Co-developing Research in Geospatial Sciences: Experiences from a Research Institute in the Co-creation of Impactful Solutions with Indigenous Communities in Aotearoa New Zealand

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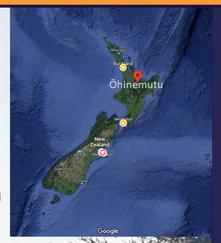
Introduction:

Guided by the **UN-SDGs** and focused on generating **innovative geospatial research**, the Geospatial Research Institute **Toi Hangarau** is committed to developing, implementing, and **facilitating** the use and access to **geospatial technologies** for multiple sectors of New Zealand society. We partner with various groups, including **Māori** to co-design research that reflects Indigenous **perspectives**, related to the use and application of **geospatial tools** and methods for **equitable outcomes**. We strive to work with people and the environment in equitable ways, to ensure that they are key **research beneficiaries.**

Project 1:
Map-based tools for Community and Rūnanga-led sustainable town planning, in small and medium settlements in New Zealand

Research team:
Rita Dionisio (PI) Dean Walker, Ines Falcao, Sharmila Savarimuthu, Luke Parkinson and Prof. Simon Kingham: GRI
Riria McDonald, Mokonuiarangi Kingi: Ōhinemutu community
Professor Hīrini Matunga: key researcher, Lincoln University
Prof. Angus Macfarlane: Te Arawa and Ngāti Whakaue.



Aim: to strengthen the integration of Mātauranga Māori and local knowledge in town planning in Aotearoa NZ. The research focuses on the development of place-based tools to support local Māori communities to engage in and lead local spatial planning processes.

Co-creation process:

Community engagement

Dr. Rita Dionisio (PI) engaging with community members

In 2018, collaborative models were delineated with two project partners: Ngāti Whakaue in Rotorua, and Ngāi Tūāhuriri in Waimakariri. Representatives of both rūnanga, took part in the analysis and deliberations related to the organisational structure of the partnership. Runanga communities planning needs and priorities were assessed, focusing on the regeneration and revitalisation of Māori villages. Bicultural planning in NZ was reviewed.

Co-design

In Ōhinemutu, Mr. Mihaere Kirby shares cultural narratives of Ngāwhā (hot springs).

The research team and community partners co-created the technical description of the place-based tools. In Rotorua, the process was supported by Te Tatau o Te Arawa - representing Ngāti Whakaue. The tool development was decided to be focused on the cultural narratives around the ngāwhā (hot springs) in the Māori village of Ōhinemutu to support the whānau in leading town planning processes related to urban regeneration.

Research output

Te Kete o Kōrero ki te Ōhinemutu, place-based web tool.

Co-developed in partnership with Te Manatōpu Haukāinga o Ōhinemutu, the tool collates, protects, and enables the sharing of local knowledge collectively held by Ngāti Whakaue and the people of Ōhinemutu. Mainly focused on cultural narratives about ngāwhā (hot springs) and their relationships with the community, the tool can hold another kind of Mātauranga. The narratives are organised through koromātua (sub-tribe), type, and through Atua (seven key spiritual guardians).

MOU

Signing of MOU between Ōhinemutu and the GRI Toi Hangarau

After almost 5 years of co-designing and co-development of the map base project, the relationship between the project's team and the Ōhinemutu community members involved in the project grew strong. This co-creation process enabled a stronger sense of collective trust, which was celebrated by signing a Memorandum of Understanding that outlines our mutual aspirations to advance the tool and continue co-developing future research.

