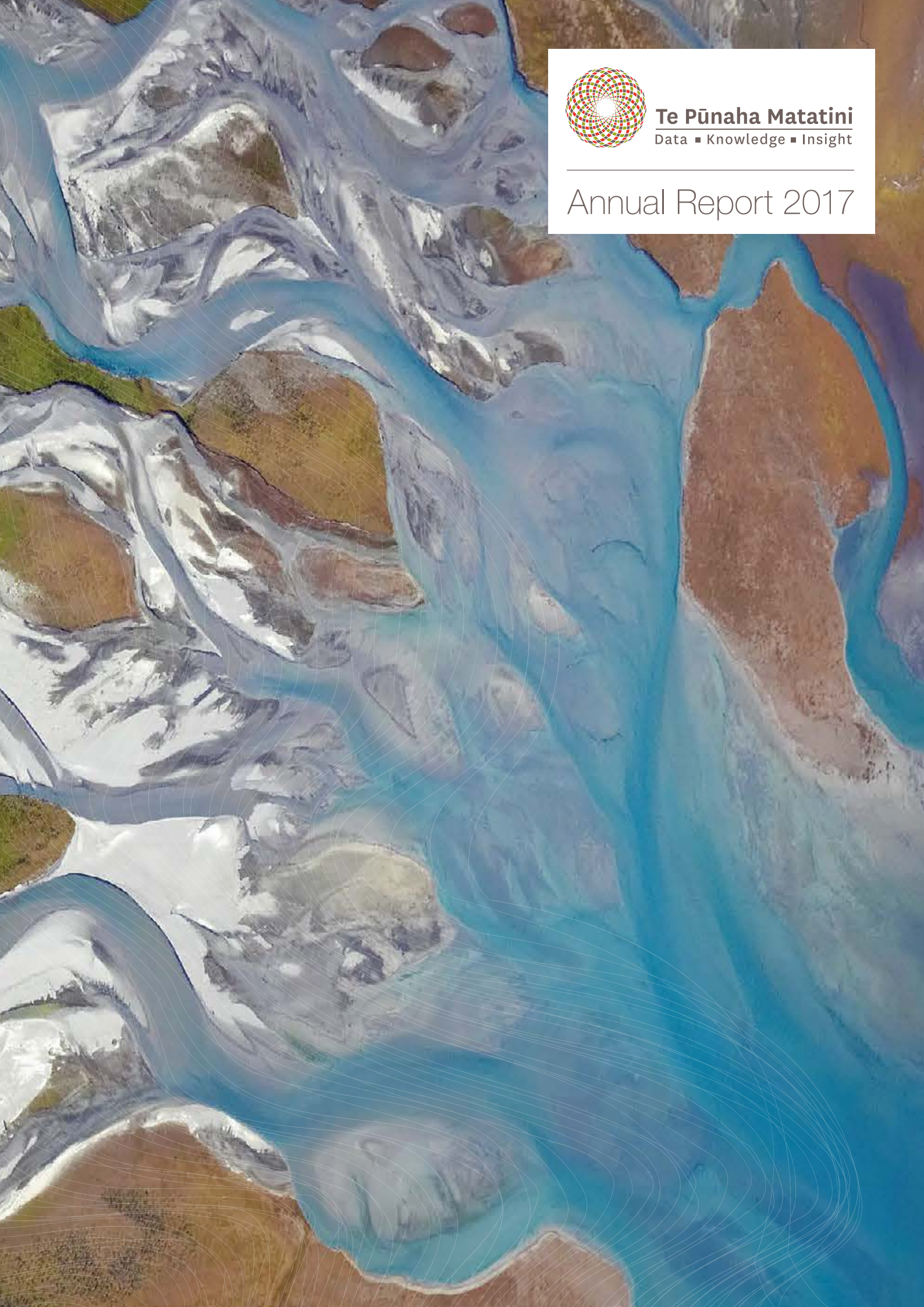

Te Pūnaha Matatini

Data ▪ Knowledge ▪ Insight

Annual Report 2017

A Centre of Research Excellence hosted by the University of Auckland

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About Us

Our Partners

We're bringing together leading researchers from across New Zealand's research institutions

Partners:

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA UNIVERSITY OF WELLINGTON

MASSEY UNIVERSITY
TE KUNENGA KI PUREHUROA
UNIVERSITY OF NEW ZEALAND

Motu

Collaborators:

University of Waikato
Te Whare Wānanga o Waikato

Landcare Research
Manaaki Whenua

GNS Science
Te Pū Ao

University of Otago
Te Whare Wānanga o Otāgo

2012
Shaun Hendy and Dion O'Neale discuss how a complex systems research team with a broad set of collaborators could make an impact.

Early 2013
Shaun Hendy encouraged to submit a proposal for a Centre of Research Excellence (CoRE).

Mid 2013
Kate Hannah comes on board as bid manager.

October 2013
Investigators from around the country come together for the first time.

Our Story

We live in a data-rich but knowledge-poor world

Te Pūnaha Matatini – 'the meeting place of many faces' – is a New Zealand Centre of Research Excellence developing methods and approaches for transforming complex data about the environment, economy, and society into knowledge, tools, and insights for making better decisions.

As 'a meeting place for many faces', we are committed to equity, diversity, and inclusion, focussed on transdisciplinary research, and connected to colleagues across research, government, industry, and communities.

We're working together to enable New Zealanders to grow up and thrive in an increasingly complex and interconnected world

Te Pūnaha Matatini brings together the expertise of New Zealand's leading researchers in social sciences, economics, biology, mathematics, computer science, operations management, statistics, engineering science, and physics.

Our transdisciplinary approach advances knowledge of complex systems and networks, and their applications, for the social, economic, and environmental benefit of New Zealand.

Director Shaun Hendy discusses Te Pūnaha Matatini's work on RadioLIVE.
http://bit.ly/1ohHOmk

Early 2014
Bid team interviewed by Royal Society of New Zealand selection panel.

January 2015
Te Pūnaha Matatini comes into official existence with 24 Principal Investigators.

February 2015
Official launch of Te Pūnaha Matatini.

January 2016
Te Pūnaha Matatini continues to grow.

December 2017
- 24 Principal Investigators
- 25 Associate Investigators
- Executive Management Team of 10
- Over 100 students aligned with Te Pūnaha Matatini Whānau
- 33 affiliated or directly funded PhD students.

Board Chair's Report

This is the third annual report of Te Pūnaha Matatini in a year that has seen growth and consolidation of the Centre along with much success.

The recognition and reputation of Te Pūnaha Matatini is increasing as well as its influence on other Centres of Research Excellence. For example, Te Pūnaha Matatini's promotion of diversity and collaboration within the New Zealand science system. This growth and consolidation will set the platform for our next three years which, I for one, am looking forward to because of the interesting projects and the research that is being undertaken by our investigators and researchers.

I believe that the potential benefits to Government and society in unlocking the knowledge that is hidden in large data sets is huge. I note the passion that our investigators have for their research and the interest the public take in the results. For example in the gender pay gap being investigated and reported on by Isabelle Sin. Her findings received a lot of publicity and her research along with other commentators is forcing businesses to investigate what gender pay gap exists in their own organisations and taking action if there is a problem. This is pleasing to see and I have direct evidence of this taking place in a business as I am on its board of directors.

I mentioned the word success above and thought it appropriate to give you some success highlights for our third year that are covered in detail in the report. These are listed below:

- Investigator Dr Rebecca Priestley won the Prime Minister's Science Communication Award, worth $100,000, making Rebecca the fourth Te Pūnaha Matatini investigator to win the award. Rebecca used her prize money to establish the Aotearoa New Zealand Science Journalism fund, which will support journalists to write long form pieces on topical science-related issues.
- Our internship programme has proven to be highly popular with both students and employers, with several dozen students having now carried out projects in government and industry. These include placements at the Social Investment Agency, Westpac, and Ngāti Whātua Orākei. One high profile project with Te Hiku Media and Dragonfly Data Science resulted in a *New Zealand Herald* data visualisation classifying all New Zealand place names by whether they are Te Reo Māori or English.
- In 2017, our investigators brought in approximately $490,000 in co-funding from stakeholder organisations to support Te Pūnaha Matatini's research programme, well ahead of our annual target of $250,000. This helps us multiply the impact of our research and shows that it is valued highly by external organisations.

Any success the Centre is achieving is the result of team work, collaboration and hard work. On behalf of the Board I would like to thank Professor Shaun Hendy, our director, for his leadership and commitment, and our executive manager, Kate Hannah, for her efficient management of the Centre and for all the contributions our investigators and researchers have made in what has been a successful third year for Te Pūnaha Matatini.

Richard Aitken
Board Chair

Director's Report

In our third year, transdisciplinary and cross-institutional research has become the norm at Te Pūnaha Matatini, with investigators who had not met prior, now writing papers and winning grants together. These innovative collaborations would not have developed without the framework Te Pūnaha Matatini has provided.

In April 2017 Te Pūnaha Matatini was reviewed by an international panel of experts who noted that:

"The level of collaborative research across disciplines and the gender balance of the network are especially impressive. Looking across the academic disciplines of the researchers participating in TPM gives one an idea of the breadth of expertise available in the network: from traditional fields such as physics, mathematics, anthropology, and economics, through network science, operations research, and computational social science, to science communication and mātauranga Māori.

It is hard to imagine a similar research network anywhere in the world. This fact creates an opportunity for unique research output from a small country." Te Pūnaha Matatini's third year was also a time for self-reflection and planning. An international panel was appointed to review our science programme, we participated in the TEC's mid-term review processes, and we reviewed the performance of our investigators.

These reviews all took place at the same time as we prepared our 2018–2020 research plan and started the process to recruit students and post-doctoral fellows for this second round of funding. At the end of these processes we have emerged as an organisation that can be more confident about its place in the world. Te Pūnaha Matatini is very much delivering on our mission. In our first three years, Te Pūnaha Matatini investigators were awarded more than $8.4m from outside the New Zealand science and innovation system to pursue our research plan. A good deal of this success can be attributed to Te Pūnaha Matatini's engagement activities, particularly our relationship building between the central government agencies involved in social investment and the research sector. This research is not only delivering new tools and policy insights for government, it is also preparing students for jobs in the rapidly growing data analytics industry.

Te Pūnhaha Matatini investigators are competing in the New Zealand science and innovation system at the highest levels of excellence, winning numerous awards, fellowships, and prestigious grants. Te Pūnaha Matatini research and scholarship is being discussed in the public sphere by commentators ranging from the former Prime Minister, John Key, to Fiona Fox, the head of the United Kingdom's Science Media Centre. Major policy initiatives have been launched that are based on or informed by the work of our investigators, including the government's move to support Predator Free New Zealand, and the establishment of the National Research Information System.

There are now several Te Pūnaha Matatini research projects that draw on the distinctive contribution of Māori, focusing on the interaction of mātauranga Māori with complex systems approaches. The 'Kōrero Māori' project, initiated in partnership with Te Hiku Media and Wellington company Dragonfly Data Science, will develop language processing software for te reo Māori, and a new project in Te Pūnhaha Matatini's 2018–2020 plan "Mai i ngā maunga ki te tai – From the mountains to the sea – enhancing conservation using mātauranga", aims to develop best practise processes for engagement between tangata whenua and environmental scientists. We have a strong partnership with Ngāti Whātua Ōrakei, placing three interns with them over the summer of 2017–2018, and have recently endorsed a major research proposal from the hapū to build a data science capability.

Te Pūnaha Matatini has also developed strong governance and management processes, and has become well-known for good leadership in managing mutlidisciplinary research centres, advising other CoREs and research centres on structure and operational matters, governance, and policies for growing diversity. Several other CoREs have adopted Te Pūnaha Matatini's diversity policies and the Royal Society Te Aparangi has changed its practices in the course of responding to our sponsorship policies. A number of other research collaborations, including several CoREs, have copied aspects of our operations, including our governance structure, financial model, and communications strategies.

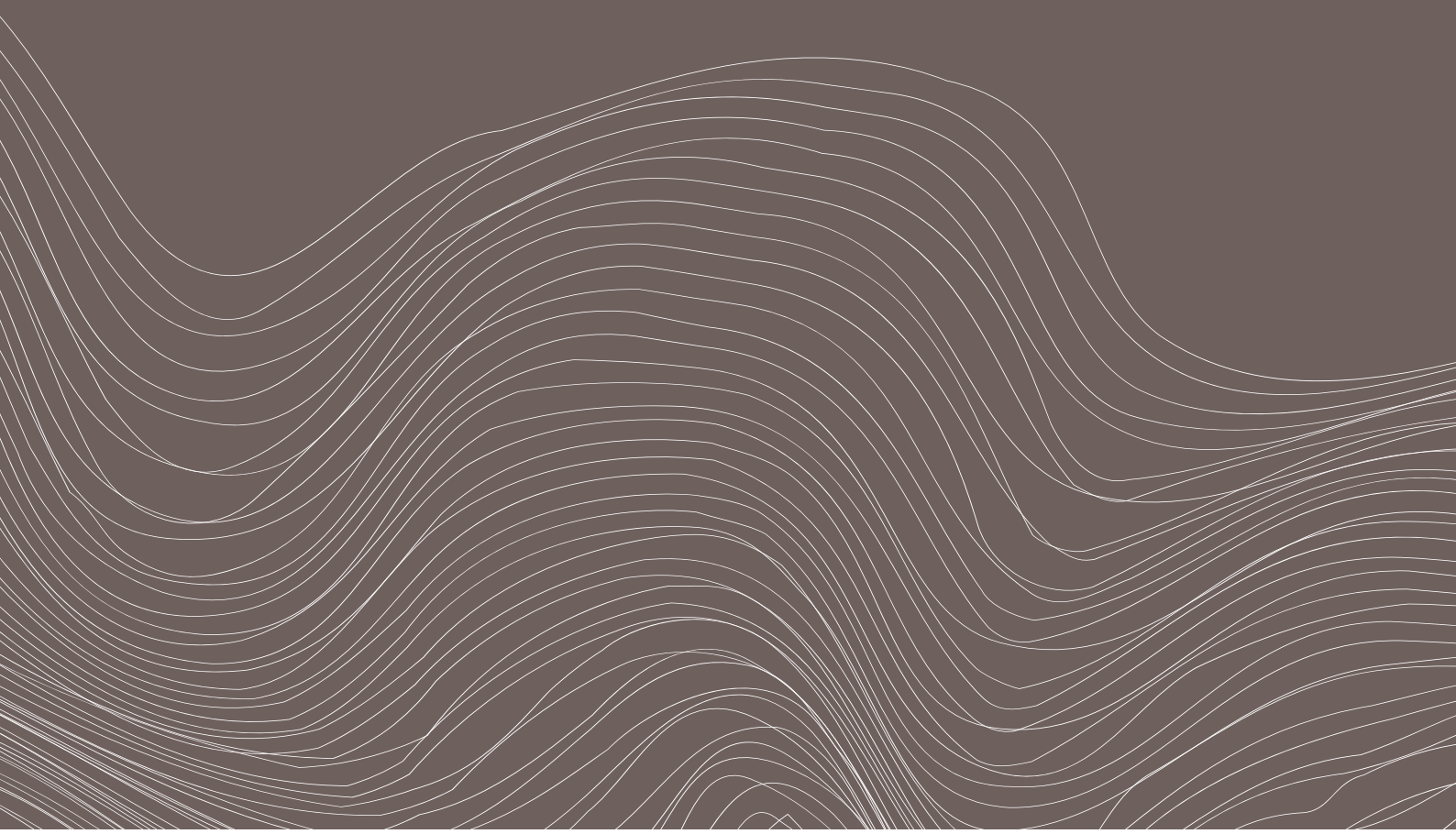
Professor Shaun Hendy
Director

Our Vision and Values

Our Vision

- We work with our stakeholders from industry, government, and the public to help reshape New Zealand's economy, society, and environment
- We train a new type of scientist for the benefit of New Zealand
- We help build the kind of New Zealand of which we can all be proud
- We enhance Mātauranga Māori

Our vision is to undertake research and education to advance knowledge of complex systems and networks, and their applications for the social, economic, and environmental benefit of New Zealand.



Our Values

- Visibility and international excellence
- Outreach and engagement – ensuring demonstrated relevance or impact
- Collaboration for discover-orientated research
- Diversity through development and participation

Our values are drawn from the words of our foundational whakataukī, given to us in 2013 by Associate Professor Mānuka Henare (Ngāpuhi, Te Aupouri, Te Rarawa, Ngāti Kuri), Director of the Mira Szászy Research Centre for Māori and Pacific Economic Development;

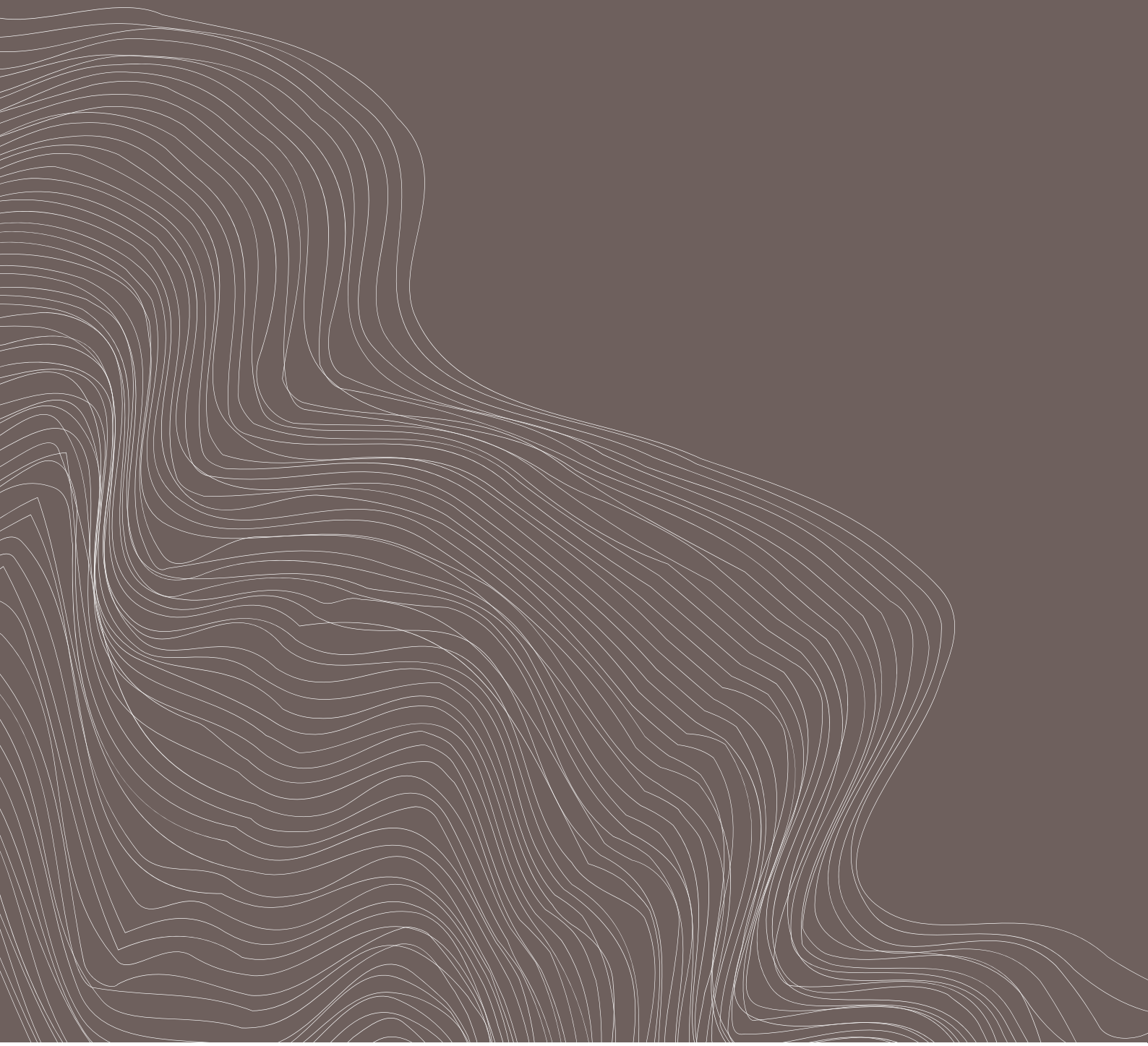
E tipu, e rea, Mo ngā ra o tau ao –

Grow up and thrive for the days destined to you.

– Sir Apirana Ngāta, 1874-1950

2017 Highlights

Realising Our Vision



Isabelle Sin and the gender pay gap

Te Pūnaha Matatini Principal Investigator Dr Isabelle Sin, a Fellow at Motu Economic and Public Policy Research in Wellington, made national and international headlines in 2017 as co-author of a Motu working paper explaining the reasons for New Zealand's gender pay gap.

Among the data reported by Isabelle (aka Izi) and her co-authors was the finding that women in New Zealand's workforce are paid 84 cents on average for work for which a man would be paid a dollar.

"This study is different to most previous wage gap studies in that it tests whether men and women are paid different wages for adding the same amount of value to their employer," said Izi.

The researchers began by analysing New Zealand tax data for the working population from 2001 to 2011, to determine how much of the overall difference between women and men's pay could be attributed to women being employed in industries that pay less.

"We found that women were over-represented in low-paying industries like food and beverage services, but this explains a mere 7 per cent of the entire gender wage gap. If you add in the fact that women also tend to work in low-paying firms, we can say that 12 per cent of the overall gender wage gap is due to the particular industries and firms where women work."

Izi and her colleagues then looked at productivity and wages of New Zealand men and women in private, for-profit organisations with five or more employees. Using employee-level data linked to business information, they found that on average, Kiwi women are paid 16 per cent less than their male counterparts for making a contribution of the same value to their employer. They found this gender wage-productivity gap varies substantially by industry and is as high as 40 per cent in some sectors – finance and insurance, telecommunications, transport equipment manufacturing, water and air transport, and electricity, gas and water, and rail.

"It's worth noting that these are all sectors that have the potential for monopoly-created profits and have low competition," Izi said.

