

Centre for Sustainability

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The Centre for Sustainability is a University of Otago premier research centre with an international reputation for its innovative interdisciplinary research on local and global sustainability challenges.

We collaborate closely with communities, iwi, industry and government agencies and form teams with other researchers from across New Zealand and internationally to generate high-quality research.

NEW SUSTAINABLE SEAS RESEARCH FOR DIRECTOR

Centre for Sustainability Director **Dr Janet Stephenson** is honoured to be joining the Science Leadership Team for the Sustainable Seas National Science Challenge.

Sustainable Seas, which brings together about 150 researchers from 26 organisations, is one of the country's 11 National Science Challenges. Its key objective is to enhance the value of New Zealand's marine resources, while providing a healthy marine environment for future generations.

Janet joins the 10-member Science Leadership Team as Programme Leader: Cross-Programme Projects and will have oversight of several projects that integrate across the programme as a whole, including a case study of implementing ecosystem-based management.

"My role is a new one for the project, and builds on my experience in leading multidisciplinary research teams and my previous research on coastal mahinga kai in the Marsden-funded Tirohia he Huarahi project," says Janet.

"I'm honoured and excited to be joining this established research programme that involves New Zealand's best marine scientists and experts."

*For more information go to sustainableseaschallenge.co.nz

“ Interdisciplinary research on sustainability challenges ”

Renewable Energy and the Smart Grid (Green Grid)

Postdoctoral Fellow **Dr Kiti Suomalainen** discusses her involvement in one of the Centre for Sustainability's key projects – Renewable Energy and the Smart Grid (GREEN Grid).

Dr Kiti Suomalainen's work on the GREEN Grid focuses on the interaction of consumers with energy in their households.

"In particular, I am looking at how approximately 20 families reported their energy-related activities in a time-use diary over one week. I'm checking how well these reported activities reflect electricity use at those times."

"The results will help determine if and how we can use reported activities in residential electricity demand modelling. They also give us some insights into how people perceive their energy use."

The GREEN Grid uses modelling of future trends in renewable electricity generation and household demand, together with in-depth knowledge of electricity networks and power management, to ensure that New Zealanders have access to reliable, safe, and affordable renewable energy.

The project, now in its fifth year, is led by the EPECentre at the University of Canterbury and partners with researchers at the University of Otago. Centre Director Janet Stephenson and physicist Michael Jack lead the project at Otago, where the research is focused on exploring consumer demand for new technologies such as solar photovoltaics (PV), electric vehicles and smart appliances, as well as current patterns of demand and opportunities for demand side management.

"We have analysed the use patterns of the household appliances with the highest electricity loads – namely hot water cylinders and heat pumps – and are currently looking at how those appliances could be managed to reduce electricity demand during peak hours," says Kiti.

Kiti gained her PhD within the MIT Portugal programme Sustainable Energy Systems in Lisbon in 2011. Since then she has worked as a research fellow at the European Commission's Joint Research Centre and at the Energy Centre at the University of Auckland. She will be based at the Centre for Sustainability for the foreseeable future.

*For more information about the GREEN Grid, go to otago.ac.nz/centre-sustainability/research/energy/otago050285.html



Postdoctoral Fellow Dr Kiti Suomalainen.
Photo: Gwenda Crawford

Director's Notes



From April until November, our wonderful Director, **Janet Stephenson**, took a well-earned break from her duties at the Centre for her first stint of research and study leave. I was very fortunate to be able to support her as Acting Director, and I've thoroughly enjoyed learning more about the "inner workings" of the Centre. As a big fan of the amazing support that general staff provide, I now have another whole level of admiration and gratitude for the incredible contribution Centre Manager Gwenda Crawford and Centre Administrator Nicki Topliss make in keeping our centre running smoothly. I really want to thank them both for helping me along so much throughout this year.

I've also enjoyed some of the "outward facing" work that I've been asked to do this year, including presenting for the launch of the University of Otago's Research Centres in August. Each Director had just three minutes to summarise what their centre was all about. It was really satisfying to see that CSAFE is one of the most established and successful centres at Otago, and we have a strong reputation, which we have to thank Janet and Hugh Campbell (our inaugural Director) for developing. It takes a huge amount of work to maintain and grow a centre, as well as building a strong research culture.

