

HORIZONS

TAGGING STINGRAYS

Research in the harbour

FORECASTING ON ICE

Climate change in Antarctica

SLEEP AND SMARTER BABIES

The impact of sleep on learning



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GETTING IN TOUCH

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SUSTAINABILITY

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FROM THE VICE-CHANCELLOR



This issue of Horizons features the research on issues relating to water that is being conducted at the University of Waikato. For more than a decade our researchers have been working on water quality issues in the Central Lakes district and achieving substantial advances in both water quality in the lakes and academic understanding of the drivers of water quality under modern land use patterns. Their work to mitigate the effects of farming and industry in lakes' catchments has resulted in a major improvement in water quality. Because climate change and weather patterns also affect water quality, our researchers are also part of an international project that will allow us to better understand the way lakes respond to climate and inputs.

Across New Zealand and around the world, academics and organisations are coming together more often, using collective knowledge and research skills to produce beneficial results. The Bay of Plenty Regional Council is to be applauded for supporting two academic positions at the University of Waikato: Professor David Hamilton who is Chair of Lakes Restoration, and Professor Chris Battershill who is Chair in Coastal Science. At the foot of many stories inside, you will see an invitation to connect with us; we urge more organisations to take the lead of the regional council for the benefit of their end-users and society in general.

In other articles, you will read about climate change being examined in Antarctica through a collaboration with several research institutes in New Zealand and the Korean Polar Research Institute. Pacific stories feature our staff and students working in Vanuatu to develop reading resources in primary schools there, and former policeman and soldier Dr Apo Aporosa is researching the effects of that traditional Pacific Island drink kava on drivers. Cyber security is an international and growing problem and one we're addressing at the University of Waikato. You can read about two of our computer science students who secured internships in Singapore at INTERPOL's Global Complex for Innovation, working on projects that will benefit international security.

A wide range of quality research at Waikato is leading to positive outcomes in New Zealand and overseas. It requires us to question the relevance and application of our research, to work closely with external partners and encourage our students to participate on projects that will enhance their research skills and technical knowledge. We welcome your participation in that.

PROFESSOR NEIL QUIGLEY

CLEANING UP OUR LAKES

Professor David Hamilton

Freshwater lakes are the sentinels for climate change. They sit at the bottom of catchments and can tell us a lot about climate effects. "They're like the canary in the mine," says Professor David Hamilton.

A freshwater authority who's researched New Zealand lakes for 30 years, Professor Hamilton is one of a group of more than 60 scientists across six continents who took part in an international lake-warming trends research project.

Until recently scientists had little knowledge of how atmospheric heating and increasing weather extremes were affecting lakes at a global scale – that is, until they began sharing their data with each other.

"In 2004, I was one of four scientists who started GLEON, the Global Lakes Ecological Observatory Network. Today there are 500 of us. We work in groups to identify and research key issues and obviously the effects of climate change are a priority," Professor Hamilton says. "So we were able to pull together a lot of data to inform the lake-warming project." Professor Hamilton worked with post-doctoral fellow Dr Mat Allan and NIWA's Piet Verburg on the New Zealand data.

What the scientists found was that lakes are warming an average of 0.34 degrees Celsius, every decade. "That's greater than the warming rate of either the oceans or the atmosphere, and it can have profound effects on lakes," Professor Hamilton says.

Temperature is one of the most fundamental and critical physical properties of water, controlling a wide range of responses that include the boundaries of temperature tolerance of aquatic animals.

Professor Hamilton says that with sudden changes in temperature, life forms in lakes can change dramatically and in some cases, disappear completely. In New Zealand eels are particularly vulnerable.

"The consequences of climate warming on lakes are numerous and diverse. Effects include increases in harmful algal blooms, which can rob the water of oxygen as they decay, or may be toxic to fish and animals.

"This is particularly harmful in a New Zealand context, where we have a lot of end-users who rely on our lakes – particularly iwi and recreational users," Professor Hamilton says.

The recent long, hot summer meant lakes stayed warmer for longer and in some instances became completely deprived of oxygen. "We know this because we have sophisticated sensors that allow us to monitor the lakes remotely. We get readings every 15 minutes on a number of lakes, including Rotorua lakes, some of the larger Waikato lakes and Lake Ellesmere in Canterbury."

"We act like a broker and distribute the best information we can to all parties to build their knowledge and capacity."

New and more sophisticated satellites also mean scientists can get a bird's-eye view of water clarity and algal levels.

"This gives us more opportunity to monitor blue-green algae levels and water colour. We can say, 'okay, something's changed that's of concern and we may need to take action'. We are gaining huge capacity to better understand the way these lakes are responding to climate and inputs."

Cleaning up Rotorua lakes

Lake Rotoiti, once known for being one of the country's unhealthiest big lakes, is now mostly clean and clear. The water quality of Lake Rotorua has also been vastly improved by chemical dosing. A soluble water purifier aluminium sulphate has been added to the water, causing impurities to coagulate into larger particles and settle on the bottom of the lake.

But Professor Hamilton says no one yet knows what the long-term effects of using alum will be, and how it will affect sediment and animals. So the next step is to continue monitoring and computer modelling to inform the Bay of Plenty Regional Council how to best manage this practice.

"Much of our work is tied up with communities, and local and regional authorities. We act like a broker and distribute the best information we can to all parties to build their knowledge and capacity."

For more than a decade scientists from LERNZ – Lake Ecosystem Restoration New Zealand – have been working on a series of projects that aim to restore indigenous biodiversity in lakes by developing new models and technologies to effectively manage harmful algal blooms and new invasive fish management and control technologies.

In 2005 LERNZ was awarded \$10 million over 10 years from the Ministry of Business, Innovation and Employment. At the end of last year LERNZ received another \$5 million over four years to link its lake research with NIWA, the Cawthron Institute in Nelson and the University of Otago.



Research Officer Chris McBride and Professor David Hamilton

The new research is designed to ensure widespread improvements in knowledge and capability of stakeholders – iwi, regional councils, DoC and other end-users.

The lakes up close

New Zealand's 3900 freshwater lakes, that's all lakes bigger than a hectare, are having their details captured to provide people and organisations with a visual picture of each one.

Lakes are required to meet national standards and the visualisation project will enable fast and comprehensive access to lake data.

