

# Developing Software-based Solutions and Infrastructures for Community Resilience Assessment

## Call for Scholarship Applications

Resilience across all sectors of society is imperative for global efforts to reduce the adverse effects of disasters and to build a society that is change-ready and seeking opportunities for future wellbeing. Building robust pathways toward resilience begins with assessment: gathering empirical evidence of what factors enhance resilience, under what contexts, and for which shocks; benchmarking a community's capacities, and monitoring resilience over time. The Resilience Trajectories work stream of New Zealand's Resilience to Nature's Challenges research programme is interested in exploring innovative, software-based solutions to robust resilience assessment.

Applications are now invited for those wishing to pursue a Doctor of Philosophy (PhD) by thesis addressing key challenges related to information and software technology in the field of disaster resilience assessment. The successful candidate will be invited to explore and develop solutions for critical issues in the field of resilience assessment, such as:

- How current software technologies and methods, including web-based software, social networks/media software, and/or knowledge-based systems, can be employed to make community resilience assessment a robust and co-creative process.
- How software-based solutions and infrastructures can be utilized to make disaster resilience assessment more accessible to communities; local, territorial, and regional authorities; and national decision makers.
- How software-based solutions and infrastructures can be designed to ensure reliability, robustness, and performance while incorporating large amounts of data, different types of users, different modes of analysis, and potentially unpredicted usage and deployment scenarios of disaster resilience assessment.
- Who are the 'end users' in resilience assessment, what are their information needs, and what are the best ways to engage end users in resilience assessment (e.g., mobile apps, apps as extensions of existing GIS software, desktop apps, web apps, expert systems, enterprise software for authorities)?

The funding for this PhD Scholarship is part of the [Resilience to Nature's Challenges research programme \(RNC\)](#) – Kia manawaroa Ngā Ākina o Te Ao Tūroa –a priority research area under the National Science Challenge (NSC) umbrella. RNC is a New Zealand-wide research programme, launched in July 2015, with the aim of achieving, “transformative resilience, discovering and implementing new research-based solutions for our society, culture, infrastructure and governance to address factors that will enable New Zealand to thrive in the face of nature’s challenges,” (Jolly 2014).

The successful applicant will explore options for co-creative resilience assessment, develop appropriate software-based methods, processes, and tool(s) (e.g., web-based software for gathering, integrating, and visualizing resilience measures, or tools for crowdsourcing relevant data, software infrastructures for monitoring and sharing data) in collaboration with the Resilience to Nature’s Challenges researchers, and then prototype the methods, processes and tools ‘in the field’ with a case study community.

## Scholarship Details

Location: University of Canterbury, Ilam, Christchurch, New Zealand

Scholarship Stipend: NZD\$25,000 per annum stipend (+\$7000 domestic tuition)

Duration: 3 years

Starting date: February 2017

Closing date for Applications: November 14, 2016 (please note applications will be reviewed upon submission)

Notes on eligibility:

- The PhD Scholarships are open to domestic and international candidates. International PhD students are eligible to pay domestic rates if they reside in New Zealand and have a [Visa](#) which allows you to study here. Please note, international candidates can also apply for an international postgraduate award to cover international tuition fees.
- It is essential that each candidate has a Bachelor's degree with Honours, or a Master's degree in a relevant discipline (including Computer Science, Civil or Software Engineering, Information Systems). Applicants with degrees in Geography, Geographic Information Systems, Public Health, and Sociology are also encouraged to apply but should have a background in software engineering/development.
- While the particular technology focus will partially depend on the applicant’s

interests and skills, it is essential for candidates to have programming and software development/engineering experience. Demonstrable experience of working with statistical packages (e.g. R, Stata, MatLab) and GIS software (e.g. ArcGIS, QGIS) would also be beneficial.

- Upon receipt of this scholarship, the successful applicant would be required to [apply for](#) and engage in full-time study at the University of Canterbury.
- English language proficiency (e.g. IELTS>6.5) must align with the [UC English language requirements](#).

