

Te Pūnaha Matatini
Data ■ Knowledge ■ Insight

Annual Report 2015



A Centre of Research Excellence hosted by the University of Auckland



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About Us

Our Partners

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

Partners:



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 Ōtāgo

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

2012

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

Early 2013

Kate Hannah comes on board as bid manager.

Mid 2013

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

October 2013

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 diversity, 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>



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

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

Official launch of the Centre.

Centre grows to include:

- 24 Principal Investigators
- 15 Associate Investigators
- Executive Management Team of 3
- over 100 students aligned with Te Pūnaha Matatini Whānau
- 8 students directly funded by or working on Te Pūnaha Matatini projects.

Early 2014

January 2015

February 2015

December 2015

Board Chair's Report



It is a pleasure to welcome readers to the first Annual Report of Te Pūnaha Matatini. Much has been accomplished in the first year of the Centre's operation.

To make the journey from an initial decision to set up the Centre of Research Excellence to an active, operating, and effective Centre in little over one year is a wonderful achievement. I would like to thank all the organisations involved for their efforts and commitment to make this happen. To harness the energy and the passion of researchers, students, investigators from a number of universities (Auckland, Canterbury, Victoria, and Massey) and Motu is no mean feat; as I know from my experience in managing large, multi-discipline, geographically-spread project engineering teams.

I believe the reader will find the research and work being done by the Centre exciting. It is like seeing for the first time what can be unlocked from large complex data systems, or complex economic and social systems, let alone the complexity in the biosphere. The more that is unlocked the greater the benefit to our economy and society, as well as growing the reputation of the Centre.

Much can be said about our first year of operation. However, there are some highlights that I would like to mention here in my report. A measure of success of any organisation is demonstrated by the reaction of external stakeholders to its activities. Our external revenue target for the first year was set at \$250,000. This target was substantially exceeded with actual revenue being \$312,478 which is an excellent outcome for our first year. In addition, many enquiries are being received from external parties as the work of the Centre becomes better known.

The ability of the Centre to form relationships with external parties is important. In this first year key relationships have been built with the Ministry of Social Development, the Productivity Commission and the data science company, Qrious. These relationships have resulted in ongoing collaborative research projects.

A third highlight is the public recognition given to a number of our researchers. I would like to make special mention of

Dr Michelle Dickinson, who won the Callaghan Medal, and Dr Izi Sin and Dr Simone Linz, who were each awarded Marsden Fast Start grants.

It is also appropriate that I direct the reader's attention to the activities of Te Pūnaha Matatini Whānau. I believe this is a great initiative, which welcomes all who feel their research aligns in some way with the principal research themes of the Centre.

I would also like to thank Professor Shaun Hendy for his hard work as Director of the Centre and the members of his Executive Team. It has been a great first year and I know I speak for all members of the Advisory Board when I say we are very much looking forward to the second year of Te Pūnaha Matatini's operation.

A handwritten signature in blue ink that reads "Richard Aitken".

Richard Aitken
Board Chair

Director's Report



Reflecting on our first year in operation, I feel very privileged to have had the opportunity to lead an organisation as new and as exciting as Te Pūnaha Matatini. In particular, the energy and enthusiasm of Te Pūnaha Matatini's investigators has surpassed all my expectations.

Interdisciplinary research is hard, and some of the challenges we have set ourselves as a Centre of Research Excellence (CoRE) are even harder. The sense of community that has developed amongst us will be vital to meeting our own expectations for Te Pūnaha Matatini, as well as those of the Tertiary Education Commission and our other stakeholders.

The year really began for us with our launch in February at the University of Auckland, and concluded in December with our Investigator Hui at the University of Canterbury. In between these two events, Te Pūnaha Matatini grew out of its set-up phase to become an operational Centre of Research Excellence. Most of our projects, research and otherwise, are now under way and will begin to bear fruit over the next five months. Our key staff are in place and most of our PhD students have commenced their studies or will shortly do so. The challenge for the next few years is to build on this momentum, while maintaining focus and allowing collaborations to mature.

During this first year, we put considerable effort into establishing a strong organisational culture and developing an identity that was distinct from our host and partner organisations. This means taking our values seriously and acting on them. Early in 2015 we agreed to only sponsor events that had effective policies in place to address diversity. Poor workforce diversity is an all too evident shortcoming of both science and the industry sectors that we serve. We were very proud of the fact that our policy to address this had a significant impact on the Royal Society of New Zealand's Honours Dinner last year. There was a noticeable effort to improve the visibility of women researchers at the dinner, and Richard Bedford, the current President of the Royal Society, has thanked us for prompting this change. I was also very proud that one of our investigators, Dr Michelle Dickinson, was awarded the Callaghan Medal for Science Communication at the dinner.

We have had a number of early successes in our research programme, which you will read about in this report. This has established a national reputation for Te Pūnaha Matatini as a thought-leader with the ability to influence government policy and carry out research with commercial significance. We have had success in attracting external research income, and have developed a public profile that is attracting students, research opportunities, and approaches from the media. We have built close relationships with government and with a number of data science companies. We are well set up for a transformative next few years that will make a real and positive impact on the lives of New Zealanders.

Our emerging researcher network, Te Pūnaha Matatini Whānau, have also had a very successful first year. Rachelle Binny (now Dr Binny), the inaugural Whānau chair, pulled together a strong and talented national committee (Catriona Sissons, Ben Curran, François Vallée, and Audrey Lustig). The committee organised their first retreat in Kaikoura in August, and contributed significantly to the success of the first Pitch on the Plains event in Christchurch, where eight students pitched their ideas to a Return on Science investment panel. The Whānau membership now exceeds fifty and has strong representation from around the country.

Let me conclude my comments on our first year by giving more thanks. Firstly, let me thank the members of our Advisory Board (Richard Aitken, John Hosking, Jane Harding, Wendy Lawson, Arthur Grimes, James Mansell, Lillian Grace, and Kevin Ross) for their advice and advocacy. I would particularly like to acknowledge the contribution of Jane Harding, who stepped down from our Board at the end of 2015. I would also like to thank my Executive Team (Kate Hannah, Andy Philpott, Alex James and Adam Jaffe), our Administration Team (Sarah Hikuroa and Danene Jones), and the other members of our Research Committee (Izi Sin, Alexei Drummond, and Uli Zuelicke) for their efforts in establishing our processes and making them work in a very active first year.

A handwritten signature in blue ink that reads "SCHAUN HENDY".

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 by building on collaborations with researchers at the Māori Centre of Research Excellence and working with Māori communities

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 Száshy 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 Ngata, 1874-1950





2015 Highlights

Associate Investigator Pierre Roudier in Miers Valley, Antarctica. *Image credit: Pierre Roudier.*

Realising Our Vision





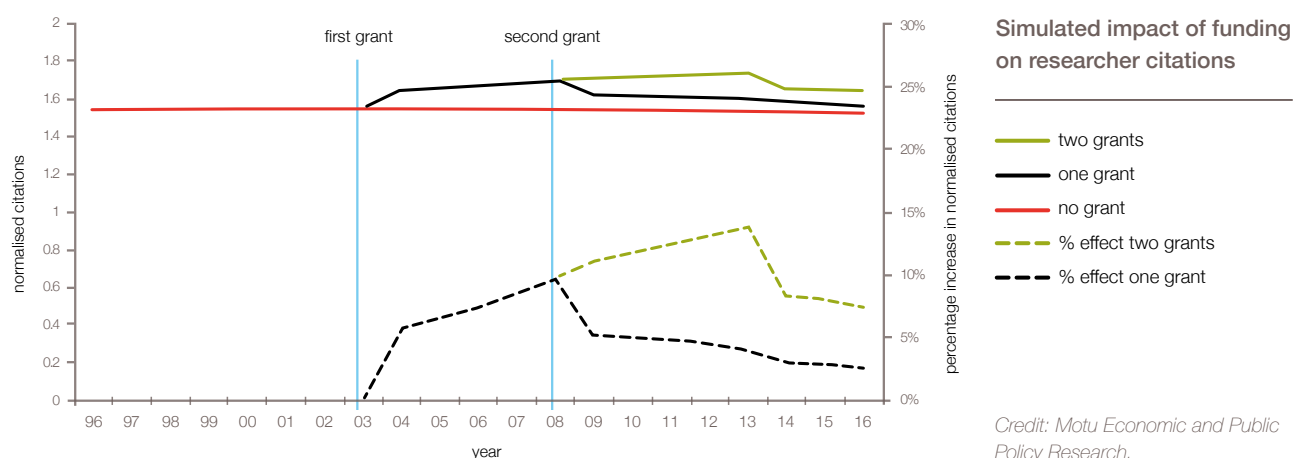
Principal Investigator Adam Jaffe.

Evaluating the Marsden Fund

In 2015 New Zealand's premiere funding mechanism for blue skies science research, the Marsden Fund, received criticism in the media regarding its selection processes.

Adam Jaffe, Director of Motu Economic and Public Policy Research and a Te Pūnaha Matatini Principal Investigator, worked with the Royal Society of New Zealand to evaluate and identify opportunities to improve their decision-making processes.

Adam demonstrated that receiving a Marsden grant leads to higher productivity and impacts in terms of papers published and citations received. Adam and his team also found there is no reason to expect diminishing returns if Marsden funding were increased. The study demonstrated the benefits of the sustained collection and retention of science and innovation data.



Credit: Motu Economic and Public Policy Research.



Adam Jaffe discusses his Marsden Fund evaluation on Radio New Zealand's *Nine to Noon*.
<http://bit.ly/2dcqXNh>





Image credit: istock.com/THPStock.

Providing training and mentoring opportunities for students

Te Pūnaha Matatini welcomed aboard a number of undergraduate students as research assistants or summer students in December 2015. The students became known as the 'Junior Data Poets' and worked on various projects across multiple disciplines.

The summer projects helped the students gain access and experience with leading academic and industry professionals, and opened doors to further career development opportunities.

New rugby insights

Wil Undy, a second year Bachelor of Arts (history) and Science (mathematics) student, was one such student. Wil spent the summer analysing data from New Zealand Rugby to determine the best method for predicting how Super Rugby teams would perform from season to season. Most prediction algorithms use win/loss data or points margins for prediction. Wil's research compared these traditional methods with a network-

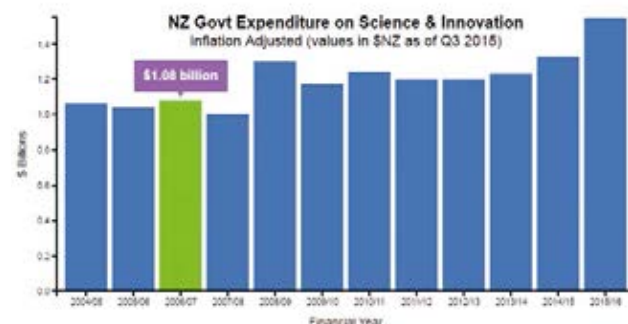
based algorithm that makes predictions using properties of the connections between teams, training squads, and coaches.

The project enabled Wil to work closely with Te Pūnaha Matatini Principal Investigator Dr Dion O'Neale and NZ Rugby's senior scientist Dr Ken Quarrie, as well as spend a week at the New Zealand Herald Insights data journalism unit. Wil is now working on an academic paper detailing his findings and will be presenting the work at an international conference in 2016.

Of the experience, Wil says, "The skills I have learnt will help me as I further my study in statistics and provide the foundation for my future work in the data science field."

A closer look at the National Statement of Science Investment

Other students involved in summer projects have gone on to present their work at conferences, such as the 2016 New Zealand Association of Scientists conference. Students Nicola Gujer and Catherine Webb presented a redesign of the National Statement of Science Investment at the conference, which was acknowledged by the Ministry of Innovation, Business and Employment (MBIE) as contributing to a redesign of the way science investment data is reported.