Under the Takiwa project, University of Waikato and LERNZ scientists are working with Waiora Pacific, a New Zealand company that provides information modelling and visualisation solutions that enable capture and display of massive amounts of data collected from sensors and satellites.

As well as water quality, the maps also feature the climate, topography and uses of surrounding lands. Collecting and analysing the data will allow scientists to see patterns and trends in how climate, land-use and on-water activities affect lake health.

Professor Hamilton says during the 10-plus years of LERNZ, other government agencies have come on board, such as DoC and the Ministry for the Environment.

"This was an OBI, a government outcome-based initiative and I think we showed in the project's early years that we were getting good results and that end-user groups could identify with what we were doing and benefit directly. That kept us on track and over the years we have been extremely successful in meeting their goals and building capacity."

Catch a carp

At the National Agricultural Fieldays this year, a new app is being launched to help control the spread of invasive fish in lakes, rivers and streams.

"Catch a Carp" will help the Waikato Regional Council control invasive fish species in Waikato waterways. Developed at the University of Waikato, the app is an excellent example of citizen science.

Once downloaded anyone can tap in, noting where, when, and how many unwanted fish, such as koi carp, they see.

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Good outcomes from Outcome-Based Investment

One of the side benefits from working on the LERNZ project has been the number of University of Waikato students who have completed higher degrees and moved into jobs.

Seventy-five students enrolled in either master or doctoral degrees during the first 10 years of the Lakes Restoration project, and there were 20 other students, mostly undergraduates, who were involved in different research projects. Seventeen students completed doctorates, 45 completed Master of Science degrees and there was one Master of Social Science qualification conferred.

Deputy Vice-Chancellor Research Professor Bruce Clarkson says the University has traced 61 graduates through to professional employment.

"Most of them, nearly 60%, are now working in research institutes, such as NIWA, Cawthron, GNS and Scion, for councils, universities and industry," says Professor Clarkson. "Sixteen percent of this graduate group have moved to overseas posts, which indicates the learning and skills achieved during the LERNZ project set them up well in a competitive international market.

"Other graduates are working as consultants, in museums and zoos, as teachers, and many have decided to continue postgraduate study," he says.

While OBIs (Outcome-Based Investments) have had their critics, Professor Clarkson says he supports this type of mission-led research – where there's a clear end-goal or goals and the research is geared towards providing solutions to environmental and other problems. "There's still opportunity within the brief to engage in blue-skies research, but this OBI has delivered positive outcomes for all involved."

The LERNZ project has so far generated 1356 significant knowledge transfers to end-users, including 137 commissioned reports.

ACTION NEEDED IN FLOOD ZONES



Professor Iain White

Flooding is New Zealand's most frequent natural hazard, yet we don't seem to learn much from each occurrence. There's a lot of post-flood talk, but once the water subsides, so too does the action.

University of Waikato Professor of Environmental Planning Iain White says in the wake of floods politicians will routinely talk about solutions, such as relief funds, or refer to climate change and infrastructure investment, but little is done to remedy the consequences of repeat flooding. For example, after last year's floods in Whanganui, Rangitikei and Manawatu, Prime Minister John Key admitted that there was a 'need to act', but provided little detail.

Professor White says with climate change and urbanisation we can expect flooding to increase. "And the aftermath of a flood provides an important 'policy window' to galvanise the diverse stakeholders into action to provide the political momentum needed to attract new investment or implement more effective policies, but all too often it doesn't happen."

With his colleague Professor Graham Houghton at Manchester University,

Professor White has researched major flood events in the UK over recent years, and their work sounds a warning that not only do the after-flood calls to action fail to inspire significant policy change, responses are entirely predictable.

"There are the usual questions about whether floods are related to climate change, calls for international solutions, calls to listen to local knowledge that would have helped prevent flooding and politicians are always accused of not acting quickly enough," Professor White says.

"This formula seems to replay again and again. So, it's not just the floods that reoccur, but the conversations too."

He says in New Zealand, flooding is regional and requires tailored and integrated solutions. "For example, parts of low-lying land around the Thames Coast have certain types of risk, but we also know Wellington and Dunedin have had floods too, so that's different kinds of risk and different types of solutions we should be thinking about. But it still requires an integrated approach because flood policies in one area will

almost always require integrated policy interventions in surrounding upstream and downstream areas."

Professor White is advocating better integration of scientific and local knowledge about the causes and consequences of flooding, moving away from polarised debate between scientific experts and local knowledge. He advises integrating flood policy at local, regional, national and global levels. "The threat demands serious, integrated reform across sectors, rather than small-scale tinkering or an incremental rise in flood-defence funding.

"Given how much we know about flooding and what causes it, we should really be better at managing our response," Professor White says. "We need to get used to the fact that extreme weather may become our new normal, and we need a policy environment that changes as the science does."

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After the initial fanworm discovery in 2013, the University worked closely with the regional council to establish and conduct a six-monthly Bay of Plenty-wide surveillance programme. Divers were also sent at more regular intervals to places where fanworms had been previously found, areas such as Bridge Marina and the Sulphur Point Marina. BOPRC is now leading the surveillance with assistance from the University.

Dr Ross says the University has now moved into a research phase where scientists are trying to better determine how Sabella is spread and feasible treatment options once an area becomes infected.

"Masters student Staci King is looking at different viable treatments for aquaculture farms that will kill the fanworms but do not affect the mussels. The ability of Sabella to regrow after being fragmented is also being investigated.

"This research is funded by the Waikato Regional Council and the Ministry of Primary Industries, with the aim of producing effective solutions to treating Sabella infestations at aquaculture facilities. The research is focussed on the Firth of Thames where mussel farms and fanworms co-exist."

Staci also recently completed a Priority One-funded summer research project that detected rafting of Sabella on marine debris in the Coromandel region. This clearly shows that other pathways of movement from location to location for this species exist. The enormity of this finding saw Staci present her findings at the recent International Conference on Marine Bio-invasions in Sydney, Australia.

Dr Ross is one of many Waikato researchers who have contributed to new research just released on the 2011 Rena disaster. It explores lessons learned and the ensuing chemical, toxicological, social and ecological studies of contamination and environmental recovery. While legacy issues remain, New Zealand's state of preparedness for future maritime disasters has been greatly enhanced by the scientific work done in response to the Rena grounding.