"The gender wage-productivity gap is also larger in industries and economic conditions in which firms have more bargaining power and employees have less. Taken as a whole, our research suggests sexism is likely to be a major driver of the gender wage gap. What we're going to do about it is another matter."

Te Pūnaha Matatini Deputy Director (Industry and Stakeholder Engagement) Professor Tava Olsen, Director at the New Zealand Centre for Supply Chain Management at the University of Auckland, described the results as "pretty definitive".

"There is a gap and [because the study researchers] were able to get firm-level data on productivity, there's really no explanation for it other than implicit bias or sexism," said Professor Olsen. The Motu research is a lot harder to ignore than previous studies due to its sheer size and the nature or quality of the data collected, she added.

"It's not until you get a really big study like this that you can say 'Oh yes, there is actually a problem here.' Obviously, this isn't

the first study to show gender pay gaps, it's just a very clean one in terms the data they got access to," she said.

"I doubt there are many countries that allow researchers access to their tax data. It is pretty phenomenal.

"So I think this is quite important research in terms of showing there is a real gap. There is a problem here and it's not really okay," said Professor Olsen.

"Hopefully, companies will start putting procedures in place to check themselves and try and start looking at their own gender gaps."

Izi says that her work in this field has sparked her interest in researching deeper into the dynamics of New Zealand's workforce.

"It has made me curious to delve further into how movements within and between employers and in and out of the labour force differ for men and women, and how these lead to the genders receiving different pay for contributions of the same value," said Izi.

"I enjoy the challenge of figuring out how to use the data that exist (or could exist) to shed light on big picture questions that affect everyone, bouncing ideas back and forth with smart, interesting people, and drinking coffee."

Her involvement with Te Pūnaha Matatini has been invaluable for a variety of reasons, she added.

"My TPM collaborations challenge me to think more broadly about the questions I might ask in my research, and the methodologies I might use to answer them. Plus it's always an inspiration to be surrounded by a lot of passionate researchers with such diverse ideas."

References:

Sin I., Stillman S., Fabling R. (August 2017). What drives the gender wage gap? Examining the roles of sorting, productivity differences, and discrimination. Motu Working Paper 17–15 Motu Economic and Public Policy Research.

Science scholarship campaign for under-represented students

In early 2017, Kate Hannah and Siouxsie Wiles from Te Pūnaha Matatini, together with Nicola Gaston, Associate Professor in the University of Auckland's Department of Physics, co-organised a fundraising campaign for under-represented students to undertake either a science, technology, engineering or mathematics (STEM) programme in 2018.

The campaign, which aimed to raise the profile of Māori and Pacific female scientists in particular, was held in association with a gala screening of Hidden Figures – a critically acclaimed 2016 film about three Black female mathematicians working at NASA in the 1960s who helped America win the 'Space Race'.

The Association for Women in the Sciences (AWIS) will administer the funds raised from the campaign for three 'AWIS STEM Study Awards'. Valued at $3000 to $9000, the awards will be available as one-off grants to help scholars with study and/or living expenses.

In addition to donations via a Givealittle page, five New Zealand Centres of Research Excellence provided financial contributions toward the scholarship: Te Pūnaha Matatini, the Dodd-Walls Centre for Photonic and Quantum Technologies, the MacDiarmid Institute for Advanced Materials and Technology, the Maurice Wilkins Centre, and Brain Research New Zealand. The University of Auckland's Departments of Maths and Physics also contributed. EVENT Cinemas, 20th Century Fox, L'Oreal New Zealand and SOHO Wines also provided valuable assistance and promotional material for the gala screening.

The campaign was well covered in the New Zealand media:

- Scientists raise $13k for women to study – Radio New Zealand
- Q+A: NZ science's own 'Hidden Figures' – *New Zealand Herald*
- Interview with Kate Hannah – Radio New Zealand Morning Report

Photo: John Schnobrich / Unsplash.

Summer internships – the perfect opportunity

Te Pūnaha Matatini offered keen students from around New Zealand the opportunity to participate in a 10-week paid internship over the 2017–18 summer months. Now in its third year, this programme provides students with invaluable data analytics experience and new perspectives while working for organisations in a real-world setting.

Through its student internship programme, Te Pūnaha Matatini is able to engage with partners to complete small-scale projects with defined outcomes, develop relationship networks, and introduce talented students to potential employers.

Overall, 21 undergraduate and postgraduate students enrolled at universities across the country took up the opportunity and accepted a place in our 2017-18 programme. Divided into teams, they were placed on a wide range of projects working for various organisations, including Iwi, government and private firms based in either Auckland or Wellington.

This year, there were some exciting new opportunities. One team, for instance, were placed on a project with Dragonfly Data Science and Te Hiku Media based in Wellington. Their internship involved work related to Te Hiku's Kōrero Māori project, developing language tools that will enable speech recognition and natural language processing of te reo Māori. This requires the collection of more than 100,000 sentences and 250 hours of Māori language corpus. Once complete, it aims to provide these language tools to the Māori ICT industry.

One of the student interns on this project was William Asiata, a BSc Mathematics graduate from the University of Canterbury and a current Master of Information Technology student at the University of Auckland.

"As a result of the internship I was able to generate a corpus of all te reo Māori spoken in Parliament which will be included in the greater corpus used to train the digital natural language processor language model," said William. "As an interesting by-product we also produced some statistics about the historical usage of te reo in Parliament. I had the opportunity to learn and practice the Python and R programming languages and exercise data processing skills.

"I believe that it was a great opportunity for an inexperienced student to sharpen one's skill set, to clarify future career goals, and to gain direct insight into the ICT and data science industries through practical work experience on meaningful, high-impact projects and the chance to learn directly from working professionals," he added.

Another team worked on a project supporting research by Kate Hannah, Te Pūnaha Matatini's Executive Manager, into the historical representation of women in science.

Emma Vitz, a statistics and psychology graduate from Victoria University of Wellington assigned to this project, researched an algorithm that classifies people by gender according to their first name, and blogged about the ethical pitfalls of such an approach. Emma also began research into networks

Photo: rawpixel / Unsplash.

underlying science collaboration in New Zealand. "I particularly enjoyed using both R and Python in the internship, and collaborating with researchers and other interns from Te Pūnaha Matatini," said Emma.

Also on the team was Beth Rust, a BA (Hons) history graduate from Victoria University of Wellington, who conducted a literature review of the background and achievements of women in science. "Women are everywhere in science," said Beth. I noticed a few trends: a lot of early women scientists tended to be in botany – then later women dominated home science – now they are everywhere."

"I've also learnt a lot these past ten weeks, not just in terms of the history of science but also in a more general sense," she added. "I'm very grateful for the experience and everything it's taught me."

Te Pūnaha Matatini Whanau member Stephen Merry, who is pursuing a PhD in mathematics at the University of Canterbury, also took part in the internship programme working with the Social Investment Agency in Wellington.

"I worked on two projects," said Stephen. "The first investigated the scope of data held inside and outside of the Integrated Data Infrastructure, and the second examined how people's use of health services is affected by the services' accessibility."

"This internship gave me the opportunity to work in a different environment, and I felt a genuine sense of purpose completing the projects," he added. "My colleagues in the Social Investment Agency were enormously helpful and understanding throughout, and the experience overall is something I would recommend to anyone interested."

Following the programme, several of the interns were invited to write a blog for the Te Pūnaha Matatini website detailing their work. These articles were then promoted through Twitter resulting in very positive feedback from stakeholders – with even some New Zealand parliamentarians chiming in.

Intern blogs on the TPM website:

- A story of some Māori and Pacific Island women in science – by Beth Rust
- Te Reo Māori in New Zealand Parliament, as recorded in the Hansard Reports – by William Asiata
- How machine learning can perpetuate racism – by Emma Vitz

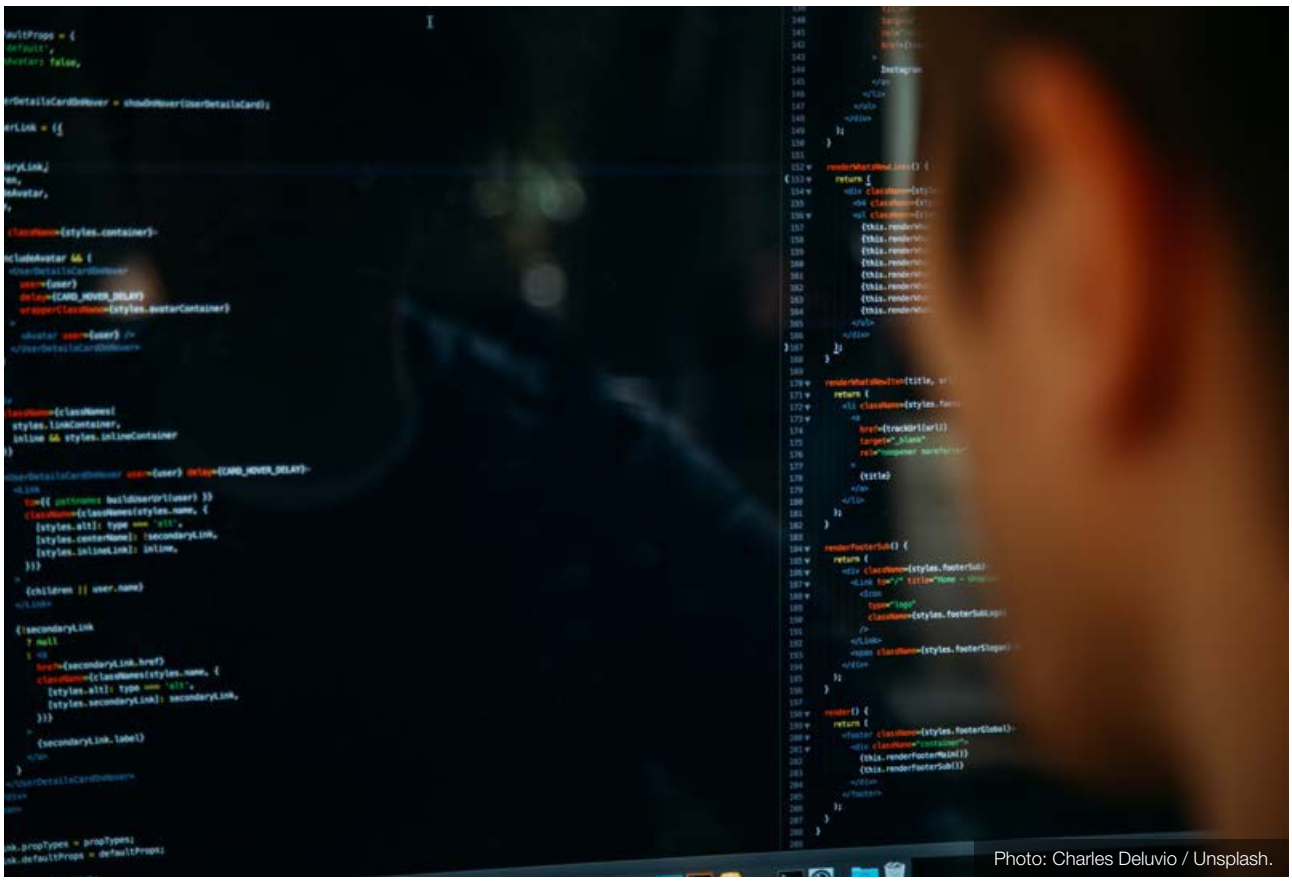


Photo: Charles Deluvio / Unsplash.

Kōrero Māori – Using data to enhance Te Reo and protect taonga

Te Pūnaha Matatini has a strong partnership with Te Hiku Media, a charitable joint venture between the Far North Iwi of Ngāti Kuri, Te Aupouri, Ngai Takoto, Te Rārawa and Ngāti Kahu who have created Kōrero Māori, a project to teach machines how to speak te reo Māori.

In the summer of 2016–2017, Te Hiku Media and Te Pūnaha Matatini co-funded a number of student internships – the output from which ultimately led to the development of the Kōrero Māori project later in 2017.

One of the interns was University of Auckland conjoint BComm/BEng (Honours) degree student Jamie Chow. Jamie's work on Te Hiku's Data Analytics and Visualisation Project involved using online audience data to measure the performance of the organisation's digital platform, matching it with other information such as demographics and geographical data.

Jamie was able to create visualisations of the data that allowed Te Hiku staff to quickly understand and interpret the behaviour of their audience. Staff can now immediately examine their content for audience engagement, allowing them to adapt their future programming.

The Kōrero Māori project

Te Hiku's Data Analytics and Visualisation Project led to discussions about the need for ICT tools for te reo Māori. Working together, Keoni's team developed the Kōrero Māori project to create computer language models for te reo Māori – the basic tools which will allow machines to be able to transcribe and speak the language.

Keoni is optimistic about how Te Hiku and Te Pūnaha Matatini can collaborate in terms of research direction in the future.

"I do look forward to us continuing to work together… and doing research around Te Reo, language processing and also looking to the languages of the Pacific – because there's a lot of similarities," says Keoni.

"If we can turn these into machine models, perhaps we can learn something about the evolution of our languages."

Keoni says that Te Pūnaha Matatini has been very helpful and open in terms of how the data are managed.

"It's about managing data in a way that aligns with our tikanga and our values, as Māori and as a Māori organisation and as indigenous people. Our language is our culture. It's our identity. We're talking about giving that to a machine and I guess the question comes, well, who owns that data or who owns the machines that have access to that data," explains Keoni.

"As indigenous people, we want to maintain some sovereignty… and Te Pūnaha Matatini has been helpful in terms of having quite a broad and open understanding of those aspects of the project."

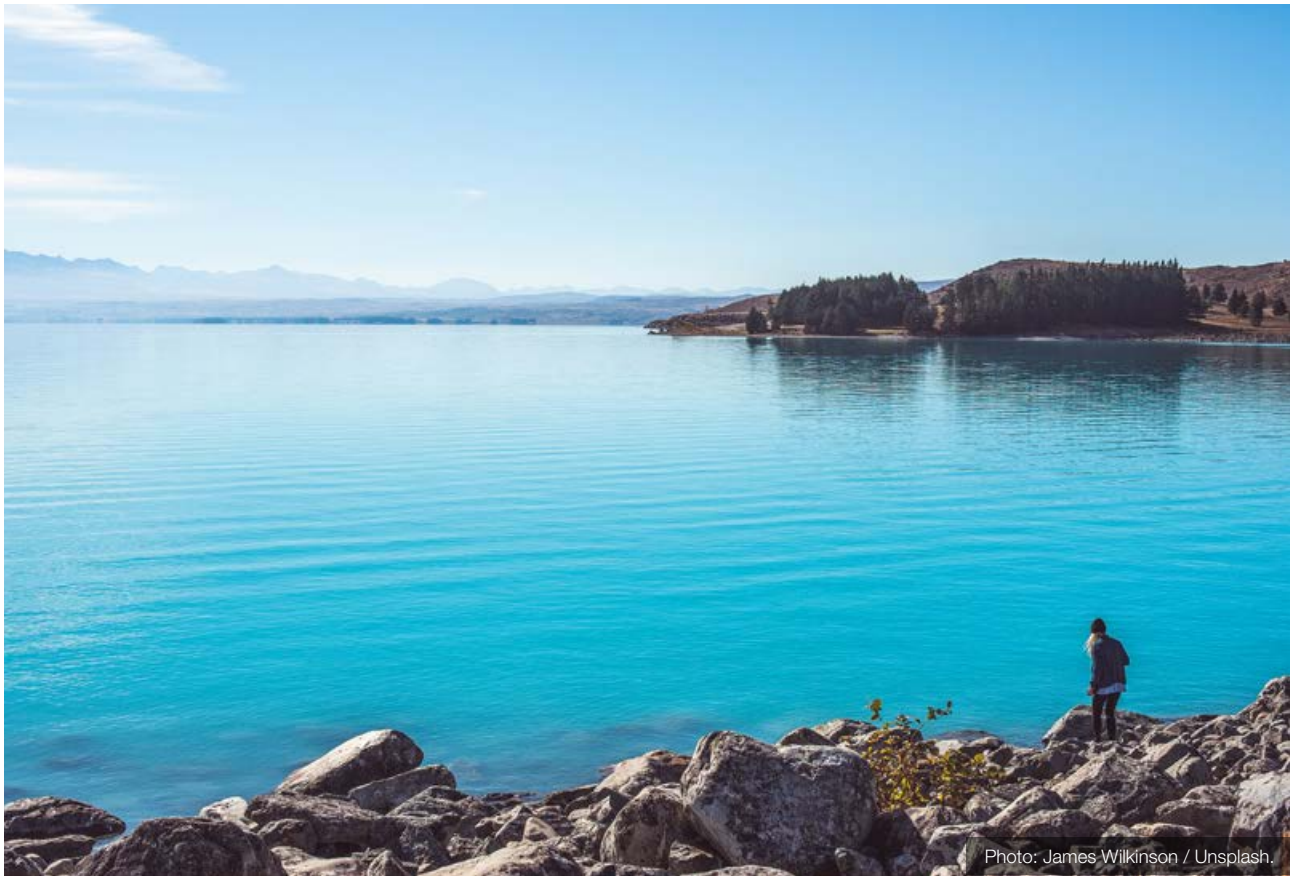


Photo: James Wilkinson / Unsplash.

WaiNZ – An online conversation about our water

Te Pūnaha Matatini organised a curated online campaign in September 2017 to highlight the issue of polluted waterways in New Zealand and how data science can help to inform debate and policy decisions.

We asked leading environmental, social and health researchers to write blog articles sharing their personal and professional perspectives about the state of New Zealand's waterways, illustrating their points with charts from Figure.NZ, which are based on public repository, government department, academic and corporate data. These blogs were then posted to Te Pūnaha Matatini's website and shared across social media with the hashtag #WaiNZ.

Te Pūnaha Matatini Principal Investigator Dr Daniel (Dan) Hikuroa and Deputy Director (Outreach and Public Engagement) Dr Siouxsie Wiles, both from the University of Auckland, fronted the online campaign on this issue of national importance, a fortnight prior to New Zealand's 2017 General Election. The bloggers who contributed included such esteemed names as Marnie Prickett, Mary Sewell, Siouxsie Wiles, Mike Joy, David Hamilton, Ani Murchie, Dan Hikuroa, David Hamilton and Tara McAllister.

Dan Hikuroa, an earth systems scientist who integrates mātauranga Māori and science to realise the dreams and aspirations of the communities he works with, and Siouxsie Wiles, an award-winning microbiologist and 2017 New Zealander of the Year Finalist, summed up the mood on the final day of the campaign:

"We hope the stories that have been shared on WaiNZ have invoked some feelings in you. We certainly have traversed the

full range of emotions – anger, disgust, sadness, frustration and despair at the state of water in Aotearoa New Zealand, described in the blogs. But those emotions were tempered with surprise and joy in formative memories shared, and in the collective message of hope for better outcomes for water, and with that hope I trust that we can make better decisions."

"The Te Pūnaha Matatini project 'Mai i ngā maunga ki te tai' that is about to start is an example of shifted thinking – we draw from mātauranga Māori and complexity science. We can do this New Zealand, and in fact we must. Tuturu whakamaua kia tina, haumie, hui e, taiki e."

Website data analysis found there was a significant increase in traffic to the tepunahamatatini.ac.nz website, with 1,944 page views during the week of the campaign (from 9 to 16 September), much higher than the historical weekly average (652 page views) since January 2016).

Professor Adam Jaffe, Director of Motu Research and Te Pūnaha Matatini Theme Leader, Complex Economic and Social Systems.

MBIE bibliometrics

Te Pūnaha Matatini researchers at Motu in Wellington are working with the Ministry of Business, Innovation and Employment (MBIE) Science Policy group to refine performance indicators for New Zealand research based on journal publications in various fields over time.

Professor Adam Jaffe, Director of Motu Economic and Public Policy Research and Theme Leader (Complex Economic and Social Systems) at Te Pūnaha Matatini, together with Kate Preston, Research Analyst at Motu, are researching the strength of various research disciplines within New Zealand based on their publication success and impact.

The researchers tested the sensitivity and accuracy of various measures that indicate different ways of treating papers by New Zealand and non-New Zealand authors, assignment of papers to multiple scientific fields, and correcting inaccurate benchmarking interpretations.