Credit: Catherine Webb and Nicola Gujer.

Pitch on the Plains

In December 2015, Te Pūnaha Matatini, in conjunction with Return on Science, held Pitch on the Plains – an early career researcher event in which students pitched ideas emerging from their research to an expert panel.

The panel, made up of Lance Wiggs, Chair of the ICT panel within Return on Science and Founder and Director of the Punakaiki Fund; Sacha Judd, Managing Director of Hoku Group, co-host of Refactor, and co-founder of The Flounders' Club; and Kjesten Wigg, Programme Director, Multinational Research and Development Attraction with MBIE, were hugely impressed with the calibre and diversity of pitches from students. The pitched projects had to be related to the students' research, and to have a clear potential for commercial or social enterprise applications.

The successful application of complex systems and networks knowledge to real-world, commercialisable problems is a key focus for Te Pūnaha Matatini and our students

The panel provided expert advice and feedback to all participants, and offered mentoring to the winners, Oscar Dowson from the University of Auckland (supervised by Professor Andy Philpott), and Matthew Ruffles from the University of Canterbury (supervised by Dr Jeanette McLeod).

Oscar's proposed commercialisation project will be worked through with Return on Science mentors once he has completed his PhD, while Matthew is currently working on establishing a more detailed pitch and business plan to present to potential investors with the support of Return on Science.

For subsequent events, we are providing further pitch development opportunities so as to better prepare students for the chance to pitch their work to real angel investors.



Oscar Dowson: a Pitch on the Plains winner.



A commitment to diversity

Te Pūnaha Matatini is committed to increasing diversity in science and technology and in 2015 we took a number of steps towards that aim.

In 2015 we developed a sponsorship policy that ensures we only support conferences and other events that can demonstrate a commitment to gender equity. The Association of Centres of Research Excellence (aCoRE) has adopted a similar policy after a presentation of our policy and approaches.

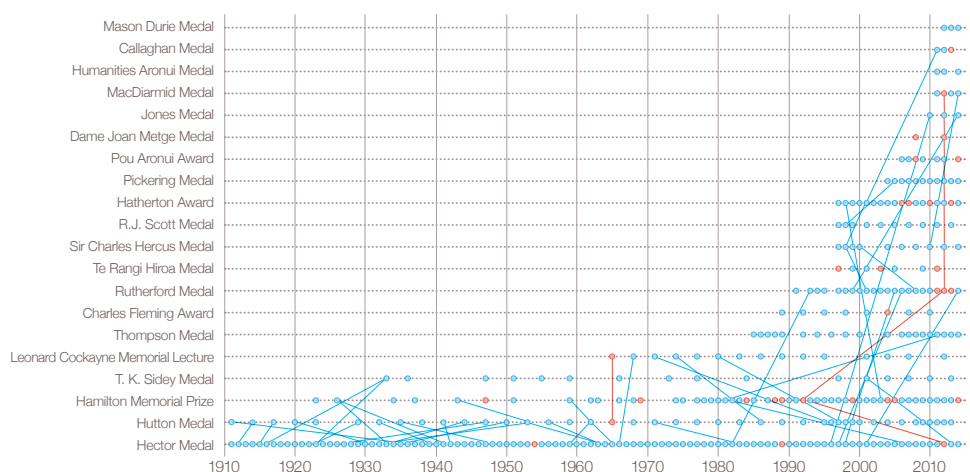
We're also encouraging conversations around diversity more broadly as demonstrated when we instigated a conversation with the Royal Society of New Zealand regarding its Honours Dinner. The conversation highlighted Executive Manager Kate Hannah's work, in collaboration with Principal Investigator Dr Dion O'Neale, analysing the gender breakdown of the awards and prizes of the Royal Society over its 149-year history.

The Royal Society responded with a clear commitment to both increase the visibility of diversity at the event itself, and to increase the number of women nominated for prizes and awards. This in turn has led to further conversations about gender and other diversity with both the Society's President, Richard Bedford, and Chief Executive, Andrew Cleland.



Dr Michelle Dickinson, recipient of the 2015 Callaghan Medal from the Royal Society of New Zealand.

Dr Siouxsie Wiles, recipient of the 2013 Callaghan Medal from the Royal Society of New Zealand.



RSNZ Awards visualisation

Prizes, medals, and assorted other honours awarded by the Royal Society of New Zealand with awardees colour-coded by gender. Points indicate when a prize was awarded, lines indicate that prizes were won by the same person. The code is a modification of Mike Bostock's visualisation in d3 of Marey's train timetable.

Visualisation by Dion O'Neale.
Concept by Kate Hannah.

—●— male —●— female



Executive Manager Kate Hannah discusses the gender breakdown of the Royal Society of New Zealand's awards and prizes.

www.tepunahamatatini.ac.nz/a-prize-of-ones-own/





Te Pūnaha Matatini Director Shaun Hendy works with students from Manurewa High School. *Image credit: Dr Sarah Morgan.*



Intern Tulele Masoe. *Image credit: Dr Sarah Morgan.*



Dr Sarah Morgan, programme manager for the Participatory Science Platform – South Auckland, with intern Tulele Masoe and a student from Rongomai School.

Supporting community-driven science

In 2015, Te Pūnaha Matatini funded an internship position for Tulele Masoe at SouthSci, the Science in Society Participatory Science Platform pilot in South Auckland.

Tulele, a Bachelor of Civil Engineering and Bachelor of Science (Applied Mathematics), assisted in communicating and marketing the project, and supported community groups to design, implement, and evaluate science research projects of local benefit and interest.

Te Pūnaha Matatini researchers, including the Executive Team, were able to develop new relationships with South Auckland schools and community groups through our involvement with SouthSci. These relationships will continue to develop in 2016 via ongoing collaboration with SouthSci and the communities of South Auckland.



Roland Brown, far left, researching eels in a Gisborne stream. Image credit: Roland Brown.

Partnering with Ngā Pae o te Māramatanga

In 2015, Ngā Pae o te Māramatanga, the Māori Centre of Research Excellence, was refunded for six years, and Te Pūnaha Matatini revised its key performance indicators for supporting the distinctive contribution of Māori and Mātauranga Māori to reflect our partnership model with Ngā Pae o te Māramatanga.

Each year, two Māori undergraduate or graduate students will be supported in co-funded Ngā Pae o te Māramatanga and Te Pūnaha Matatini summer scholarships. In 2015, these summer scholarships were offered to Roland Brown and Hitaua Aranga-Doyle.

Roland, supervised by Associate Investigator Dr Daniel Hikuroa (Ngā Pae o te Māramatanga, University of Auckland) and Dr Ian Ruru (Ngā Pae o te Māramatanga, Gisborne District Council), evaluated and analysed data collected by Gisborne District Council regarding the deaths of eels in a Gisborne stream next to the Paokahu Landfill. Hitaua, supervised by Dr Dianne Ruwhiu (Ngā Pae o te Māramatanga, University of Otago) developed a localised case study with stakeholders the Kāti Huirapa Rūnaka, conducting an asset base analysis, and identifying potential commercial opportunities for development.

This partnership model typifies Te Pūnaha Matatini's approach to our outcomes statement of supporting the distinctive contribution of Māori to complex systems and networks through both community engagement, and working with existing Māori entities to develop further opportunities for capability building.



Dr Daniel Hikuroa. Image credit: Ngā Pae o te Māramatanga.

Realising Our Values





Increasing our national and international visibility

2015, as Te Pūnaha Matatini's first year of operation, was a critical time to increase our national and international visibility.

Visits from our International Advisory Board members

In 2015 we hosted three International Advisory Board members: Professors Ian Foster (Chicago), Alan Hastings (UC Davis), and Bronwyn Hall (UC Berkeley), ensuring that our research excellence and people-centred approach is shared internationally in the community of complexity scholars.

Professor Ian Foster, from the University of Chicago and Argonne National Lab, joined us as the keynote speaker at Te Pūnaha Matatini's launch in February. Professor Foster, a Kiwi expat, is often described as the "father of cloud computing". On his return, he wrote a blog about our launch: "...the ambition and beauty of Te Pūnaha Matatini is that these topics are all connected – they each involve complex systems, network effects, and researchers imaginative enough to cross disciplinary boundaries. I am not sure that this dynamic group is entirely typical of New Zealand researchers, but I left the meeting feeling tremendously excited for the future of Kiwi science and innovation." Professor Foster also spoke at the Multicore world conference in Auckland.

Professor Alan Hastings, the eminent mathematical biologist from the University of California at Davis and member of our International Advisory Board, visited in August and September with the assistance a University of Auckland Distinguished Visitor Award. Alan gave public talks in Auckland, Christchurch,

and Dunedin, and attended the Complexity and the Biosphere Theme meeting as a keynote speaker. Professor Bronwyn Hayward, one of the world's pre-eminent innovation economists, visited for Te Pūnaha Matatini's Investigator Hui at the University of Canterbury in early December. Bronwyn also attended the Productivity Commission's annual Productivity Symposium "Growing more innovative and productive Kiwi firms" as keynote speaker.

Santa Fe Institute

Te Pūnaha Matatini students are also contributing to our growing international reputation. Through a connection with the Santa Fe Institute's early-career researcher network, Catriona Sissons and Demival Vasques Filho laid the groundwork for Te Pūnaha Matatini to host a Santa Fe Institute Summer School in late 2017.

Professor Alexei Drummond in Switzerland

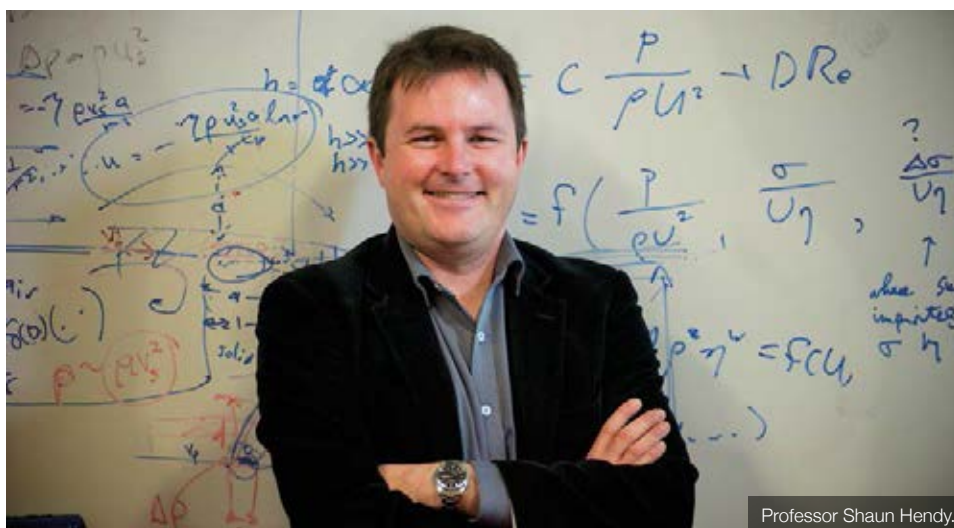
Professor Alexei Drummond participated in a long-term research stay permitted by special leave to pursue joint research on Bayesian phylodynamics with Professor Tanja Stadler of D-BSSE, ETH Zurich at the Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland. The collaboration also involved a number of students from his research group.



Professor Ian Foster talks about the new research network in New Zealand.

<http://bit.ly/2cEBNjd>





Professor Shaun Hendy.



Director Shaun Hendy presents to Whānau students at the Kaikoura retreat.



Dr Siouxsie Wiles.

Contributing to science communication

The role of science and scientists in communicating complex information in times of uncertainty is a key focus for Te Pūnaha Matatini's skills development.