This research can be accessed at:

<http://www.tandfonline.com/toc/tnm20/50/1>

TAURANGA HARBOUR FANWORMS UNDER THE MICROSCOPE

Despite initial concerns that the discovery of a Mediterranean fanworm in Pilot Bay could lead to an infestation of the marine pest in Tauranga Harbour, it has so far turned out not to be the case.

In 2013, divers from the University of Waikato discovered a Mediterranean fanworm (*Sabella spallanzanii*) in Pilot Bay. The University worked with the Bay of Plenty Regional Council (BOPRC) with support from the Ministry for Primary Industries to set up a surveillance programme to monitor any increase in fanworm numbers.

Post-doctoral research fellow Dr Phil Ross, who is based at the University's Coastal Marine Field Station, initially co-ordinated the surveillance with BOPRC. He says because there haven't been a huge number of fanworms discovered in Tauranga Harbour over the past three years, there was still potential to keep them out, whereas in places such as Auckland where they are well established, there's no way to control them.

"At this stage we're lucky that there is still potential to prevent fanworms becoming established in Tauranga Harbour, but it's going to depend very much on educating boat-owners. They need to keep their boat hulls clean and their anti-fouling paint in good order so as not to spread fanworms."

Sabella are present in Auckland Harbour, Lyttelton and Whangarei harbours, on aquaculture facilities in the Hauraki Gulf, on marine debris in the Coromandel, and have also been found on barges in Coromandel Harbour.

Tube-dwelling Mediterranean fanworms grow up to 40cm in length. If established, they can grow in dense clumps and form meadows, competing with native filter-feeders for food and space. In high densities, they are likely to impact on mussels, oysters and scallops.

They can also interfere with boating, aquaculture and recreational pursuits. Like other marine pests, they typically arrive in and move throughout a region through biofouling on vessels, movement of aquaculture equipment and stock, and ballast water.



TAGGING SHORT-TAILED STINGRAYS

Stingrays and sharks are threatened species because they grow slowly, mature late and have few young. Waikato University PhD student Helen Cadwallader says increasing fishing pressure and growing coastal communities, means their numbers are declining rapidly so she's studying the movements of short-tailed stingray in Tauranga Harbour and the impacts that urbanisation might be having on these largely un-researched ocean-living creatures. This involves tagging them and tracking their movements.

She calls in other willing staff from the University's Coastal Marine Field Station at Sulphur Point in Tauranga to help her tag the fish. "There's a Sanford's retail shop right by the boat ramp and they give me some of their older fish frames which we use to attract the rays," Helen says.

"The stingrays come in to ankle-deep water where we catch them briefly on a

big tarpaulin, calm them down and tag them.

That sounds easy, but it's not. A stingray's skin is soft and smooth and Helen has no idea how long the tags will stay on a stingray's body. So she's trialling two sorts of tag; a conventional dart-type, and a disc-type which is much harder to place but likely to remain in place longer.

Helen has also targeted other points around the harbour to tag the fish, and the colour of the disc and dart will tell her where each fish was tagged. "This will help us follow their movements and determine their seasonal patterns. And we also want to know if they stay within the harbour all year or whether they in fact leave for deeper waters for any reason."

All the stingrays they've tagged so far are females. "We have no idea why. Males may be more transitory, but we're not sure. It's something I hope to find out during the course of the project."

Further down the track, Helen will also take biopsy samples from some of the stingrays so she can compare heavy-metal levels of stingrays in the southern harbour with other areas with less industry and urbanisation.

"That will help us see if rays that spend time in urbanised areas have a build-up of harmful chemicals that might be affecting their reproduction and health."

Waikato staff are not the only ones working on the research, in an example of citizen science, Sanford staff and other people in the know are reporting to Helen via www.apexpredator.co.nz registering when they see a stingray, what colour its tags are, and the number on the disc if they can see it.

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STUDY TO EXAMINE KAVA'S EFFECTS ON DRIVERS



Kava root, a central ingredient in Pasifika culture

Kava is a central ingredient in Pasifika culture, and its effects on drivers and road safety are being studied by former policeman and soldier Dr Apo Aporosa who has received a Pasifika post-doctoral fellowship worth \$230,000 from the Health Research Council of New Zealand.

Dr Aporosa is a research fellow based in the University of Waikato's Anthropology Programme working with Psychology's Traffic and Road Safety research group. He has a doctorate in Development Studies from Massey University that focusses on the interplay between traditional kava use and contemporary society.

Kava is a traditional Pacific Island drink with great cultural significance that produces soporific relaxant effects similar to sedative drugs. In his study, which is the first of its kind, Dr Aporosa will work with three groups of 20 participants: one group will be non-kava users (control), the second will be a kava-fasting group (kava-users who have abstained from kava for a 90-hour elimination period) and the third group will be a regular kava-using group (users who drink frequently throughout the week).

Participants will undergo cognitive testing at hourly intervals over a six-hour period, the average kava session duration.

To comply with average traditional kava consumption rates, each participant within the two active groups will drink six cups of kava an hour.

Participants will be tested using a computer-mounted psychometric measure that assesses vigilance, divided attention and reaction.

"This study resulted out of my own history of kava use as a Fijian, my experience of drug-drivers and motor vehicle accidents as a policeman, and more recently consultation by the New Zealand Police Prosecution Service as part of their prosecution of kava drivers," says Dr Aporosa.

"Until a quantitative assessment of kava drivers has been completed, no authoritative comments can be made on kava's effect on driving."

Dr Aporosa says in the Pasifika culture, kava is recognised as having a 'mana' aspect to it, therefore kava and its use is uniquely linked to traditional practices and respect behaviours.

"Fijians also refer to kava as 'wainivanua', literally meaning an 'ingestible manifestation of our culture, the land and our people'."

Dr Aporosa estimates there are more than 20,000 kava users on an average Friday or Saturday night in New Zealand with its popularity growing among non-Pasifikans. Most of these users are consuming kava at volumes 32 times greater than pharmacologically recommended, with many then driving home.

"Injury resulting from road traffic accidents is the leading cause of hospitalisation for Pasifika men and women living in New Zealand, with anecdotal reports suggesting kava contributes to this," says Dr Aporosa.

