happen without ERI, and a good application for the ERI Seed Grant should demonstrate credible contributions to the following goals:

- Recognising existing capabilities
- Increasing collaborations
- Increasing capabilities

Due to its out-of-cycle nature (i.e., funding decisions are made within a short time after application submission), it is not possible to explicitly favour early career researchers in administering the ERI Seed Grant. However, ECRs are strongly encouraged to work with the ERI Co-Directors to develop their applications where the research may fit the description above.

Eligibility

All [ERI Members](#) who are currently employed by the University of Waikato on a fixed-term or a continuing contract can apply. The ERI Seed Grant does not provide FTE funding but can fund work done through casual contracts where appropriate.

Instructions

Please have a kōrero with at least one of the ERI Co-Directors to ensure that your application fits in the scope of the ERI Seed Grant **before** filling out the application below. To use the template below, replace all the [text in blue](#) with your content. To reduce the overhead associated with the application, citations are not expected but can be included as footnotes if really necessary. *Please respect the word limits (the application should be 2-3 pages).*

Project Title

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Project Team Members

Name	Affiliation	Project Role
John Doe		
Jane Doe		
Manaia Doe		

Background Information (200 words)

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What is the Challenge? (70 words)

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Novel Idea/Capability/Application (200 words)

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Budget

Item	Rationale	Amount

Anticipated Funding Opportunities and Mechanisms (100 words)

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Anticipated End Users and Wider Impact (100 words)

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Appendix II: ERI Reports published since July 2020

- Tempero G.W. 2020. Seasonal changes in phytoplankton nutrient limitation: Lake Rotorua. **ERI Report No. 135**. Client report prepared for Bay of Plenty Regional Council.
- Elliot Noe E., Wallace K.J., Cornes T., Kirby C.L. 2020. A three-part report: Overview of the Kukutaaruhe Gully Restoration Initiative, Operational Forest Restoration Plan for Kukutaaruhe Gully and Ecological Restoration Plan Template. **ERI Report 136**. Client report prepared for the Kukutaaruhe Education Trust.
- Sandwell D.R., Bryan K. 2020. Real-Time Kinetic (RTK) elevation survey of sediment plates located in Raglan (Whaingaroa) and Firth of Thames for The Waikato Regional Council Regional Estuarine Monitoring Programme. **ERI Report 137**. Client report prepared for Waikato Regional Council and the Kukutaaruhe Education Trust.
- Ross PM. 2020. Assessment of impacts of mechanical spat harvesting on the surf clams of Te Oneroa a Tōhē. **ERI Report 138**. Client report prepared for the Te Oneroa a Tōhē Spat Working Group.
- O'Neill, T. 2019. Scott Base Redevelopment CEE environmental monitoring report: Year one (January 2019). **ERI Report 139**. Client report prepared for Antarctica New Zealand.
- O'Neill, T. 2020. Scott Base Redevelopment CEE environmental monitoring report: Year two (December 2019 - January 2020). **ERI Report 140**. Client report prepared for Antarctica New Zealand.
- Farnworth, B., Wallace, K.J., Cornes, T. 2021. Waiwhakareke Natural Heritage Park Long-term Monitoring Report of Ecological Restoration Progress. **ERI Report 141**. Client report prepared for Tui 2000 and the Hamilton City Council.
- Battershill C., Gallop S., Kellett M., Johnson K., Pritchard K., editors. 2020. Biophysical and ecological dynamics of the Maketu Estuary prior to re-diversion of the Kaituna River: a compilation of reports by SCIEN301-19A students. **ERI Report 142**.
- McBride, C.G., Verburg, P. 2019. Estimated catchment loads of nitrogen and phosphorus to the Rotorua Te Arawa Lakes. **ERI Report 143**. Client report prepared for the Bay of Plenty Regional Council.
- Abell, J., C.G. McBride, C.G., T. Baisden. 2020. Assessing effects of changes to nutrient loads on Lake Tarawera water quality: Model simulations for 2010 to 2020. **ERI Report 144**. Client report prepared for the Bay of Plenty Regional Council.
- Ling, N. 2020. Electric fishing survey of the lower Ruamāhanga River – February 2020. **ERI Report 145**. Client report prepared for Greater Wellington Regional Council.
- Allan, M.G., Baisden, T, and Bruere, A. 2020. Assessing the effects of nutrient load reductions to Lake Okaro: Model ensemble simulations. **ERI Report 146**.
- Nepia, RE and Drage P. 2021. Waiwhakareke Natural Heritage Park 2020 ground truthing. **ERI Report 147**. Client report prepared for Tui 2000.
- Beet CR and Lee CK. 2021. Baseline terrestrial biology assessment for the Scott Base Redevelopment project. **ERI Report 148**. Client report prepared for Antarctica New Zealand.
- Farnworth, B., Wallace, K.J., Hall, M.M., Clarkson, B.D. 2021. Waiwhakareke Natural Heritage Park 2021 Long-term Monitoring: Report on Ecological Restoration Progress. **ERI Report 149**. Client report prepared for Tui 2000 and the Hamilton City Council.