In 2015, a national conversation was occurring regarding the role of the scientist as critic and conscience. Te Pūnaha Matatini researchers and staff contributed to shaping that conversation throughout the year: Associate Investigator Dr Siouxsie Wiles shared her experiences of 'going public' at the New Zealand Association of Scientists' annual conference; Director Shaun Hendy negotiated a book deal with publisher Bridget Williams Books for a book called *Silencing Science* (release date 8 May, 2016); and we had ongoing and impactful conversations with the Royal Society of New Zealand about the proposed Guidelines for Public Engagement.

In 2015 Te Pūnaha Matatini also developed an approach to communicating complex science that begins with well-trained and equipped researchers. We partnered with the Science Media Centre to develop a customised Science Media Savvy Course for our researchers and students that included well-known data journalist Keith Ng, and had a focus on visualising date-driven research.

Students' communication skills were also supported by a virtual seminar titled '14 Ways of looking at a grant proposal, with apologies to Wallace Stevens' presented by Executive

Manager Kate Hannah. Other communication training activities included a mock TV newsroom experience led by Director Shaun Hendy at the student retreat in Kaikoura.

Once researchers and students are equipped with tools, resources, and experience, the Te Pūnaha Matatini approach is to provide multiple opportunities for both media-led engagement and personal engagement – through our blog and other social media. By the end of 2015, more than a dozen of our investigators were tweeting regularly.

2015 stats



836 Twitter followers



566 website page views/week



Principal Investigator Suzi Kerr. Image credit: Motu Economic and Public Policy Research.

Shaping a national conversation on climate change

Principal Investigator Dr Suzi Kerr's economic research has made her an authoritative voice in the debate about emissions trading schemes.

In the lead up to the Paris Climate Change talks in late 2015, Suzi was highly sought after by the media for commentary and expert opinion on climate change, emissions trading schemes, and carbon markets.

Suzi was interviewed by the *New Zealand Herald*, *National Business Review*, and *Stuff*, and sat on a panel discussion chaired by Radio New Zealand's Kim Hill regarding "green growth" and the use of economics to drive change.



Principal Investigator Dr Suzi Kerr from Wellington-based Motu Economic and Public Policy Research discusses New Zealand's emissions trading scheme in a *New Zealand Herald* Q & A. <http://bit.ly/1ZNI9Of>





Director Shaun Hendy speaking at the Wicked Problems – Senior Practitioner event. Image credit: Fiona Goodall.

Sponsorship

Te Pūnaha Matatini has instituted a sponsorship policy to ensure that events we support reflect our diverse, 21st century society.

In 2015 we worked with the following events, informing the relevant organisations of our stance, and assisting with identifying suitable speakers and panellists:

- Royal Society of New Zealand (RSNZ) Honours Dinner
- New Zealand Mathematical Society Colloquium – Te Pūnaha Matatini sponsored the welcome reception and Women in Mathematics networking event
- Siouxsie Wiles' talk 'Illuminating new medicines' in Napier for the Royal Society of New Zealand Ten by Ten series
- In kind support for the Public Relations Institute of New Zealand (PRiNZ) Wicked Problems – Senior Practitioner Event
- In kind support for the Maths In Industry New Zealand event
- In kind support for the National Research Data Strategy Workshop
- Figure.NZ data-driven curated conversations.



Associate Investigator Michelle Dickinson speaking at the Royal Society of New Zealand's Honours Dinner. Image credit: Royal Society of New Zealand.



Investing in future leaders

Critical to the development of Te Pūnaha Matatini's culture and impact is building a collaborative, connected cohort of investigators and students who combine a culture of research excellence with enthusiasm for communicating that research.

A key focus of 2015 was creating opportunities to establish meaningful and ongoing relationships with communities of interest.

In July, after a Twitter exchange between Chris MacDowell, Kate Hannah, and Aaron Schiff, the idea of a regular meeting of the Data Poets' Society emerged – a semi-structured get-together, hosted by Te Pūnaha Matatini, in which a diverse range of data visualisation practitioners and data specialists from a number of sectors share current work, inspiration, and ideas. The diversity of the group – from museum curators to data journalists, transport economists to financial data modelers – means that Te Pūnaha Matatini investigators and students

are constantly engaged with people from a range of fields, including those working in jobs that critically involve the kind of complex systems and networks approaches and methodologies that unify the diverse team within Te Pūnaha Matatini.

The Data Poets' Society has resulted in several key, ongoing relationships. Through the involvement of the New Zealand Herald Insights team we now have an arrangement that investigators or students with a particular dataset to visualise or work on – specifically ones that might be suitable for publication – are able to hotdesk with the Insights team, accessing data journalism expertise and experience.

Fostering multidisciplinary research

We pride ourselves on training the next generation of multidisciplinary scientists to help solve significant problems of relevance to New Zealand.

Dr Rachelle Binny is a prime example of Te Pūnaha Matatini's multidisciplinary approach. Rachelle's mathematical skills are enabling her to work in a wide variety of research areas, from cell biology to pest control.

Rachelle, a rising early career researcher in the Te Pūnaha Matatini network, completed a PhD in mathematics at the end of 2015 supervised by Principal Investigators Alex James and Mike Plank. Rachelle was also the inaugural Chair of Te Pūnaha Matatini Whānau – a network of emerging scientists with a shared interest in complex systems and networks.

During her PhD, Rachelle investigated the complex systems of cells, including cell movement and interactions. Rachelle developed a model to explain how different cell interactions can lead to certain cell behaviours and how this in turn would affect the movement of whole cell populations. The model has applications in the development of new wound healing drugs or investigations into the movement of cancer cells.

Throughout her PhD, Rachelle drew heavily upon modelling methodologies used in ecology, and her skills led to a postdoctoral position with Landcare Research. Of the career progression, Rachelle says it was a nice natural step: "Going from a PhD to a postdoc is a really great opportunity to broaden my skills."

Rachelle is now applying her many skills to assess the impacts of various invasive pest control methods on New Zealand's native flora, fauna, and biodiversity.





Whānau Chair Dr Rachelle Binny.





The Te Pūnaha Matatini team with staff from SouthSci, the Science in Society Participatory Science Platform pilot in South Auckland, and staff and students from Manurewa High School and Rongomai School. Image credit: Dr Sarah Morgan.

Partnering for success

We're partnering with Ngā Pae o te Māramatanga and SouthSci, the participatory science platform for South Auckland, to increase the participation of under-represented groups in tertiary education, and in the industries our graduates serve.

In seeking to have critical impact over our six year funding cycle, Te Pūnaha Matatini has partnered with Ngā Pae o te Māramatanga, New Zealand's Māori Centre of Research Excellence, and SouthSci, the Science in Society Participatory Science Platform pilot for South Auckland funded by the Ministry of Business, Innovation and Employment's (MBIE) Curious Minds programme.

Te Pūnaha Matatini has also established collaborations with other research programmes. Our investigators are involved in

Mātauranga Māori projects within both the Science for Technological Innovation and New Zealand's Biological Heritage National Science Challenges. In addition, a Motu-led MBIE 2016 bid, which was developed through research meetings and community collaborations in 2015, has a focus on partnering with Māori researchers to ensure the distinctive contribution of Māori to inventiveness and the research system is realised.



Diversity in science

In 2015, Te Pūnaha Matatini took a leadership role nationally around gender equity and broader equity issues in science.

In October, Executive Manager Kate Hannah presented to the Centres of Research Excellence (CoRE) and the Tertiary Education Commission (TEC) a case for providing baseline data for each CoRE on their gender equity at all career stages, and on methodologies for increasing gender diversity in science, with an overview of the international literature. This followed on from a presentation at the Association of Centres of Research Excellence that saw the collected CoREs adopt a sponsorship policy intended to increase diversity at conferences and other events.

Sharing ideas

Leadership in diversity in science has seen the Te Pūnaha Matatini Executive team work closely and share ideas with the Royal Society of New Zealand, concentrating on increasing numbers of underrepresented minorities nominated for fellowships, prizes, and awards; and on providing training for panellists on unconscious bias.

A crowdfunding campaign

Associate Investigator Siouxsie Wiles and Kate Hannah ran a successful crowdfunding campaign in late 2015 to send copies of Dr Nicola Gaston's book *Why Science is Sexist* to people with decision-making power in New Zealand universities, and science more generally. Nearly 400 copies of the book were mailed out in March 2016, and Siouxsie and Kate received a lot of positive feedback from recipients.

Awards, Media, and Whānau



A CoRE of leading researchers

In 2015 a number of Te Pūnaha Matatini investigators received awards recognising their research efforts, leadership skills, and science communication activities.

Professor Alexei Drummond

Principal Investigator Professor Alexei Drummond was elected as a Fellow of the Royal Society of New Zealand at the Annual General Meeting of the Society's Academy in Wellington.

Alexei specialises in probabilistic models at the intersection of computational biology, phylogenetics, population genetics, epidemiology, and evolution. He is a world leader in Bayesian inference for phylogenetics and population genetics and is a leader in the development of the internationally renowned open scientific software package BEAST and related statistical methodology. He is founder of scientific software company Biomatters Ltd, which has won awards for its commercial software Geneious.

Principal Investigator Professor Alexei Drummond became the youngest fellow of the Royal Society of New Zealand in 2015



12 questions: Alexei Drummond – *New Zealand Herald*
<http://bit.ly/2cj2CTK>



Other awards

Dr Andrea Byrom: Associate Investigator Dr Andrea Byrom was appointed Director of New Zealand's Biological Heritage National Science Challenge.

Dr Michelle Dickinson: Associate Investigator Michelle Dickinson received the Callaghan Medal from the Royal Society of New Zealand in recognition of outstanding contributions to science communication and raising public awareness about the value of science.

Professor Mike O'Sullivan: Principal Investigator Professor Mike O'Sullivan was made a life member of the New Zealand Geothermal Association.

Dr Mike Plank: Principal Investigator Dr Mike Plank won the University of Canterbury Teaching Award, recognising excellence in teaching (including thesis supervision) in both undergraduate and graduate programmes.

Dr Troy Baisden: Associate Investigator Troy Baisden received an "excellence in reviewing" award from the American Meteorological Society for his work in the Journal of Hydrometeorology.

Fast-tracked for success

Associate Investigator Dr Simone Linz's research career gathered momentum in 2015 after she received a Fast-Start grant from the Marsden Fund. Simone was one of only three applicants from 38 proposals in her field to receive the highly competitive national funding.

You're originally from Germany. What brought you to New Zealand?

I first came to New Zealand in 2006, mid-way through my PhD, to do a three month summer studentship funded by the Allan Wilson Centre. In 2011, I received a Marie Curie International Outgoing fellowship which enabled me to return to the University of Canterbury for two years before I took up my current position at the University of Auckland in 2014. New Zealand has a long history of excellent research in mathematical phylogenetics, which is my area of research, and I was always looking into funding that would allow me to come back after my first visit in 2006.

Tell us about your research

Broadly speaking, I'm interested in unraveling complex evolutionary histories of life on Earth, a multidisciplinary endeavor that spans biology, computer science, and mathematics.

Specifically, I work in mathematical phylogenetics, which is the development of new mathematical tools and algorithms to solve problems related to the reconstruction and analysis of evolutionary (phylogenetic) trees and networks. Such networks are used to represent ancestral relationships of living entities and they have applications in evolutionary biology, linguistics, cancer research, and epidemiology.

Why phylogenetic networks?