While kava contains a number of active compounds called kavalactones making it mildly psychoactive, it is neither alcoholic nor hallucinogenic and its gentle effects are different to those of alcohol or most other drugs. Users describe kava as subtle, producing a sense of relaxation and sociability without impairing judgement or causing inhibition as experienced with alcohol.

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MICHÈLE'S TOP SCIENTIFIC MIND



Associate Professor Michèle Prinsep

An academic from the University of Waikato has been named one of the world's most influential scientific minds.

Associate Professor Michèle Prinsep is a highly cited researcher in Pharmacology and Toxicology, and is one of nine New Zealand researchers – and 3126 worldwide – identified as being one of the "world's most influential scientific minds of 2015" by Thomson Reuters.

"The work I do is quite interdisciplinary, sitting on the boundary between chemistry and biology, and it has broad applications," says Dr Prinsep.

"For example I'm working with other scientists from the University and from Plant & Food Research investigating whether anti-Psa chemicals can be found in marine organisms."

Dr Prinsep received her BSc(Hons) and PhD degrees from the University of Canterbury, where she studied the isolation and structural elucidation of biologically active secondary metabolites from sponges and bryozoans.

She undertook postdoctoral research on cyanobacteria at the University of Hawaii before returning to New Zealand

in 1991 to take up a lectureship at the University of Waikato. Dr Prinsep won the Zonta award for Women in Science in 2000, is a fellow and past president of the New Zealand Institute of Chemistry, and a committee and foundation member of the Australia-New Zealand Marine Biotechnology Society Inc.

She is on the editorial board of the journal Marine Drugs and is one of the New Zealand team that writes the highly cited annual reviews on marine natural products for the high-impact journal Natural Product Reports published by the Royal Society of Chemistry

"There is a very strong trend in the field towards research on micro-organisms, so my workload keeps increasing," she says. "The Thomson Reuters recognition is very gratifying. It's good to know that what you do has significant impact elsewhere."

Dr Prinsep is involved in many international and national collaborative projects that are predominantly interdisciplinary in nature. Her research interests include the isolation and structural elucidation of biologically active and/or novel metabolites from marine organisms, especially bryozoans and from marine and freshwater cyanobacteria and

coastal fungi. Chemical ecology, or looking at how organisms use the chemicals they produce in their interactions with other organisms, is another strong interest.

It's estimated there are about nine million researchers in the world who together produce more than two million reports each year. Dr Prinsep's work has been recognised as consistently wielding outsized influence in the form of citations from fellow scientists.

The more than 3000 highly cited researchers listed in the Thomson Reuters report were selected by analysing citation data over a recent 11-year period (2003-2013) and identifying those who published the greatest number of highly cited papers. Also identified were "hot researchers", authors of papers published in a recent two-year period (2013-2014) that were cited immediately after publication at extraordinarily high levels. Highly cited papers rank in the top 1% and hot papers rank in the top .1% of the citation distributions of comparable papers, those matched for field and age.

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ANTARCTIC RESEARCH BENEFITS FROM MBIE FUNDING FOR INZ-KOREA COLLABORATION



Two helicopters, two aeroplanes, five tonnes of gear, eight people and 500,000 penguins. That was the scene at Antarctica's Cape Adare last November when a three-week expedition travelled to Victoria Land's northern-most point.

The group was there to conduct a bio-complexity survey (surveying the different types of biology), install a new weather station on the beach, and repair an existing weather station on a nearby ridge.

Nearly a year on from being granted funding from the Ministry of Business, Innovation and Employment (MBIE), the expedition, led by Professor Gary Wilson from the University of Otago, was a collaboration involving University of Waikato's Professor Craig Cary, and scientists from Otago and Canterbury universities, NIWA, Landcare Research, Antarctica New Zealand, and Korean Polar Research Institute (KOPRI).

"It was about establishing a presence at Cape Adare," says Professor Cary. "There's a future plan to develop a semi-permanent facility there. The expedition allowed us to further work on projects with South Korea, developing active research programmes with the Koreans in terrestrial ecosystems."

While the expedition took three weeks, Professor Cary says much of that time was taken up getting in and out of the area, setting up the camp and trying to work in between bad weather systems where the group was battling winds of up to 185kmh, major storms, and at one point being confined to their tents for 36 hours due to bad weather.

"The expedition was a monumental task and a huge achievement, especially in terms of logistics. We only had six full days in which we could carry out the work," Professor Cary says. "But the collaboration experience was so valuable in terms of learning how to work together as we have very different approaches



to this type of work. We've come a long way in forming what I'd consider to be a significant relationship with our Korean colleagues. When two independent programmes come together, it takes time to mesh them."

"The expedition was a monumental task and a huge achievement, especially in terms of logistics."

In February 2015, MBIE announced the University of Waikato was one of three multi-institutional joint research projects with the Republic of Korea to be awarded funding through a newly established bilateral funding scheme. The projects will receive \$450,000 over three financial years through the New Zealand-Korea Strategic Research Partnership Fund. The projects focus on priority areas agreed by the two governments: Health, Advanced Technologies and Environment/Antarctica.

Based at the Thermophile Research Lab at the University of Waikato, Microbial Ecologist Professor Cary is Waikato's principal researcher in the project, which is in collaboration with Canterbury University, the New Zealand Antarctic Research Institute, GNS Science, University of Otago and NIWA and joined by KOPRI to investigate the impacts of a warming climate on Antarctica. The project is entitled "A multidisciplinary approach to understanding the vulnerability of Antarctica's physical and ecosystems to changing global climate".

The University of Waikato has been collaborating with KOPRI for the past five years including taking part in a series of workshops looking at aspects of microbial ecology in terrestrial (land) Antarctica.

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MATHS AND APPS

While mobile technologies and the associated apps are widely used in schools, and there is evidence that they can motivate students to engage with mathematics, there is a scarcity of research into the ways these technologies influence learning and mathematical thinking.

Dr Nigel Calder and Dr Carol Murphy from the University of Waikato in Tauranga are leading a project on teaching and learning primary mathematics through the use of apps with mobile devices.

They have been awarded \$200,000 from the government-funded Teaching and Learning Research Initiative for the two-year project that will focus on how teacher knowledge and using mobile technologies when teaching maths can influence mathematical learning through the use of apps, particularly the understanding of concepts.