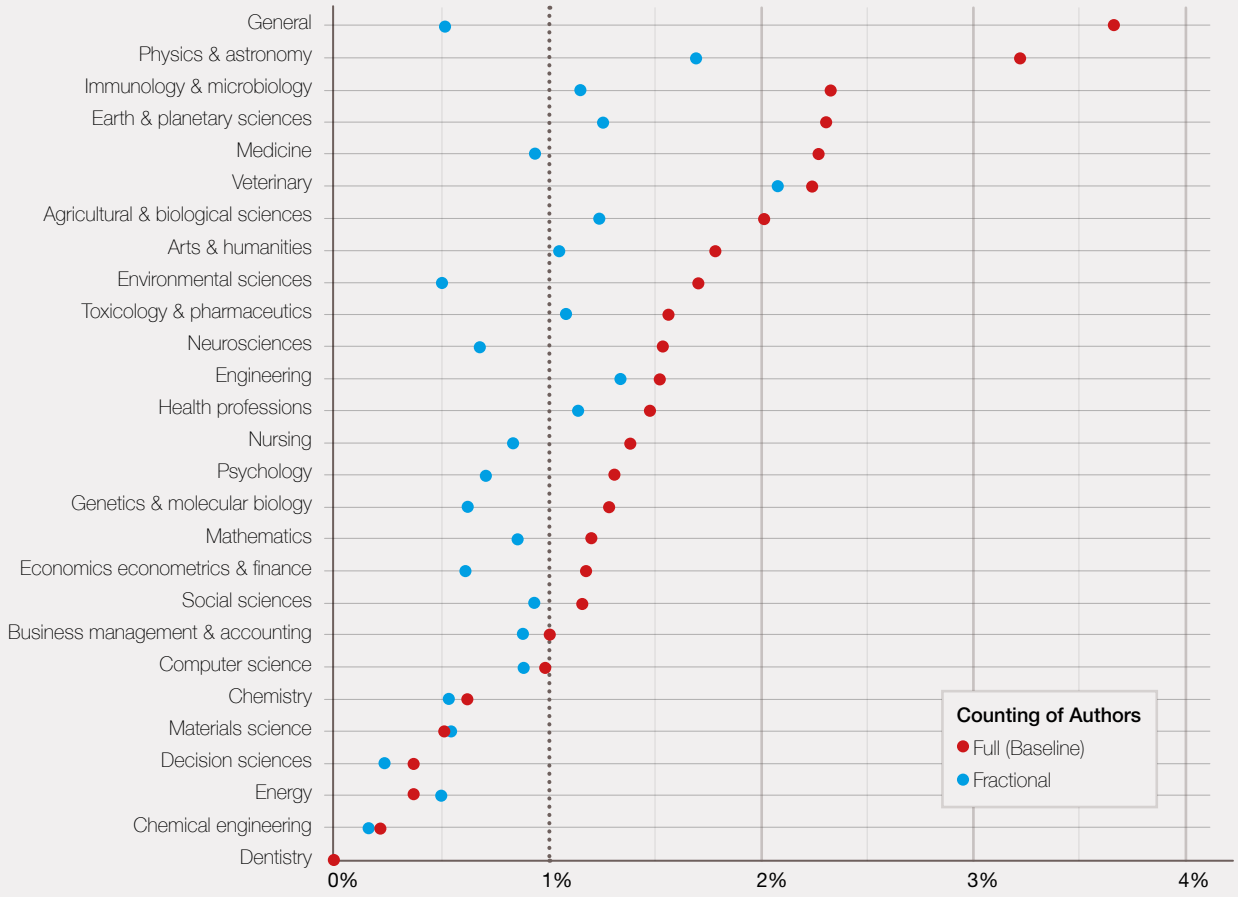
Adam and Kate have also explored assigning papers to fields based on semantic analysis, and found ways to construct confidence intervals for the new measures. Their work is a precursor to research that Adam, Kate Preston, and Shaun Hendy will be continuing as part of the 'Science of Science Policy' project in Te Pūnaha Matatini's new three-year plan.

Samin Aref's summer internship assists MBIE to evaluate scientific collaborations

Samin Aref, a PhD student in the University of Auckland's Computer Science department, successfully applied for a Te Pūnaha Matatini 2016-2017 summer internship, and undertook work for the Ministry of Business, Innovation and Employment (MBIE) Bibliometrics project. Over the ten-week internship period during the 2016 to 2017 summer months, Samin assisted MBIE in evaluating scientific collaborations between New Zealand institutions using network analytic tools suitable for analysing big data.

"My responsibilities in this project included defining the research question, developing the analysis framework and methodology, and analysing large amounts of bibliometric data – which was essentially all New Zealand publications in Scopus from 2010 to 2015," said Samin.

Samin's work involved obtaining records of joint publications for more than 1,500 New Zealand institutions at the Evidence Monitoring and Governance (EMG) unit that provides support for evidence-based policy and regulation in MBIE's Corporate, Governance and Information group. A major output of the project was a network of institutions and their co-publication connections (see image on next page).



Fraction of NZ Papers in Top 1% in 2012–2014
Full and fractional counting of authors

Fraction of NZ publications in the top 1% of the citation distribution from Scopus Custom Data 2012–2014 extracted June 2016, using full and fractional counting of authors. Full counting gives full weighting to any publication that has at least one NZ author, while fractional counting weights each publication by the share of its authors that are based in New Zealand. Results are based on articles, reviews, and conference proceedings and each publication is compared against the citation distribution of publications from the same discipline, publication year, and document type.

The collaboration network is unique in that it embodies New Zealand business enterprises, government institutions, private not-for-profit organisations, as well as higher education institutions and all their research connections.

"After the internship, I made all research outputs related to this project publicly available online (https://doi.org/10.6084/m9.figshare.5705167)," said Samin.

"My supervisors Shaun Hendy and David Friggens and I also published the main outputs of the project as a conference paper which received a presentation award as well as a travel grant from the conference organisers."

Realising Our Values

PhD student Catriona Sissons.

Te Pūnaha Matatini forges strong links with Santa Fe Institute

The Santa Fe Institute (SFI) in Santa Fe, New Mexico, USA, is a world-leading not-for-profit think tank specialising in complex systems. Bringing together many of the very top researchers in the field, the Institute focuses on generating ideas that can help to solve some the major challenges facing the world today.

Each year, the SFI runs a flagship four-week summer school that attracts around 80 attendees from around the world. Participants typically have diverse backgrounds and work in a wide variety of disciplines – in academia and industry – but share a common interest in complex systems.

After attending the Institute's summer school in 2016, Te Pūnaha Matatini PhD student Catriona Sissons from the University of Auckland (pictured above) returned there in 2017 as a Primary Advisor helping to manage the collaborative research projects for that year's participants.

"[In addition to the] four weeks of lectures, another important part of the school is the collaborative projects where self-formed groups try to come up with cool ideas, working on projects together," says Catriona.

"My role [in 2017] was focussed around the group project process. I was their project liaison, which meant I was acting as the main advisor for helping managing that process and how they would formulate their research questions, collaborations and help with project directions and all of those sorts of things. A lot of that was around how to get collaborations happening and happening well."

Catriona explains that part of the reason she was keen on the role was that it involved observing the process of collaborations, a major focus of her research, happening in real life.

"From an intellectual perspective, it was interesting to me for that reason," Catriona says.

"[However], it was a much more practical role in the sense that it was doing collaboration, rather than studying it, and it exposed me to a huge range of topics… coming across my desk from people with all sorts of backgrounds. So [it was] much more broad ranging from a research perspective [compared with] what I work on from my own research."

In terms of attending SFI summer school, Catriona describes it as an amazing opportunity and recommends the experience to anyone working in the field of complex systems or interested in doing so.

"This is the best place to be able to get a strong foundation in the tools and knowledge in that field, and a broader range of perspectives," she says.

"Importantly, it's an amazing place to meet people from all over the world with backgrounds that you have something in common with… You spend a month together and in that sense, it's also just really fun. You meet people that you end up becoming long-term friends with, future collaborators [or] colleagues, and you get to go to lectures from the top minds in complex systems. People love it and come away with way more than they expected. [They] know they'll learn a lot but they don't realise how much fun they'll have doing it."

Over 3,400 people visited the 2-day Maths Craft Festival held at the Auckland Museum in September 2017.

Maths Craft Festival hits the road in 2017

Following the success of the 2016 Maths Craft Festival, which entertained almost 2,000 people, in February 2017 the team were awarded $120k from MBIE's Unlocking Curious Minds fund to take Maths Craft on the road.

Principal Investigator Dr Jeanette McLeod (University of Canterbury) and Dr Phil Wilson (University of Canterbury) together with PhD student Sarah Mark (University of Canterbury, and Dr Nicolette Rattenbury (University of Auckland) toured several cities around New Zealand, raising interest in maths through their quirky brand of maths outreach.

Thousands of people, adults and children alike, came along to a Maths Craft event to knit a mathematical knot, crochet a Möbius strip, fold an origami tetrahedron, or colour a Latin square, and experience mathematics in a whole new way. Armed with knitting needles and origami paper, the Maths Craft tour aimed to uncover the beautiful maths behind the art.

"Maths is often overlooked as a subject of beauty and imagination, with many people viewing it as boring, irrelevant and downright unpleasant," Jeanette said.

"However, by using craft as a medium, from clothing to ancient Greek art, we aim to introduce adults and children alike to a new and fun way of engaging with mathematics."

Primary Mathematics Association (PMA) Seminar Day, Auckland (March 25) – Each year, the PMA holds a day of workshops and talks dedicated to sharing ideas about teaching mathematics. Maths Craft was delighted to have been invited to give two one-hour workshops with primary maths teachers, where they discussed the links between mathematics and craft, and how this can be used to engage students with mathematics.

Space & Science Festival 2017, Wellington (May 13) – Maths Craft were invited to "make maths fun" at the Space & Science Festival 2017. They ran five craft stations, and attracted over 450 of the 2,000 festival visitors.

Maths Craft Day, The Arts Centre, Christchurch (June 18) – This day-long event combined eight craft stations with three public talks. The day attracted nearly 1,800 visitors, and was featured on One News.

INSPIRE Festival 2017, Nelson (July 6) – Maths Craft was invited to the INSPIRE Festival 2017 (Ministry of Inspiration), which hosted 660 school children from 42 schools in the Nelson region. The team ran two one-hour workshops, and were one of the few mathematics workshops at INSPIRE.

Maths Craft Festival at Auckland Museum (September 9–10) – At this flagship event held at the Auckland Museum, the team hosted 10 craft stations, five public talks, and had over 3,400 visitors!

In The Media

One News: Bringing maths to the masses in a craft day

Radio Rhema: Bringing maths to the masses

RNZ: Maths and crafts: Using crochet and origami to teach mathematics

Dr Siouxsie Wiles, Deputy Director at Te Pūnaha Matatini.

Dr Siouxsie Wiles calls attention to antibiotic resistance crisis

Dr Siouxsie Wiles, Deputy Director at Te Pūnaha Matatini, is an award-winning science communicator renowned for her ability to make scientific information understandable to a wide audience. In April 2017, she published her first book, 'Antibiotic resistance: the end of modern medicine?' – a brilliant commentary on what is a major health threat.

Antibiotic resistance: the end of modern medicine?, by Siouxsie Wiles, is an insightful exploration into what is shaping up to be an impending catastrophe for New Zealand and globally – antibiotic resistance. Siouxsie concludes that more needs to be done to protect ourselves from a future without antibiotics.

Published as part of Bridget Williams Books' BWB Texts series, Siouxsie's book has received glowing reviews.

"This is an important new book on the pressing issue of anti-microbial resistance. Engagingly written, well informed and provocative, it is a clear call to action for New Zealanders on one of the most critical issues we face," said Professor Kurt Krause, Webster Centre for Infectious Diseases at the University of Otago.

Sarah-Jane O'Connor, a science writer from Sciblogs, wrote a marvellous review detailing what she learned from the book and commending Siouxsie for her story-telling abilities.

"One of Siouxsie's particular skills as a science communicator is not leaving the interesting bits out," said Sarah-Jane. "She gets it that we want to hear about flesh-eating bacteria, so uses them as a vehicle to inform us about crucial issues. Her fabulous story-telling made the pages fly by."

Following the book's publication, Siouxsie appeared on several national TV and radio shows – including TVNZ's the Project, RNZ, and 95bFM – and was interviewed for articles in *The New Zealand Herald*, *Stuff*, RNZ and *The Listener*.

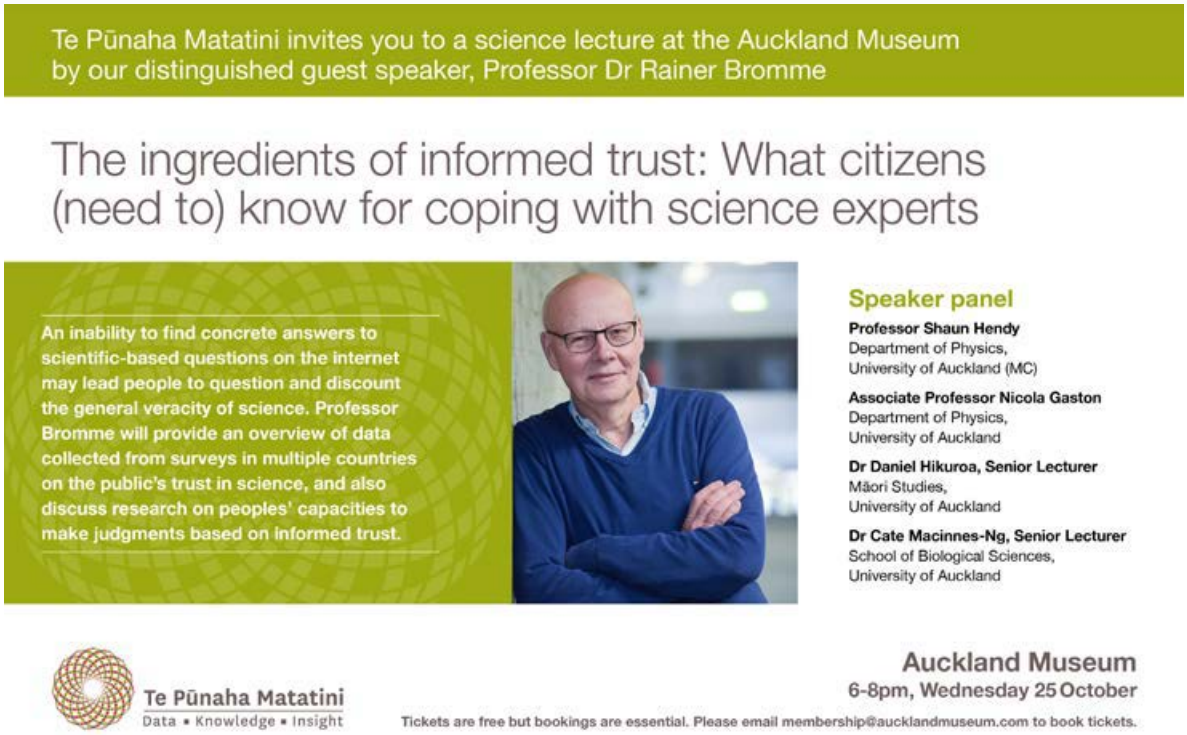
Future research directions

Siouxsie said her involvement with Te Pūnaha Matatini has her considering how data analytics can aid her antibiotic resistance research.

"The idea is about the use of antibiotics and potentially mapping that use around the country. Now it's a case of pulling together the right people who have [complex data science] skills. I really hope we can get that off the ground because I'd love to be involved."

Mapping out the extent and nature of our antibiotic use is very important for New Zealand as that data is very much lacking, Siouxsie said.

"If we're going to put policies in place around how we use antibiotics wisely and around understanding what the risks are, we need to understand not just that these are the organisms we're frightened of, but what the situation is in New Zealand."



Te Punaha Matatini sponsored a wide range of events in 2017, including a speaking tour by science policy communication expert Professor Rainer Bromme from Germany.

Sponsorship

Te Pūnaha Matatini has a well-publicised Sponsorship Policy which enables us to ensure that our values around diversity – equity, access, and inclusion – are met by the projects, events, and people we sponsor. In 2017, Te Pūnaha Matatini supported the following activities:

- Principal and founding sponsor, Kindness in Science Hui, December 2017
- Principal and founding sponsor, Data Poets' Society, dates throughout the year
- Principal sponsor, Association of Women in Science (AWIS) Annual Conference, July 2017
- Foundational sponsor, Maths Craft Festival in Auckland, Wellington, Christchurch, and Dunedin – dates throughout the year
- Principal sponsor (and organiser of other CoREs' sponsorship), The Story Collider Auckland workshops and Wellington event, September 2017
- Bronze sponsor, New Zealand Institute of Physics (NZIP) Annual Conference, July 2017
- Sponsor, Asia Pacific Innovation Conference, November–December 2017
- Sponsor, New Zealand Mathematical Society Colloquium 'What can departments do to address their lack of diversity?' event, December 2017
- Sponsor, International Women's Day event, hosted by the University of Auckland's Women in Science Network, March 2017
- Sponsor, Girls into R and Women into R workshops, December 2017
- The subtheme Controversial Technologies within the Aotearoa-NZ Science Journalism Fund, with our contribution of $10,000 supporting the development of articles which appeared in New Zealand Geographic and Radio New Zealand online.
- A public lecture, hosted by the New Zealand Association of Scientists at the Royal Society Te Aparangi in Wellington on Suffrage Day, delivered by visiting scholar Dr Zuleyka Zevallos, entitled 'Research Equity From Australia to New Zealand – a Suffrage Day Conversation'.
- A public lecture, hosted by the Auckland Museum Institute, delivered by visiting Professor Rainer Bromme, entitled 'The Ingredients of Informed Trust: what citizens (need to) know for coping with science experts'.
- A public talk, hosted by the Auckland Museum Institute, delivered by Associate Professor Siouxsie Wiles in conversation with broadcaster and science journalist Damian Christie, to launch her book, Antibiotic Resistance, August 2017
- We also supported a number of people's attendance at hui and conferences, including supporting travel and accommodation for dependent children, and for childcare to enable access to professional opportunities for caregivers.
- We chose not to sponsor the Royal Society Te Aparangi Research Honours Dinner in 2017 due to taking issue with the lack of diversity and inclusion in the 150th Anniversary celebrations more broadly. We were pleased to note by the end of 2017 that significant changes to the Royal Society's processes around fellowships, prizes, and awards were announced, as well as new early career award categories. These changes are aspects of a conversation Te Pūnaha Matatini has been having with the Royal Society since 2015.

Photo: Caleb Woods / Unsplash.

Social network analytics to aid vulnerable kids

Te Pūnaha Matatini investigators Mike Plank, Alex James, Jeanette McLeod, and postdoc research fellow Daniel Lond, are using social network analysis to assess risk in vulnerable children in New Zealand.

Collaborating with our stakeholders in the government sector

Working with an extensive data set, the team is exploring how the Ministry for Social Development (MSD) can improve their measures of the risk of harm to vulnerable children, for use by front-line practitioners. Directly funded by MSD, the researchers aim to develop tools that can be used to protect at-risk children and improve their lives.

The project uses relationship data pertaining to children who have had contact with Child, Youth and Family (CYF) from 2005 to 2016, and includes all relationships observed by CYF staff in their work with that child and their family. CYF has since been succeeded by the Ministry for Children, Oranga Tamariki (MCOT).

Using network science to develop tools that can improve outcomes

Networks are constructed to map the relationships between different individuals within the database. By examining these networks we are identifying key relationship risk factors that lead to children being of high estimated concern.

Preliminary results suggest that this approach can provide insight to help social worker decision making. The tool can be used by CYF staff, in addition to their existing experience and protocols, to assist in making real-time assessments regarding in-depth investigation or intervention.

Stephen Marsland and Isabel Castro with 'Blandy the Kiwi'.

Estimating bird numbers from forest sounds

Te Pūnaha Matatini investigators at Massey University are using birdsong audio recordings to identify and estimate the abundance of different species of native birds in the New Zealand wild.

Massey University researchers and Te Pūnaha Matatini investigators, Professor Stephen Marsland (now at Victoria University of Wellington) and Associate Professor Isabel Castro, are running a Marsden-funded project that aims to reliably recognise birdsong and bird population numbers from audio recordings taken in the bush.

Identifying birds from their calls is potentially very useful given their calls are heard more often than the birds are seen. However, there are some challenges in getting audio recordings. For example, birds rarely come close to a microphone and noise from other sounds such as wind and rain is also recorded.

The challenge is to reliably recognise the bird calls under these conditions and to infer the approximate number of birds present in an area from the number of calls. This requires a combination of signal processing, machine learning, study of individual bird species, and statistical analysis.

Stephen and Isabel are developing mathematical and computational tools that analyse the sounds they have captured and, combining them with data obtained in ecological experiments, correlate these with population estimates.

"We will use new statistical ideas to create a framework for estimating population size purely from birdsong recordings," say Stephen and Isabel on the project's AviaNZ website (www.avianz.net).

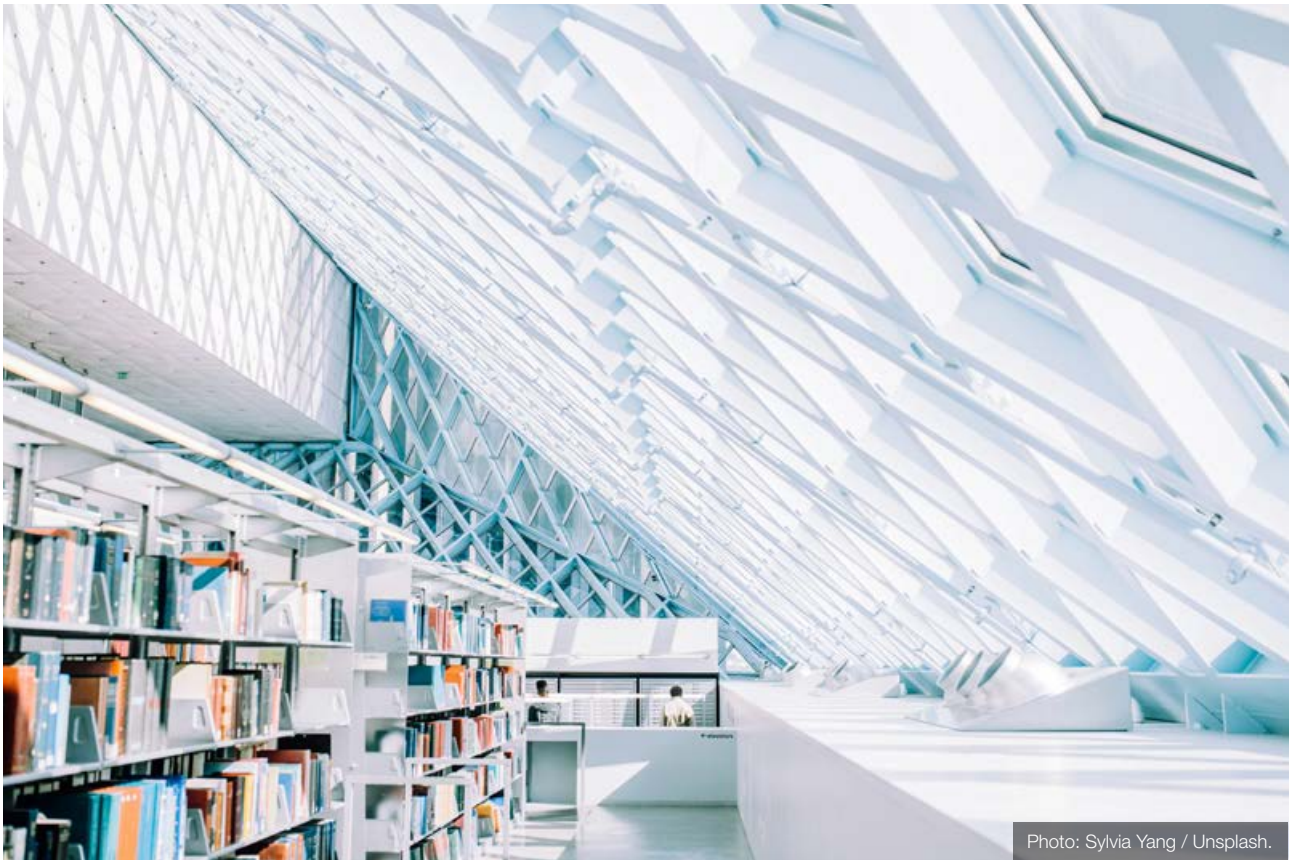


Photo: Sylvia Yang / Unsplash.