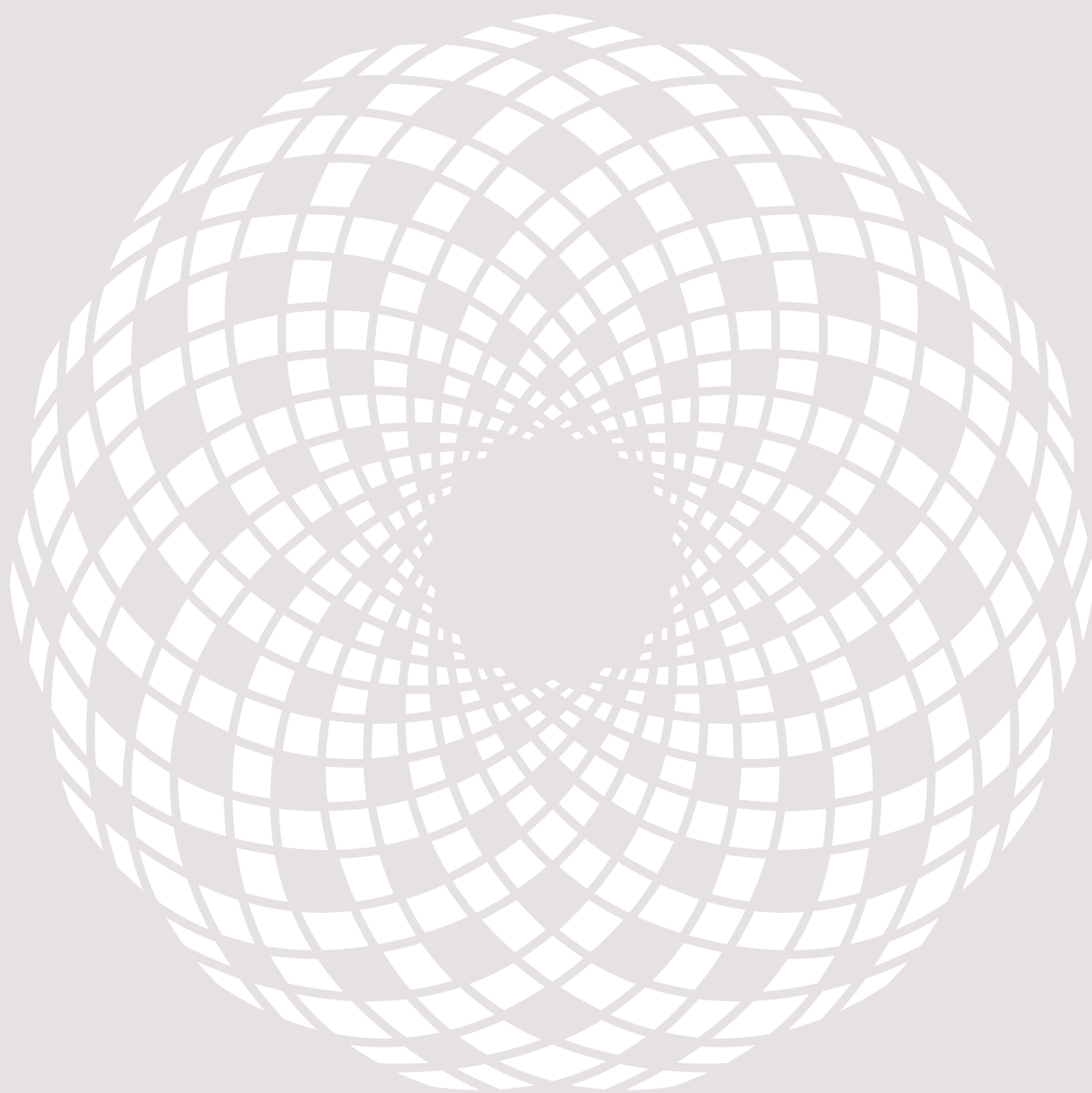
Traditionally, phylogenetic trees are used to analyse ancestral relationships between organisms. However, recent investigations into horizontal gene transfer and hybridization, which are processes that result in mosaic patterns of relationships, challenge the model of a phylogenetic tree. It is now widely acknowledged that graphs with cycles, called phylogenetic networks, are better suited to represent evolutionary histories because they provide a more accurate picture of the relationships between organisms. From a mathematical perspective, phylogenetic networks pose many challenging questions since they are much more entangled than trees and, consequently, make the underlying problems more complicated to address.

How does the Marsden Fund Fast-Start grant help?

The Fast-Start grant provides a fantastic opportunity to further develop my own independent research programme in mathematical phylogenetics. In particular, I will develop new mathematics to search and analyze the huge space of all phylogenetic networks. A precise understanding of this space will, for example, enable us to reconstruct phylogenetic networks directly from biological data such as DNA.



Associate Investigator Dr Simone Linz.



In the media

As leading researchers and science communicators, Te Pūnaha Matatini investigators were regularly sought after by local and international media in 2015 to offer expert opinion and comment on a vast range of subjects.

- The launch of Te Pūnaha Matatini was profiled by RNZ's *Our Changing World* – (Science of complex systems.)

Shaun Hendy appeared regularly on RNZ *Nights* as a physics correspondent, and was featured in a number of articles across both mainstream and digital media.

- Q +A: Auckland's New Centre of Research Excellence (*NZ Herald*)
- The science behind being part of a crowd (*NZ Herald*, also featuring other investigators)
- Bigger cities make brighter ideas (*NZ Herald*, also featuring other investigators)
- New Zealand's Economy: Shaun Hendy (Radio LIVE)
- Kiwi brains to help boost homegrown tech innovation (*NZ Herald*)
- Marsden Fund comes under the microscope (*NZ Herald*)
- We don't need no innovation (*National Business Review*)
- Ingredients to grow innovation (*TedXAuckland* talk)

Siouxie Wiles is a regular science commentator on RNZ and also appeared regularly throughout the media in 2015.

- Building blocks of bias: Lego and gender (*TedXAuckland* talk)
- Michele Hewitson interview: Siouxie Wiles (*NZ Herald*)
- Flu the next global disaster (*Stuff*)
- Should we be worried about a MERS pandemic? (*The Paul Henry Show*)
- South Korea doing all the right things to contain MERS (*Newshub*)
- Women in Science (*The Wireless*)

Michelle Dickinson, winner of the Callaghan Medal for science communication, is a trusted name in science media in New Zealand. Michelle was regularly a featured contributor for *NZ Herald*, *RadioLIVE* and *Newshub*.

- Science and tech: heart disease (*NZ Herald*)
- Trusty sunscreen does hard yards against rays (*NZ Herald*)
- Nanogirl: Would you eat a burger grown in a lab? (*NZ Herald*)
- Why you're unlikely to see Sonny Bill Williams' torso exposed again (*NZ Herald*)
- Science and Tech: Self-driving car (*NZ Herald*)
- Science and tech: Michelle Dickinson (*NZ Herald*)
- Scientist slams engineering firm's sexist advertising (*NZ Herald*)
- Carey or scary? Love of Christmas all in the mind (*NZ Herald*)

- It's about how much you want to pay (*NZ Herald*)
- Nanotechnology Series (RadioLIVE)
- Technology and innovation (RNZ)
- Science Commentator Michelle Dickinson (RNZ)
- Nanogirl (RNZ)
- Women in Science (*The Wireless*)

Pierre Roudier hosted a recurring segment on RNZ Monday nights called Soil Science and appeared on TV3's *Newsworthy*.

- Soil Scientist Explains Why International Year of Soils Is Important (*Newsworthy*)

Other Te Pūnaha Matatini investigators whose research featured in the media in 2015:

Alexei Drummond

- Twelve Questions: Alexei Drummond (*NZ Herald*)
- Smartphone data to help fight the flu (*NZ Herald*)

Andrea Byrom

- Is humanity the asteroid or the dinosaurs? (*NZ Herald*)
- Natural disasters, will we be ready for the next big one? (*NZ Herald*)
- Ten climate change canaries (*NZ Herald*)
- Predator Free New Zealand (RNZ)

Richard Easther

- Twelve Questions: Richard Easther (*NZ Herald*)
- New Zealand meteor: Space rock just a flash in history (*NZ Herald*)
- Kiwi scientist reviews *The Martian* (*NZ Herald*)
- Battle of the planets: Yock strikes back (*Stuff*)
- Why the World's Most Powerful Telescope Has Just Been Ruled Unlawful (*Gizmodo*)

Rebecca Ford

- Would you buy an electric car? (*NZ Herald*)
- Spotlight on solar systems (RNZ)

Dan Hikuroa

- Traditional Māori myths may hold clues for natural hazards (*Stuff*)
- Iwi shown path for growth (*Rotorua Daily Post*)
- Research identifies strategies for Māori economic development (Māori Television)

Adam Jaffe

- Science funding under the microscope (RNZ)
- Marsden Fund comes under the microscope (RNZ)

Suzi Kerr

- Paris climate talks – live chat with Suzi Kerr (*Stuff*)
- Climate of Hope – Q & A with Suzi Kerr (*NZ Herald*)
- Age of resilience (RNZ)

Thegn Ladefoged

- New research blows Rapa Nui collapse theory (RNZ)
- Debate Over Puzzling Demise Of Easter Island Population May Finally Be Over (*Huffington Post*)
- Easter Island's demise may have surprising new explanation (*Fox News*)
- Easter Island Extinction Blamed on Environment (*Nature World News*)
- Rapa Nui Population Decline: Demise of Easter Island Society Linked To Environmental Constraints (*International Business Times*)

David Mare

- Productivity stats get a nudge (*NZ Herald*)
- Research shows average skill of workers fell between 2001-12 (RNZ)

Barry Milne

- New flag survey shows solid majority reject change (*NZ Herald*)
- Expats say let's keep monarchy (*NZ Herald*)
- Flag options put in front of public before referendum (*Wanganui Chronicle*)
- New Zealand Picks a Challenger for Nation's Flag (*New York Times*)
- New Zealand Debates Replacing Union Jack Flag, But With What? (*New York Times*)

Les Oxley

- Waikato University professor needs help to transcribe World War I documents (*Stuff*)
- Food poverty's impact on agriculture (*Bay Of Plenty Times*)



Collapse or constraint: first paper attracts international media attention

In Te Pūnaha Matatini's first official scientific publication, Principal Investigator Professor Thegn Ladefoged and international colleagues reported on archaeological data from Easter Island. Their findings challenged long-held theories about the demise of Easter Island's Rapa Nui people.

The scientific publication, published in the *Proceedings of the National Academy of Sciences* in January 2015, attracted wide-spread media attention and Thegn conducted media interviews with Radio New Zealand, *Fox News*, *The Huffington Post*, *Nature World News* and the *International Business Times*.

The downfall of Easter Island's Rapa Nui people has long been categorised as a population collapse attributed to over-exploitation of the island's natural resources prior to European occupation, compounded by the introduction of diseases and Peruvian slave trading post European arrival. Thegn and colleagues analysed more than 400 obsidian tools from six study areas around Easter Island. Their results suggest variation in rainfall and soil quality meant the local population was struggling against natural environmental barriers, rather than reacting to massive environmental degradation.

"I think a better way to look at it is not in terms of this massive degradation and collapse, but rather in terms of environmental constraints and that people were using certain areas of the island and then changing to other more optimal areas," Thegn says.

Thegn and colleagues hope their approach is useful in the study of other prehistoric societies for which a sudden demographic collapse has been proposed in prehistory.



View links to all of Te Pūnaha
Matatini's 2015 media
<http://bit.ly/2foOL1W>

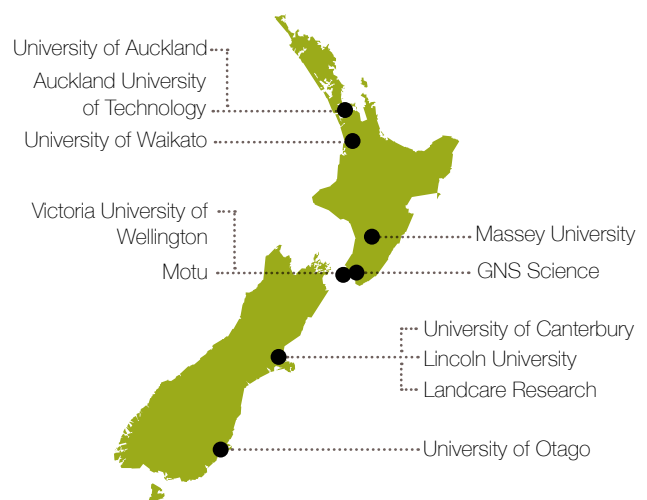




Te Pūnaha Matatini Whānau

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 a meeting place for early career researchers to develop new skills, in particular leadership and entrepreneurship, and acquire the tools needed to become successful scientists and entrepreneurs in New Zealand. Whānau provides a space for collaboration and skill sharing and members are encouraged to take an active role in shaping shared goals and activities.