The academics will work with teachers to construct a framework to evaluate and inform teachers' decisions regarding the use of apps to enhance student understanding.

Dr Calder has been a teacher, secondary school maths advisor and a lecturer in maths, science and technology education, and has already done other research and written a book about the use of digital technologies in mathematics education.

The first year of this new project will involve three expert teachers and their classes with students aged 8 to 11, says Dr Calder. One class will be in a BYO device school and the other two will be in a school with classes working one-to-one with iPads.

"We'll collect data through mathematics assessments, teacher and student interviews and blogs, and videoed classroom observation," says Dr Calder. "Themes will be co-constructed to develop the initial draft framework. In the second year the teacher group will expand to 12 teachers with a broad range of class levels, and expertise and experience with mobile technologies. The same data collection and collaborative processes will refine the framework and exemplars for best practice."

Some of the apps they'll use are Math Shake, Explain This, Multiplier, TouchCounts, Maths Run, Hopscotch

and others that teachers identify and use in their practice for specific learning objectives.

This is important research says Dr Calder. "Because while many New Zealand primary schools are investing in a range of mobile technologies, teachers are often expected to integrate the technologies into programmes without the support of systematic research.

"So far there's been little research into students' conceptual understanding of mathematical ideas through the use of apps in primary classrooms. Hopefully this research will help deepen our understanding of how digital technology can be used to create learning experiences that match student needs."

He says there's international interest in this area of study and this project will consolidate and build on knowledge from current research on the potential of mobile devices and apps on learning behaviour, engagement and motivation.

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Associate Professor Tahu Kukutai and Research Officer Moana Rarere

MISSING MĀORI MEN

Māori women substantially outnumber Māori men in nearly every tribe and two University of Waikato researchers are working to find out why.

Associate Professor Tahu Kukutai and Research Officer Moana Rarere from the National Institute of Demographic and Economic Analysis at Waikato University say it's important to know the reasons behind the imbalance so that it is appropriately acknowledged and addressed.

The ratio of men to women identifying with an iwi in the census has dropped steadily from 96 men for every 100 women in 1991 to 89 men for every 100 women in 2013. Female-favoured sex ratios tend to be greatest at 25-44 years. In some iwi the sex ratios at those ages are as low as 60 men for every 100 women.

"Our main focus is on trying to explain the systematic demographic dominance of women in iwi populations reported in

the census and it's not clear cut," says Dr Kukutai. "The three demographic factors that could explain the skewed sex ratios are births, deaths and migration. Sex-selective migration, especially to Australia to work, accounts for some of the imbalance, along with higher Māori male mortality. Māori males are also more likely to be missing from the census in terms of not being counted. But these things together cannot explain the dominance of women in most iwi."

Instead, the research points to what's called an identification gap. Māori women in the census are identifying with iwi at a higher rate than men.

Ms Rarere says the female dominant sex ratios seem to be linked to gender differences in iwi identity more broadly. "Women are more likely than men to know all aspects of the pepeha – their tribal identity, and are more likely than men to speak Māori in all age groups under 50."

Dr Kukutai says their study is limited to iwi reporting in the census so they don't know if imbalanced sex ratios are also an issue on iwi registers that are maintained by iwi and subject to privacy restrictions. "We're looking for patterns and we're looking for answers, but to do that successfully we have to understand the cultural and historical context within which Māori identify with their iwi, and the differences between official data and iwi-controlled data."

Ms Rarere says the dearth of men in most iwi is concerning, especially if it is evident within tribal registers. "It matters for cultural roles on the marae, for kaumatua and language revitalisation. It matters for iwi development and for settlement pay outs," she says.

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How do you accurately measure world hunger?

One of the high-profile Millennium Development Goals was to reduce world hunger by half. But it didn't happen. University of Waikato economist Professor John Gibson says we can blame volatility of world food prices and damaging protectionist responses by some countries for not making target, but he suggests part of the failing may be as simple as the survey methods.

He's been working with the World Bank Development Research Group to find a better and more consistent measuring method. The UN's Food and Agriculture Organisation measures hunger in terms of calorie availability, by working down from a country's national food balance. Competing approaches work up from household consumption expenditure surveys, but many different survey designs are used.

"So we decided to test the competing survey designs in one country, Tanzania, and randomly assigned seven types of surveys to more than 3500 households in 168 communities and surveyed over a year."

The designs varied in four dimensions; how the data were obtained, from whom, over what period, and in what degree of commodity detail. The variation in apparent hunger rates was huge, with estimates ranging from 19% to 68% of the population being hungry.

"That's a difference of 23 million people in Tanzania. Scaling up, across all of Sub-Saharan Africa these differences would amount to hundreds of millions of people potentially misclassified as either hungry or not hungry depending on what survey method is used," Professor Gibson says.



"So while I think the calculation of hunger numbers directly from household surveys holds great promise, this approach may only be feasible once much more effort is put into harmonising household survey design."

Clever thinking about accessibility for all



As signatories to the UN Convention on the Rights of Persons with Disability, New Zealand must build inclusive environments – including transport,

footpaths, road crossings and parking. That's fine in theory, but replacing old and existing infrastructure for new will be expensive.

Professors Stuart Locke, pictured, and Frank Scrimgeour from Waikato Management School worked with Bridget Burdett from Hamilton's Traffic Design Group to develop conceptual models of the economics of equitable participation.

Word of their work spread and Professor Locke and Ms Burdett were invited by the OECD to present their models at a closed round-table meeting of the International Transport Forum in Paris in March this year.

"This all-round economic approach is a new concept for the transport industry," says Professor Locke.

"They talk about the rights and principles of universal design, but to date the industry has not put these values in dollar terms. We need to start by being inclusive and measuring the cost of that, rather than, for example, constructing a new road and then planning for universal access.

"Without the tools to value investment in accessible transport, we can't prioritise it effectively," says Professor Locke.

He says we need more and better data about links between transport and participation, "and once we've got that, we can make practical and useful recommendations to transport planners and policy makers".