How do scientific articles and patents gather in importance?

Te Pūnaha Matatini researchers are collaborating across disciplines to develop novel tools that allow us to better understand trends underlying the citation of scientific papers and patents, a key indicator of their subsequent impact or importance.

PhD student Kyle Higham and his supervisors Ulrich Zuelicke (Uli) and Michele Governale from Victoria University of Wellington, and innovation economist Adam Jaffe from Motu Economic and Public Policy Research, have been researching how patents and scientific articles accumulate citations. Mapping the observed dynamics to a well-known network model, they were able to improve on previous studies by controlling for 'citation inflation' – an effect caused by the ever-increasing rate at which patents or articles are produced by inventors and researchers.

"As a result, we were able to reliably extract crucial network-model parameters and obtained extremely good agreement between data and model predictions for citation distributions," says Uli. "Our work has proved to be a useful basis for gaining a deeper understanding of citation dynamics and is being utilised by us and others in the field to design improved network-model descriptions."

Study suggests current rate of innovation faster than ever

The "icing on the cake", says Uli, is that their study considered citation dynamics within specialised technology sectors for patents and individual physics research fields for articles.

"We were able to identify faster-moving technologies and research fields based on their faster rate of obsolescence exhibited in the citation dynamics."

"Interestingly, we also found evidence for obsolescence times to have become shorter for physics articles published in 2000 compared with older ones from 1990. This indicates a general trend for the research frontier to move faster now than in the past, which is an interesting finding whose social origin deserves further exploration."

Research helps to inform science and innovation policies

Uli explains there are good reasons to study citation dynamics.

"Research on citation dynamics can provide tools with which to inform rational science and innovation policies. Such research also underpins the design of meaningful and robust informetric impact measures."

"To us, citation data provide a fingerprint or reflection of knowledge generation as a social endeavour. Citations could be, or are being, mined to understand [for example] geographical and social patterns of knowledge diffusion through communities of inventors and academics, as well as historical trends and drivers for knowledge generation and consumption."

International collaborations

Adam Jaffe	Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, Economic impact of scientific research Queensland University of Technology, Brisbane, Australia, Investigating Disclosure in Patents using Computational Linguistics Queensland University of Technology, Brisbane, Australia, using citations from patents to scientific papers to assess the commercial connectedness of universities
Alexei Drummond	Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland, Bayesian phylodynamics
Andy Philpott	Ecole Polytechniqe, Paris, France, MIDAS
Ilze Ziedins	(Visiting Fellowship) Karlsruhe Institute of Technology, Karlsruhe, Germany, Primary and emergency care modelling and improvement
Isabel Castro	(Visiting Fellowship) Cornell Lab of Ornithology, Ithaca, NY, USA, Wildlife Acoustics (Visiting Fellowship, Supervisor) Universidad del Valle, Cali, Colombia, Project Sicalis
Mike O'Sullivan	(Visiting Fellowship) Karlsruhle Institute of Technology, Karlsruhle, Germany, Research alliance for logistics and analytics in primary care Watermark Numerical Computing, Brisbane, Australia, Uncertainty quantification
Mike Plank	(Sabbatical visit) University of York Centre for Complex Systems Analysis, York, UK, Sizespectrum models of marine ecosystems School of Mathematical Sciences, Qu, Brisbane, QLD, Australia, Mathematical models of collective cell behaviour
Pierre Roudier	INRA, Orleans, France, Quantitative soil science
Simone Linz	University of Western Sydney, Sydney, Australia, Counting phylogenetic networks
Suzi Kerr	International team: UC-Santa Barbara; Seoul National University, Bogota, Colombia, Development of Climate Teams
Tava Olsen	Durham University, Durham, UK, Leadtime pricing Indiana University, Bloomington, USA, The future of driverless cars
Thegn Ladefoged	Virginia Commonwealth University, Richmond, Virginia, Untangling Late Prehistoric and Post-European Culture

Kate Hannah, Executive Manager at Te Pūnaha Matatini, has played an outstanding leadership role promtoing diversity within the New Zealand science system.

Diversity – development and participation

Te Pūnaha Matatini continued to take a leadership role in promoting diversity within the New Zealand science system in 2017. The Centre's commitment to diversity, access, and inclusion underpins all of its collaborative research practices.

Throughout the year, Te Pūnaha Matatini continued to promote the open exchange of ideas, the freedom of thought and expression, and respectful debate at events and meetings. A key element of fostering an inclusive environment and embracing diversity is the recognition of the inherent worth of every person and group, dignity, understanding, and mutual respect.

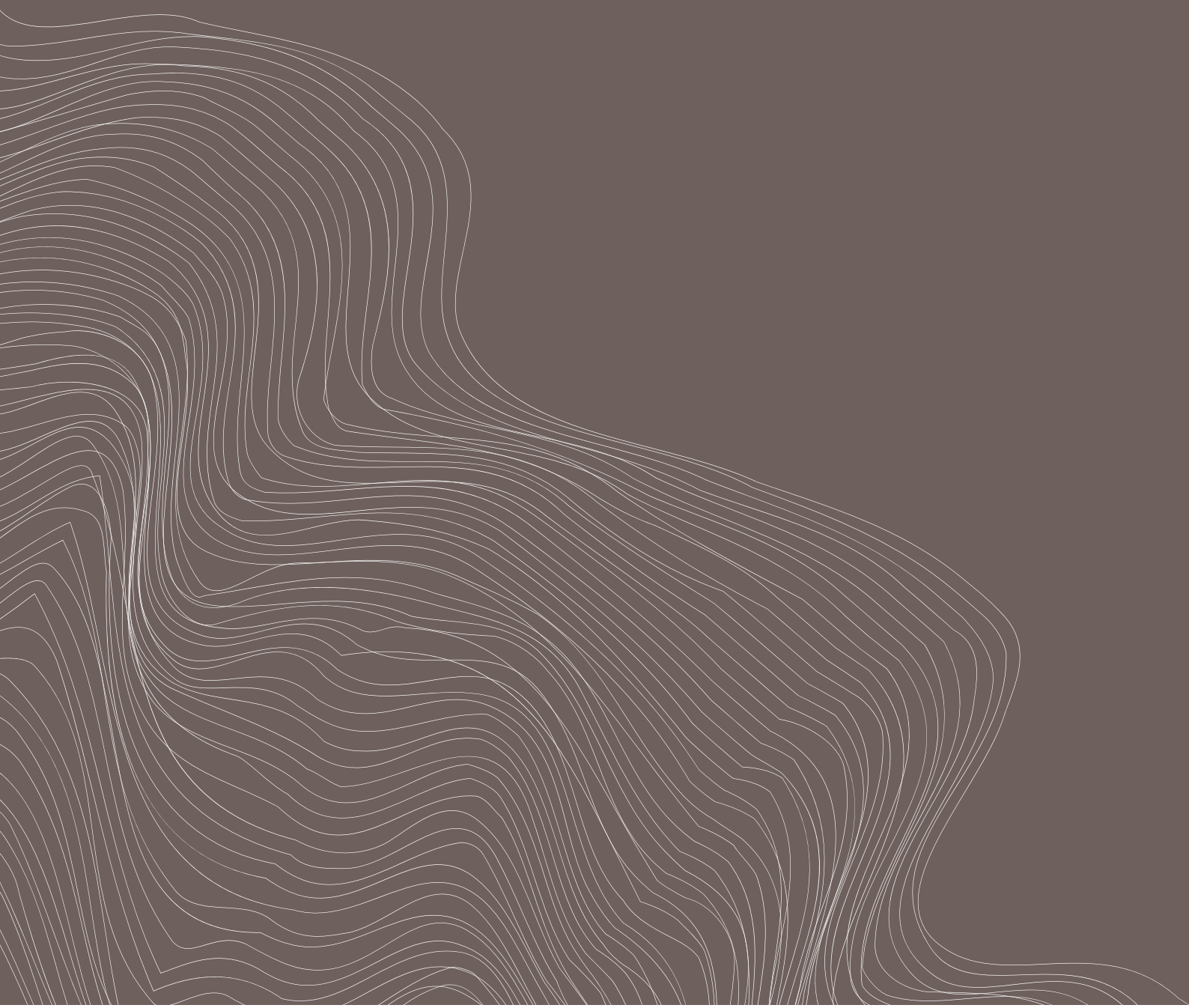
Since our establishment in 2015, we have been committed to reaching gender parity in our investigator cohort by 2020, with 32% of the founding Principal Investigators being women. In August 2017, including our latest cohort of Associate Investigators, women make up 48% of our researchers.

We note the issues with the notion of 'excellence' and 'merit', and are developing an approach that assesses merit relative to opportunity. Te Pūnaha Matatini has a sponsorship policy for all hosted and sponsored events; and we have an event code of conduct. All Te Pūnaha Matatini investigators and members of the Te Pūnaha Matatini Whānau are expected to be cognisant of the policy and code, and to implement them.

Case study

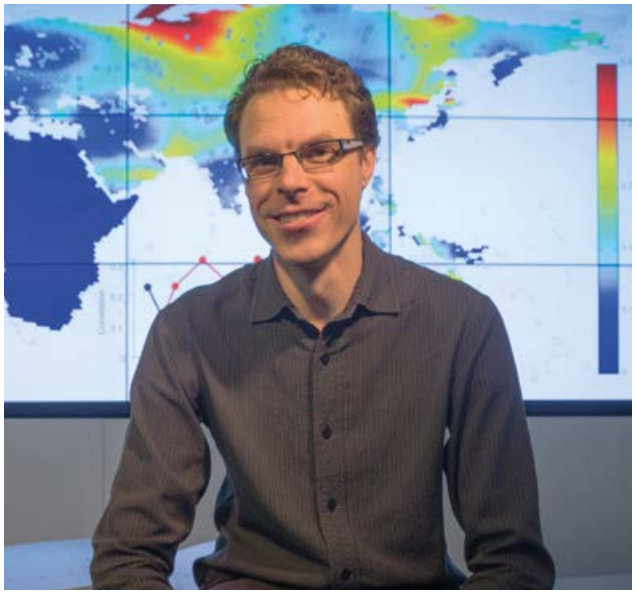
In mid-2015, the Royal Society Te Aparangi invited Te Pūnaha Matatini to sponsor a table at the Research Honours Dinner. Noting the limited numbers of women prize-winners in the history of the Research Honours Dinner, Te Pūnaha Matatini wrote to the Royal Society, suggesting some concrete steps that could be taken to increase representation and visibility both in the awards, and on the night itself. This letter has been instrumental in the very clear changes seen in the nature of the Research Honours Dinner in 2015 and 2016, and the companion changes to the awards and prizes announced in 2017.

Awards, Media, and Whānau



Recognising excellence within our CoRE

Several Te Pūnaha Matatini researchers received awards recognising their research efforts, leadership skills, and science communication activities in 2017.



Dr Murray Cox

The Te Rangi Hiroa Medal is awarded biannually by The Royal Society Apārangi for historical approaches to societal transformation and change; current issues in cultural diversity and cohesion; social and economic policy and development; or medical anthropology. Principal Investigator Professor Murray Cox, from Massey University, received this medal in 2017 for his anthropological work to reconstruct processes of transformation and change in past societies using genetic data. His research has revealed a number of social features from the past such as marriage rules and farming expansion in South East Asia.

Other awards

Professor Stephen Marsland, Massey University, was made a Visiting Fellow of the Isaac Newton Institute for Mathematical Sciences.

Professor Ilze Ziedins, University of Auckland, was made a Fellow of the New Zealand Mathematical Society.

Senior Lecturer Jeanette McLeod, University of Canterbury, was made Honorary Senior Lecturer at Australian National University.

Professor Andy Philpott, University of Auckland, was made a Fellow of the Institute for Operations Research and the Management Science (INFORMS) at the INFORMS annual meeting in Houston Texas.

Senior Fellow/Adjunct Professor Suzi Kerr, Motu Research, was elected President of the Australasian Association of Agricultural and Resource Economics Society.

Senior Fellow Adam Jaffe, Motu Research, won the award for Publication of Enduring Quality, at the Association of Environmental and Resource Economists annual meeting.

Professor Tava Olsen, University of Auckland, won a Research Excellence Award from the University of Auckland Business School.

In the media

Te Pūnaha Matatini investigators were regularly sought for their expert opinion and comment by a range of local and international media in 2017.

Adam Jaffe
- Coalition deal: Is our new R&D goal realistic? *(NZ Herald)*
- Climate's impact on NZ health and more (Science Media Centre)

Andrea Byrom
- 50 questions about the environment: Our nature (*NZ Herald*)
- Should we learn to live with introduced species rather than wipe them out completely? (*Stuff*)
- Summer brings risk of rapid myrtle rust spread (Radio NZ)
- NZ 'may have lost battle' against myrtle rust (*NZ Herald*)
- Brighter Future? Doing DOC's work (Radio NZ)
- Gene drives in conservation (Science Media Centre)
- Lack of genetic diversity hinders native birds (Radio NZ)
- Are there too many native birds? (Radio NZ)
- Myrtle rust: It's not too late to eradicate (Radio NZ)

Cate Macinnis-Ng
- Fighting kauri dieback with the 'super science' of cow dung? Stinks of bullshit (*The Spinoff*)
- Closing the Waitakere Ranges might be 'just not possible', but could it even work? (*Stuff*)
- Kauri Dieback in the Waitakeres – Expert Reaction (Science Media Centre)

Dan Hikuroa
- Combining the knowledge and values of our ancestors, with science (Māori Television)
- The world's struggling seas need new legal status, expert says (*Stuff*)
- Anne Salmond: Election is a seismic shift in the nation's psyche (*NZ Herald*)
- Mātauranga Māori and science (RadioLive)
- Beneath New Zealand Season 2, 2017. Presenter of a three-part part documentary series (The Discovery Channel)
- Whakarongo, whakarongo, whakarongo, ki te kōrero o te Tohora: Who speaks for the gulf? (*Gulf Journal*)
- Nau mai haere mai ki WaiNZ – An online conversation about water (#WaiNZ)
- Te Awaroa – Voice of the river (#WaiNZ)
- Kaitiakitanga it is our only hope (Newsroom)
- Mauri of waters compromised (Newsroom)
- Mātauranga Māori in contemporary research (Royal Society Te Apārangi)
- Dan was also a panellist on Five R & R shows; Te Awa Tupua, Silencing Science, Te Reo Rangatira, Marae Resilience, and Climate Change, and was also invited to be interviewed by Phillippe Cousteau for the fourth season of Exploration Awesome Planet.

Dion O'Neale
- Study tracks historic movement of Maori groups (*NZ Herald*)

Isabel Castro
- Big-brother listens in to native birds to help protect them (*Stuff*)
- Saving our birds through their own song Gisborne Herald Kiwi research partnership in Motu (*NZ Herald*)
- Bird scarers sound off in The Square (*Stuff*)

Isabelle Sin
- Report says women paid less even when as productive (*Stuff*)
- Women's Work and the Gender Wage Gap (Radio NZ)
- Sexism pure & simple, blamed for gender pay gap (Radio NZ)
- The new evidence that proves, beyond a doubt, the NZ gender pay gap is real (*The Spinoff*)
- Gender pay gap continues to persist (Newshub)
- Sexism driving gender pay gap – study (*NZ Herald*)
- A full list of international media coverage of Izi's gender wage gap research.

Jeanette McLeod
- Maths & crafts: Using crochet and origami to teach mathematics (Radio NZ)
- Bringing maths to the masses in a craft day (One News)

Kate Hannah
- Scientists raise $13k for women to study (Radio NZ)
- Hidden Figures: 'Doing science backwards in high heels' (The Spinoff)
- The science of spin (in response to) NZ could be Trump-era 'Athens' (Noted)
- New Zealand's invisible women scientists (Radio NZ)
- Is this pale, male, stale Royal Society line-up some kind of historical reenactment? (*The Spinoff*)

Mark Wilson
- Why are universities spending millions to access publicly funded research? (*The Spinoff*)
- Universities spend millions on accessing results of publicly funded research (*The Conversation*)

Michelle Dickinson
- Real dangers of drinking (*NZ Herald*)
- How to sleep your way slim and healthy (*NZ Herald*)
- Can you prove who you are? (*NZ Herald*)
- A glimpse at the future of tech in 2018 from CES (*NZ Herald*)
- Bursts of flavour (*NZ Herald*)
- Moods and booze – It's all in the mind (*NZ Herald*)
- Nanogirl Michelle Dickinson – an engineering superhero with a story to tell (*NZ Herald*)
- Sweet news about cancer and sugar (*NZ Herald*)
- Documentaries bad for your health? (*NZ Herald*)
- Power in placebo rationale (*NZ Herald*)

Murray Cox
- How Indonesia's DNA secrets could help NZ (*NZ Herald*)
- Top research honour for NZ supervolcano expert Colin Wilson (*NZ Herald*)

- $15.6m Marsden funding a record for Massey (*Scoop*)
- Native Affairs reveal DNA test of full-blooded Maori woman (*Stuff*)

Rebecca Priestley

- Tears, cheers and a timely celebration of good, meaningful science (*The Spinoff*)

Rhian Salmon

- Q&A: Is our media covering climate change well? (*NZ Herald*)

Richard Easther

- Lift off! New Zealand's Rocket Lab launches first rocket into orbit from Māhia Peninsula (*Stuff*)
- NZ study: what holds our universe together? (*NZ Herald*)
- RIP, Cassini. Thanks for all the memories *NZ Herald*: A huge discovery' – Kiwis hail Nobel win (*The Spinoff*)
- Everything you wanted to know about... gravity (*NZ Herald*)
- University of Auckland Celebrates $19.8M from Marsden Fund (*Scoop*)
- Watch: Rocket Lab's successful Hawke's Bay launch fuels commercial interest (One News)
- What was that strange object glowing above New Zealand on Anzac Day? (*The Spinoff*)
- Rocket Lab successful launch and payload deployment – Expert reaction (Science Media Centre)
- What's next for NZ's teen genius? (*NZ Herald*)

Sally Davenport

- New Year Honours 2018: Business, philanthopy, arts and media (NBR)
- Where science benefits business and society (NZ Business)
- SfTI Challenge Researcher Numbers Near 200 (National Science Challenges)

Shaun Hendy

- Does NZ really have a science denial problem? (*NZ Herald*)
- Agency criticised for favouring business over science (Radio NZ)
- Coalition deal: Is our new R&D goal realistic? (*NZ Herald*)
- Experts ponder solution to lagging research and development spending (*Stuff*)
- Budget: Five takes on this year's science spend (*NZ Herald*)
- Analysts welcome R&D investment (*NZ Herald*)
- Should daylight saving time be extended in New Zealand? (*Stuff*)
- University group rejects 'white pride' accusations (Radio NZ)
- Marsden Fund awards $84m (Science Media Centre)
- Thousands take part in science protests around world (Radio NZ)

Siouxsie Wiles

- Placebo effect likely behind Te Kiri Gold testimonials, Dr Siouxsie Wiles says (*Stuff*)
- Could superbug 'Kryptonite' be in NZ forests? (*NZ Herald*)
- Microbiologist warns of 'pre-antibiotic era' and urges action on resistance (*Stuff*)
- Siouxsie Wiles: Warning against growing number of anti-science sceptics (Newstalk ZB)
- A message to Whakatāne about Vaxxed, from a microbiologist and parent (*The Spinoff*)
- Today and every day we salute you: the brilliant, invisible women of science (*The Spinoff*)
- Search for NZ superbug cure turns to crowdfunding Radio NZ: Diving into the muddy water of 'swimmable'' (Radio NZ)
- Cold discomfort pharma: what does the science say on whether the drugs work? (*The Spinoff*)
- Sorry Paleo Pete, but I'll take medical qualifications over your 'common sense' any day (*The Spinoff*)

Stephen Marsland

- Big-brother listens in to native birds to help protect them (*Stuff*)
- Saving birds through their own song Massey University: $15.6m Marsden funding a record for Massey (*Voxy*)

Suzi Kerr

- ETS or carbon tax? NZ needs a strategy (Newsroom)
- Carbon report: Plant native trees, save cash *NZ Herald*: Air NZ sustainability panel gets new members (*NZ Herald*)
- Global support for 'Trump Forest' stuns NZ trio (*Otago Daily Times*)
- Study boost for carbon farming on Coast (*Gisborne Herald*)
- East Coast land study builds case for lucrative native forest future (*NZ Herald*)
- Synthetic milk? Lab-grown meat? Microgrids? How New Zealand can disrupt climate change (*The Spinoff*)

Thegn Ladefoged

- Study tracks historic movement of Maori groups (*NZ Herald*)

Troy Baisden

- New regional council chair in lake and freshwater science (*Rotorua Daily Post*)

View links to all of Te Pūnaha Matatini's 2017 media
http://bit.ly/2DHyu2f

Te Pūnaha Matatini Whānau

Te Pūnaha Matatini Whānau is a network for the emerging scientists of Te Pūnaha Matatini. The Whānau is an active transdisciplinary community, with a shared interest in complex systems and networks. The Whānau has 60 postgraduate students, postdocs and early career researchers from all over New Zealand.