Clockwise – Whānau at Kaikoura.



2015 activities

Te Pūnaha Matatini's Whānau network was launched with a Welcome Day at the University of Auckland in December 2014. The Whānau met again at Te Pūnaha Matatini's launch in February 2015, where students had the opportunity to network for the first time with Te Pūnaha Matatini investigators.

Kaikoura proved to be an inspiring setting for the first annual retreat of the Te Pūnaha Matatini Whānau in August. The purpose of the retreat was to build a strong team atmosphere, working together as a cohesive group. Group discussions were held to give members the opportunity to contribute their ideas, create a Vision for Whānau, and help shape activities in the future.

A three-part seminar series on proposal writing was held in November, hosted at the University of Auckland and video-conferenced to other institutes across New Zealand. The series comprised seminars on '14 Ways of looking at a grant proposal, with apologies to Wallace Stevens' by Kate Hannah (Executive Manager, Te Pūnaha Matatini), 'How to get

a Marsden grant' by Juliet Gerrard (Chair, Marsden Council), and 'The effect of public funding on research output: the New Zealand Marsden Fund' by Adam Jaffe (Director, Motu).

In December, Te Pūnaha Matatini Whānau participated in a networking event in Christchurch that connected students with a panel of leading New Zealand entrepreneurs. Each Pitch on the Plains participant pitched an idea to the panel based on their research. A wide variety of ideas were encouraged, including those with commercialisation potential or requiring social entrepreneurship to get off the ground.

Three finalists were then selected and received expert advice from the panel about how to expand their ideas and further explore their potential for development.

The Pitch on the Plains event was immediately followed by Te Pūnaha Matatini's Annual Hui, during which the Whānau held breakout sessions involving talks from members and a panel discussion on pursuing a research career.





Our Research





Today, both 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

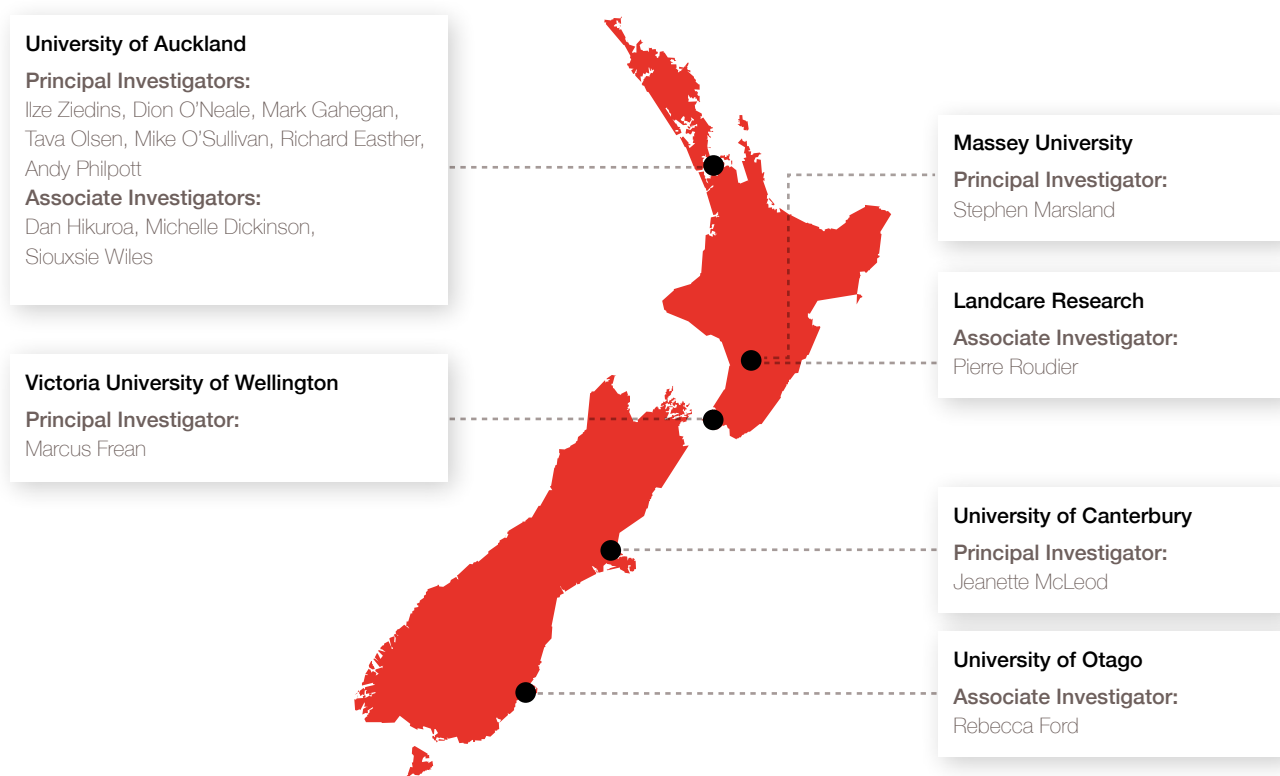
We're developing sophisticated mathematical and computational tools that will contribute to solving the questions of national significance that New Zealand faces in coming decades.

Our impact

The models and algorithms for attacking these challenging problems will become the intellectual foundations of new and existing internationally competitive businesses.

Data-driven optimisation techniques developed in our Complex Data Analytics research will spill over into business analytics applications, guiding decision support systems in manufacturing, primary production, healthcare, social development, and services.

Our team



Our research

Te Pūnaha Matatini is developing and applying advanced analytics methods including network analysis, methods from dynamical systems and statistical physics, graph theory,

Agenerative and agent-based modelling, advanced visualisation techniques, and optimisation to enable understanding and management of increasingly complex systems and networks.



Find out more about our Complex Data Analytics research.

www.tepunahamatatini.ac.nz/about-us/our-research/complex-data-analytics



Research highlight: the changing landscape of soil science



Principal Investigator Dr Dion O'Neale from the University of Auckland.



Associate Investigator Dr Pierre Roudier from Landcare Research.

Te Pūnaha Matatini investigators Drs Dion O'Neale and Pierre Roudier are digging the dirt on soil science and applying network science methods to visualise, analyse, and explore large soil survey data sets. Their methods have applications nationally and in the development of environmental assessment tools to protect Antarctica.

Acting as an interface between rocks and the atmosphere, soil harbours 25 per cent of Earth's biodiversity and supports between 95 and 99 per cent of food production globally. As Pierre puts it: "Life cannot exist without soil."

Scientists conduct soil surveys to capture and record the high variability of soils and their wide range of physical properties affecting their use and productivity. The use of network science to explore this soil survey data provides a new tool for soil scientists, and a contemporary way to extract and infer new knowledge previously hidden by the complexity of the original data sets.

Drawing on soil survey data from S-MAP (NZ) and SSURGO (USA), and working with Dr Dylan Beaudette from the US Department of Agriculture's Natural Resources Conservation Service, Dion and Pierre are creating network diagrams that reveal the degree of connections between different soil types, soil communities, and geographical locations. Their work is already uncovering varying levels of complexity between different regions. Representing soil survey data as networks also has potential applications in determining a soil's conservation value or informing agricultural practices.

Applications in Antarctica

Pierre is now applying the data analysis and network science methods to studies he is undertaking in Antarctica as part of a

Ministry of Business, Innovation and Employment project. The results will aid the development of environmental risk assessment tools to inform and meet New Zealand's obligations under the Antarctic Treaty.

"We're trying to get a grip on the different pressures that occur in the very precious and fragile environments of Antarctica's Ross Sea terrestrial region," Pierre explains.

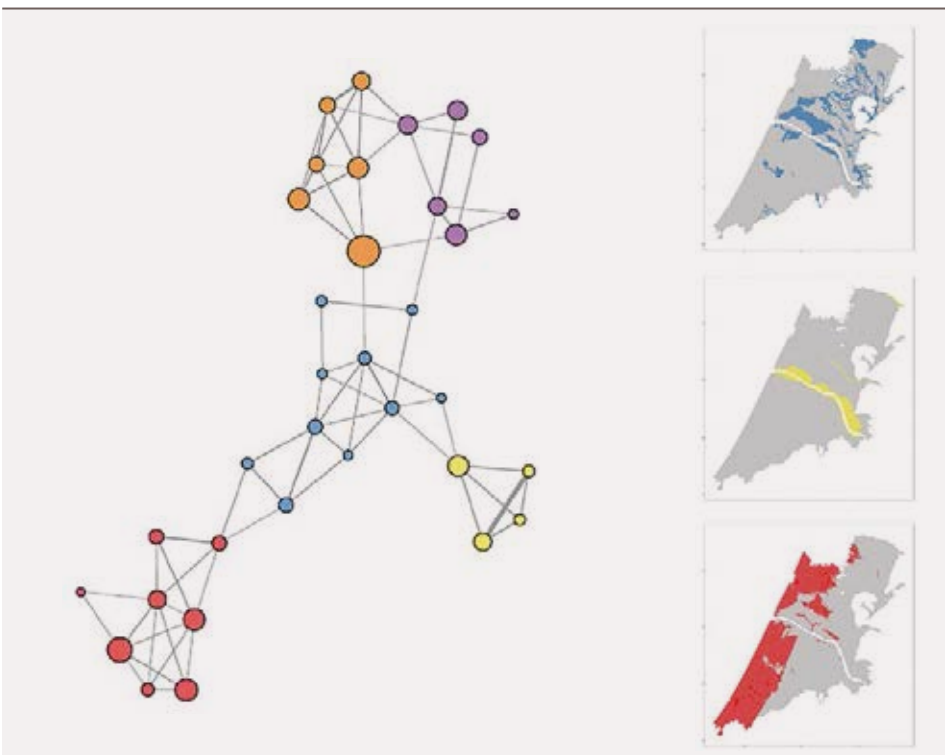
Using high performance computing, Pierre and colleagues are collating multiple large data sets from Antarctica, including information on land surface temperature, altitude, wind, and soil environments. Once collated, a range of numerical methods can compare those environmental datasets with records of organisms. Researchers can then quantify the relative influence of these factors on life distribution on the frozen continent and the potential impact of changes in these environmental factors, such as temperature.

"We want to establish a bioregionalisation – a classification of the Ross Sea terrestrial environment into bioregions based on a range of environmental attributes derived from data," Pierre says.

The result is a unique blend of data and network science to aid environmental management, and Antarctica New Zealand can take these bioregions into account when discussing ways to manage these very fragile regions.



Antarctica's Miers Valley. Image courtesy Pierre Roudier.



A soil network diagram

Different colours represent different soil communities, and different nodes show different soil types. The network diagram shows the relationships between the soil types and communities, including inland (top), riparian (middle), and coastal (bottom) soils.

Credit: Dr Dion O'Neale.