Apps provide incentive to keep on running

For couch potatoes keen to adopt a fitter lifestyle, exercise apps might just be the incentive they need. University of Waikato psychology student Rebecca Jenkins tested the effectiveness of the exercise app Couch to 5K as part of her Masters degree. It's an app specifically designed for people who are exercise novices.

She tested 17 willing participants against a number of different measures using the Health Action Process Approach – a health behaviour change model that incorporates measures such as self-efficacy, action control and planning, which, according to this model, are constructs that are essential for health behaviour change.

"Other things I measured were mood and wellbeing which were measured with the Depression Anxiety Stress Scale (DASS) and SF-8, a health-related quality of life instrument."



She found that the app increased the likelihood of people keeping themselves in check and that everyone's levels of vigorous exercise increased. And Rebecca says while there may have been other influences, participants reported that their moods improved too. There was

strong correlation between action control and app usage.

She says if the app helped people self-regulate and monitor, then apps may become an important contributor to keep people exercising long term.

Linking Chinese art and cultural diplomacy

History and Art History academics are unravelling the stories behind New Zealand's most extensive collection of Chinese art.



The collection, held in Canterbury Museum, came about through New Zealander Rewi Alley's connections to the highest levels of China's communist leadership, including Chairman Mao.

Associate Professor James Beattie from Waikato University and Dr Richard Bullen from the University of Canterbury are principal investigators on a three-year Marsden-funded project to investigate the scope of Canterbury Museum's Rewi Alley Collection, why and how it developed and the extent to which the artefacts encouraged favourable perceptions of 'New China' in New Zealand.

As part of the project, they have created a public website that features the art, which includes ceramics, jades, Tibetan scripts, prints, paintings and bronzes; some of them thousands of years old. The site was launched by the Chinese Consulate-General, Jin Zhijian, at the

recent *Museums, Art and Chinese Cultural Diplomacy in the Pacific symposium*.

"This site will be used as a curation tool, connecting researchers around the world by enabling them to share knowledge about the artworks in the collection," says Dr Beattie.

Alongside the website, the \$434,000 Marsden grant is planned to include an international art exhibition, articles, talks, and a major international monograph, tentatively titled *Chinese Art and Cultural Diplomacy during the Cold War: Rewi Alley, Museums, and the Politics of Art Display*.

Dr Beattie says project findings will significantly advance knowledge in many areas of art, exhibition and diplomatic history, as well as New Zealand-China relations.

<http://www.rewialleyart.nz>

AGEING IN REMOTE LOCATIONS



Dr Sheena Moosa (right)

There's been plenty of talk and research into ageing populations in the developed world, but there's little information available about the needs of older people in small-island developing countries.

Dr Sheena Moosa, a GP from the Maldives, has just completed a PhD at the University of Waikato where she investigated the needs of older people in her homeland, interviewing nearly 400 of them to learn about what they wanted and needed for wellbeing as they aged.

The Maldives is a relatively young democracy, with a population of about 350,000. It's located in the Indian Ocean, composed of 26 coral atolls, made up of hundreds of islands – 200 of them are inhabited. Its residents face distinctive challenges, with the population widely dispersed and relying on a narrow economic base and vulnerable to climate change and sea-level rise.

"The geo-spatial aspects of the Maldives present issues for older people that older New Zealanders are unlikely to face," says Dr Moosa.

"For example just getting access to a routine health check can be a problem. The majority of older people will have to travel to another island, and due to the social norms you're unlikely to send an elderly person off on their own on a boat to get the services they need with no one to support them at the other end."

Dr Moosa found that in the Maldives' collectivist culture, social connections and the role of the extended family were just as important to older people's wellbeing as good health.

"The welfare benefits available to people in the Maldives are not adequate to meet the needs of the older person, so it often comes down to family to ensure their elders' needs are met. The money earned is for the household, not the individual, and family connections and support are necessary for older people's wellbeing."

In addition to talking to 393 older people, Dr Moosa met with stakeholders, people working with and servicing the needs of older people. "Once I'd gathered and analysed all my research, I was able to

develop some tools to measure wellbeing in the specific socio-cultural and geo-spatial context of a small-island country and suggest indicators for monitoring older people's wellbeing and inform policy development," she says.

Dr Moosa presented her research at the 2014 International Federation of Ageing Conference and wrote about surveying in small-island countries in the international journal *Field Methods*. In New Zealand she has contributed to research on active ageing and living alone.

Dr Moosa is now working for the Waikato District Health Board as an analyst to support healthcare service and performance, which includes statistical analysis of healthcare targets, and service utilisation patterns by different demographic characteristics and case-mix patterns across the Waikato.

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Baby Pippa on her mother Le-Anne's knee and Dr Sabine Seehagen

LEARNING WHILE ASLEEP

Babies sleep a lot, and research shows that in their first year of life, sleep is essential for them to remember facts and events. What's more, babies learn best if they sleep soon after learning something new.

Dr Sabine Seehagen, a developmental psychologist now based at the University of Waikato, led a study with colleagues at Ruhr-Universität Bochum in Germany and the University of Sheffield in England which, for the first time, used an experimental design that assessed declarative memories, that is, memories for facts and events. The researchers concluded that sleeping after learning appeared to be important for infants' long-term memories.

"We studied more than 200 infants aged 6 and 12 months. We visited each infant twice in their home, either shortly after the infant had slept or just before they were expected to fall asleep, always following their natural sleeping patterns," says Dr Seehagen.

A hand puppet with a removable mitten was used in the experiment during a

learning event. Inside the mitten was a bell. A researcher would engage an infant, remove the mitten and shake it three times to show how the mitten sounded and moved. Afterwards, the mitten was placed back on the puppet's hand. The procedure was repeated several times.

Half of the infants took a nap within four hours of watching the researcher showing the actions with the puppet while the rest either slept for less than 30 minutes or not at all. The infants were tested after 4 or 24 hours to see if they would be able to repeat what was done with the puppet.

Only those infants who took substantial naps within four hours of learning remembered the actions the researcher had shown them with the puppet, as indicated by their imitative behaviour. In contrast, those who had little or no sleep time shortly after learning did not remember the shown actions.

"Most people would assume that being wide awake is best for learning, but this study showed that events occurring relatively close to sleep time may be remembered particularly well by infants," Dr Seehagen says.