- Cho E, Hamilton DP, White P and McBride CG. 2020. Catchment and lake water quality modelling to assess management options for Lake Rerewhakaaitu. **ERI Report 150**. Client report prepared for the Bay of Plenty Regional Council.
- Tempero G.W. and Davies-Calway C. 2021. Sediment aluminium content of lakes Rotorua and Rotoehu: 2020 monitoring survey. **ERI Report 151**. Client report prepared for Bay of Plenty Regional Council.
- Ross P.M. 2021. The coastal habitats of Tairāwhiti: A review of the scientific, local, and customary knowledge. **ERI Report 152**. Client report prepared for Gisborne District Council.
- Ling, N. 2021. Utuhina Stream monitoring 2006-2020: In-stream alum dosing effects on fish and aquatic invertebrates. **ERI Report No. 153**. Client report prepared for Bay of Plenty Regional Council.
- Hawes I. and Battershill C. 2021. Review of elements of Comprehensive Environmental Evaluation of the proposal to build an aerodrome, and ancillary structures, at Davis Station, Antarctica. **ERI Report 154**. Client report prepared for The Australian Antarctic Division.
- Duggan I. and Hussain E. 2021. Assessment of trophic state change and lake health in selected lakes of the Auckland Region based on zooplankton assemblages: 2012-2019. **ERI Report 155**. Client report prepared for Auckland Council.
- La Croix, A.D. 2022. Recent and historical sedimentation and sediment characteristics of Ōhiwa Harbour, New Zealand. **ERI Report 156**. Client report prepared for Bay of Plenty Regional Council.
- Tempero, G.W. 2022. Phytoplankton nutrient limitation in Lake Rotorua. **ERI Report No. 157**. Client report prepared for Bay of Plenty Regional Council.
- Hicks B.J., W. S. Powrie and G. Larkin. 2022. Boat electrofishing salvage of fish in the Mangamahoe Low Head Dam reservoir. **ERI Report No. 158**. Client report prepared for New Plymouth District Council.

Appendix III: Select Publications by ERI Members

- **Puke, W.T.** Conception, construction and the cultural significance of Te Parapara Garden in Hamilton, Aotearoa New Zealand. *Journal of New Zealand & Pacific Studies*. Volume 9 Number 2. doi:10.1386/nzps_00071_1
- Potapov, A.M., Dupérré, N., Jochum, M., Dreczko, K., Klarner, B., **Barnes, A.D.**, Krashevskaya, V., Rembold, K., Kreft, H., Brose, U., Widyastuti, R., Harms, D., and Scheu, S. 2020. Ground Spider Communities Under Tropical Land-Use Change. *The Bulletin of the Ecological Society of America*. doi:10.1002/bes2.1668
- Jochum, M., **Barnes, A.D.**, Brose, U., Gauzens, B., Sünemann, M., Amyntas, A., and Eisenhauer, N. 2021. For flux's sake: General considerations for energy-flux calculations in ecological communities. *Ecology and Evolution*. doi:10.1002/ece3.8060
- Ebeling, A., Lind, E.W., Meyer, S.T., **Barnes, A.D.**, Borer, E.T., Eisenhauer, N., and Weisser, W.W. 2020. Contrasting effects of plant diversity on β - and γ -diversity of grassland invertebrates. *Ecology*. doi:10.1002/ecy.3057
- Stolze, K., **Barnes, A.D.**, Eisenhauer, N., and Totsche, K.U. 2022. Depth-differentiated, multivariate control of biopore number under different land-use practices. *Geoderma*. doi:10.1016/j.geoderma.2022.115852
- Allen, W.J., Bufford, J.L., **Barnes, A.D.**, Barratt, B.I., Deslippe, J.R., Dickie, I.A., Goldson, S.L., Howlett, B.G., Hulme, P.E., Lavorel, S., O'Brien, S.A., Waller, L.P., and Tylianakis, J.M. 2022. A network perspective for sustainable agroecosystems. *Trends in Plant Science*. doi:10.1016/j.tplants.2022.04.002
- Grass, I., Kubitzka, C., Krishna, V.V., Corre, M.D., Mußhoff, O., Pütz, P., Drescher, J., Rembold, K., Ariyanti, E.S., **Barnes, A.D.**, Brinkmann, N., Brose, U., Brümmer, B., Buchori, D., Daniel, R., Darras, K.F.A., Faust, H., Fehrmann, L., Hein, J., Hennings, N., Hidayat, P., Hölscher, D., Jochum, M., Knohl, A., Kotowska, M.M., Krashevskaya, V., Kreft, H., Leuschner, C., Lobite, N.J.S., Panjaitan, R., Polle, A., Potapov, A.M., Purnama, E., Qaim, M., Röhl, A., Scheu, S., Schneider, D., Tjoa, A., Tschardt, T., Veldkamp, E., and Wollni, M. 2020. Trade-offs between multifunctionality and profit in tropical smallholder landscapes. *Nature Communications*. doi:10.1038/s41467-020-15013-5
- Morgan, S., Binks, N.A., Didham, R.K., and **Barnes, A.D.** 2022. Functional group-dependent responses of forest bird communities to invasive predator control and habitat fragmentation. *Diversity and Distributions*. doi:10.1111/ddi.13539
- Hirt, M.R., **Barnes, A.D.**, Gentile, A., Pollock, L.J., Rosenbaum, B., Thuiller, W., Tucker, M.A., and Brose, U. 2021. Environmental and anthropogenic constraints on animal space use drive extinction risk worldwide. *Ecology Letters*. doi:10.1111/ele.13872
- **Barnes, A.D.**, Scherber, C., Brose, U., Borer, E.T., Ebeling, A., Gauzens, B., Gilling, D.P., Hines, J., Isbell, F., Ristok, C., Tilman, D., Weisser, W.W., and Eisenhauer, N. 2020. Biodiversity enhances the multitrophic control of arthropod herbivory. *Science Advances*. doi:10.1126/sciadv.abb6603
- Corbett, T., **Hartland, A.**, Henderson, W., Rys, G., and **Schipper, L.A.** 2022. The temperature and flow dependence of nitrate concentration and load estimates based on diffusive gradients in thin films. *Journal of Environmental Quality*. doi:10.1002/jeq2.20323

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