Te Pūnaha Matatini Whānau is the emerging scientists network affiliated with Te Pūnaha Matatini. The Whānau is an active transdisciplinary community, with a shared interest in complex systems and networks. The Whānau has about 100 postgraduate students, postdocs and early career researchers from all over New Zealand, including University of Auckland, Auckland University of Technology, Massey University, University of Waikato, Victoria University of Wellington, Motu, University of Canterbury, Lincoln University, Landcare Research, GNS Science, and Scion.

2017 was a year of change for the Whānau, as many our emerging scientists moved on to bigger and better things while many new faces joined the network. Against this backdrop, a conscious decision was made by the committee to focus on one large event near the end of the year to regroup and strengthen a core of enthusiastic early-career researchers around which the Whānau could move into 2018 with increased momentum.

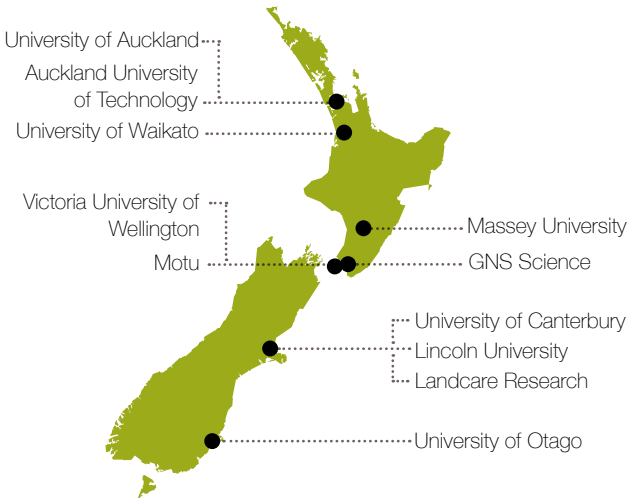
In early October we held a four-day Whānau retreat at the beautiful Waitetuna Retreat Centre between Hamilton and Raglan, where 18 Whānau members got training in R, Python, and agent based modeling, and participated in social events in the evenings which included board games, movies and a quiz night. We were also fortunate to have guest lectures on the indigenous data sovereignty movement, privacy and big data, and the ethics of artificial intelligence. The skill-sharing and productive discussions between participants from a myriad of different academic backgrounds exemplified the goals of the Whānau as a community and a great time was had by all.

The Te Pūnaha Matatini October Hui represented the last chance for Whānau members to meet up before the end of the year, and so we made sure to include a Whānau-organised session as part of this event. This session included a small panel discussion with two recent PhD graduates who had built companies from ideas formulated during their research, part of an ongoing effort to encourage entrepreneurial thinking among Whānau members, as well as a fun hands-on workshop

L-R: Mohammad Sanjari (UoA), Daniel Coats (UoA), Julie Mugford (UC), Caleb Gemmell (UoA), Jo Bailey (VUW), Karan Dasgupta (UoA), Audrey Lustig (UC), Demival Vasques Filho (UoA), Emma Sharp (UoA), Steven Turnbull (UoA), Angela Natali (VUW), Stephen Merry (UC), Reno Nims (UoA), Kyle Higham (VUW).

session with laser cutters in the new Unleash Space at the University of Auckland.

Going into 2018, we are very optimistic about the continued growth and connectivity of the Whānau network. With recent high turnout and engagement at our events, even those that require a large time commitment, we are encouraged to continue on this path with similar events at regular intervals going forward in order to retain the sense of kinship and productive collaboration we have fostered in the past year.



Our Research

Complexity, Risk, and Uncertainty

Today's society and the economy generate a complex torrent of data. If this unprecedented flow of information is to be made useful, we require new tools and methods for its analysis.

Our work

The measurement, interpretation, and communication of complexity and risk is a key part of modern science.

Researchers working within Te Pūnaha Matatini's Complexity, Risk, and Uncertainty theme are developing tools for understanding and dealing with complex systems. Using a mix of qualitative and quantitative research methods, their work includes optimising stochastic systems from supply chains to healthcare, inferring numbers of New Zealand birds from their calls (AviaNZ), building a library of New Zealand soils from the spectral signatures, and developing new mechanisms for reflexive analysis of science communication activities by scientists. Public engagement with science is also a key part of Te Pūnaha Matatini's work, and the researchers in this theme are working on ways to foster scientist-public interactions.

This theme has received substantial additional funding from the Science for Technological Innovation (SfTI) National Science Challenge, the Marsden Fund, and from external stakeholders.

Our impact

Data underlies our modern world. By developing theoretical approaches to data analysis, from optimisation through statistical models to machine learning techniques, Te Pūnaha Matatini will provide the theoretical underpinnings of many challenging problems, both national and international.

Our team

University of Auckland

Principal Investigators:
Ilze Ziedins, Dion O'Neale, Mark Gahegan, Tava Olsen, Mike O'Sullivan, Richard Easther, Andy Philpott

Associate Investigators:
Dan Hikuroa, Michelle Dickinson, Siouxsie Wiles, Kate Hannah, Cameron Walker

Victoria University of Wellington

Principal Investigator:
Marcus Frean

Associate Investigators:
Rebecca Priestley, Rhian Salmon

Massey University

Principal Investigator:
Stephen Marsland

Landcare Research

Associate Investigator:
Pierre Roudier

GNS

Associate Investigator:
Troy Baisden

University of Canterbury

Principal Investigator:
Jeanette McLeod

Our research

The Complexity, Risk, and Uncertainty theme is particularly diverse. We have research interests covering all parts of the process of using data, from developing visualisations of data (particularly networks) through theoretical developments in game theory, dynamical systems, machine learning, to investigating public engagement with science. As well as applications that link to the other themes (most notably, a game theoretic investigation of how money arises, and a mathematical machine learning approach to birdsong recognition to estimate abundance), we also work in digital humanities, medical signals, soil science, anthropology, and biology.

This theme has changed its scope in response to the developing needs of Te Pūnaha Matatini and evolving trends in our research programme. In particular, at our 2016 cross-theme hui, investigators identified the need for a research project to understand and assess our efforts in science communication and public engagement.

Led by investigators Dr Rhian Salmon and Dr Priestley, with PhD student Jo Bailey appointed in October 2017, The Reflexive Scientist project continues to build on a recent paper by Salmon et al. proposing that new mechanisms are required for reflexive analysis of science communication activities by scientists. These mechanisms involve unpacking and articulating the communication objectives of individual science communication practitioners and their organisations, as well as the political and cultural context in which they operate.

Find out more about our Risk, Uncertainty, and Decision-Making research.
http://bit.ly/2DHyu2f

Research highlight:
Using analytics to improve healthcare delivery

Photo: Hush Naidoo / Unsplash.

Te Pūnaha Matatini investigators Ilze Ziedins, Mike O'Sullivan, Cameron Walker and Tava Olsen are collaborating in the field of healthcare analytics research, developing solutions to help hospitals optimise the scheduling and flow of patients through their facilities and services.

A major feature of New Zealand's healthcare system is the complex but organised collection of District Health Board (DHB) hospitals and associated healthcare units scattered throughout the country. As the population of New Zealand has grown significantly in the past few decades, so has the pressure on the services provided by these facilities and on the doctors, nurses and other professionals who staff them. Resource management and limitation of waste are critical issues for DHBs – expenditure and quality of care are major performance indicators under constant scrutiny by the New Zealand Government.

The work being done by Te Pūnaha Matatini researchers Ilze, Mike, Cameron and Tava aims to provide practical solutions that have the potential to solve real world problems within New Zealand's healthcare system.

Their patient pathways project work, for example, involves the analysis of a complex series of steps between the time a patient presents for healthcare and the time of discharge, amidst a background of limited resourcing (e.g. staffing, surgical teams, and equipment). Prioritising one patient's access to a resource may have adverse effects for other pathways that also need that resource.

To determine effective prioritisation strategies for patients therefore requires modelling of the complexity of patient pathways, their use of resources, and the effect of different prioritisation strategies.

In addition to crunching numbers, the work has involved engaging and developing relationships with the end-users (in particular, healthcare specialists and hospital management professionals), through regular outreach and communication.

Te Pūnaha Matatini jointly sponsored a healthcare analytics workshop organised by Ilze, Mike and Cameron in December 2016. A total of 46 participants attended, including students, academics from New Zealand and Australia, industry representatives, managers and clinicians from Auckland and Counties Manukau DHBs, and Pharmac representatives. Presentations and brainstorming sessions ensured useful dialogue between the researchers and the attendees, with topics covering common 'pain points'.

Indeed, such engagement with stakeholders has enabled the team to gain a better understanding of how New Zealand hospitals structure their patient treatment pathways, how they communicate critical health information to their patients, how they keep their patient records, and the quality of life of their

Associate Professor Ilze Ziedins, Principal Investigator at Te Pūnaha Matatini.

staff. At the same time, it has provided hospital professionals with an insight into the potential of the work we are doing.

"Buy-in from clinicians is crucial to help decide what is important to work on, and what is practicable," says Ilze.

"I think we are getting a great balance between doing good research and being useful in practice, which is challenging but exciting!" Mike adds.

In 2017, the team achieved several important outcomes from their research.

For Auckland's North Shore Hospital, they developed a patient scheduling app based on their analysis of surgery duration data. In addition, they used orderly simulations to determine appropriate staffing numbers and assess the potential impact of AGVs (robots) and planning tools at present and in the future.

Together with PhD student June Lau, they have also developed a new electronic remaininglength-of-stay system for use in cardiovascular-intensive care unit (CV-ICU) settings to help them dynamically determine staffing levels and elective schedules. A pilot for this system will be run from the beginning of May 2018.

Complex Economic and Social Systems

The last decade has seen dramatic advances in our understanding of complex economic networks. We're applying new methods from complexity science to better understand New Zealand's economic and innovation performance.

Our work

New Zealand's inability to close the gap in GDP with other advanced economies has been attributed to our small scale and distance from major markets, but the manner in which these factors influence the New Zealand economy's ability to capture and benefit from knowledge spillovers is largely unexplored.

We're using methods from complex systems analysis and organisational-level data sets to understand the role of innovation in productivity growth, and to assess the importance of knowledge, network, and supply-chain spillovers on firm behaviour.

Our impact

Understanding the potentiality of spillovers from diversity will inform government policy and decision-making, and will assist in the evaluation of the effectiveness and impact of government policies.

Our team

University of Auckland

Principal Investigators:
Dion O'Neale, Shaun Hendy, Tava Olsen, Mike O'Sullivan

Associate Investigators:
Barry Milne, Mark Wilson, Dan Hikuroa, Roy Lay-Yee

Waikato University

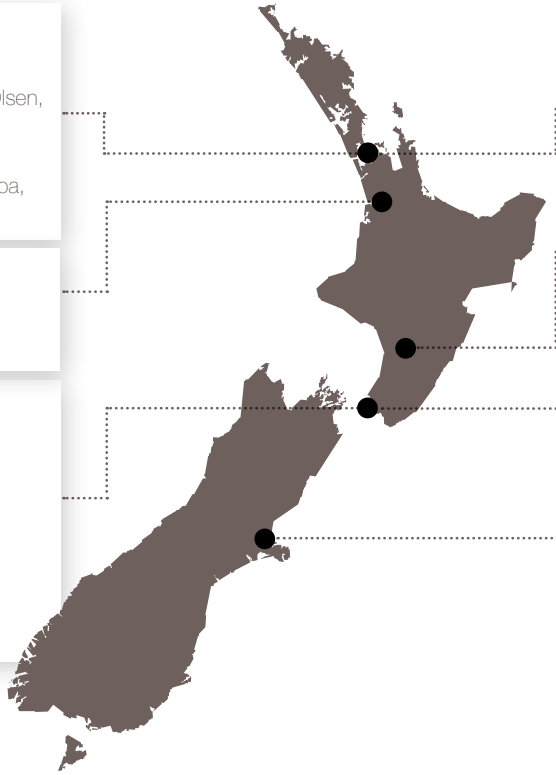
Associate Investigator:
Les Oxley

Victoria University of Wellington

Principal Investigators:
Marcus Frean, Michele Governale, Sally Davenport, Uli Zuelicke

Associate Investigator:
Rhian Salmon

PhD Student:
Kyle Higham



Market Economics

Associate Investigator:
Emily Harvey

Massey University

Principal Investigator:
Stephen Marsland

Motu Research

Principal Investigators:
Adam Jaffe (Theme Leader), David Maré, Izi Sin

University of Canterbury

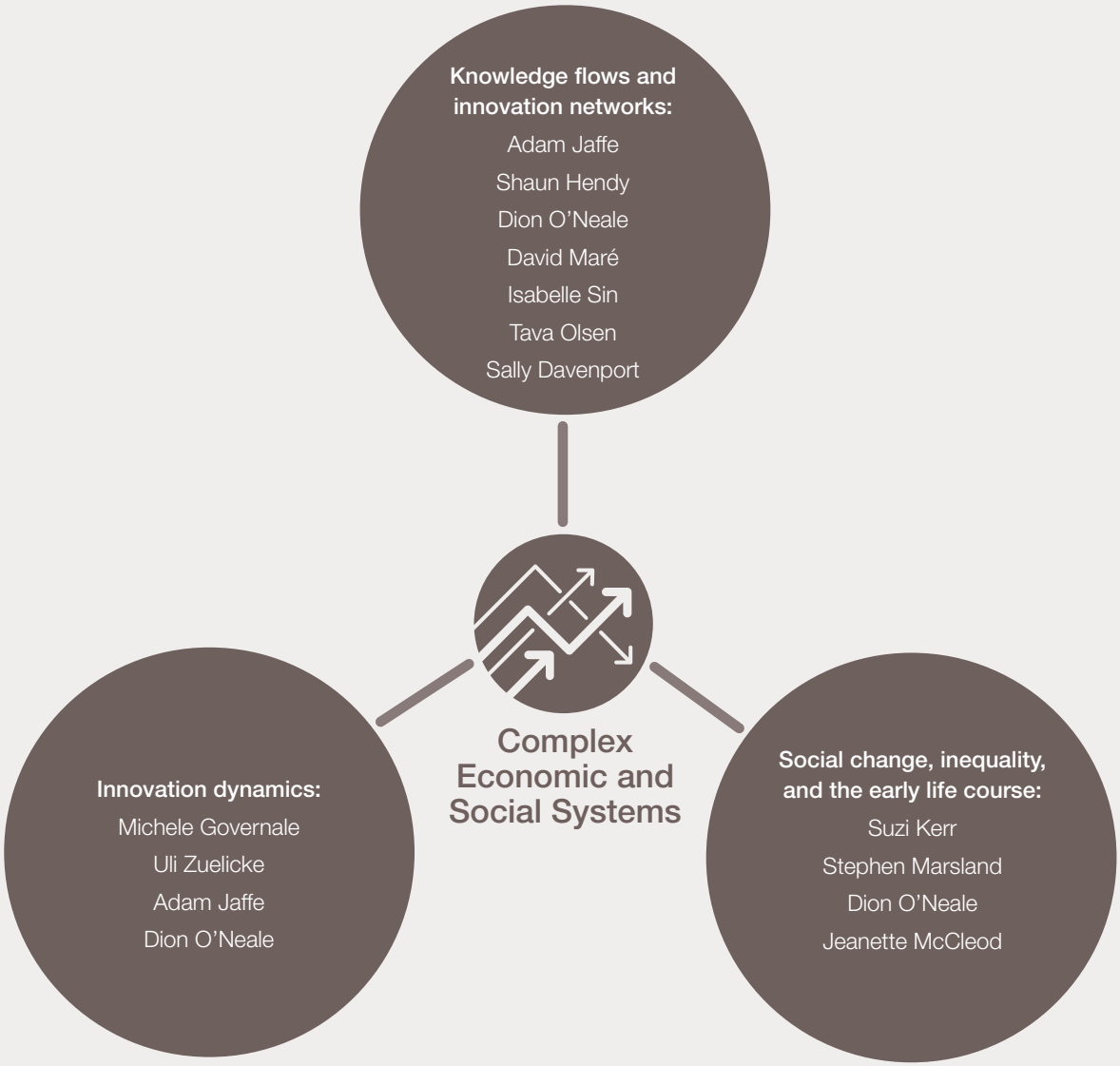
Principal Investigators:
Alex James, Jeanette McLeod, Mike Plank

Our research

Te Pūnaha Matatini researchers are applying new methods from complexity science to better understand New Zealand's economic performance, and the impact of innovation. This understanding will inform government policy and decision-making, and will assist in the evaluation of the effectiveness and impact of government policies.

Applications of new methods for looking at New Zealand's social development data form the basis of the partnership that Te Pūnaha Matatini established with the Ministry of Social Development in 2015, with $114,000 of funding for a postdoctoral fellowship examining predictive risk modelling for child protection.

The project (Network Science for the Social Services Sector) has used social network analysis to develop a new model that uses relationship information held by the Ministry to assess risk to children.



Find out more about our Complex Economics and Social Systems research.
http://bit.ly/2u5oErt

Research highlight: Network scientists explore the dynamics of pre-European Māori society

Te Pūnaha Matatini Whānau PhD student Caleb Gemmell from the University of Auckland.

Te Pūnaha Matatini Whānau student Caleb Gemmell, supervised by Principal Investigators Thegn Ladefoged and Dion O'Neale, has used social network analysis to examine the movement of material used for ancient artefacts by Māori in pre-European New Zealand – a strong indicator of how local and regional communities interacted.

In their efforts to unravel some of the mysteries of pre-European New Zealand society, Caleb, Dion, post-doctoral fellow Alex Jorgensen and Thegn examined a set of artefacts used by Māori that were made from obsidian volcanic rock.

Using information about where each artefact was found, as well as the location where pre-European Māori would have originally sourced the material from, the researchers were able to apply social network science to uncover some surprising facts. Archaeological sites in South and East Auckland, for example, contained obsidian that had been sourced from very different parts of New Zealand (Figure).

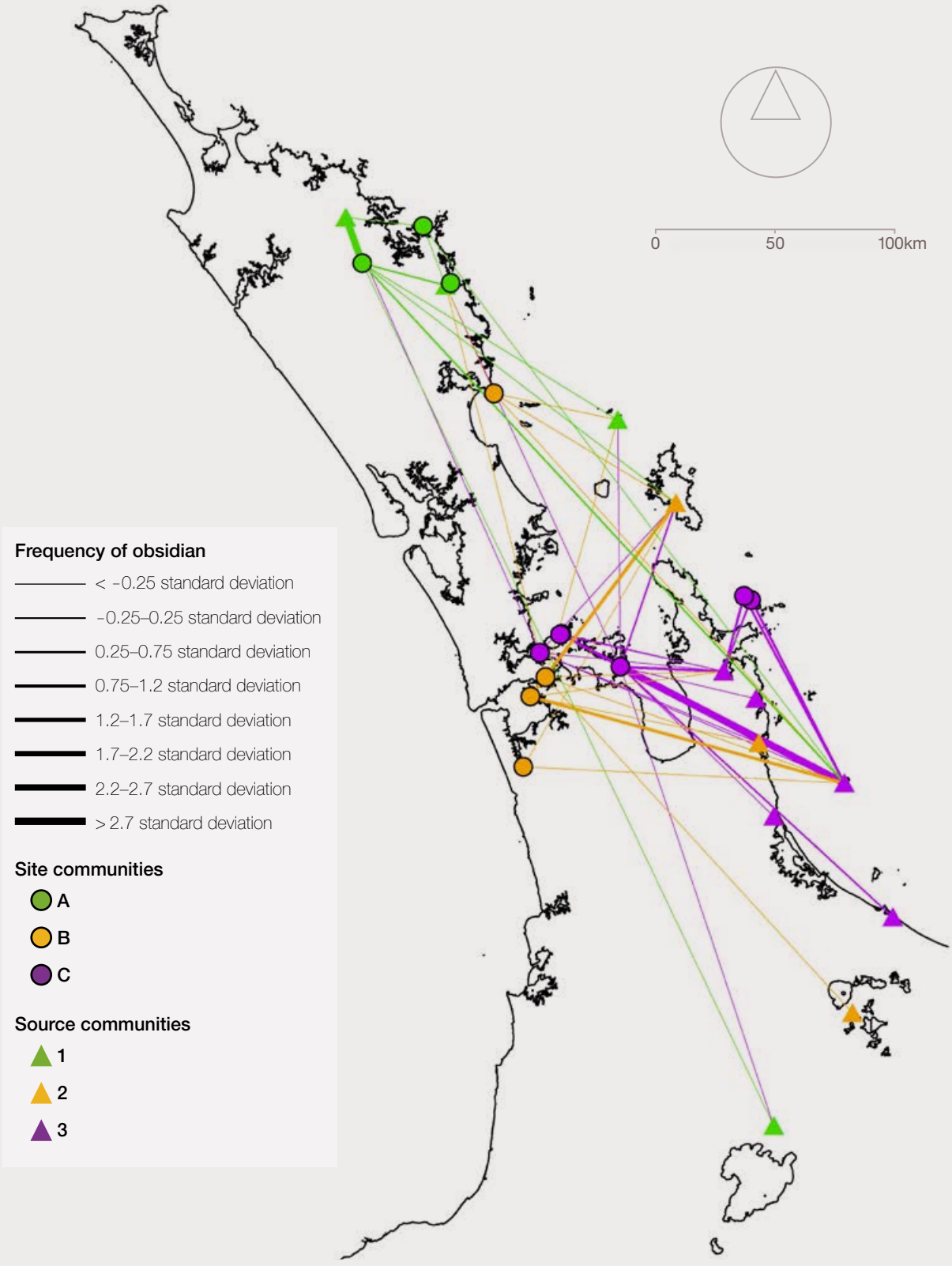
The team's study used artefacts from a large number of sites that had been excavated in previous studies. Using network analysis, they have been able to identify collections of sites that procured obsidian from similar source regions.

"The property we focussed on was the idea of 'community detection' in which an algorithm divides the network into smaller groups based on where the archaeological sites were getting their obsidian," says Caleb. "That is how we discovered that even though the South and East Auckland sites were geographically close, they were sourcing their obsidian from different regions, which was surprising."

"So far we have determined that simple geographic explanations for obtaining obsidian based on the distance of an archaeological site to an obsidian source were not valid," says Caleb. "One hypothesis is that it was social factors that created this distribution of obsidian, suggesting that access to resources was influenced by the local hapū affiliations causing groups to not source obsidian from the closest possible regions, but from regions in which they had a positive social relationships".