Another highlight of the year was the glory of winning the inaugural Postgraduate Research Culture Award for small departments of research centres at Otago. Many thanks to Nicki and Emeritus Professor Colin Campbell-Hunt (who provides the Centre with postgraduate support) for putting together our application – it wouldn't have happened without you.

We have a big year ahead in 2018; there are plans for bidding into some major research grants, and we have several new PhD students, an intern and a number of international visitors. In June 2018, CSAFE is being reviewed by the Quality Advancement Unit, which presents a fantastic opportunity for us to focus on our strategic direction and future plans.

Hei konā mai
Caroline

QuakeCoRE workshop planned

Centre researchers will hold a workshop in Oamaru in December as part of a project exploring the issues around the town's earthquake-prone heritage buildings.

The QuakeCoRE workshop, to be held in conjunction with Tracy Hatton from Resilient Organisations, will bring together stakeholders in Oamaru's heritage tourism precinct with the aim of promoting collaboration between individuals and organisations. The workshop will encourage participants to consider the future consequences and various trade-offs associated with actions they make take now.

Postgraduate student **Will Stovall** – who conducted two rounds of interviews with stakeholders, such as council officials, Whitestone Civic Trust members, and tenants of heritage buildings – says there is an air of optimism surrounding the future of the tourism precinct.

"I've really enjoyed seeing the amount of pride many of Oamaru's citizens have in the town's rich heritage. While stakeholders' specific visions for the town's future may differ, all are passionate about preserving the visible history in the form of Victorian architecture."

*For more on the QuakeCoRE project, go otago.ac.nz/centre-sustainability/research/otago638084.html



Photo: Jason Ingham (University of Auckland)

SfTI data highlights impact of irrigation

Data from PhD candidate **Jefferson Dew's** research on the energy and agricultural sectors shows that irrigation has a significant impact on energy use nationally.

"Both in national electricity statistics and in conversations with energy companies, last summer's rain caused a noticeable decrease in the energy use of the agriculture sector. I didn't think it would be such a big effect considering all the other noise in energy use, such as changes in farm production volumes year to year."

Jefferson's work comes under the Smart Services portfolio of the Science for Technological Innovation (SfTI), which is one of New Zealand's 11 National Science Challenges.

His research focuses on identifying and overcoming the social and technical barriers to increased demand response capabilities in the agricultural sector.

"Demand response has the potential to lower costs in the electricity system by reducing the infrastructure requirements built for peaks in demand through behaviour changes by consumers or automation. Renewable energy consumption could possibly be boosted too."

With his first round of interviews complete, Jefferson now plans to analyse data from one of his case studies on a group of farms in the Waikato, to find their contribution to peak demand and potential to shift electricity consumption.

*For more information on SfTi, go to sftichallenge.govt.nz

Hazard-related projects to enhance readiness and resilience

Natural disasters and resilience are key themes in the research of CSAFE Deputy Director

Dr Caroline Orchiston.

"I've always been interested in natural hazards – mainly earthquakes and more recently tsunamis – and how people prepare for them. Some people will struggle to deal with these kind of events while others will find a really proactive way forward."

"I'm interested in why some people choose to be prepared and others don't. All of my work feeds into this in some shape and form."

Caroline is currently involved in several hazard-related projects. Here we look at her Resilience to Nature's Challenges work for one of the National Science Challenges.



Resilience to Nature's Challenges (RNC)

As part of her RNC work, Caroline is involved with the Rural Priority Laboratory and the Cultural Toolbox, which aim to develop innovative solutions to enhance rural resilience, while building an understanding of the social norms of resilience in rural places that underpin a resilient culture.

Multi-level Resilience to Hazards is a collaborative project that aims to improve New Zealand's response capability for a future Alpine Fault earthquake. Project AF8 is a close partnership with Civil Defence Emergency Management (CDEM), which brings scientists and CDEM groups together with the goal of creating a response plan for a predicted magnitude 8 earthquake on the Alpine Fault.

Caroline, who is Science Lead for Project AF8, says the main output of the project is the South Island Alpine Fault Earthquake Response (SAFER) Plan, which will be a guide to how CDEM and partner agencies should respond in the first seven days post earthquake. The overarching goal is to develop societal and community resilience to a future major earthquake disaster.

