

Stakeholders, volcanologists, and the vulnerability of critical infrastructure — by Alana Weir, PhD student

The Taranaki region has its own nearby volcano: the topographically dominant Mt Taranaki, which is surrounded by dairy production and processing facilities, oil and gas operations, and supporting infrastructure. Mt Taranaki has an eruption likelihood of 33 – 42% within the next 50 years. This combination of hazard potential and high exposure prompted the question that underpins my PhD: what impact would a Mt Taranaki eruption have on the surrounding infrastructure and agriculture? In addressing this question, my main focus is developing decision-support tools that are useful, useable and used by local stakeholders. My primary stakeholder is the Taranaki Civil Defence and Emergency Management (CDEM) Group, whose extensive and well-maintained stakeholder network ensures the dissemination of relevant research outputs to the wider user community.

As a novice in the field of disaster management, an early objective of my PhD was to immerse myself in day-to-day civil defence operations and long-term resilience objectives. Taranaki CDEM kindly hosted me for two months at the Taranaki Emergency Management Office, where I shadowed Taranaki CDEM Analyst Teresa Gordon. I attended local council and advisory group meetings, and had many informative informal discussions about the potential outputs of my PhD. Ex-cyclone Gita hit Taranaki in the second week of my immersion. Being part of the CDEM response team dealing with the ensuing water outage inspired my main research question: how interdependent are critical infrastructure networks, and how can we include this information quantitatively in vulnerability models and impact assessment frameworks?

Over the past six months, I've worked with open-access datasets, and industry and council representatives to collate data from all critical infrastructure sectors in Taranaki, and have found a strong dependence of all sectors on the Stratford power grid exit point (GXP). This isn't surprising, considering this is the primary power transmission entry point for the region. What I didn't expect was the strong dependence of the majority of potable water and waste water customers on only a handful of water treatment plants. This has considerable implications for industry and agriculture in the region, where potable water supply and effective waste water networks are essential for their daily operations. By identifying and quantifying these interdependencies, I can now identify the most systemically vulnerable infrastructural assets in the Taranaki region. In my infrastructure model, I can quantify the change in customer loss of service with the theoretical implementation of 'hard' (e.g. the construction of additional infrastructure) and 'soft' (e.g. tactical shut down of assets) mitigation measures.

Mt Taranaki has the potential to produce spatially and directionally distinct volcanic hazards (such as volcanic ash, lahars and pyroclastic flows) with different physical behaviours. The response of the infrastructure system will therefore vary depending on the type of volcanic activity. My goal is to continue to work closely with Taranaki CDEM and infrastructure managers to identify the optimal mitigation measures under different eruption regimes. My model has the potential to inform planning and policy pre-volcanic event, but perhaps more importantly, inform an adaptive response during a period of complex, prolonged volcanic activity.

My continued engagement with Taranaki CDEM throughout my PhD is integral in my work towards providing useable, useful and used research products to local stakeholders and end-users. The Taranaki CDEM group's enthusiasm, flexibility and local knowledge is invaluable, and as a result, I hope to provide local stakeholders with relevant, effective decision-support tools for planning and responding to the next eruption at Mt Taranaki.

My PhD is part of a larger collaboration between Taranaki CDEM and the Natural Hazards Research Platform funding program, involving practitioners and researchers from many institutions across New Zealand.