## How to apply

Applicants will need to submit an email to both Dr. John Vargo ([john.vargo@resorgs.org.nz](mailto:john.vargo@resorgs.org.nz)) and Dr. Joanne Stevenson ([joanne.stevenson@resorgs.org.nz](mailto:joanne.stevenson@resorgs.org.nz)) attaching:

- 1) Full curriculum vitae,
- 2) Copies of your full tertiary level education academic transcript,
- 3) The contact details of two academic referees,
- 4) An example of your best academic written work (this can be a piece of coursework or a published journal article),
- 5) Link to GitHub page (or another repository), if applicable,
- 6) Evidence of English language proficiency if applicable (e.g. IELTS>6.5), and
- 7) A cover letter of no more than 1 page of A4 containing the following information:
  - State why you would like to be considered for a PhD Scholarship and rationale for the selected area(s) of interest;
  - Describe your experience in using statistical and/or GIS software to examine quantitative data and solve problems;
  - Describe your software development/engineering experience and expertise.

## Background

Within the RNC research programme, Dr. John Vargo and Dr. Joanne Stevenson from Resilient Organisations Ltd. are co-leading the Resilience Trajectories work stream. This work stream aims to guide disaster resilience benchmarking and monitoring across a range of systems (e.g., rural and urban communities, horizontal infrastructure, regional economies), and will help RNC stakeholders identify barriers and opportunities to accelerate progress toward a resilient New Zealand.

Communities that are disaster resilient need the ability to absorb the effects of a

disruptive event, minimize adverse impacts, respond effectively post-event, maintain or recover functionality, and adapt, while mitigating the adverse impacts of future events (Stevenson et al. 2015).

There is growing momentum behind efforts to ‘operationalise’ disaster resilience – creating meaningful change that enhances communities’ ability to prepare, adapt, and respond to and recover quickly from hazards and disasters. Operationalizing resilience begins with understanding where communities are, where they would like to be, and through repeated trials and evaluation, building pathways to get there. Such activities require the integration of data and knowledge across a number of platforms.

Researchers and practitioners use a wide range of tools to assess resilience to disasters and to integrate relevant information for ongoing monitoring and development. Top-down tools tend to rely on secondary data and provide systematic comparable assessments across a number of communities. For example, the [PEOPLES Resilience Framework](#) uses a GIS-based assessment that integrates different elements of resilience into a single inventory model and the Baseline Resilience Indicator for Communities (BRIC) is a quantitative measure for resilience indicators designed to facilitate systematic comparisons of the inherent community characteristics across US counties.

So-called ‘bottom-up’ methods are intended to generate areas of focus and strategy-development from the community of interest. For example, users of the [Communities Advancing Resilience Toolkit](#) (CART) gather community information using surveys and key informant interviews and seek to facilitate community planning and action, emphasizing building and sustaining connections within communities.

Critiques of resilience assessment (and interventions) have noted a systemic and chronic gap between government and research-led ‘top-down’ approaches and participatory, community-driven ‘bottom-up’ approaches.

An important frontier for advancing resilience assessment exists at the intersection of top-down and bottom-up approaches. Being able to combine the systematic replicability and comparability of top-down approaches with the contextual specificity and data generation capacity of bottom-up approaches would facilitate resilience assessments that are useful for both large-scale investment decision making and for facilitating community action. Such an approach would need to be transparent, robust, and replicable; align with the community’s goals and visions; help prioritize needs; and establish baselines for monitoring progress and recognizing success. It should also be accessible, usable, and useful for multiple stakeholders.

Barriers to such an approach include the cost of facilitating large-scale community data collection to produce comparisons (regionally and nationally); the difficulty of integrating secondary and primary datasets with dissimilar spatial extents, periodicity, and quality; and the cost and difficulty of maintaining engagement with relevant communities and decision makers for continued monitoring and progress evaluation.

We are interested in exploring innovative, socially engaged, technology-based solutions to this problem.