She is now keen to extend this research, to fully understand the role sleep plays in retaining memory. "I want to know how sleep helps infants to remember different types of information, and why sleep only strengthens some memories and manages to lose others.

"In addition to exploring the role of sleep, I also aim to explore further aspects of learning, such as when do young children start to put themselves in someone else's position and distinguish their own opinions from others, and how do infants learn from different media, such as television and picture books."

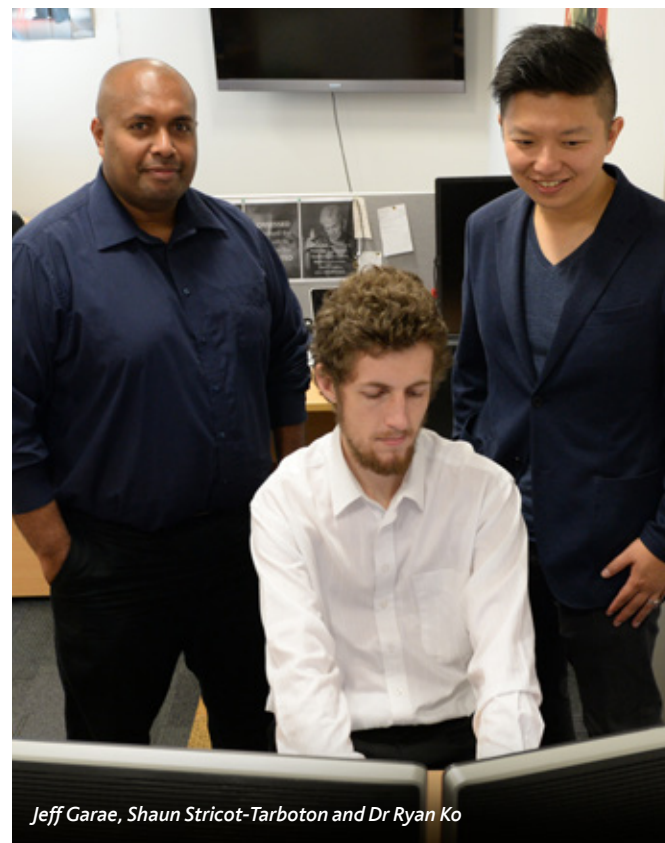
To that end, Dr Seehagen is looking to recruit families with children between six months and five years to participate in her research. "The more we know, the more we'll be able to create environments and situations that help them learn." www.waikato.ac.nz/fass/weds

For more information:
contact sabine@waikato.ac.nz

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INSIGHT IIINTO IIINTERPOL



Jeff Garae, Shaun Stricot-Tarboton and Dr Ryan Ko

Two University of Waikato Computer Science students secured internships at INTERPOL's Global Complex for Innovation in Singapore, working for three months on projects that will benefit the international security organisation and their own postgraduate study.

Doctoral student Jeff Garae is working on a Security Visualisation Intelligence research project and Masters student Shaun Stricot-Tarboton was awarded a 2015 Prime Minister's Scholarship for Asia for an internship with INTERPOL's Global Complex for Innovation (GCI) in its cybercrime division. Shaun is carrying out extended research into attack classification, which slots in nicely with his Masters research.

Both students were encouraged to apply for the INTERPOL positions by their research supervisor Dr Ryan Ko, head of the University of Waikato's Cyber Security Lab, also known as CROW (Cybersecurity Researchers of Waikato).

"It took a year of planning and discussions with INTERPOL staff," says Dr Ko. "Our lab is aiming to address pressing cyber security issues, and an INTERPOL research attachment adds real-life validation and

truly global experience to the students involved."

Shaun says the sheer quantity of cyber-attacks that occurred in the past 12 months is staggering. "Over the past year 34.2% of 3.2 billion internet users' computers were subject to at least one web attack and about 10% of those, or 320,000,000, were successful.

"I would say as a society, myself included, we are of the notion that we are a single person among billions, and that cyber-criminals would not possibly target us as we have nothing of exceptional value stored online," Shaun says.

"But anyone who pays attention to cybercrime and cyber security will come to the scary realisation that unless you are prepared to lose everything, from your precious holiday photos to your identity, you are not prepared."

Shaun says his internship at INTERPOL will allow him to verify and validate his Masters degree taxonomy (classification) of man-in-the-middle attacks on HTTPS, eg, where an attacker intercepts communication between a client (your browser) and a server (your online bank).

Jeff Garae, from Vanuatu, came to Waikato University in 2013 on a Ministry of Foreign Affairs and Trade (MFAT) NZ Aid programme scholarship and was the first student to graduate with Waikato University's Master of Cyber Security.

For his doctorate, Jeff is working to develop a security visualisation framework that will help law enforcement investigations for attribution purposes and situation awareness. Security visualisation is a security visual technique which allows users (law enforcement, end-users, CEOs, children, etc) to perceive security events derived from complex data in a visual representation with the aim of obtaining insights from the given visualisation.

Long-term Jeff hopes his research will contribute to the security of his own country and the Pacific as a whole. "Cybercrime is a global, no-boundary threat and therefore cyber security can't be dealt with by individual countries alone. There needs to be continuous international (transnational) collaborations to address these issues."

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Tapugao Falefou

SEA LEVEL RISE DEVASTATES

Sea water bubbling up through the ground is a sight Tapugao Falefou hadn't seen in Tuvalu, his homeland, until recent years. He says it's one of the signs of rising sea levels brought about by climate change that threaten the small Pacific Ocean nation.

Tapu is a third-year PhD student from the Faculty of Arts and Social Sciences at Waikato. He is researching the impacts of climate change and sea level rise on the cultural identity of low-lying atoll states such as Tuvalu.

"During high tides on Funafuti 30 years ago I'd hardly ever see places inundated with sea water, but now every high tide is like this. I've seen changes in vegetation in these areas too. Where once it was green and flourishing, now it's yellow and dying. The increased salination of the soil threatens traditional farming."

Tuvalu is made up of nine islands covering 26 sq km. The former British colony now has a population of 10,782 and used to be known as the Ellice Islands. There are no streams or rivers so rainwater must be collected for use.

Tapu's research has included two field studies: one from August 2014 to

December 2014 in Tuvalu, and the other from December 2014 to February 2015 on the island of Kioa and Suva in Fiji where almost 1000 Tuvaluans now live after continued migration there since 1946.