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 failure 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, Peter Davis

Associate Investigators:

Barry Milne, Mark Wilson, Michelle Dickinson

Waikato University

Associate Investigator:

Les Oxley

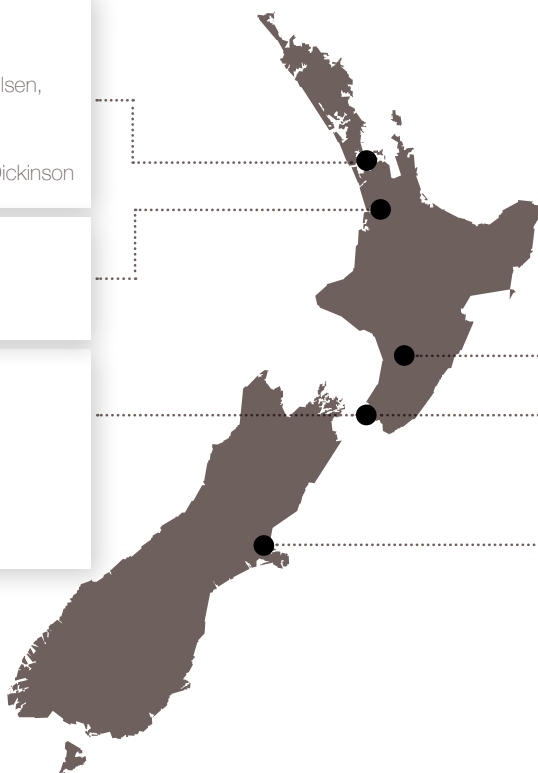
Victoria University of Wellington

Principal Investigators:

Marcus Frean, Michele Governale, Sally Davenport, Uli Zuelicke

PhD Student:

Kyle Bingham



Massey University

Principal Investigator:

Stephen Marsland

Motu Research

Principal Investigators:

Adam Jaffe (Theme Leader), David Mare, Izi Sin

University of Canterbury

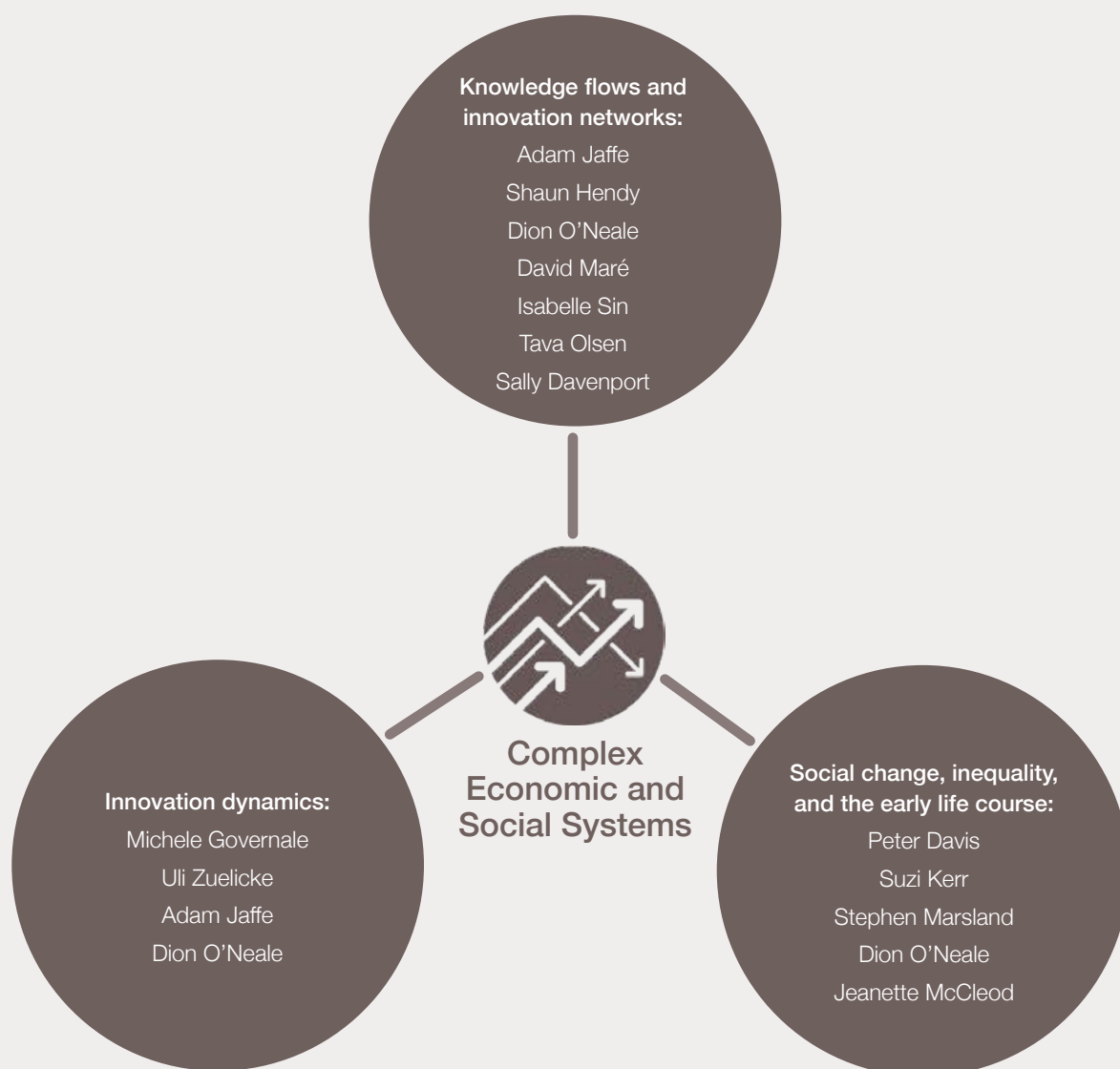
Principal Investigators:

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.



Find out more about our Complex Economics and Social Systems research.

www.tepunahamatatini.ac.nz/about-us/our-research/complex-economic-and-social-systems



Research highlight: money, migration, and the transfer of knowledge



In 2015, Principal Investigator Dr Isabelle Sin from Motu Economic and Public Policy Research in Wellington received a Marsden Fund Fast-Start grant to investigate the impact of financial incentives and personal wealth on international and domestic migration decisions.

Isabelle will study the migration decisions of people leaving tertiary education in New Zealand in recent years. She will first ask how sensitive international migration decisions are to the financial gains from migration. Her research will show whether policies such as interest-free student loans, which provide modest financial incentives to stay in New Zealand, can encourage skilled graduates to remain in or return to New Zealand. She will then investigate whether beneficial

migration of skilled individuals, either domestic or international, is hampered by inability to pay for the migration. The research will have implications for the provision of tertiary education and regional development.

Isabelle's Marsden work will also inform proposed Te Pūnaha Matatini research into knowledge diffusion across New Zealand's network of firms and employees. In the network model Isabelle and fellow Principal Investigator Dr Dion O'Neale plan



to build, skilled immigrants are entry points for flows of knowledge into the New Zealand economy. Isabelle's Marsden work will shed light on the government's ability to incentivise such people to migrate or return to New Zealand.

Dion and Isabelle hypothesise that the network of employers and employees will have strong links within regions and weaker links between regions; employee moves between employers in different regions are thus likely to have greater benefits for knowledge diffusion. Such moves are less likely to occur if employees have trouble financing the move. Isabelle's Marsden research will determine whether this is the case, and may suggest appropriate policy responses.



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

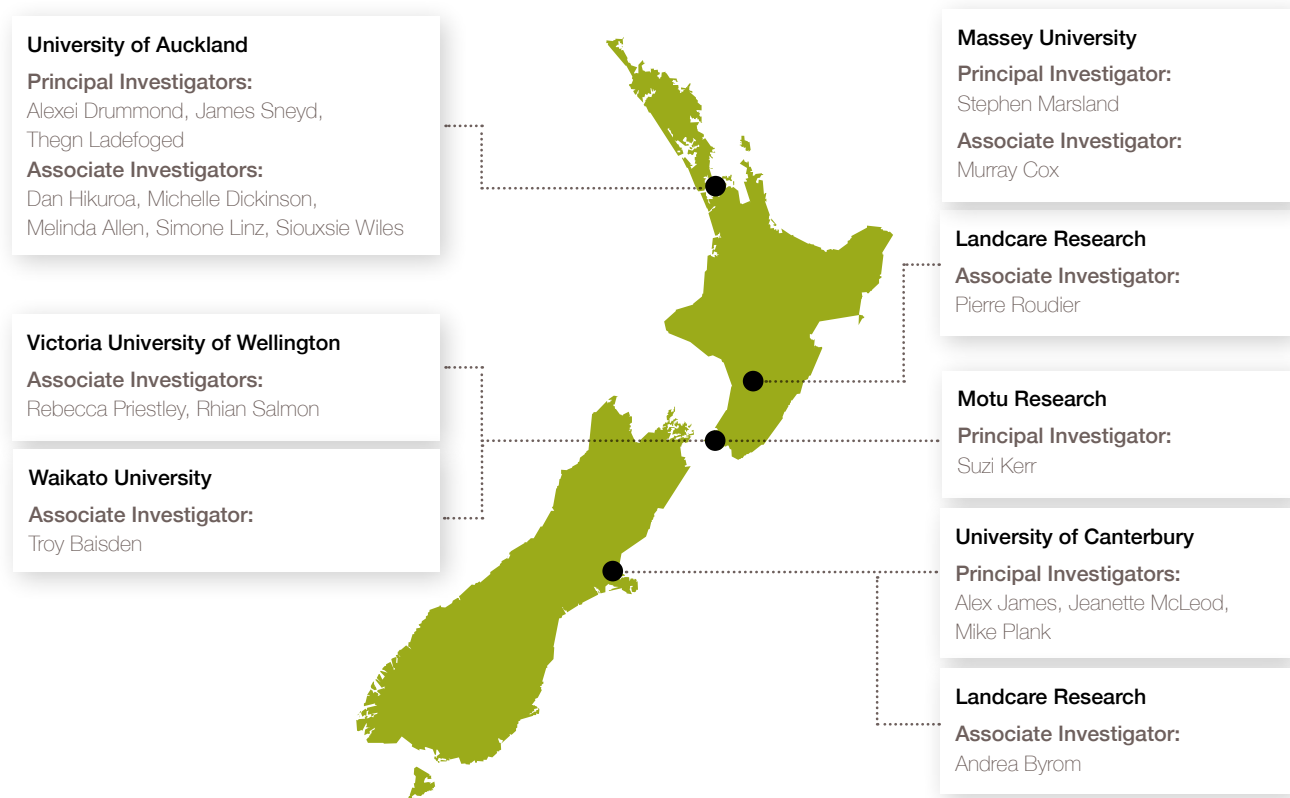
The diversity of life on Earth is the planet's most striking feature; recent estimates are that fewer than a million of approximately eight million animal species have been described.