The Te Pūnaha Matatini research team will work with local Māori historians and iwi members to see if the South and East Auckland divide fits in with the known social history of the area.

This particular work described above is part of a larger Marsden-funded study (Principal Investigator Thegn Ladefoged). Their ground-breaking research is an excellent example of successful multidisciplinary collaboration taking place across Te Pūnaha Matatini's various themes. In this case, between the mathematical and anthropological/archaeological sciences.



Locations where obsidian artefacts were found (circles) and the network links to where pre-European Maori would have sourced the material from (triangles). The social network analysis communities of sites and sources are colour coded. Image: Thegn Ladefoged.

In the media: Study tracks historic movement of Māori groups (*NZ Herald*)
https://bit.ly/2EoppiF

Complexity and the Biosphere

We're making use of data concerning New Zealand's biodiversity in order to better manage and understand New Zealand's unique flora and fauna.

Our work

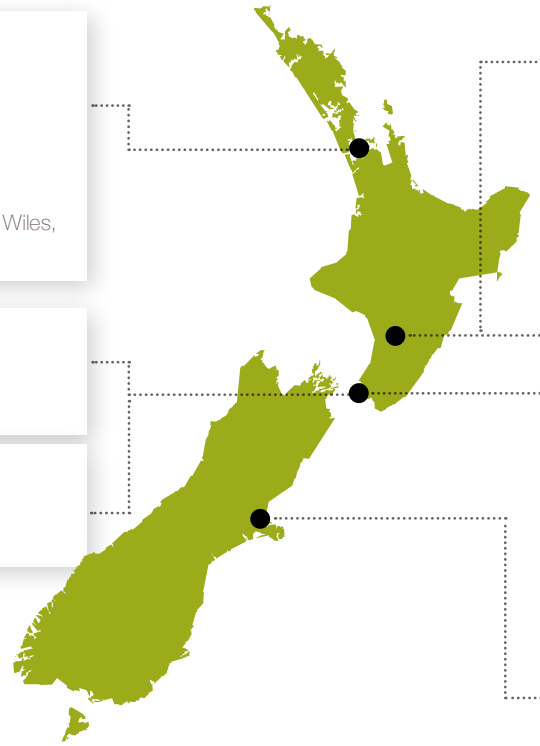
New Zealand's native flora and fauna are a unique taonga to be preserved for future generations. We are very excited to be playing our part in the government's recent commitment to Predator Free New Zealand by 2050.

We're applying network analysis, complexity theory, and dynamical systems methodologies to understand the biosphere; developing models that couple the interactions between biodiversity, the economy, and human decision-making.

Our impact

Our Complexity and the Biosphere research helps to inform national and local government policy and decision-making, and aims to provide the data that New Zealanders can use to better understand the relationship between us and our unique flora and fauna by analysing the NatureWatch Citizen Science platform.

Our team



University of Auckland
Principal Investigators:
Alexei Drummond, James Sneyd, Thegn Ladefoged
Associate Investigators:
Dan Hikuroa, Michelle Dickinson, Melinda Allen, Simone Linz, Siouxsie Wiles, Cate Mcinnis-Ng

Victoria University of Wellington
Associate Investigators:
Rebecca Priestley, Rhian Salmon

Waikato University
Associate Investigator:
Troy Baisden

Massey University
Principal Investigator:
Stephen Marsland
Associate Investigator:
Murray Cox, Isabel Castro

Landcare Research
Associate Investigators:
Andrea Byrom, Pierre Roudier

Motu Research
Principal Investigator:
Suzi Kerr

GNS
Associate Investigator:
Troy Baisden

University of Canterbury
Principal Investigators:
Alex James, Jeanette McLeod, Mike Plank

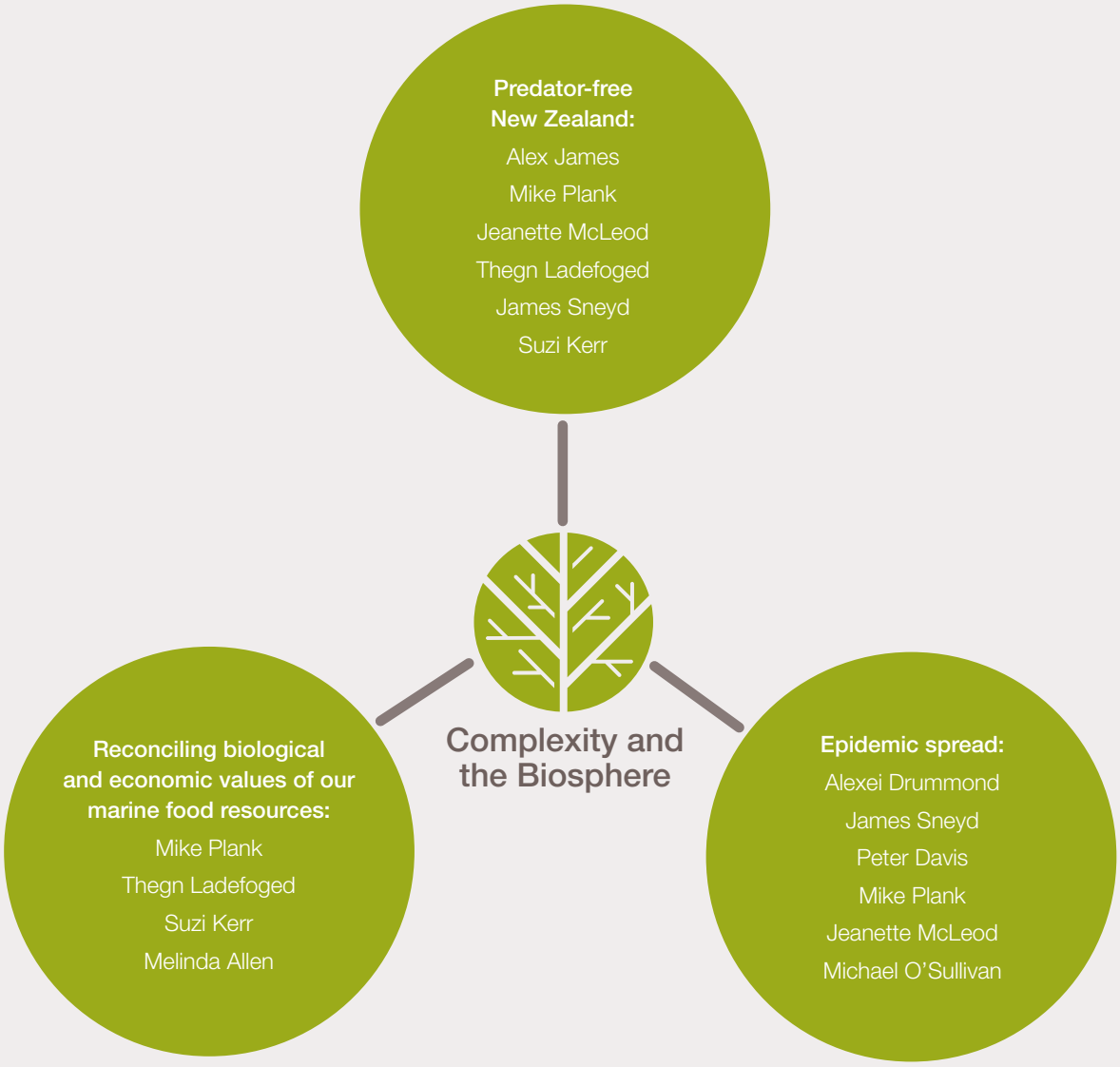
Our research

Making use of data concerning New Zealand's biodiversity will enable better understanding of our unique flora and fauna, by both informing policy and decision-making, and building community capacity. This research theme has a close partnership with New Zealand's Biological Heritage National Science Challenge, via investigator Dr Andrea Byrom, its Director. We are now building a new relationship with Scion Research through a postdoctoral fellow, Rebecca Turner, funded by Te Pūnaha Matatini and the Biological Heritage National Science Challenge, who will start in early 2018.

We continue to work closely with colleagues at Landcare Research Manaaki Whenua; co-funding and co-supervision of PhD students and postdoctoral fellows are a feature of this partnership. Manaaki Whenua has provided co-funding and co-supervision for a new PhD student developing methods for using Citizen Science data. Manaaki Whenua also provides co-supervision a postdoctoral fellow developing pan-regional models of predator control, based at the University of Canterbury. Finally, the data at the heart of a third Te Pūnaha studentship on possum networks has also been provided by Landcare Research.

Strong support from the University of Canterbury has resulted in the co-funding of three PhD students. One of these is also funded by Landcare Research and two are co-funded by Te Pūnaha Matatini. The University of Canterbury has also provided substantial co-funding for the postdoctoral fellow working on pan-regional predator control, based in the Geospatial Research Institute, a research centre led by our board member Professor Wendy Lawson.

With Te Pūnaha Matatini, the Complexity and the Biosphere theme is also working across centres. Our project on evolutionary games for small-scale fisheries is a joint venture between Principal Investigators Assistant Professor Mike Plank (UC) and Dr Suzi Kerr at Motu.



Find out more about our Complexity and the Biosphere research.
http://bit.ly/2HSiPzJ

Research highlight:
Testing large-scale predator control in Hawke's Bay

Photo: James Coleman / Unsplash.

Te Pūnaha Matatini investigators Audrey Lustig, Mike Plank and Alex James, from the University of Canterbury, are involved in a large-scale predator control initiative in Hawke's Bay – part of a wide range of research activities referred to as the Cape to City research project.

New Zealand has an excellent record of conserving its native flora and fauna through pest control measures, especially in large uninhabited areas. Predator Free 2050 is a bold initiative that aims to rid the country of its most damaging invasive predators. However, to completely eliminate such predators from our shores, new and ambitious approaches are needed.

Implementing effective predator control over large areas

New Zealand's unique and diverse native species of flora and fauna are extremely vulnerable to invasive mammals. Our often-publicised successes in conserving the country's biodiversity by managing pests has mainly been restricted to large uninhabited areas. Meanwhile, large tracts of land owned by private individuals remain relatively unprotected.

When it comes to land management decisions such as pest control actions, careful negotiations are required with a wide range of stakeholders with differing views – from cat-lovers to rabbit-haters – so that agreements can be reached.

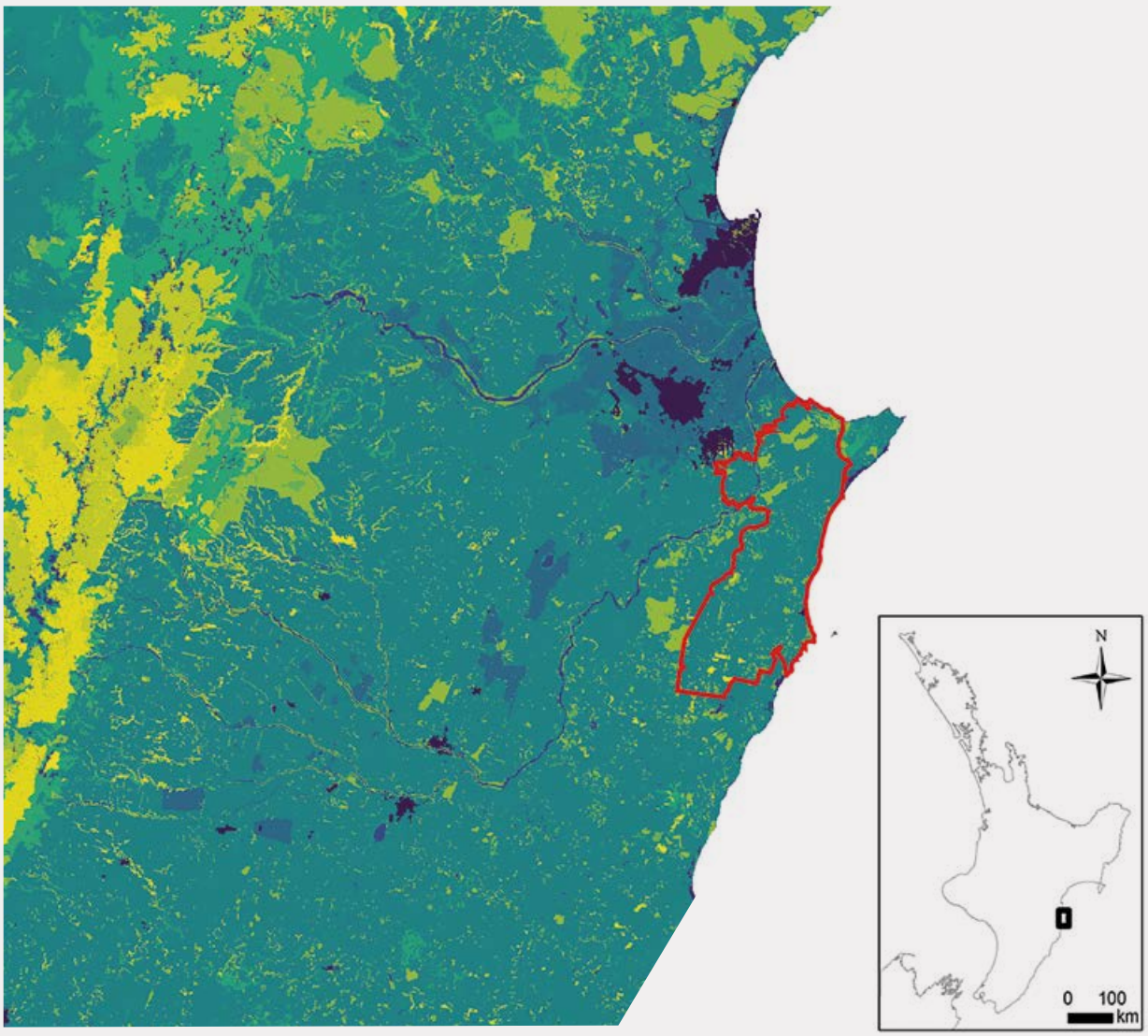
Experience has shown there are minimum thresholds for landholder participation in predator control measures for them to be successful. In practice, coordinated community efforts are required so that pest reinvasion from a few untreated properties does not compromise pest control achieved by others.

Another crucial element is biological connectivity between properties – the establishment of 'safe passage' corridors crossing landowner boundaries greatly assists in the dispersal of native species between fragments of suitable habitat. Large-scale pest control is therefore a spatial issue with social, environmental, and economic components.

The spread model is still being developed to provide more functionality for managers. In particular, we are investigating the ways in which landholders influence one another, how agencies influence landholders, and the presence of key influential landholders who might help catalyze actions are the current focus of research. Ultimately, the aim of the model is to improve strategic planning for mammal control at regional scales. Also, this model serves as a template for future dynamic maps of other mammal species.

Large-scale Cape to City research project in Hawke's Bay

Te Pūnaha Matatini investigators Audrey Lustig, Mike Plank and Alex James, from the University of Canterbury, are involved in a large-scale predator control initiative covering 26,000 hectares of agricultural land in Hawke's Bay, part of a wide range of research activities referred to as the Cape to City research project by the Hawke's Bay City Council.



Cape-to-City project, Hawkes Bay

Map of estimated densities of possums in various classes of habitat, characterized by the land-cover they contain (purple colour indicates low densities and yellow colour indicates high densities) across the lower North Island. Such maps form the basis of a generic modelling approach for predicting hot-spots of top mammalian predators activity in an uncontrolled landscape. Such modelling can be refined to predict the abundance and likely persistence of four of New Zealand's top mammalian predators in the light of potential changes in management effort across human-dominated landscapes. We used the Cape-to-City area (red outline) in Hawke's Bay (39°47 0 S; 176°57 0 E) as a case study.

"This is just a start for a much more ambitious project that proposes a vision to eliminate invasive predators from the entire country," says Audrey. "In this work, we develop a generic modeling approach as a planning tool for predicting the abundance and the likely persistence of four New Zealand top mammalian predators in the light of potential changes in management effort across human-dominated landscape."

The first part of the project aims to generate a computer model for predicting the distribution and abundance of mammalian species across the landscape, the ways in which animals move from their natal sites, and how their distributions and abundance are affected by control interventions.

Such modelling can help inform managers on the likelihood of success of a specific pest control action (assuming every landholder participates in the control action). It also allows exploration of some of the mechanisms by which mammal populations might recover after control operations.

Importance of multi-stakeholder engagement

The work builds on a pre-existing knowledge base and data acquired by the Hawke's Bay Regional Council, Department of Conservation, Manaaki Whenua and the Biological Heritage Challenge to bring about practical improvements in mammalian pest management in New Zealand.

"Such inter-organisational joint effort is common in New Zealand, but to me, what was critical was to bring a more practical insight into my research," says Audrey. "In particular, the provision of direct feedback from decision-makers forms an integral part of the learning process and enriches my research experiences and outcomes, while providing useful information to the Hawke's Bay Regional Council."

Research Outputs

Photo: Samuel Zeller / Unsplash

Publications and Presentations of Note

Thomas Adams, **Michael O'Sullivan**, Jonathan Christiansen, Paul Muir, **Cameron Walker**; Rostering general medicine physicians to balance workload across inpatient wards: a case study, *BMJ Journals*, Volume 3, Issue 2, March 2017

Behzadi, G., **O'Sullivan, M.J**., **Olsen, T.L**., Zhang, A; *Agribusiness supply chain risk management: A review of quantitative decision models*, Omega, July 2017.

Tumanako Ngawhika Faauia, Te Kipa Kepa Brian Morgan, **Daniel Carl Henare Hikuroa**; Ensuring objectivity by applying the Mauri Model to assess the post-disaster affected environments of the 2011 MV Rena disaster in the Bay of Plenty, New Zealand, *Ecological Indicators*, Volume 79, August 2017, Pages 228–246

J. Gush, **A. Jaffe**, V. Larsen and A. Laws; The effect of public funding on research output: the New Zealand Marsden Fund, *New Zealand Economic Papers*, 16 May 2017

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E. Penelope Holland, **Julie Mugford, Rachelle N. Binny, Alex James**; How Herbivore Browsing Strategy Affects Whole-Plant Photosynthetic Capacity, *Bulletin of Mathematical Biology*, April 2017, Volume 79, Issue 4, pp 772–787

Alex James, Jeanette C. McLeod, Carlos Rouco, Kyle S. Richardson, Daniel M. Tompkins; Spatial utilization predicts animal social contact networks are not scale-free, *Royal Society Open Science*, December 2017

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Cate Macinnis-Ng; Drought and native trees in Aotearoa-New Zealand, *New Zealand Arbouriculture Association Conference*, 2017.

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Journal articles

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Anderson, D., Gormley, A., Ramsey, S.L., Nugent, G., Martin, P., Bosson, M., Livingston, P.I., **Byrom, A.,** *Biological Invasions*, Bio-economic optimisation of surveillance to confirm broadscale eradications of invasive pests and diseases

Behzadi, G., **O'Sullivan, M.J., Olsen, T.L.,** Scrimgeour, F., Zhang, A., *International Journal of Production Economics*, Robust and resilient strategies for managing supply disruptions in an agribusiness supply chain

Behzadi, G., **O'Sullivan, M.J., Olsen, T.L.,** Zhang, A., *International Journal of Production Research*, Allocation flexibility for agribusiness supply chains under market demand disruption

Behzadi, G., **O'Sullivan, M.J., Olsen, T.L.,** Zhang, A., *Omega* (United Kingdom), Agribusiness supply chain risk management: A review of quantitative decision models

Bond-Smith, S., McCann, P., **Oxley, L.,** *Spatial Economic Analysis*, A regional model of endogenous growth without scale assumptions

Bordewich, M., **Linz, S.,** Semple, C., *Journal of Theoretical Biology*, Lost in space? Generalising subtree prune and regraft to spaces of phylogenetic networks

Broad, J.B., Lumley, T., Ashton, T., **Davis, P.B.,** Boyd, M., Connolly, M.J., *Australasian Journal on Ageing*, Transitions to and from long-term care facilities and length of completed stay: Reuse of population-based survey data

Brucato, N., Kusuma, P., Beaujard, P., Sudoyo, H., **Cox, M.P.,** Ricaut, F.-X., *Scientific Reports*, Genomic admixture tracks pulses of economic activity over 2,000 years in the Indian Ocean trading network

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Dupont, P.-Y., **Cox, M.P.,** *G3: Genes, Genomes, Genetics*, Genomic Data Quality Impacts Automated Detection of Lateral Gene Transfer in Fungi

Faauia, T.N., Morgan, T.K.B., **Hikuroa, D.C.H.,** *Ecological Indicators*, Ensuring objectivity by applying the Mauri Model to assess the post-disaster affected environments of the 2011 MV Rena disaster in the Bay of Plenty, New Zealand

Garvey, P.M., Glen, A.S., Clout, M.N., Wyse, S.V., Nichols, M., **Pech, R.P.,** *Ecological Applications*, Exploiting interspecific olfactory communication to monitor predators:

Gavryushkina, A., Heath, T.A., Ksepka, D.T., Stadler, T., **Welch, D., Drummond, A.J.,** *Systematic Biology*, Bayesian total-evidence dating reveals the recent crown radiation of penguins

Glen, A.S., Latham, M.C., Anderson, D., Leckie, C., Niemiec, R., **Pech, R.P., Byrom, A.E.,** *Biological Invasions*, Landholder participation in regional-scale control of invasive predators: an adaptable landscape model

Glen, A.S., **Pech, R.P.,** Davey, C., Molsher, R.L., *New Zealand Journal of Zoology*, Raptors vs aliens: can indigenous birds of prey help control invasive predators?