"A magnitude 8 will be felt across most of the country. The worst damage will be around the Southern Alps close to where the fault ruptures."

A Tier 4 National Ministry of Civil Defence and Emergency Management exercise has been confirmed for 2020, which will provide an opportunity for CDEM and partner agencies across the country to test their readiness.

"North Island CDEM partners need to think about how they would support South Island

CDEM groups during the first seven days, so including the whole country in an exercise is an important recognition of the hazard presented by the Alpine Fault," she says.

The science team is also producing a series of videos to raise public awareness, which will include a Ted-style talk presenting the science of the fault and the potential impacts of a major earthquake, as well as shorter videos that tell stories of people in the South Island who are getting prepared.

"Essentially, a community that is well engaged and is cohesive will do much better after a disaster because they know their neighbours, they talk to each other, they're supportive and are on the same page with their community. People who don't engage like that are far less likely to do well after a disaster."

"I'm interested in why some people choose to be prepared and others don't. All of my work feeds into this in some shape and form"

The RNC Rural Priority Laboratory and Cultural Toolbox projects use Kaikoura and the West Coast/Canterbury as case studies and follow a co-creation model whereby the communities and stakeholders play a part in guiding the project objectives and goals.

"The whole idea of the Challenge is that we are trying to work closely with stakeholders to build resilience to natural hazards. It's about co-creation – working with people who live in these places to figure out ways to make their community more resilient."

One of Caroline's Rural projects investigates tourism recovery, which has been particularly relevant in Kaikoura following

the November 2016 earthquake. The event completely isolated the community and caused significant changes to the coastline and damage to marine life.

"I'm doing a series of interviews with tourism operators looking at how the recovery played out with them. The big operations have had a relatively positive experience in a way. There's been a huge amount of support from the government."

"I haven't talked to any small operators yet and I think that will be a different story. The next phase is to go back up and have more of those conversations."

The Cultural Toolbox has three priority areas, which include understanding new technologies, citizen science, and social norms.

"We plan to investigate new technologies and how they can be harnessed to develop social norms of resilience across diverse communities and hazard profiles. We will also engage with citizens to encourage their involvement in hazard-related science, and develop a framework for citizen-science initiatives."

The Rural Priority Laboratory and Cultural Toolbox involve researchers from many institutions, including the University of Canterbury, Victoria University Wellington, Lincoln University, Massey University, GNS Science and Landcare Research. Both projects will be completed in mid-2019. The next phase of the RNC spans 2019-2024, and will have a reorganized programme structure, currently being devised.

Caroline's work is funded by Resilience to Nature's Challenges and QuakeCoRE

*For more information about these projects go to otago.ac.nz/centre-sustainability/research/environment-people/

Five new postgraduate students have joined the centre recently, bringing a diverse range of research topics with them. They are (from left): Jefferson Dew, Will Stovall, Abbi Virens, David Wither and Rudi Kresna.



New students

PhD candidate **Jefferson Dew** first joined the centre in 2015 as an intern working on the GREEN Grid project. His PhD, which is part of the National Science Challenge – Science for Technological Innovation, is concerned with energy use in agriculture, particularly around increasing the flexibility of electricity consumption. Jefferson is also a research assistant for Flip the Fleet, which focusses on electric vehicle promotion and research in NZ.

Will Stovall is a PhD candidate from Missouri, USA. His research examines the sociology of anthropogenic climate change and the contribution of aviation and other industrial sectors to greenhouse gas emissions. He is particularly interested in the association between climate change perception and political identity, and the role of media and community in facilitating

that relationship. Will is also a research assistant for the Centre's QuakeCoRE project involving heritage tourism and seismic safety in Oamaru, New Zealand.

Abbi Virens is a masters candidate from Ontario, Canada. Her research explores how urban foraging practices in Dunedin connect people to the land, plants, animals and their own community. She is particularly interested in what people forage for and why, and hopes that foraging will show how humans can interact with the environment in novel ways to access different forms of food, medicine and craft materials.

