FIG WORKING WEEK 2025
AND Locate25 THE NATIONAL GEOSPATIAL CONFERENCE
Collaboration, Innovation and Resilience: Championing a Digital Generation
FIG Geospatial Council of Australia
Brisbane, Australia 6–10 April

Mapping Vulnerabilities: Empowering Grassroots Disaster Management and Community Resilience through Geospatial in Tonga

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Presentation Focus

- Context of Project – Pacific Geospatial Skills Development Program
- Disaster management and climate resilience in the Pacific
- Project design and approach
- Impact and broader implications

Pacific Geospatial Skills Development Program

Veris' (previously Spatial Vision's) Pacific Geospatial Skills Development Program: 12-week program that provides an opportunity for a professional to advance their spatial skills through a geospatial project of their choice.

Empowering geospatial capacity in the Pacific region through:

- Mentoring & guidance
- Technical skill development
- Melbourne office visit
- Support in-country

Climate Resilience & Disaster Management in Tonga

Challenges

Limited application of geospatial integration for decision-making at the grassroots level

Limited data availability and quality, particularly in remote or underserved areas

Opportunities

Increasing community resilience by better understanding and mapping vulnerabilities, and building geospatial capability

Project: Developing Community Risk Profiles & Mapping Vulnerabilities in Tonga using Geospatial Techniques

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Aim:

To enhance decision-making for disaster management and increase climate community resilience at the grassroots.

Objective:

To develop geospatial-enabled risk profiles to enhance existing plans for two disaster-prone communities in Tonga.

Note:

Emphasis on building capacity of Kau He Lau Staff

Project Approach:

Stage 1 Needs Assessment & Stakeholder Engagement

Stage 2 Data Collection and Analysis

Stage 3 Risk Profiling & Vulnerability Mapping

Stage 4 Visualisation and Technical Integration

Stage 5 Capacity Building and Knowledge Transfer

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Outputs:

Spatial Vision

Island: Tongatapu **District:** Nukunuku **Village:** Kanokupolu

I. Background

Kanokupolu, a historically significant community renowned for its deep ties to the chiefly lineage and ancestry of the Tongan royal family, is located on the northwestern coast of Tongatapu Island, along the coastal strip near Nuku'alofa *(Figure 1)*. The area is characterized by its low elevation, making it highly susceptible to coastal hazards such as sea-level rise and inundation.

Figure 1 - The map highlights the location of Kanokupolu on Tongatapu Island, showcasing its geographic position within the island's northwestern coastal region.

Geographically, Kanokupolu lies within the typical cyclone path that affects Tonga between November and April. It often endures severe impacts from strong winds, heavy rainfall, and storm surges, which frequently result in widespread damage to infrastructure and homes.

In addition, while the western side of Kanokupolu features slightly elevated terrain, rising approximately 10 meters above sea level (Figure 2), most of the community resides toward the eastern side, predominantly low-lying and more vulnerable to flooding and storm surges. This geographic contrast underscores the community's exposure to environmental risks and disaster resilience challenges.

Spatial Vision Kanokupolu: Digital Elevation Model

Figure 2 - The map displays LiDAR-derived elevation data for Kanokupolu, with a clipped elevation model overlaid with contour lines indicating height in meters. It also highlights the locations of buildings within the community.

- Risk Profiles for two vulnerable communities

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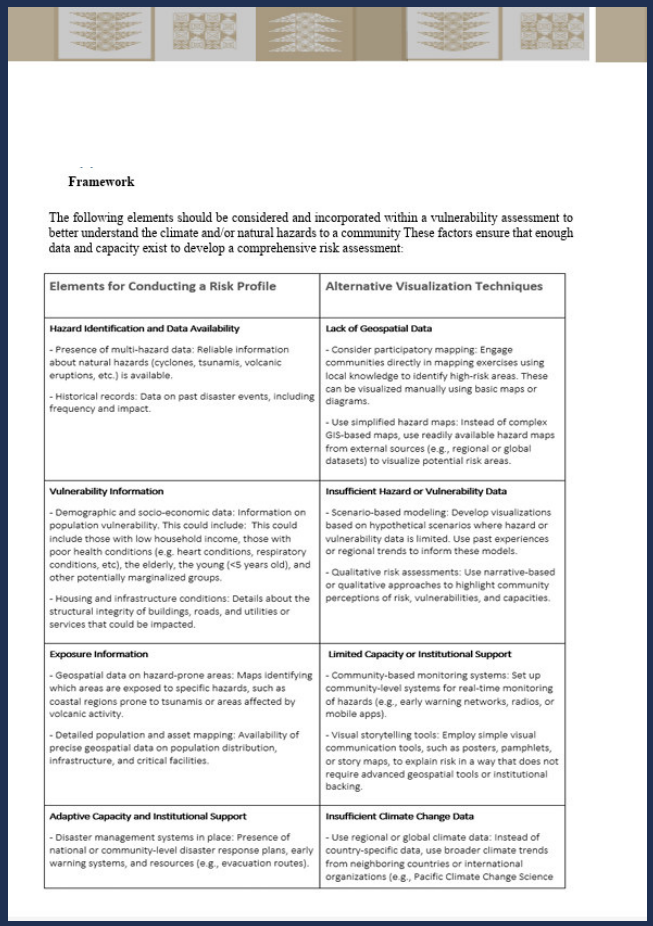
Outputs:



Framework

The following elements should be considered and incorporated within a vulnerability assessment to better understand the climate and/or natural hazards to a community These factors ensure that enough data and capacity exist to develop a comprehensive risk assessment:

Elements for Conducting a Risk Profile	Alternative Visualization Techniques
Hazard Identification and Data Availability - Presence of multi-hazard data: Reliable information about natural hazards (cyclones, tsunamis, volcanic eruptions, etc.) is available. - Historical records: Data on past disaster events, including frequency and impact.	**Lack of Geospatial Data** - Consider participatory mapping: Engage communities directly in mapping exercises using local knowledge to identify high-risk areas. These can be visualized manually using basic maps or diagrams. - Use simplified hazard maps: Instead of complex GIS-based maps, use readily available hazard maps from external sources (e.g., regional or global datasets) to visualize potential risk areas.
Vulnerability Information - Demographic and socio-economic data: Information on population vulnerability. This could include: This could include those with low household income, those with poor health conditions (e.g. heart conditions, respiratory conditions, etc), the elderly, the young (<5 years old), and other potentially marginalized groups. - Housing and infrastructure conditions: Details about the structural integrity of buildings, roads, and utilities or services that could be impacted.	**Insufficient Hazard or Vulnerability Data** - Scenario-based modeling: Develop visualizations based on hypothetical scenarios where hazard or vulnerability data is limited. Use past experiences or regional trends to inform these models. - Qualitative risk assessments: Use narrative-based or qualitative approaches to highlight community perceptions of risk, vulnerabilities, and capacities.
Exposure Information - Geospatial data on hazard-prone areas: Maps identifying which areas are exposed to specific hazards, such as coastal regions prone to tsunamis or areas affected by volcanic activity. - Detailed population and asset mapping: Availability of precise geospatial data on population distribution, infrastructure, and critical facilities.	**Limited Capacity or Institutional Support** - Community-based monitoring systems: Set up community-level systems for real-time monitoring of hazards (e.g., early warning networks, radios, or mobile apps). - Visual storytelling tools: Employ simple visual communication tools, such as posters, pamphlets, or story maps, to explain risk in a way that does not require advanced geospatial tools or institutional backing.
Adaptive Capacity and Institutional Support - Disaster management systems in place: Presence of national or community-level disaster response plans, early warning systems, and resources (e.g., evacuation routes).	**Insufficient Climate Change Data** - Use regional or global climate data: Instead of country-specific data, use broader climate trends from neighboring countries or international organizations (e.g., Pacific Climate Change Science

- Risk Profiles for two vulnerable communities
- Development of a risk-profile framework to replicate the process for other communities

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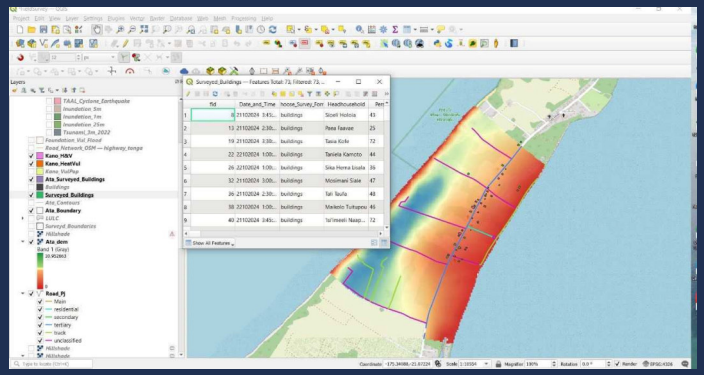
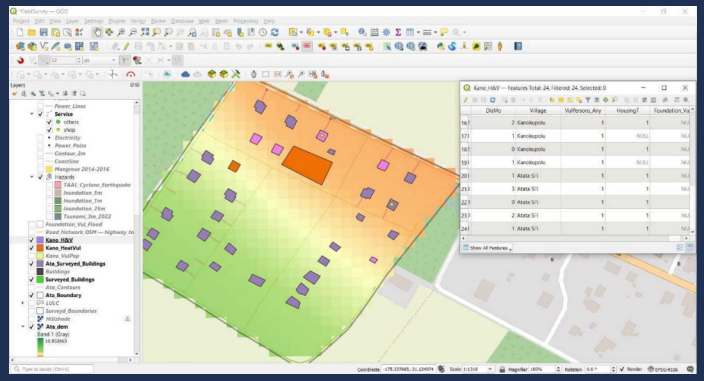
Outputs:





- Risk Profiles for two vulnerable communities
- Development of a risk-profile framework to replicate the process for other communities
- Creation of a QGIS viewer with all available collated data on climate hazards, assets, demographics, project analysis outputs and other relevant information for Kau He Lau

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Outputs:

- Risk Profiles for two vulnerable communities
- Development of a risk-profile creation framework for replication of process to other communities
- Creation of a QGIS viewer with all available collated data on climate hazards, assets, demographics, project analysis outputs and other relevant information for Kau He Lau
- Capacity building for Kau He Lau – QGIS training, in-field data collection training, interpretation of results

Key Learning

- Establishing network with community leaders with grassroots knowledge was critical in navigating household dynamics & understanding known vulnerabilities

Impact, Significance and Broader Implications

‘Ofa Masiwawa - speaking on the significance of work and broader implications of the project

AP CDN/SIDS questions

What capacity / capability development initiative has been implemented and worked / been successful?

- Enhancing geospatial skill within the Pacific through program
- Project itself focuses on building geospatial capacity of grassroots organisations

What are the main capacity / capability challenges that need to be overcome / resolved?

- Limited data availability and access to data, and sharing of data between organisations/agencies/countries
- Retention of skilled geospatial resources within the Pacific (overseas opportunities)

What can agencies like FIG, UN GGIM, or professional / scientific / technical bodies or aid organisations do to assist?

- Provide skill development opportunities and partnership opportunities with local organisations

Thank you

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