"I talked to people about how they feel about being migrants, how this has affected their cultural identity, and almost all of them still feel connected to their home land in Tuvalu. It's hard for them being away from their roots and the land of their ancestors."

Tapu says a 2014 report by the Intergovernmental Panel on Climate Change shows sea levels are rising by 2.8mm a year and, with the highest point in Tuvalu being only five metres above sea level, even a small increase in sea levels has devastating effects.

"Tuvaluans have no option to move inland away from areas affected by rising sea levels. We just have to squeeze ourselves in until there is nowhere left to run. Relocation is one option, and there are others: elevating the land, coastal protection such as mangrove planting and seawalls, or the creation of floating islands.

"People are already affected by climate change and their lives are uncertain. Should they continue working on their farms, or should they migrate for the sake of their children? When there's a cyclone, people are threatened and want to leave Tuvalu, but as time goes by after such an event, the anxiety to leave changes."

Tapu is from Tuvalu's largest island, Vaitupu. He has a conjoint LLB and BA in Management and Public Administration from the University of the South Pacific in Vanuatu, a conjoint Master of Public Policy and Master of Diplomacy from the Australian National University.

He has represented Tuvalu at climate change conferences, leading delegations from the Tuvalu Government to international climate change conferences COP17 2011 in Durban and COP18 2012 in Qatar in his capacity as Permanent Secretary of Foreign Affairs, Trade, Tourism, Environment and Labour. This is a role Tapu held from 2011-13 and will resume once he completes his PhD.

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Dr Julie Barbour (left) and Masters student Royce Dodd (far right) working with educators in Vanuatu to produce school readers

GIVING BACK IN VANUATU

What began as a research project on the languages in Vanuatu has led to schools there receiving new resources.

It all began in 2011 when University of Waikato linguist Dr Julie Barbour was awarded a Marsden Fast-Start Grant to complete the world's first large-scale comparative study of "mood systems" in Vanuatu languages. There are more than 100 languages spoken in Vanuatu, many of which have never been written or described.

The languages do not use recognisable tenses to describe events in time, but rather they classify events as being real or unreal. Their grammatical structures are very different from English.

Dr Barbour spent long periods on the island of Malekula, Vanuatu's second largest island, and in the capital Port Vila while she and a Masters student completed the massive data collection needed for what was an ambitious project.

"We centred much of our research on Malekula, which has a population of about 28,000 and more than 24 distinct

languages," says Dr Barbour. "The initial fieldwork involved recording native speakers talking on a range of subjects. I suggested topics and scenarios but they chose what to talk about. Then once we'd recorded speakers, we had to transcribe their stories, and then translate, first into Bislama, a dialect of Melanesian pidgin commonly spoken in Vanuatu, and then into English." It was a slow but interesting process. "We talked to many older members of communities as we sought to understand how the languages worked."

In the meantime local teachers were keen to find out more about the work Dr Barbour was doing and this year she was asked to facilitate a literacy workshop on Malekula. "There is a plan in progress to use vernacular languages in the first three years of formal education. The challenge is that there are so many languages and most are not used in a written form."

Working under the Vanuatu Curriculum Development Unit, and in collaboration with staff at the University of the South Pacific, Dr Barbour was assigned to develop materials for the seven most

commonly spoken languages of Malekula. She headed back to Vanuatu with another Waikato University linguist, Dr Nicola Daly, Masters student Royce Dodd and three undergraduate student volunteers. Together they worked with local teachers and teacher trainers to prepare resources for year-one primary school children.

"It's good to be in a position to support local initiatives," says Dr Barbour. "As researchers, we've been 'taking' information and now we're finding ways to return it. As well as the readers, we've created and updated dictionaries, and given local communities photo archives of the work we've done. Making a real contribution to community education is immensely satisfying," she says.

Dr Barbour's research continues a Waikato tradition. Her PhD supervisor, the late Professor Terry Crowley, spent years recording and documenting the languages of Vanuatu.

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WHAT'S ON AT WAIKATO

The University of Waikato links with the community on and off campus



FIELDAYS 15-18 JUNE, 2016

Visit us at this year's National Agricultural Fieldays at Mystery Creek.

The theme for this year's Fieldays is 'Collaborate to Accelerate Innovation' and provides an opportunity for the University to highlight its research and expertise in the agri-sector.

We have developed strong research platforms across important land-based fields, including ecosystems, agribusiness, industrial processes, planning and regulatory processes, all of which contribute to New Zealand's reputation as a leader in the land-based industry sector.

Waikato University's stand at Fieldays will be easy to find inside the main pavilion.



INAUGURAL PROFESSORIAL LECTURES 21 JUNE AND 19 JULY

Waikato's Inaugural Professorial Lectures introduce our newest professors to the community and give them a chance to demonstrate how their work is having a real impact on the world around us.

All lectures are free and open to the public and are held at the Gallagher Academy of Performing Arts beginning at 5.15pm.

Biological scientist Professor Conrad Pilditch, pictured top left, from the Faculty of Science and Engineering, will present on Tuesday 21 June. His speciality research areas are marine and estuarine ecology.

On 19 July, new professor of population health Ross Lawrenson, pictured top right, will talk about his work, including the history of New Zealand general practice and the importance of primary healthcare.

Professor Lawrenson's is a joint appointment with Waikato District Health Board where he is clinical director of strategy and funding.



SCIENCE AND ENGINEERING OPEN DAYS 13 AND 14 JULY 2016

Science Open Day on 13 July offers the chance to explore the areas of science available to study at Waikato University.

Would-be students can take part in hands-on workshops and lab demonstrations and find out about the structure of the Bachelor of Science and Bachelor of Science (Tech) degrees at Waikato, and the many majors and specialisations within these qualifications including Earth Sciences, Chemistry, Physics and Biological Sciences.

Engineering Open Day on the 14th also offers hands-on workshops and the opportunity to discuss study and career options with staff. From B Semester 2016, the University of Waikato will add civil and environmental engineering to its suite of offerings.



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The University of Waikato
Private Bag 3105
Hamilton 3240
New Zealand

Toll Free: 0800 WAIKATO
0800 924 528
Email: info@waikato.ac.nz
Website: waikato.ac.nz