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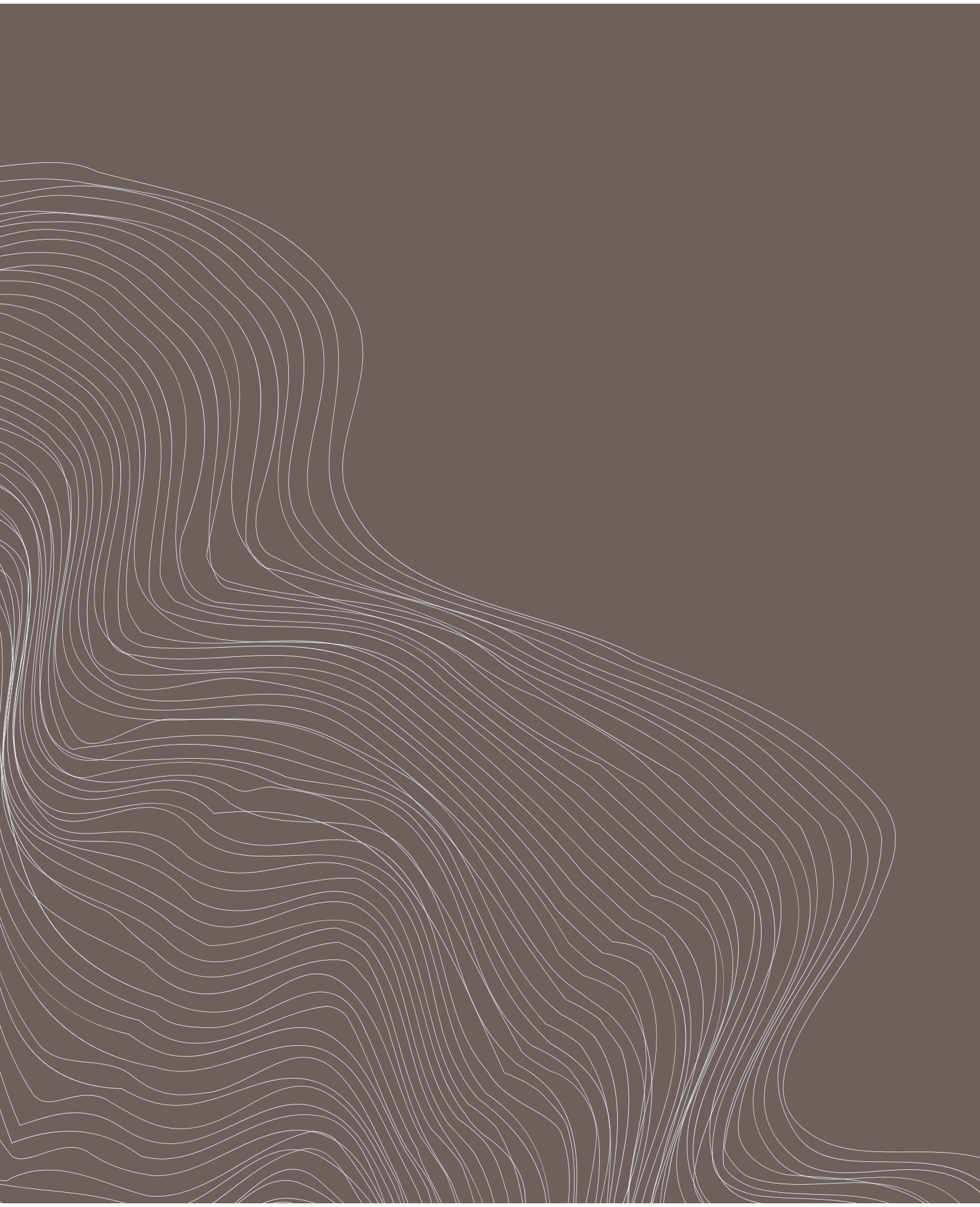


Governance and Management

Financial Report 2017

	2017 Actuals $000
Funding received	
Tertiary Education Commission grant	2,194
Total Funding received	**2,194**
Expenditure	
Salaries	
Director and Principal Investigators	613
Associate Investigators	25
Research/Technical assistants	4
Others	171
Total Salaries & Salary-related costs	**812**
Other costs	
Overheads	850
Project Costs	200
Travel	96
Postgraduate students	194
Total Other Costs	**1,353**
Total Expenditure	**2,165**
Net Surplus/(Deficit)	**29**

Notes

This report covers the period from 1 January 2017 – 31 December 2017 and details funding received and funds distributed to collaborative partners of the CoRE.

All amounts are shown exclusive of Goods and Service tax (GST).

The net surplus will be carried forward into 2018 to fund future expenditure of the CoRE.

2017 Summary

Broad category	Detailed category	Yr3
Value of CoRE funding from TEC ($M)		2,193,500
FTEs by category	Principal investigators	3.30
	Associate investigators	0.35
	Postdoctoral fellows	3.03
	Research technicians	0.40
	Administrative/support	2.50
	Total	**9.58**
Headcounts by category	Principal investigators	24
	Associate investigators	25
	Postdoctoral fellows	4
	Research technicians	1
	Administrative/support	3
	Total	**57**
Peer reviewed research outputs by type	Books	1
	Book chapters	4
	Journal articles	66
	Conference proceedings	24
	Other	16
	Total	**111**
Value of external research contracts awarded by source	Vote Science and Innovation contestable funds	8,620,354
	Other NZ Government	349,600
	Domestic – private sector funding	201,662
	Domestic – other	280,000
	Overseas	1,584,840
	Total	**11,036,456**
Commercial activities	Patent applications	1
	Total	**1**
Students studying at CoRE by level	Doctoral level	33
	Other	38
	Total	**71**
Number of students completing qualifications by level	Doctoral level	0
	Other	11
	Total	**11**
Immediate post-study graduate destinations	Further study in NZ	64
	Further study overseas	1
	Employed in Māori organisation	0
	Employed in NZ other	2
	Employed overseas	2
	Unknown	2
	Other	0
	Total	**71**

Meeting Our Strategic Outcomes

Research Excellence

A strong collaborative network of investigators, students, and practitioners will be established in New Zealand, with a culture of research excellence that attracts and retains the very best national and international talent, and with expertise in the research, education, industry, and policy sectors that is required by stakeholders, end-users, and thought leaders.

- After three years, Te Pūnaha Matatini has tangible evidence that our collaborative networks are delivering on our mission. Our international review panel commented in April 2017 that "The level of collaborative research across disciplines and the gender balance of the network are especially impressive. Looking across the academic disciplines of the researchers participating in TPM gives one an idea of the breadth of expertise available in the network: from traditional fields such as physics, mathematics, anthropology, and economics, through network science, operations research, and computational social science, to science communication and mātauranga Māori. It is hard to imagine a similar research network anywhere in the world. This fact creates an opportunity for unique research output from a small country."
- As detailed throughout this report, Te Pūnaha Matatini investigators are competing in the New Zealand science and innovation system at the highest levels of excellence, winning numerous awards, fellowships and prestigious grants. Our researchers are also known for their leadership, with several winning significant national leadership awards and national honours.
- Te Pūnaha Matatini's expertise is in demand from stakeholders and end-users, as shown by high levels of funding, co-funding, and funding in-kind by end-user organisations. Investigators are regularly invited to give talks, presentations, and workshops for stakeholder and end-user organisations, and several investigators sit on or have sat on key stakeholder advisory boards.

Sought-After Graduates

Our graduates will be sought after for their knowledge of complex systems methods and their ability to apply this knowledge to significant problems of relevance to our end-users.

- More than thirty Te Pūnaha Matatini students (both graduate and under-graduate) have now been placed for 10 weeks at stakeholder and end-user organisations with joint internal and external supervisors. The internships were funded or cofunded by the external organisations (SIU, MBIE, Te Hiku Media, Dragonfly Data Science, Ripe Time, MSD, Oranga Tamariki, Westpac). In some instances students worked individually, but at several organisations we have used a teambased approach, where a PhD student leads a team of two undergraduate students. This team-based approach has worked very well, with both the students and hosting organsations being very pleased with the outcome.
- We have had several interns work with Te Hiku Media, a charitable joint-Iwi venture between the Far North Iwi of Ngāti Kuri, Te Aupouri, Ngai Takoto, Te Rārawa and Ngāti Kahu. One student built a dashboard for tracking their audience analytics. At the conclusion of the project Te Hiku Media had a working tool and will continue to employ the student part-time in the coming year to add extra features. A second pair of interns worked with Te Hiku and Dragonfly Data Science using natural language processing tools to analyse Te Reo Māori in Hansard, and New Zealand Gazetteer of place names. This work was featured in the New Zealand Herald.
- As we complete our third year, a number of PhD students from our first funded cohort are approaching graduation. There is good evidence that these graduates will be in demand once they enter the job market following the success of our 2016–17 and 2017–2018 internship programmes. We note that our first Whānau Chair, Dr Rachelle Binny, is now a research scientist at Manaaki Whenua.

Research Uptake

Our research will be used by stakeholders and end-users in New Zealand to provide direct savings, enhanced productivity, growth and diversification of the economy, environmental and social benefit, and develop new business.

- There are now many examples of ways in which Te Pūnaha Matatini research has been used in New Zealand. For instance, work with the New Zealand Rugby Union and the data science company Qrious helped them develop new products and services. For the New Zealand Rugby Union a visualisation method was developed that allowed team coaches to visualise complex performance data sourced from games. Te Pūnaha Matatini researchers have worked with Qrious as they develop their mobile phone location-based human movement product Voyager.
- Work being done by Te Pūnaha Matatini researchers Ilze Zeidins, Mike O'Sullivan, Cameron Walker and Tava Olsen provides practical solutions to real world problems within New Zealand's healthcare system. Their patient pathways project work for example involves the analysis of a complex series of steps between the time a patient presents for healthcare and the time of discharge, amidst a background of limited resourcing (e.g. staffing, surgical teams, and equipment). Prioritising one patient's access to a resource may have adverse effects for other pathways that also need that resource. To determine effective prioritisation strategies for patients therefore requires modelling of the complexity of patient pathways, their use of resources, and the effect of different prioritisation strategies. This is undertaken in partnership with District Health Boards so findings can be swiftly implemented to deliver benefit.
- Te Pūnaha Matatini work on the evaluating the impact of the Marsden Fund and the effectiveness of decision-making by its evaluation panels has been acknowledged as extremely valuable by the Marsden Fund Council: "This work was invaluable in allowing us to obtain an objective measure of proposal quality. We had asserted for many years that our near miss proposals were of equivalent quality to those that were funded, but this work allowed us to confirm this in an independent and quantitative manner." (Juliet Gerrard, Chair of the Marsden Fund Council). The study was also very important for getting Statistics New Zealand's Science and Innovation domain plan agreed upon by the sector, as it was a clear demonstration of what was possible with good data collection practices.
- Te Pūnaha Matatini is regularly commissioned to investigate and measure research impact. In the last three years we have carried out impact evaluation for the Concrete and Cement Association of New Zealand, the NZ Food Safety Science and Research Centre, the Bioheritage and Science for Technological Innovation National Science Challenges, and the University of Auckland's Centre for Innovation and Entrepreneurship. In MBIE's discussion paper on measuring research impact, the two New Zealand studies cited were both undertaken by Te Pūnaha Matatini researchers.
- Te Pūnaha Matatini has worked with the Ministry of Social Development (MSD) to provide network analysis tools for identifying at-risk children. Researchers characterised the networks that exist in their relational client database and provided workshops to MSD staff in using network tools. MSD funded a postdoctoral fellow, who has worked along MSD analytics staff to facilitate diffusion of network analysis methods into the Ministry. MSD and Oranga Tamariki are supporting further work in this project.

Partnership Models

In building close engagement with Māori communities and developing opportunities for Māori capability-building, the distinctive contribution of Māori to complex systems and networks will enhance social, economic, and environmental outcomes for New Zealand.

Capability-building

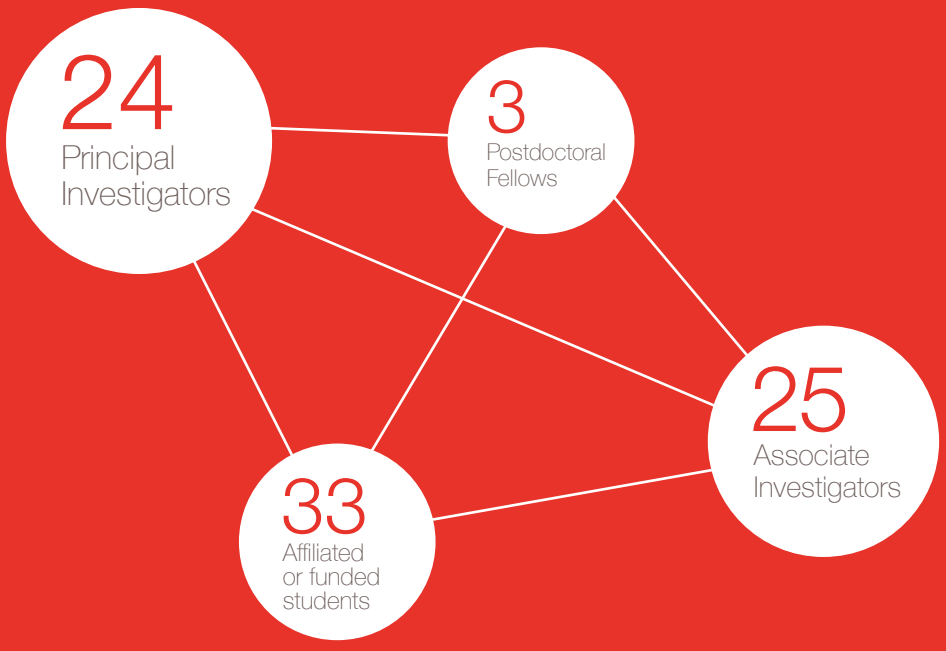
- We have a growing partnership with iwi digital media venture Te Hiku Media. As noted above a jointly-funded intern was placed at Te Hiku from December 2016 to build a dashboard and will continue in part-time employment this year. We are partners on the Kōrero Māori project with Te Hiku and Dragonfly Data Science to develop natural language processing tools for Te Reo Māori.
- Te Pūnaha Matatini is participating in two Māori business networks. The first – Te Waka o Tama-rereti – has been organised by the Science for Technological Innovation National Science Challenge and involves smaller ICT businesses, iwi representatives, and some Māori researchers. The second – Te Tira Toi Whakangao – is run by New Zealand Trade and Enterprise and involves mediumsized technology companies and investors.
- There are now several Te Pūnaha Matatini research projects that will enable the distinctive contribution of Māori, focusing on the interaction of mātauranga (Māori traditional knowledge) with complex systems and networks methods and approaches. Our flagship project Mai i ngā maunga ki te tai starts in 2018. A key outcome will be developing processes of best practice for engagement by environmental scientists with tangata whenua. Furthermore, this project will be scoped and designed in partnership with Māori, with direction of the locus of research being entirely a response to community need and priority.
- Te Pūnaha Matatini has partnered with Ngā Pae ō te Māramatanga, the Māori Centre of Research Excellence, on paid internship projects for Māori postgraduate students; there is also a partnership with the Participatory Science Platform for South Auckland, SouthSci, an MBIE-funded science outreach project into hard-toreach communities, to provide scientific expertise to community-led science projects and to develop paid internship positions for undergraduate and postgraduate students from those communities.

Improved Decision-Making

Through knowledge-sharing and best practice, our research will inform and improve decision-making in policy and public debate in New Zealand on issues related to complex systems and networks and their role in society, the economy, and the environment.

- Te Pūnaha Matatini has led the national discourse on the public responsibilities of scientists to communicate their work and participate in public debate. Four Te Pūnaha Matatini investigators have won the Prime Minister's Science Communication Prize (Priestley (2016), Dickinson (2014), Wiles (2013), Hendy (2012)), three have won the Callaghan Medal for science and/or technology communication (Dickinson (2015), Wiles (2013), Hendy (2012)), and Siouxsie Wiles has been awarded a Blake Leadership medal. Books such as Silencing Science (Hendy 2016) and the Fukushima Effect: A New Geopolitical Terrain (Priestley 2016) have also contributed to international discourse on science communication.
- Our researchers are consistent contributors to public debate as commentators themselves, but also by making their research accessible and promoting its use in public discourse. For instance, Isabelle Sin's work on the New Zealand government's 90-day employment trials policy (commissioned by Treasury) and then her ground-breaking paper on the gender pay gap, sparked national debate, with the latter study making the front page of the New Zealand Herald. Siouxsie Wiles' book "Antibiotic Resistance" has been a major focal point for national discussion about the overuse of antibiotics.
- Te Pūnaha Matatini has run three national media campaigns "Reframing Innovation" (August 2016), "InfectedNZ" (November 2016), and "WaiNZ" (September 2017) to promote the using of data and evidence in public discourse. The third campaign, WaiNZ, sought to highlight the issue of polluted waterways in New Zealand. Held over the week of 11–15 September 2017, it was based around blog articles shared by leading environmental, social and health researchers. Overall, it generated more than 1,900 website views and 32,600 Twitter impressions.
- Te Pūnaha Matatini has become well-known for leadership in collaborative management, advising other CoREs and research centres on structure and operational matters, governance, and policies for growing diversity. In particular, Te Pūnaha Matatini has taken a leadership role in promoting diversity within the New Zealand science system, beginning with evaluating the publicly available data for each Centre of Research Excellence. The Association of CoREs agreed in 2015 to adopt Te Pūnaha Matatini's Sponsorship Policy as its own. Critical to these initiatives was the decision to formalise Te Pūnaha Matatini's diversity and inclusion statement as a policy, and to develop a sponsorship policy for public dissemination via the website. Alongside the sponsorship policy, an event code of conduct was developed, for Te Pūnaha Matatini events or events that we sponsor.
- Te Pūnaha Matatini research has played an instrumental role in establishing the National Research Information System (NRIS). Our research was presented to the then Minister of Finance, Bill English, in 2015, and this proved crucial in the adoption of Statistics New Zealand's Science and Innovation Domain Plan, which will lead to the creation of NRIS, allowing the value of New Zealand's investments in science and innovation to be rigorously quantified.

Our People


24
Principal Investigators
3
Postdoctoral Fellows
25
Associate Investigators
33
Affiliated or funded students

Executive team

Professor Shaun Hendy
University of Auckland
Director, Te Pūnaha Matatini

Shaun Hendy is Director of Te Pūnaha Matatini and Professor of Physics at the University of Auckland. His interest in the science of complexity stems from a conversation at a lunchtime journal club at Industrial Research Ltd about Geoffrey West's work on the increase in the number of patents per capita with city size in the US. Hendy then downloaded an international patent database and found that the difference in patents per capita between Australia and New Zealand could be explained by the difference in population distributions.

Dr Siouxsie Wiles
University of Auckland
Deputy Director, Public Engagement (Maternity cover for Alex James)

Siouxsie has made a career of combining her twin passions of bioluminescence (think glow worms and fireflies) and infectious diseases. In a nutshell, Siouxsie and her team make nasty bacteria glow in the dark to better understand how superbugs cause disease and to find new medicines. Siouxsie is also a keen blogger, podcaster, artist, curator and media science commentator and has won a hat trick of prizes for her efforts.

Professor Tava Olsen
University of Auckland
Deputy Director, Industry and Stakeholder Engagement

Tava Olsen is Professor of Operations and Supply Chain Management and Director of the Centre for Supply Chain Management at the University of Auckland Business School. Tava's research interests include supply-chain management, pricing, and inventory control, and stochastic modelling of manufacturing, service, and healthcare systems. Tava is a past president of the Manufacturing and Service Operations (MSOM) society and has been awarded the Auckland Business School's sustained research excellence award.

Dr Alex James
University of Canturbury
Theme Leader, Complexity and the Biosphere

With a PhD in combustion engineering, Associate Professor Alex James made the transition from catalytic converters to the rest of the world, where she uses mathematical modelling to solve problems. At heart she's a mathematical modeller and works on problems from social science to climate change, but her main hobby is ecology. Although Alex says she is no ecologist – "friends had to teach me the difference between beetles and bugs" – she is excited by the contribution mathematics can make to the analysis and study of interactions among organisms and their environment.

Professor Stephen Marsland
Massey University
Theme Leader, Complexity, Risk and Uncertainty Data Analytics

Stephen Marsland is Professor of Mathematics at Victoria University of Wellington. He was previously Professor of Scientific Computing at Massey University and has PhD from Manchester University and a degree from Oxford University. His research interests are in the applications of mathematics, especially differential geometry, to a wide variety of problems such as bird-song recognition, shape and medical image analysis, machine learning, and smart homes for the elderly. He also works in complexity science, including complex networks and agentbased models.

Adam Jaffe
Motu Research
Theme Leader, Complex Economic and Social Systems

Dr Adam Jaffe arrived in New Zealand in the autumn (fall) of 2013, joining Motu Economic and Public Policy Research, as its director, with a significant research programme focusing on technological innovation and its diffusion; in particular diffusion effects in environmental and energy technologies. He's leading a group of diverse researchers investigating the impact of scale, diversity, connectivity, and dynamics on social and economic systems.

Kate Hannah
Executive Manager, Te Pūnaha Matatini

Kate Hannah has a Master of Arts (2004) from Waikato University in 19th Century American Literary Culture. Her principal research area is the historiography of the history of science, with a focus on the cultures and subcultures of science, gender in science history, and narrative and complexity. She held a variety of research roles within New Zealand universities 20042014, as well as running her own historical consultancy, with clients including telecommunications companies, public art galleries, local and central government, and research organisations. Since January 2015, she has been executive manager of Te Pūnaha Matatini, providing theoretical and qualitative rigor within the Centre's research programmes and public engagement activities. Since January 2018, Kate has been an Associate Investigator in Te Pūnaha Matatini. From May 1, 2018, Kate is a Te Pūnaha Matatini-funded PhD candidate in the Science and Society Group at Victoria University Wellington, investigating novel hybrid methodologies for the historiography of science.

Kathryn Morgan
Research Operations Coordinator, Te Pūnaha Matatini

Kathryn coordinates Te Pūnaha Matatini's research operations and communications activities, and provides critical support to the executive management team. After graduating with a MSc (Physical Geography) at the University of Auckland, Kathryn worked initially as a researcher at several organisations, and spent 12 years in a variety of roles at the Auckland Museum. Later, she trained in secondary education and for a number of years was a high school teacher.