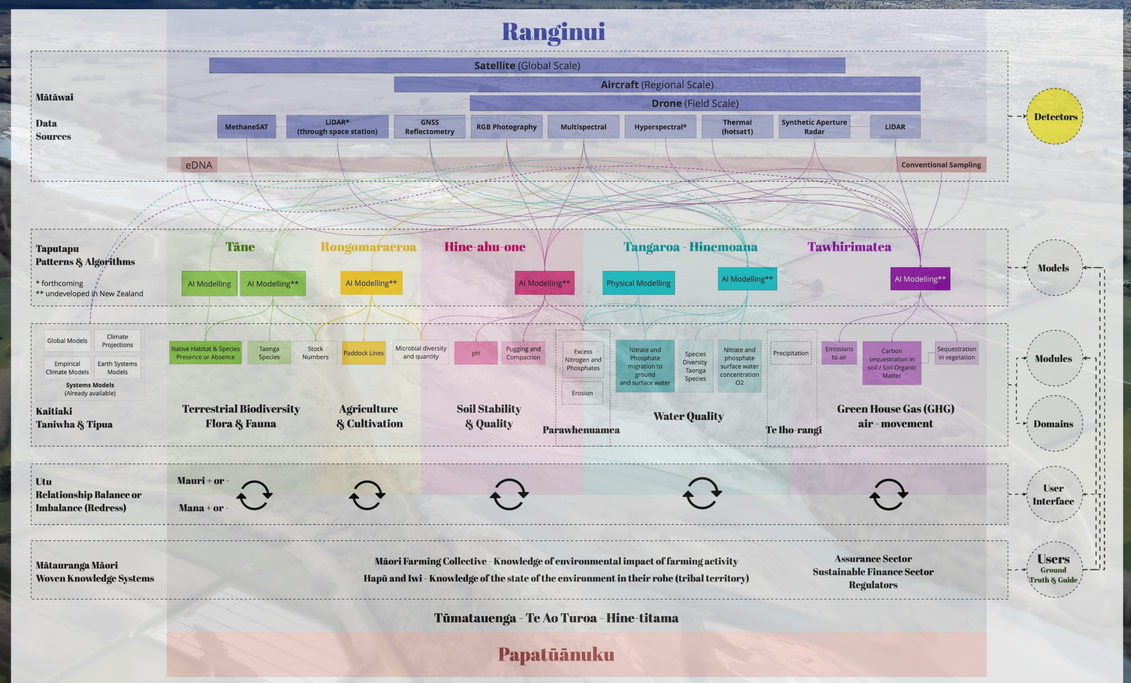
Future projects

Workshop held in Ōhinemutu for future projects identification and co-design.

In 2023, two workshops were held in Ōhinemutu, with the participation of members of the community and the GRI. During the workshops, three projects were identified as priorities for future co-designed: monitoring of Ngāwhā dynamics, resilience to natural hazards and climate change, and the collection, curation and preservation of cultural narratives. The third project has been prioritised, emphasizing the narratives around Ngāwhās, as a way to reinforce Mātauranga Māori for the younger generations.

Project 2:
The Kaitiaki intelligence platform

Research team:
John Reid (PI, UC,NRC), Matthew Wilson (UC-GRI), Kevan Cote (MD), Corey Ruha (UoW), Jason Mika (UoW).



Goal and Vision

Goal: to combine advanced environmental sensing technologies with mātauranga Māori (Māori knowledge) to design a state-of-the-art environmental sensing platform that meets the needs, requirements, and values of **Māori Agribusiness Collectives (MACs) and iwi.**
Vision: to offer MACs and iwi a model, and process, for constructing their own environmental sensing platforms to guide environmental governance when engaging with government, inform land management choices, and the fulfil of kaitiaki (guardianship) obligations.

Technology

Remote sensing: LiDAR, Radar, SAR and GNSS Reflectometry. Optical, multispectral, thermal, and hyperspectral cameras. All used for analysis of taonga species, biodiversity, carbon sequestration, methane emissions, soil quality and moisture, erosion, water quality and flows and livestock management.
on-ground, or in-situ, sensors, alongside conventional sampling techniques, are used for analysis of biodiversity, such as eDNA, cameras trap, and acoustic sensors. Lysimeters for groundwater quality and quantity assessment. AI is used for analysis of large data sets. Hydrological, climatic and environmental modelling are used. Data visualisation using VR and AR

Mātauranga Māori and Tech

Māori engagement: MACs and iwi agreed on the need for high-quality environmental indicators. indigenous knowledge will be used through three processes: **Holistic Framing –Mātauranga Māori**, including primary atua Papatuanuku (earth mother) and Ranginui (sky father) and their 7 atua environmental descendants, which health will be analysed. **Holistic Measurement**: impacts of the human atua domain (Tūmatuenga) on other atua domains (the environment). **Ground-truthing and guiding AI:** iwi and hapū historical environmental knowledge. AI will support analysis and data interpretation guided by Mātauranga Māori.

Outputs

The user interface: dashboards, mapping systems, virtual reality, or augmented reality, will bring together quantitative information with local qualitative information, allowing indigenous connections to place.
Modules & Domains: KIPs design comprises either independent modules or groups. A domain is made-up of groups of modules that together provide a comprehensive picture of an environmental domain, such as water quality, biodiversity, or Greenhouse Gas Emissions which loosely correspond to atua domains. Economic opportunities: Helping to reduce cost for MACs, iwi, for environmental reporting or even to market sustainable indigenous products.

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