Community Science

Supporting Information for

Mahi Tahi - Rū Whenua: Tangata Whenua & Kairangahau Pūtaiao. Reflective learnings on partnering with Indigenous Māori communities in field-based scientific research.

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Text S1 to S3

Introduction

In this supporting information, we include three one-page documents used in this research. First, in Text S1, we include the document of initial open-ended questions we used to reflect on our co-production approach to research. In Text S2 and S3, we include two explainers that we distributed throughout the project. These explainers were for the ECLIPSE programme (S2) and the seismometer project (S3).

Text S1.

The next page contains the document of initial open-ended questions we used to reflection on our co-production approach to research. We included the questions in black in both reflection discussion sessions. The questions in red were added for the second session to focus on the set-up and design of the project.

Reflecting on the co-production approach taken to the planning, deployment, and management of the ECLIPSE seismometer network

QUESTION IDEAS

Think about the way this project has been conducted:
what are five good things and one thing you think could be improved?

Reflecting on our mahi

What value does this mahi bring to you and your community?

What do you think were the important competencies/capabilities across the ECLIPSE team?

What were the main barriers that we encountered?

Were there differences between engaging with people/communities already linked to the ECLIPSE programme versus those who were new to it?

Looking to the future

Where do you see the relationships that we have built in the future? (5, 10, 20 years)

How do you think the following people should approach monitoring networks like this in the future?

- Communities
- Scientists
- This group of researchers specifically

Additional

Is there anything you feel has been missed in these discussions?

Is there anyone else that you think that we should discuss this with?

Early stages of the project

How was co-production within the ECLIPSE programme defined?

How was co-production built into the design of the project?

How did the research team come together?

Text S2.

The next page contains the ECLIPSE programme explainer that we distributed throughout the project. We have edited the explainer to redact contact information for publication.

Programme Information Sheet

Co-produced research (with GeoNet, Iwi and CDEM) to provide a sound science basis for the interpretation and response to unrest and possible eruption (or not) at New Zealand's caldera volcanoes

Overview: What is ECLIPSE?

ECLIPSE (Eruption or Catastrophe: Learning to Implement Preparedness for future Supervolcano Eruptions) is a 5-year multi-institutional research programme funded by the New Zealand Ministry of Business Industry and Employment (MBIE) Endeavour Research Programme that runs from October 2017 - September 2022 (www.supervolcanoes.nz).

Aotearoa New Zealand's central North Island is home to the world's most active supervolcano system. The volcanic lakes, domes, and geothermal systems that stretch from Taupō to Rotorua are surface expressions of this super-sized underground magma system. Every few decades, this supervolcano system can become restless, causing the land to shake, swell, sink, steam, and crack. Every few hundred years, this unrest can lead to a volcanic eruption. These eruptions may be small or very large, and can have devastating impacts on people, the environment, and economy.

Oral histories and geological research have taught us that this supervolcano system has activated in the past, and will reactivate again one day in the future. The ECLIPSE programme aims to better understand how we can recognise and prepare for when it does become restless and active again. ECLIPSE research will investigate the underground roots of the volcanic system to identify what conditions cause it to become restless or erupt and aims to better define the tipping point when unrest leads to eruption. Through deep partnership with the national volcanic monitoring agency GeoNet, tangata whenua, the community (including schools) and emergency management groups, ECLIPSE will also explore ways in which we can enhance resilience to these events.

The ECLIPSE project will work with central North Island communities to help them understand uncertainties in the science of forecasting and understanding eruptions, as well as helping them better prepare for such emergencies.

ECLIPSE Goal: make significant step-changes towards an **aware and self-reliant society**

We want to encourage New Zealanders to:

- Have opportunities to learn about this research programme
- Discover more about the central Taupō Volcanic Zone (TVZ) and associated hazards
- Understand their risk in relation to volcanic unrest and to understand how they can mitigate that risk and develop their preparedness, including developing networks within their communities and (e.g. social media) relationships with scientific experts and agencies involved with emergency management.
- Have ready online access to official emergency management information (Waikato & BOP CDEM, MCDEM/NEMA, GeoNet, MetService) and to consider using relevant apps through which the "one source of truth" guidance in an emergency will be delivered.

[CONTACT INFORMATION]

Text S3.

The next page contains the seismometer project explainer that we distributed throughout the project. We have edited the explainer to redact contact information for publication.

Proposed Seismometer Deployment Around Taupō Moana

We are a team of scientists from Victoria University of Wellington who are trying to understand the volcano which lies deep beneath Taupō moana as part of the ECLIPSE supervolcano research programme.

Many kilometres beneath the lake there is a chamber of magma which has caused multiple eruptons in the past. We know the volcano is active because of the hot geothermal springs that are found all over the region. However, we do not know how deep it is, how large it is, or when it will erupt again.

We can try to answer these questions using seismometers. Seismometers are instruments that are very sensitive to vibrations. They can help us detect earthquakes that humans cannot feel.

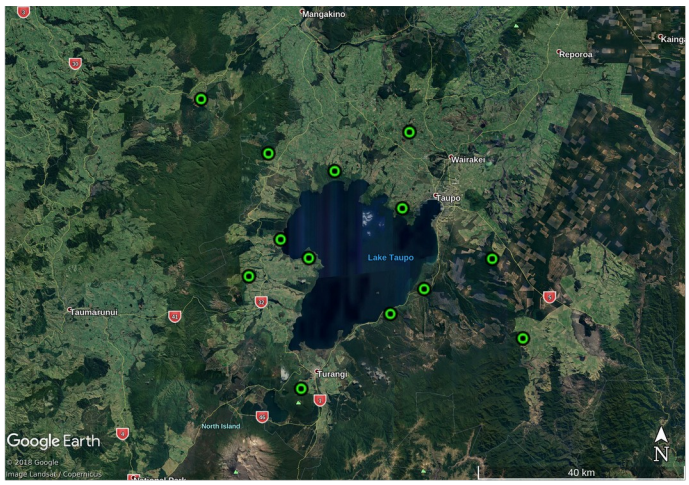
If we put enough seismometers around the lake, we can learn about patterns in these underground vibrations that will allow us to image what is happening in the magma chamber deep beneath the ground, similar to the way a CT scan allows us to create images of things inside the body. We can use the information we learn about the magma chamber to understand how we can better monitor the volcano and try to understand what might happen if it becomes restless again in the future.

We plan to deploy 13 seismometers for this science project. Each seismometer is about 40 cm tall and 40 cm wide. In order for the seismometers to capture only vibrations caused by underground magma chamber activity, and not vibrations caused by daily activity happening on the surface of the land, such as traffic and storms, the seismometers must be buried in a narrow hole 2 feet in the ground. The seismometers are then powered by a small solar panel located on top of the hole. We plan for them to remain there for a durat on of 2 years, and one of us will visit each site every 3 months to check on them.

We would like to use this experiment as an opportunity to teach local students about the volcanoes which have shaped their land. We are happy to host visits from school groups who are interested to come with us when we install the seismometers to learn more about how we do scientific research. We also have a few simple seismometers which can be gifted to schools so that teachers and students can monitor the volcanoes themselves.

We hope we can work with you to understand your land.

Nā mātou noa, nā
[CONTACT INFORMATION]



The proposed seismometer locations

An example seismometer, buried underground