Greg Town
Communications and Marketing Advisor, Te Pūnaha Matatini

Greg is supporting Te Pūnaha Matatini's communications requirements as part of his role with the University of Auckland's Science Faculty marketing team. Since graduating with a Science degree in Physiology from the University of Auckland, Greg has worked as a magazine and news editor, medical writer, health journalist, and technology blogger for a variety of publishing firms and marketing agencies based in New Zealand, Singapore and the UK.

Kyle Higham
Chair, Te Pūnaha Matatini Whānau

Kyle is a PhD student at Victoria University of Wellington. He places patents into a growing network framework in order to examine the diffusion of knowledge and better understand of the dynamics and evolution of invention. He is particularly excited about the potential for conceptual breakthroughs that are made possible when problems faced in traditionally nonmathematical fields are placed within a complex systems framework.

Advisory Board

Richard Aitken
Advisory Board Chair
Executive Chairman, Beca (New Zealand)

Through his 45-year career at Beca, Richard has played an active part in growing this professional services consultancy to a team around 3000-strong throughout New Zealand, Australia and Asia. He has served in several executive positions and held a range of directorships both internal and external. Before taking up the Chairmanship of the Beca Group in 2009 he held the lead role of Group Chief Executive for a decade.

Richard has in-depth experience in engineering project management and with partnering and alliance contracting. Current external directorships are with Trustpower Ltd and Panuku Development Auckland Ltd (Deputy Chair) and since February 2015 the Te Pūnaha Matatini Advisory Board (Chair). Richard has represented Beca on the Project Alliance Board for the Waterview Project (Auckland) for the last five years and was appointed to the Chair in late-2015. He remains a member of the Construction Strategy Group (a high-level industry body) having chaired it from inception for nearly five years.

Richard is a Distinguished Fellow of the Institution of Professional Engineers NZ (IPENZ) and a Fellow of the Institution of Structural Engineers UK (IStructE).

Lillian Grace
CEO and Founder of Figure.NZ

Lillian is CEO and Founder of Figure.NZ, the first organisation globally to designate everyone as a user of data and to build systems and software to deliver to this standard. As a purpose-driven social enterprise, Figure.NZ is committed to creating a data democracy and helping everyone to make sense of data so we can see New Zealand clearly.

Lillian is on the board of the NZ Innovation Partnership and on the NZ Data Futures Partnership Working Group. Previously Lillian was at Academy Award-Winning Massive Software at think tank The New Zealand Institute.

Arthur Grimes
Senior Fellow, Motu Economic and Public Policy Research

Arthur completed his PhD in Economics at the London School of Economics in 1987 following his BSocSc (Hons) at University of Waikato. He is a Senior Fellow at Motu Research, an Adjunct Professor at Victoria University of Wellington, Board Member of the Financial Markets Authority, and chairs the Hugo Group. He was Reserve Bank of New Zealand Chair from 2003–2013.

Prior to his time at Motu, Arthur was Director of the Institute of Policy Studies (Victoria University of Wellington), Chief Executive of Southpac, and Chief Economist at both the Reserve Bank of New Zealand and the National Bank of New Zealand.

In 2005, Arthur was awarded the NZIER Economics Award recognising excellence in economics related to New Zealand's economic welfare. His current research centres around urban economics, the economics of wellbeing, and aspects of central banking (including exchange rates and currency union).

Professor John Hosking
Dean of Science, University of Auckland

John is Dean of Science at the University of Auckland assuming the role in June 2014. Immediately prior to that he was Dean of Engineering and Computer Science at the Australian National University and before that was Professor of Applied Computer Science in the Department of Computer Science at the University of Auckland including a six-year term as Head of Department between 1999 and 2005.

John's research career has been in software engineering, with over 200 publications to his name, and a long history of university-industry research engagement. He has been awarded both an FRSNZ in recognition of his research activities and a National Tertiary Teaching Excellence award reflecting his passion for teaching.

Professor Wendy Lawson
Pro-Vice-Chancellor Science, University of Canterbury

Professor Wendy Lawson is the Pro-Vice-Chancellor of Science at the University of Canterbury. She is a glaciologist with a passion for fieldwork and more than 30 years of experience of remote fieldwork in polar and alpine environments including in Greenland, Svalbard, Alaska and Arctic Norway – as well as Antarctica.

Her previous roles include Dean of Science and Head of Department of Geography at the University of Canterbury and as an academic at the University of Auckland. She has a range of academic and Crown sector strategic science sector governance experience including Ministerial appointments as a Board Director of NIWA and of Antarctica New Zealand.

Her PhD is from the University of Cambridge and her most recent qualification awarded in 2008 is a Postgraduate Certificate in Public Administration from the University of Warwick Business School. One of her career highlights of which she is most proud is the naming of stream in Antarctica – Lawson Creek – in her honour in 1995.

James Mansell
Business owner at Noos Ltd

James is an independent consultant who also provides mentoring courses and presentations on leadership big data and government. James champions the safe use of data science to deliver public and economic value. This includes supporting organisations to use analytics and shared data to solve challenges in child protection, social development, education, tax, and health.

At a whole of government level James is supporting ministers and senior officials in New Zealand and Australia to adapt to and use data science to better orientate the state sector to be more outcomes focused and innovative. This includes building the right kind of national data ecosystem required for safe use of data science and data sharing.

In 2011 James was awarded the public sector's Leadership Development Centre (LDC) fellowship prize. This was used to study leadership at Harvard the Wharton School and Centre for Creative Leadership. He holds a first class honours degree in Philosophy from Victoria University of Wellington.

Professor Jim Metson
Deputy Vice-Chancellor (Research), University of Auckland

Arthur completed his PhD in Economics at the London School of Economics in 1987 following Professor Jim Metson is the Deputy Vice-Chancellor (Research) at the University of Auckland. He recently stood down from his role as Chief Science Adviser for the Ministry of Business, Innovation and Employment. With experience in academic research, working with industry and also with government, his past positions include: Deputy Dean of the University of Auckland's Faculty of Science, Associate Director of Light Metals Research Centre (LMRC), a Councillor for the Australian Institute of Nuclear Science and Engineering, the Chair of the Australian Synchrotron Science Advisory Committee, the former Head of the School of Chemical Sciences, chair of the Research Infrastructure Advisory Group (RIAG) for MBIE's predecessor MoRST, and a Principal Investigator of the MacDiarmid Institute.

Dr Kevin Ross
Research Director, Orion Health

Dr Kevin Ross is Research Director at Orion Health where he leads a program to utilise analytics and data science to improve clinical workflow, decision-making, and patient-centered care. Prior to joining Orion Health, Kevin was Chief Scientist of Optimisation Modelling at Fonterra. In 2013, he founded the New Zealand Analytics Forum – a group of professionals committed to learning and sharing best practice analytics to help make a positive impact in the country. Prior to joining Fonterra in 2012 he was an Associate Professor of Technology and Information Management at the University of California Santa Cruz. His research and teaching focussed on network scheduling and optimisation including contributions to air traffic management and call centre design. He has consulted for energy telecommunication and public service organisations. Dr Ross holds a PhD from Stanford University in Management Science and Engineering and a BSc(Hons) from the University of Canterbury in Mathematics.

International Advisory Board

Professor Alan Hastings
University of California, Davis

Professor Alan Hastings is interested in a range of topics in theoretical ecology and population biology, and more generally in mathematical biology.

He is a Professor in the Department of Environmental Science and Policy and also a member of the Centre for Population Biology. Alan completed his PhD in Applied Mathematics at Cornell University in 1977 under the supervision of Simon A. Levin and have been at UC Davis (located in beautiful Davis, California) since 1979. He is the founding Editor in Chief of the journal Theoretical Ecology, published by Springer.

Professor Bronwyn H. Hall
University of California, Berkeley

Bronwyn H. Hall is Emerita Professor at the University of California at Berkeley, a Research Associate of the National Bureau of Economic Research and the Institute for Fiscal Studies, London, and a Visiting Fellow at NIESR, London. She currently serves as an associate editor of the Economics of Innovation and New Technology, and of Industrial and Corporate Change. She is also a member of several advisory boards (Solvay Brussels School of Economics and Management, European Patent Office, DIW – German Institute for Economic Research). She received a BA in physics from Wellesley College in 1966 and a Ph.D. in economics from Stanford University in 1988.

Professor Frank Kelly
Fellow of Royal Society
Professor of the Mathematics of Systems
University of Cambridge

Frank Kelly is Professor of the Mathematics of Systems in the University of Cambridge. He was elected a Fellow of the Royal Society in 1989, and a Foreign Member of the National Academy of Engineering in 2012. In 2013 he was awarded a CBE for services to mathematical sciences.

His main research interests are in random processes, networks and optimization. He is especially interested in applications to the design and control of networks and to the understanding of self-regulation in large-scale systems.

From 2003 to 2006 he served as Chief Scientific Adviser to the United Kingdom's Department for Transport. He was chair of the Council for the Mathematical Sciences, and a member of the RAND Europe Council of Advisors.

Professor Ian Foster
Director, Computation Institute

University of Chicago

Ian Foster, Senior Fellow, is Director of the Computation Institute, a joint institute of the University of Chicago and Argonne National Laboratory. He is also an Argonne Senior Scientist and Distinguished Fellow and the Arthur Holly Compton Distinguished Service Professor of Computer Science.

Ian received a BSc (Hons I) degree from the University of Canterbury, New Zealand, and a PhD from Imperial College, United Kingdom, both in computer science. His research deals with distributed, parallel, and data-intensive computing technologies, and innovative applications of those technologies to scientific problems in such domains as climate change and biomedicine. Methods and software developed under his leadership underpin many large national and international cyberinfrastructures.

Dr Foster is a fellow of the American Association for the Advancement of Science, the Association for Computing Machinery, and the British Computer Society.

Professor Julia Lane
Wagner School of Public Policy at New York

Julia Lane is a Professor in the Wagner School of Public Policy at New York University. She is also a Provostial Fellow in Innovation Analytics and a Professor in the Centre for Urban Science and Policy. Julia has published over 70 articles in leading economics journals, and authored or edited ten books. She has been the recipient of over $50 million in grants and has organized over 40 national and international conferences, received several national awards, given keynote speeches all over the world, and serves on a number of national and international advisory boards.

Professor Manuel Trajtenberg
Tel Aviv

Manuel Tajtenberg is an economist and chair of the Planning and Budgeting Committee of the Council for Higher Education in Israel. Manuel graduated from the Hebrew University of Jerusalem with a major in economics in 1973 and completed a master's degree in economics and sociology in 1976, also at the Hebrew University. In 1984 he received his PhD from Harvard University for work entitled 'Economic Analysis of Product Innovation: The Case of CT Scanners.' Upon completing his PhD, he returned to Israel, and has since been serving as a professor in the Tel-Aviv University School of Economics.

Trajtenberg has served in several public roles. He was a consultant to the Ministry of Industry, Trade and Labour and to the Prime Minister's Office. In 2006 he was appointed the first chair of the Israeli National Economic Council.

Professor Philip McCann
Groningen

Philip McCann trained as an economic geographer. He studied at and gained his PhD (1993) from the University of Cambridge (UK) and then worked at the University of Pennsylvania in the US (1993-1995), the University of Reading (UK) (1995-2005) and the University of Waikato in New Zealand. At Reading he was a professor of Urban and Regional Economics, in Waikato a professor of Economics. He has also been a guest professor in the US, Japan, Thailand and Italy. He has long had an intensive relationship with the Faculty of Spatial Sciences in Groningen, which he regularly visits for guest lectures, seminars and PhD ceremonies.

Philip McCann's research covers a wide range of topics. Much of his research has been financed by extra-university clients such as the British Ministry of Trade and Industry, the EU and the OECD.

Research Committee

Professor Shaun Hendy
University of Auckland

Associate Professor Alex James
University of Canterbury

Professor Tava Olsen
University of Auckland

Professor Stephen Marsland
Massey University

Dr Siouxsie Wiles
University of Auckland

Dr Isabelle Sin
Motu Research

Dr Jeanette McLeod
Canterbury University

Professor Adam Jaffe
Motu Research

Kate Hannah
University of Auckland

Kyle Higham
Victoria University of Wellington

Te Pūnaha Matatini Whānau

Kyle Higham (Chair), Victoria University of Wellington
Reno Nims (Vice-Chair), University of Auckland
Audrey Lustig (Treasurer), University of Canterbury
Catriona Sissons (Immediate Past-Chair), University of Auckland
Emma Vitz (Communications), University of Auckland
Mubashir Qasim, University of Waikato
Hamza Ajmal, University of Waikato
Jonathan Goodman, University of Auckland
Elisenda Ortiz, Victoria University of Wellington
Demival Vasques Filho, University of Auckland

Principal Investigators

Professor Adam Jaffe
Motu Research

Associate Professor Alex James
University of Canterbury

Associate Professor Alexei Drummond
University of Auckland

Professor Andy Philpott
University of Auckland

Dr Dave Maré
Motu Research

Dr Dion O'Neale
University of Auckland

Associate Professor Ilze Ziedins
University of Auckland

Dr Izi Sin
Motu Research

Professor James Sneyd
University of Auckland

Dr Jeanette McLeod
University of Canterbury

Associate Professor Marcus Frean
Victoria University of Wellington

Professor Mark Gahegan
University of Auckland

Associate Professor Michele Governale
Victoria University of Wellington

Professor Mike O'Sullivan
University of Auckland

Associate Professor Mike Plank
University of Canterbury

Professor Peter Davis
University of Auckland

Professor Richard Easther
University of Auckland

Professor Sally Davenport
Victoria University of Wellington

Professor Shaun Hendy
University of Auckland

Professor Stephen Marsland
Massey University

Dr Suzi Kerr
Motu Research

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University of Auckland

Professor Thegn Ladefoged
University of Auckland

Professor Uli Zuelicke
Victoria University of Wellington

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Landcare Research

Dr Barry Milne
Compass

Associate Professor Cameron Walker
University of Auckland

Dr Cate Macinnis-Ng
University of Auckland

Dr Dan Hikuroa
University of Auckland

Dr David Welch
University of Auckland

Dr Emily Harvey
Massey University

Associate Professor Isabel Castro
Massey University

Professor Les Oxley
Waikato University

Dr Mark Wilson
University of Auckland

Associate Professor Melinda Allen
University of Auckland

Dr Michael O'Sullivan
University of Auckland

Dr Michelle Dickinson
University of Auckland

Professor Murray Cox
Massey University

Dr Pierre Roudier
Landcare Research

Dr Rachael Ka'ai-Mahuta
University of Auckland

Dr Rachelle Binny
Landcare Research

Dr Rebecca Priestley
Victoria University of Wellington

Dr Rhian Salmon
Victoria University of Wellington

Dr Roger Pech
Landcare Research

Mr Roy Lay-Lee
Compass

Dr Simone Linz
University of Auckland

Dr Siouxsie Wiles
University of Auckland

Dr Steffen Lippert
University of Auckland

Dr Troy Baisden
GNS Science

Postdoctoral Fellows

Postdoctoral fellow	*Supervisor*
Dr Addison Pan	Steffen Lippert
Dr Adrian Croucher	Mike O'Sullivan
Dr Audrey Lustig	Alex James, Mike Plank
Dr Daniel Lond	Alex James, Mike Plank
Dr Rachelle Binny	Andrea Byrom

PhD Students

Name	*Supervisor*	*Institution*
Alex Wang	Ilze Ziedins	University of Auckland
Alex Jorgensen	Thegn Ladefoged	University of Auckland
Amir Ghodrati	Stephen Marsland	Massey University
An Yu Yu	Cameron Walker	University of Auckland
Avinesh Pillai	Cameron Walker	University of Auckland
Ben Cranston	Cate Macinnis-Ng	University of Auckland
Catriona Sissons	Dion O'Neale, Shaun Hendy	Univeristy of Auckland
Demival Vasques Filho	Dion O'Neale	University of Auckland
Elvar Bjarkason	Michael O'Sullivan	Univeristy of Auckland
Jericho Omagbon	Michael O'Sullivan	University of Auckland
Jiri Moravec	Stephen Marsland	Massey University
Jo Bailey	Rebecca Priestley, Rhian Salmon	Victoria University
Jonathan Goodman	Alex James, Rachelle Binny	University of Auckland
Julie Mugford	Alex James, Andrea Byrom	University of Canterbury
Kanokporn Pongjetanapong	Cameron Walker	Univeristy of Auckland
Kian Wee Soh	Michael O'Sullivan	University of Auckland
Kyle William Higham	Adam Jaffe, Michele Governale, Uli Zuelicke	Victoria University of Wellington
Liza Bolton	Barry Milne	University of Auckland
Michael Hackney	Alex James, Mike Plank	University of Canterbury
Miriam Scotter	Cameron Walker	University of Auckland
Mubashir Qasim	Les Oxley	University of Waikato
Neda Sakhaee	Mark Wilson	University of Auckland
Niffe Hermansson	Ilze Ziedins	University of Auckland
Peiran Quan	Michael O'Sullivan	University of Auckland
Ploy Pongjetanapong	Michael O'Sullivan	University of Auckland
Raneetha Abeywickrama	Ilze Ziedins	University of Auckland
Reno Nims	Thegn Ladefoged, Melinda Allen	University of Auckland
Ryan Tonkin	Michael O'Sullivan	University of Auckland
Samin Aref	Mark Wilson	University of Auckland
Sandra Cortes Acosta	Suzi Kerr	Victoria University
Stephen Merry	Jeanette McLeod, Mike Plank	University of Canterbury
Steven Turnbull	Dion O'Neale	University of Auckland
Thomas Adams	Cameron Walker, Michael O'Sullivan	University of Auckland

Honours Students

Name	*Supervisor*	*Institution*
Angela Natali	Isabelle Sin, Sally Davenport	Victoria University of Wellington
Beth Rust	Rebecca Priestley	Victoria University of Wellington
Charlie Norton	Mike O'Sullivan	University of Auckland
Christina Yin-Chieh Lin	Mike O'Sullivan	University of Auckland
Edmund Lou	Suzi Kerr	Motu Economic and Public Policy Research
Hayley Glover	Thegn Ladefoged	University of Auckland
June Lau	Ilze Ziedins	University of Auckland
Muyang Gao	Michael O'Sullivan	University of Auckland
Nickolas Morton	Shaun Hendy	University of Auckland
Sarah Bradley	Thegn Ladefoged	University of Auckland

Masters Students

Name	*Supervisor*	*Institution*
Bonnie Yu	Shaun Hendy	University of Auckland
Darby Filimoehala	Melinda Allen	University of Auckland
Dong-hwan Kim	Suzi Kerr	Seoul National University
Elisenda Ortiz Castillo	Marcus Frean	Victoria University of Wellington
Fatima Alshami	Michael O'Sullivan	Univeristy of Auckland
Lijun Wang	Ilze Ziedins	University of Auckland
Matthew Gibbons	Les Oxley	University of Waikato
Mitchell Easter	Suzi Kerr	Univeristy of Auckland
Tony Butler-Yeoman	Marcus Frean	Victoria University
Will Collin	Suzi Kerr	University of Canterbury

2017/2018 Summer Interns

Intern	*Project title*	*Industry/ sector partner*	*Industry supervisor*	*TPM supervisor*	*Location*
Bella Hannah	Kindness in science	TPM	Tammy Steeves	Kate Hannah	AKL
Beth Rust	Hidden networks	VUW/TPM	Rebecca Priestley	Kate Hannah	WGTN
Brianne Halbert	Data analysis and visualisation	Ngāti Whātua Orākei	Anne Gibbon	Dion O'Neale	AKL
Demival Vasques Filho	Using financial data to identify disease outbreaks	Westpac	Matt Haigh	Shaun Hendy	AKL
Diego Enriquez	Using financial data to identify disease outbreaks	Westpac	Matt Haigh	Shaun Hendy	AKL
Emma Vitz	Gender equity sorting algorithms	N/A	Kate Hannah	Kate Hannah	AKL
Georgia Nixon	Stakeholder mapping	Predator Free NZ	Andrea Byrom	Shaun Hendy	AKL
Hannah Kotula	How do stoats, rats and kiwi interact in an ever-changing world	TPM/Manaaki Whenua	Andrea Byrom	Alex James	CHCH
Isabella Lyons	Developing synthetic measures of NZGSS wellbeing outcomes	Social Investment Agency	Douglas Lambert	Dave Maré/Izi Sin	WGTN
James Gilmour	Optimisation	Defence Technology Agency	Michael Lauren	Tava Olsen	AKL
Karan Dasgupta	Metrics for TPM	TEC/ Ministry of Education	Warren Smart	Kate Hannah/ Shaun Hendy	AKL
Lauren Watson	Data analysis and visualisation	Ngāti Whātua Orākei	Anne Gibbon	Dion O'Neale	AKL
Lijun Wang	Using financial data to identify disease outbreaks	Westpac	Matt Haigh	Shaun Hendy	AKL
Max Bunting	Kōrero Māori	Dragonfly/Te Hiku	Ed Abraham	Keoni Mahelona	WGTN
Nick Morton	Cleantech mapping/ TPM annual report survey and PMF data	UniServices	Analeise Murahidy	Shaun Hendy/ Kate Hannah	AKL
Rose Chisnall	Gender and societies	UC/TPM	Kate Hannah	Alex James	CHCH
Sam Davidson	Pest detectability	UC/Manaaki Whenua	Andrea Byrom	Alex James	CHCH
Stephen Merry	Social network opportunities	Social Investment Agency	Douglas Lambert	Dave Maré/Izi Sin	WGTN
Tayla Schaapveld	Data analysis and visualisation	Ngāti Whātua Orākei	Anne Gibbon	Dion O'Neale	AKL
Walter Lowe	Lifetime wellbeing model for New Zealand children	Oranga Tamariki (MVC)	Daniel Miles	Arthur Grimes	WGTN
William Asiata	Kōrero Māori	Dragonfly/Te Hiku	Ed Abraham	Keoni Mahelona	WGTN

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Te Pūnaha Matatini
Data ▪ Knowledge ▪ Insight

Cover image: Hunter River, South Island, New Zealand / David Wall.