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Tongatapu Multi-Hazard Disaster Risk Assessment (MHDRA)

Resilience Learning Month: Upstream Climate Assessments

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Focus: The Kingdom of Tonga/Tongatapu

- 170 Islands 21° South of the Equator in the South Pacific
- Home to approximately 105,000 people
- Focusing on Tongatapu and Capital City Nuku'alofa
- Home to 75,000 more than 70% of the population



Nuku'alofa & GoT/ADB Investments • TIURSP: Feasibility Study found that urban flood risk in the capital could not be managed through infrastructure measures

- Heightened interested in understanding the risk to Nuku'alofa because of a concentration of ADB investments in the city and need for long term adaptation pathway
- The risk assessment informs the 'Climate and Disaster Resilient Urban Development Strategy and Investment Plan' under the TIURSP

Piloting a comprehensive approach to Climate and Disaster Risk Assessments in the Pacific



PREVIOUS

Short-term focus on climate-/ disaster-proofing projects and structural resilience interventions

Separate Climate and Disaster Risk Assessments

PILOTING

Longer term focus on setting parameters for resilient development and adaptation strategies and supportive investments

Covering geophysical, extreme weatherrelated hazards and CC scenarios

Integrating CC projections methodically into analysis of inundation hazards; focus on SLR plus flooding from extreme rainfall events

Facilitating Government Ownership of Assessment Process and Outputs

- **Multi-agency ownership**: Governance group included 3 CEOs from the GoT and SOE representatives (Water; Tonga Power Ltd.)
- Inception phase (July/August 2020): Several workshops with different ministries. Discussions resulted in adding 2 new hazards (wind/seismic) and 2 additional asset classes (power and water infrastructure) to the study.
 - Ministries/SOEs provided the GIS datasets that formed the basis of the study
- Throughout the project (July 2020 May 2021): Multiple workshops to gather and share information
- End of project (May/June 2021): Presentations on each component of the project to share results and a workshop to handover the deliverables and database to GIS agency in Ministry of Lands
- Cabinet Approval (August 2021) of Multi Hazard Disaster Risk Assessment Outputs
- Application of Results: Immediate use (with support from ADB)

Tongatapu Multi Hazard Disaster Risk Assessment: Approach & Outputs

Hazard x Exposure x Vulnerability =



Storm Surge Pluvial Flooding Tsunami Sea Level Rise Earthquake Wind



Buildings ~28,000 Roads ~1,200 km Power assets ~26,000 Water assets ~500 items Conservation/ agricultural lands 212km² A

Asset Vulnerability Social Vulnerability



Risk

Outputs: Maps Loss Estimates Social Impacts Asset Database

> <u>To Inform:</u> Planning Investment











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Sea level rise + climate change impacts

- Sea level rise was considered independently + in combination with coastal inundation
- Deterministic SLR scenarios: **0.5m**, **1.0m**, **2.0m**, 4.0m and 6.0m
- Scenarios selected due to uncertainty in climate models allowing decisions makers to consider latest science, planning horizons and appetite for risk.
- For pluvial flooding, precipitation was scaled to account for climate change impacts



Permanent loss due to SLR: All assets

- All assets within the **highest astronomical tide** (HAT) footprint for each SLR scenario are considered a **permanent loss**(discussed with GoT)
- HAT indicates the predicted inundation in a relatively common high storm tide, ~1.5 times per year

Asset	SLR 0.5m		SLR 1m		SLR 2m		
Buildings	\$716M	6%	\$3.2B	25%	\$6.3B	49%	
Roads	\$1.4M	1%	\$11M	11%	\$26M	25%	
Water	\$2.3M	4%	\$9.8M	16%	\$16M	27%	
Power	\$36M	12%	\$85M	29%	\$189M	64%	



Losses (\$TOP)	10k - 50k	500k - 1M	10M - 50M	500M - 1B
0	50k - 100k	1M - 5M	50M - 100M	1B - 5B
0 - 10k	100k - 500k	5M - 10M	100M - 500M	5B - 10B

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Tongatapu Lower Hazard Areas







THE JANUARY 15, 2022 HUNGA TONGA-HUNGA HA'APAI ERUPTION AND TSUNAMI, TONGA

GLOBAL RAPID POST DISASTER DAMAGE ESTIMATION (GRADE) REPORT



yal New Zealand Air Force P-3K2 Orion reconnaissance flight showing damages in Nomuka Island, Tonga Photo Credit: New Zealand Defence Force

IN PARTNERSHIP WITH THE GOVERNMENT OF TONGA







3 (4) Main Areas for Applying MHDRA Information/Lessons:

- 1. Upstream CCA/DRM Planning
- **2. ADB Investments**
- 3. Disaster Risk Management AND4. MHDRA approach& lessons inform further studies (Cooks; Vanuatu)



IMPORTANCE OF **MULTI-HAZARD** APPROACH

SCOPE AND MULTI-SECTOR COVERAGE OF RISK ASSESSMENT

Lesson Learning

MORE EMPHASIS ON CAPACITY BUILDING FOR DISSEMINATING, MANAGING AND USING DATA/ INFORMATION

STRENGTHEN LOCAL HAZARD AND DISASTER IMPACT DATA COLLECTION

CENTRALITY OF ACCURATE TOPOGRAPHIC DATA CLIENT ORIENTATION/ TIMELINESS & FLEXIBILITY