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

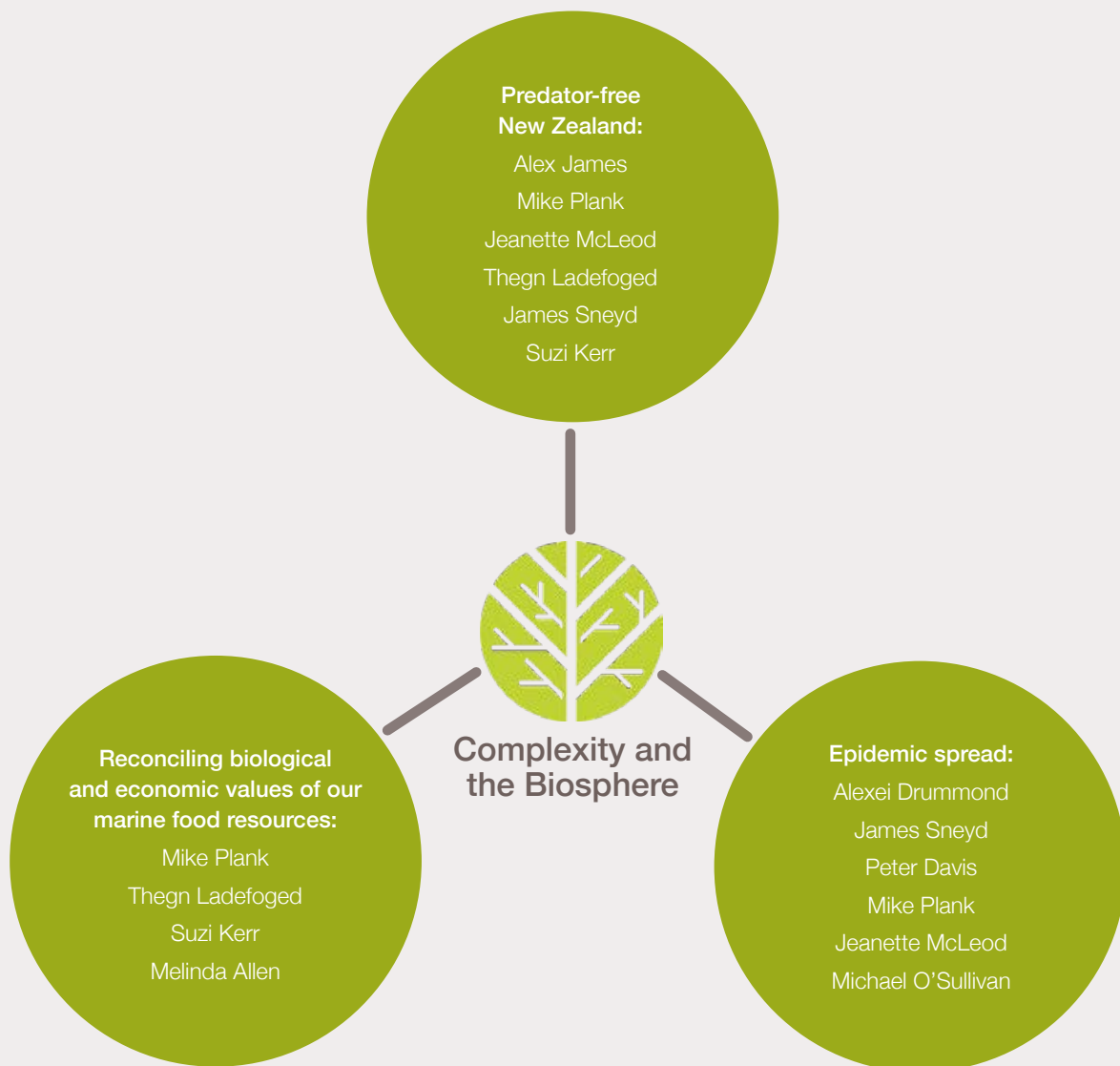
Our Complexity and the Biosphere research will inform government policy and decision-making, and will assist the New Zealand public in better understanding their relationship with our unique flora and fauna.

Our team



Our research

Making use of data concerning New Zealand's biodiversity will enable better understanding and management of our unique flora and fauna, both informing policy and decision-making, and building community capacity.



Find out more about our Complexity and the Biosphere research.

www.tepunahamatatini.ac.nz/about-us/our-research/complexity-and-the-biosphere



Research highlight: modelling epidemic spread



Principal Investigator Professor Alexei Drummond.

Principal Investigator Professor Alexei Drummond and colleagues are developing models of disease spread through a network of individuals that take into account lifestyle, biophysical, and socio-economic factors.

Human networks are complex and data rich. Day-to-day contact between New Zealanders within these networks determine how diseases spread across the country once they arrive from overseas. A striking example is the arrival to New Zealand shores each year of influenza; and other seasonal illnesses. Every year multiple types and subtypes of human influenza virus arrive in New Zealand at the beginning of the winter season. These seasonal epidemics are established from a small number of infected individuals arriving early in the season, and the epidemic subsequently spreads through local transmission via human-to-human contact and proximity, following human networks.

In order to understand the spread of influenza and other illnesses, Te Pūnaha Matatini investigator Alexei Drummond is working with Qrious, a data science company that collects over a billion anonymised network usage records every day from Spark New Zealand's mobile network. This data set is used in an aggregated form to understand movement patterns of people within New Zealand. By tracking the genome of the influenza virus as it spreads across the country and comparing this to the movements of people, the project aims to predict the probability of invasion of local areas in future seasons. This will enable our health services to develop policies and practices that can prevent or mitigate the spread of acute airborne infectious diseases in New Zealand.





Image credit: iStock.com/Alextype.



Research Outputs



Publications of Note

Pierre Roudier, "The rise of information science: A changing landscape for soil science" *IOP Conference Series: Earth and Environmental Science*, vol. 25, 2015

Adam Jaffe, "The impact of R&D subsidy on innovation: a study of New Zealand firms" *National Bureau of Economic Research*, issue w21479, 2015

Alex James, "Constructing random matrices to represent real ecosystems" *American Naturalist*, vol. 185, 2015, pp. 680-692

Thegn Ladefoged, "A multi-scalar analysis of Māori land use on Ahuahu (Great Mercury Island), New Zealand" *Archaeology in Oceania*, in pre-press, 2015

Simone Linz, "Spaces of phylogenetic networks from generalized nearest-neighbour interchange operations" *Journal of Mathematical Biology*, vol. 72, 2015, pp. 699-725

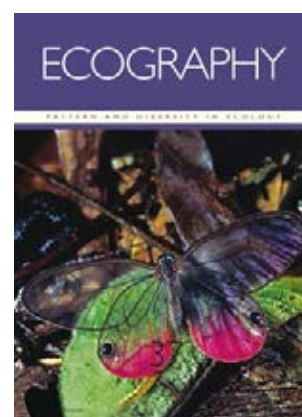
Mike Plank, "The effect of competition on species' distributions depends on coexistence, rather than scale alone" *Ecography*, vol. 38, 2015, pp. 1071-1079

Dave Maré, "Productivity spillovers from foreign direct investment in New Zealand" *New Zealand Economic Papers*, vol. 49, 2015, pp. 249-275

Ilze Ziedins, "Does extra information harm or hinder? Probabilistic and state dependent routing in networks with selfish routing." *Workshop on Congestion Games*, Institute of Mathematical Sciences, National University of Singapore, Singapore

Rebecca Priestley, "The reflexive scientist: an approach to transforming public engagement" *Journal of Environmental Studies and Sciences*, in pre-press, 2015

Mark Gahegan, "Adventures of Categories: Modelling the Evolution of Categories During Scientific Investigation" *2015 IEEE 11th International Conference on e-Science*, Munich, Germany



Presentations of Note

Steve Henry, Peter West, Jen Cruz, Peter Brown, **Andrea Byrom**, Lyn Hinds, Dean Anderson and Roger Pech, 'Will smart communications technology provide the breakthrough needed for effective surveillance and forecasting of mouse plagues in grain-growing regions of Australia?', *Australasian Wildlife Management Society Conference*, 23-26 November 2015, Perth, Australia

Urs Daellenbach, **Sally Davenport**, Margaret Hyland, Shirley Leitch and Katharina Ruckstuhl, 'Rethinking absorptive capacity for open innovation', *The ISPM Innovation Summit*, 6-9 December 2015, Brisbane, Australia

Dan Hikuroa, 'Te Whakapapa o Putaiao kei Aotearoa – The History of Science in New Zealand', *Finding New Zealand's Scientific Heritage*, 23-24 November 2015, Te Whanganui a Tara, New Zealand

Dave Maré, Jacques Poot and Omoni Alimi, 'Revisiting income inequality within and between New Zealand's regions: Analysis of 1986-2013 Census data', *Pathways 2015*, 23-24 July 2015, Wellington, New Zealand

Dion O'Neale, **Pierre Roudier** and Dylan Beaudette, 'A network perspective on soil surveys' (poster talk), *NetSci 2015*, 1-5 June 2015, Zaragoza, Spain

Rebecca Priestley and **Rhian Salmon**, 'Communicating controversial science', *BioLive ChemEd 2015*, 5-8 July 2015, Wellington, New Zealand

Isabelle Sin and Nathan Chappell, 'The effect of trial periods in employment on firms' hiring behaviour', *New Zealand Association of Economists*, 1-3 July 2015, Wellington, New Zealand

Siouxsie Wiles, 'Stepping outside the ivory tower', *Joint Conference for the New Zealand Freshwater Sciences Society and Australian Society for Limnology*, 23-26 November 2015, Wellington, New Zealand

Ilze Ziedins, Heti Afimeimounga, Lisa Chen, Wiremu Solomon, Mark Holmes, Niffe Hermansson and Alex Wang, 'Does extra information harm or hinder? Probabilistic and state dependent routing in networks with selfish routing', *Workshop on Congestion Games*, 15-18 December 2015, Singapore

Les Oxley, 'Innovation, invention and technological diffusion in New Zealand: 1871-1939. Were there spillovers?', *The World Economic History Conference*, 3-7 August, Kyoto, Japan



Publications

Journal articles

Adam B. Jaffe and Trinh Le, 'The impact of R&D subsidy on innovation: a study of New Zealand firms', *National Bureau of Economic Research*, issue w21479, 2015

Adam Jaffe, 'Science and innovation in small countries: speculation and research agenda', *Asia-Pacific Journal of Accounting and Economics*, vol. 22, 2015, pp. 4-12

Adam Jaffe, *A Framework for Evaluating the Beneficial Impacts of Publicly Funded Research*, Motu Note 15, 2015, <http://motu.nz/our-work/productivity-and-innovation/science-and-innovation-policy/a-framework-for-evaluating-the-beneficial-impacts-of-publicly-funded-research/>

Alex E. Morrison and **Melinda Allen**, 'Agent-based modelling, molluscan population dynamics, and archaeomalacology', *Quaternary International*, in pre-press, 2015

Alex James, **Michael J. Plank**, Axel G. Rossberg, Jonathan Beecham, Mark Emmerson and Jonathan W. Pitchford, 'Constructing random matrices to represent real ecosystems', *American Naturalist*, vol. 185, 2015, pp. 680-692

Alex James, Sue M. Molloy, Agate Ponder-Sutton, **Michael J. Plank**, Shona L. Lamoureaux, Graeme W. Bourdôt and Dave Kelly, 'Modelling *Tradescantia fluminensis* to assess long term survival', *PeerJ*, 2015

Andrea E. Byrom, Dean P. Anderson, Morgan Coleman, Caroline Thomson, Martin L. Cross and Roger P. Pech, 'Assessing Movements of Brushtail Possums (*Trichosurus vulpecula*) in Relation to Depopulated Buffer Zones for the Management of Wildlife Tuberculosis in New Zealand', *PLoS One*, vol. 10, 2015

Armando J. R. Amaris and **Murray P. Cox**, 'A flexible theoretical representation for the temporal dynamics of structured populations as paths on polytope complexes', *Journal of Mathematical Biology*, vol. 71, 2015, pp. 735-766

B. D. Emanuelsson, **W. T. Baisden**, N. A. N. Bertler, E. D. Keller and V. Gkinis, 'High-resolution continuous-flow analysis setup for water isotopic measurement from ice cores using laser spectroscopy', *Atmospheric Measurement Techniques*, vol. 8, 2015, pp. 2869-2883

Barry Milne, Roy Lay Yee, J.M. McLay, J. Pearson, Martin von Randow and Peter Davis, 'Modelling the Early life-course (MELC): A microsimulation model of child development in New Zealand', *The International Journal of Microsimulation*, vol. 8, 2015, pp. 28-60

Benjamin D Jones, **Thegn N. Ladefoged**, Gregory Asner, 'Tracing the resilience and revitalisation of historic taro production in wai'oli valley, Hawai'i', *Journal of the Polynesian Society*, vol. 124, 2015, pp. 83-109

Christopher M. Stevenson, Cedric O. Puleston, Peter M. Vitousek, Oliver A. Chadwick, Sonia Haa and **Thegn N. Ladefoged**, 'Variation in Rapa Nui (Easter Island) land use indicates production and population peaks prior to European contact', *Variation in Rapa Nui (Easter Island) land use indicates production and population peaks prior to European contact*, vol. 112, 2015, pp. 1025-1030

Dave Maré, Dean R Hyslop and Richard Fabling, *Firm Productivity Growth and Skill*, Motu Economic and Public Policy Research Working Papers 15-18, 2015, http://motu-www.motu.org.nz/wpapers/15_18.pdf

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Governance and Management



Financial Report 2015

	2015
	Actuals
	\$000
Funding received	
Tertiary Education Commission grant	2,194
Total Funding received	2,194
Expenditure	
Salaries	
Director and Principal Investigators	568
Associate Investigators	24
Research/Technical assistants	12
Others	99
Total Salaries & Salary-related costs	703
Other costs	
Overheads	752
Project Costs	141
Travel	94
Postgraduate students	36
Total Other Costs	1,023
Total Expenditure	1,726
Net Surplus/(Deficit)	468

Notes

This report covers the period from 1 January 2015 – 31 December 2015 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 2016 to fund future expenditure of the CoRE.