PhD Candidate **David Wither** first joined the Centre on a summer scholarship. He is now working with Rural and Cultural teams from the Resilience to Nature's Hazards Challenge for his thesis on how the institutional environments surrounding

farmers impacts on their personal resilience, with comparisons between those who have experienced natural disasters and those who have not. David is also involved in a project investigating the social impacts of the 2016 Kaikoura earthquake.

Rudi Kresna is a PhD candidate from Bandung, West Java, in Indonesia. His research examines the link between social and natural capital to promote sustainability and resilience among smallholder dairy farmers in Indonesia through the adoption of integrated dairy farming systems. Rudi's aim is to contribute to formulating suitable policies for agricultural development in Indonesia. In December he will present an abstract on the theoretical framework of his research at the 24th International Conference of the Agrifood Research Network, which is being held in Indonesia.

Perceptions of climate change

How does the experience of a place in the present influence the way we anticipate its future? This is the key question PhD candidate **Gilles Marciniak** is exploring in his doctoral project on the human experience of climate change.



Gilles, who is being supervised by Janet Stephenson, Caroline Orchiston, and Jacinta Ruru, has been at the Centre since November 2014. His research focuses on two local case studies – Waitati and South Dunedin – which are both low-lying coastal places being impacted by sea-level rise.

In order to understand people's relationship with the area, Gilles conducted mobile interviews with residents in which they gave him a "guided tour" of their area, often taking him to places that had a special significance to them, either positive or negative.

"In the interviews, I paid particular attention to the ways participants expressed their experience of these places: how long, how often, and why they have been engaging with them; why they are significant; how the places have evolved over time; and also what they imagine these places will be like in the future."

Comparing past experiences with future expectations has revealed consistencies and discrepancies, says Gilles. For example, some participants that had recently experienced a major flooding episode thought it foreshadowed the future impact of climate change on the area, while others saw it as an isolated, unrelated event.

"I'm seeking to understand how the experience of the same event can lead to different interpretations of its implications for the future."

Gilles says his results offer a contrasting perspective to the objective scientific discourse that often frames the topic of climate change.

"A better understanding of the subjective experience of this socio-environmental issue might prompt novel approaches in sensitising and mobilising people to prepare for future challenges," he says. Originally from France, Gilles has an MA in Landscape Archaeology from the University of Sheffield, UK, and a BA in Anthropology from California State University, Fullerton, USA. After finishing his PhD next year, he plans to continue doing research on the effects of climate change, with a strong community focus.

Highlighted Publications 2017

Espiner, S., Orchiston, C., & Higham, J. (2017). Resilience and sustainability: A complementary relationship? Towards a practical conceptual model for the sustainability-resilience nexus in tourism. *Journal of Sustainable Tourism*. Advance online publication. doi: 10.1080/09669582.2017.1281929

Rees, D., Stephenson, J., Hopkins, D., & Doering, A. (2017). Exploring stability and change in transport systems: Combining Delphi and system dynamics approaches. *Transportation*, 44(4), 789-805. doi: 10.1007/s11116-016-9677-7

Stephenson, J., Ford, R., Nair, N.-K., Watson, N., Wood, A., & Miller, A. (2017). Smart grid research in New Zealand: A review from the GREEN Grid research programme. *Renewable & Sustainable Energy Reviews*. Advance online publication. doi: 10.1016/j.rser.2017.07.010

Stevenson, J. R., Becker, J., Cradock-Henry, N., Johal, S., Johnston, D., Orchiston, C., & Seville, E. (2017). Economic and social reconnaissance: Kaikōura earthquake 2016. *Bulletin of the New Zealand Society for Earthquake Engineering*, 50(2), 343-351.

Jack, M. W., Suomalainen, K., Dew, J. J. W., & Eyers, D. (2017). A minimal simulation of the electricity demand of a domestic hot water cylinder for smart control. *Applied Energy*, 211, 104-112. doi: 10.1016/j.apenergy.2017.11.044

Stephenson, J., Spector, S., Hopkins, D., & McCarthy, A. (2017). Deep interventions for a sustainable transport future. *Transportation Research Part D*. Advance online publication. doi: 10.1016/j.trd.2017.06.031

*For a full list of the Centre's publications go to otago.ac.nz/centre-sustainability/publications/

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