2015 Summary

Broad category	Detailed category	Yr1
Value of CoRE funding from TEC (\$M)		2,193,500
FTEs	Principal investigators	3.60
by category	Associate investigators	0.25
	Administrative/support	1.50
	Total	5.35
Headcounts	Principal investigators	23
by category	Associate investigators	17
	Administrative/support	3
	Research students	111
	Total	154
Peer reviewed research outputs by type	Books	3
	Book chapters	6
	Journal articles	51
	Conference papers	18
	Other	5
	Total	83
Value of external research contracts awarded by source	Vote Science and Innovation contestable funds	2,330,562
	Other NZ Government	6,000
	Domestic – private sector funding	101,262
	Overseas	11,447
	Other	171,039
	Total	2,620,310
Commercial activities	Patents granted	2
	Total	2
Students studying at CoRE by level	Doctoral degree	94
	Other	17
	Total	111
Number of students completing qualifications by level	Doctoral degree	6
	Other	1
	Total	7
Immediate post-study graduate destinations	Further study overseas	2
	Employed in NZ	1
	Unknown	4
	Total	7



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.

Marsden Fund success in 2015

- Professor Andy Philpott awarded \$500,000 over 3 years for a project entitled *Robust Optimisation under uncertainty with limited data*
- Professor James Sneyd awarded \$550,000 over 3 years for a project called *Surprisingly slow dynamics in calcium models: where are the slow time scales?*
- Dr Simone Linz awarded \$300,000 over 3 years for her project *Lost in Space? New mathematical tools to analyse the search spaces of phylogenetic networks*
- Dr Izi Sin awarded \$300,000 over 3 years to work on a project called *How responsive is migration to financial incentives? Evidence from New Zealand's student support scheme*

International networking

- In 2015, Te Pūnaha Matatini hosted three internationally-renowned visitors. In February, for our launch, we were joined by Professor Ian Foster, Director of the Computation Institute, Senior Scientist at the Argonne National Laboratory, and Professor of Computer Science at the University of Chicago.
- In August, we hosted Professor Alan Hastings, Professor of Environmental Science and Policy, University of California, Davis.
Professor Hastings gave a series of public talks around the country, focussing on using mathematics to conserve and sustain: tools for environmental management; he also worked with researchers and students involved in the Complexity and the Biosphere research theme.
- In December 2015, Professor Bronwyn Hall gave the keynote at our Investigators' Forum, which was held in Christchurch.

Hall, Professor of Economics at Berkeley, and international expert in intellectual property and economic development, was guest of honour at the Productivity Commission's annual meeting earlier in the same week, and spoke to Te Pūnaha Matatini about knowledge spillovers and proxy indicators of innovation.

- Professor Alexei Drummond took special leave to participate in a long-term research stay, where he pursued joint research on Bayesian phylodynamics with Professor Tanja Stadler of Department of Biosystems Science and Engineering, ETH (Swiss Federal Institute of Technology) Zurich at the Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland. The collaboration also involved a number of students from his research group.
- In a New Zealand first, Te Pūnaha Matatini is set to partner with the Santa Fé Institute to host a complex systems summer school in late 2017.

The Santa Fé Institute (SFI) is an independent research and education centre based in New Mexico, USA. The Institute has previously run summer schools in South America, China and India. The 2017 event will be the first held in New Zealand.

The partnership was borne out of the relationships built by University of Auckland PhD candidate Catriona Sissons. Catriona is the new Chair of Te Pūnaha Matatini's Whānau network for 2016, and in 2015 attended the Conference on Complex Systems in Arizona, USA. At the conference, Catriona met other early career researchers from the Young Researchers Network on Complex Systems and initiated a conversation about hosting the SFI summer school in New Zealand. Fellow TPM Whānau member Demival Vasques Filho strengthened the relationship when he attended the SFI winter school in December 2015.

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.

- Founding Whānau chair and recent PhD graduate, Dr Rachelle Binney (supervisors Associate Professor Alex James, Dr Mike Plank, University of Canterbury) was awarded a postdoctoral fellowship in quantitative ecology at Landcare Research under the supervision of associate investigator and Director of the National Science Challenge, New Zealand's Biological Heritage, Dr Andrea Byrom.
- PhD student Leila Rajabi (supervisor Professor Shaun Hendy, University of Auckland) is working in a data analytics role at Mindfull in Parnell.

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 businesses.

- Professor Tava Olsen (University of Auckland) is leading a project, 'Equilibria and dynamics in networks and supply chain', that explores the potentiality of cooperative models within the New Zealand red meat industry. The project is extending existing equilibrium models such as supply function equilibrium, which models how competing companies can achieve profit-maximising equilibria in the marketplace within conditions of uncertain demand, and Markov perfect equilibrium, a game theory concept that is used to understand oligopolistic competition, wherein a market is dominated by a small number of players. These new models have the potential to inform policy.
- Kannan Riding, a summer student working at Te Pūnaha Matatini, completed a novel analysis of concrete and cement research in New Zealand together with an international benchmark for the Concrete and Cement Association of New Zealand (CCANZ). The analysis highlighted areas of comparative advantage for New Zealand in this sector using a new technique developed by Te Pūnaha Matatini researchers. Dr Joe Gamman, CCANZ Education and Development Manager, said the report was extremely useful and would be helpful in developing a research and development roadmap for the sector in the next decade.
- The Ministry of Social Development has partnered with Te Pūnaha Matatini to fund a postdoctoral fellow located at the University of Canterbury who is working on a project developing predictive risk modelling for child protection.

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.

- Sponsorship of an intern, Tulele Masoe, to work on the pilot participatory science platform for South Auckland, SouthSci.
- Partnership with Ngā Pae o te Māramatanga to support two summer internship projects; Deciphering the Data – is the Paokahu Landfill killing our eels? (supervisors Dr Daniel Hikuroa and Dr Ian Ruru, student Roland Brown), and Optimising the Economic Performance of Kāti Huirapa Rūnaka ki Puketeraki: a localised case study (supervisor Dr Dianne Ruwhiu, student Hitaua Arahanga-Doyle).

Capability-building

- Within National Science Challenge Science for Technological Innovation's Innovation theme, led by principal investigator Professor Sally Davenport, is a significant focus on the distinctive contribution of Māori to innovation in New Zealand
- Motu-led bid to MBIE, with three distinctive projects looking at innovation and knowledge spillovers, partnering with Māori researchers to ensure distinctive contribution of Māori to inventiveness and the research system is realised

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.

- Professor Adam Jaffe (Director of Motu and Theme Leader, Complex Economic and Social Systems) is leading a long-term project that assesses the impact of New Zealand's premiere blue skies research fund, the Marsden Fund. He has presented initial findings extensively to stakeholders,

and the ongoing body of work is being taken up by those within the research funding sector. This project is part of a Motu-led Te Pūnaha Matatini supported MBIE bid.

Contribution to public debate

The nuclear meltdown at Fukushima, the Fonterra botulism scare, and the Canterbury earthquakes – all these recent crises have put scientists in the spotlight. What is the first duty of scientists in a crisis – to the government that funds them, to the employer who pays them, or to the wider public, desperate for information? And what if these obligations clash?

These questions were brought to the fore in 2015 by Te Pūnaha Matatini investigators, Shaun Hendy and Siouxsie Wiles. Both researchers have experience in responding to a crisis, with Siouxsie in particular playing a key role in defusing the botulism scare at Fonterra. Both participated in the New Zealand Association of Scientists annual conference "Going Public: Scientists Speaking out on Difficult Issues" in April 2015 and contributed to the lengthy debate in the media concerning the Royal Society's new guidelines for public engagement. Siouxsie was subsequently elected to the Council of the Royal Society of New Zealand, and has been able to have substantial input into the guidelines.

These discussions also inspired Shaun Hendy to write *Silencing Science* due to be published by Bridget Williams Books in May 2016. Shaun finds that, in New Zealand, the responsibilities of our scientists are often far from clear, with alarming consequences for us all. The book challenges New Zealand's scientists, research institutions, and government to find better ways of engaging with the public to ensure that science is heard.



Our People

23

Principal
Investigators

2

Postdoctoral
Fellows

8

Affiliated
or funded
students

15

Associate
Investigators

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 Alex James
University of Canterbury
Deputy Director, Education and Outreach
Theme Leader – Complexity and the Biosphere

Alex James was told by a high school teacher that she couldn't be a mathematician because they "didn't exist" so she followed her dreams and became one. Not only has Alex proven her high school teacher wrong, she's committed to showing students that with a bit of effort, anyone can pursue a career in Mathematics or Science – she'll be working to ensure that Te Pūnaha Matatini research reaches students and communities.



Professor Andy Philpott
Deputy Director, Industry and Stakeholder Engagement
Theme Leader – Complex Data Analytics

Andy's got longstanding relationships with key stakeholders and experience in managing and developing industry and stakeholder relationships – he currently sits on the steering group for the important industry-led community, the New Zealand Analytics Forum. He's leading a team of diverse researchers with complementary skills in analytical methodologies, developing sophisticated mathematical and computational tools for New Zealand.



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

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 in 19th Century American Cultural History, and has worked as a writer, editor, historical consultant, and in research analysis and development. She is interested in science communication, public understanding of science, and science's understanding of the public. At Te Pūnaha Matatini, she'll be encouraging good grammar, the use of the Oxford comma, and consideration of the humanity behind the data.

**Sarah Hikuroa**

Centre Coordinator, Te Pūnaha Matatini

Ngā Puhī | Waikato | Ngāti Maniapoto. Sarah has a very creative background. She is a Multi-media Artist/ Designer and is part of the Tai Tokerau Māori Art Collective and Te Atinga. Her other interests include research in higher education and innovation, project management, and efficiency. She's keen to see how complex data and research can become innovative knowledge to benefit Aotearoa. At Te Pūnaha Matatini she'll be encouraging the daily use of Te Reo Māori and making sure everyone is where they should be.

**Rachelle Binny**

Chair, Te Pūnaha Matatini Whānau

Rachelle Binny has been developing a mathematical model to describe the collective movement of cells in the body. She loves how Te Pūnaha Matatini brings together researchers from a huge range of disciplines and different career stages to collaborate on problems involving complex systems and networks. "It's a valuable opportunity for emerging scientists to play an active role in solving problems that are relevant for New Zealand today."

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 5-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 5-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 New Zealand 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 in his area of expertise 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. For the past two years he has been 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 MBIEs 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 group of professionals committed to learning and sharing best practice analytics to make a positive impact in this 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.

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Data ■ Knowledge ■ Insight

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