

Disaster Risk Reduction in the Kingdom of Tonga

Status Report



adpc Asian Disaster Preparedness Center

 **UNDRR**
UN Office for Disaster Risk Reduction

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About this report

The disaster risk reduction status report provides a snapshot of the state of disaster risk reduction in the Kingdom of Tonga under four priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030. It also highlights progress and challenges associated with ensuring coherence with key global frameworks and provides recommendations for strengthening disaster risk management governance by government institutions and stakeholders at national and local levels.

This report was prepared by the United Nations Office for Disaster Risk Reduction (UNDRR) with support from the Asian Disaster Preparedness Center (ADPC) and Tonkin + Taylor through country consultations and a desk review of key documents, including legal instruments and disaster risk reduction frameworks, policies, strategies, and plans.

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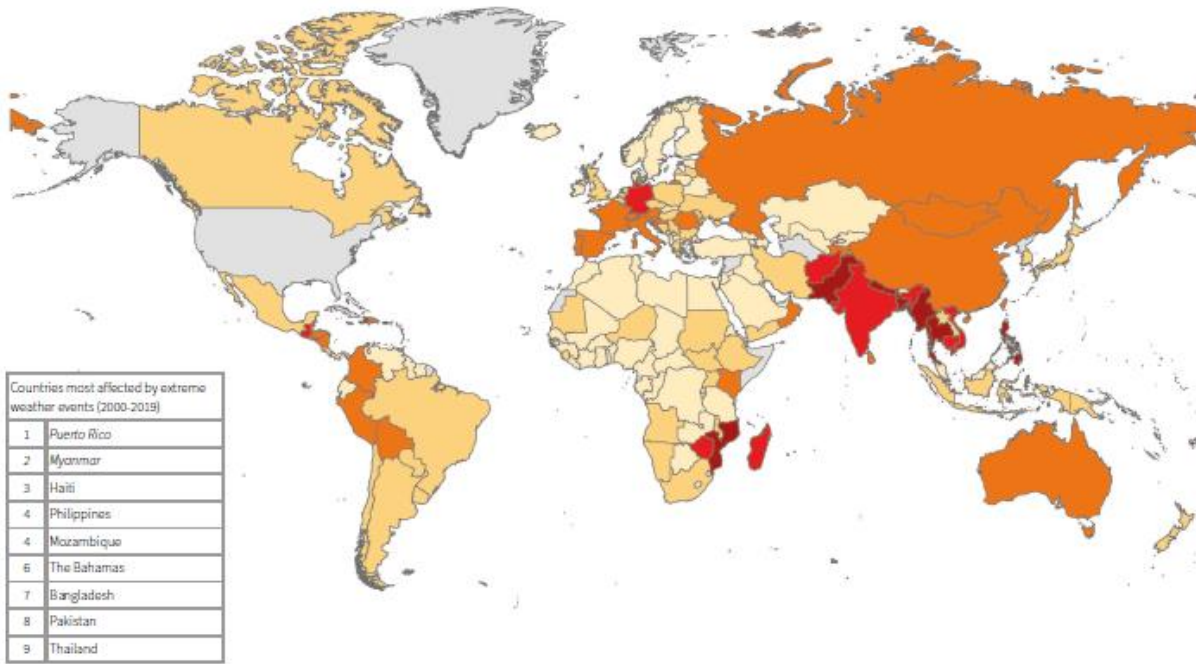
This report serves as a reference document for implementing and monitoring the Sendai Framework. The findings, interpretations, and conclusions expressed in this document do not necessarily reflect the views of UNDRR or the United Nations Secretariat, partners, and governments. They are based on the inputs received during consultative meetings, individual interviews, and the literature reviews conducted by the research team. The presentation of the material in this report concerning the legal status of any country or territory or its authorities or concerning the delimitations of its frontiers or boundaries, as well as the text and the tables, is intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. While every effort has been made to ensure the accuracy of the information, the document remains open for any corrections in facts, figures, and visuals.

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Italics: Countries where more than 90% of the losses or deaths occurred in one year or event



(GermanWatch, 2021)

POPULATION 2020	
Total Population	105,697
Urban Population	24,415 (23.09%)
Population Density Per Km ²	147
ECONOMIC INDICATORS	
Gross Domestic Product in Current \$US	448.82 million
GDP Per Capita (\$US)	4,624.8
GDP Growth (Annual %)	0.7%
HUMAN DEVELOPMENT	
Human Development Index	0.745
HDI Rank	91
Income Level Category	Upper Middle Income

(World Bank, 2021)

(UNDP, 2022)

Climate Risk Index

Rank 77, Score of 75.67*

INFORM Risk Index

Rank 101 / Medium Risk**

World Risk Index

Rank 100 / Medium***

* Climate Risk Index 2000-2019 analyses how countries have been affected by weather-related losses between 2000-2019. (GermanWatch, 2021)

** INFORM risk index is a global tool that measures the risk of humanitarian crises and disasters based on three dimensions: hazard & exposure, vulnerability, and lack of coping capacity. (INFORM, 2021)

***World Risk Index 2022 assesses the disaster risk for 192 countries based on Exposure, Vulnerability, Susceptibility, Lack of coping capacities, and Lack of adaptive capacities. (Bündnis Entwicklung Hilft, 2022)

1. Introduction

The Kingdom of Tonga is located in the Western South Pacific Ocean and is made up of 172 islands covering 749 km² of land mass and over 720,000 km² of the ocean. These islands are categorised into four island groups: the Tongatapu and ‘Eua islands in the South; the Ha’apai in the middle; the Vava’u in the North; and the Niuafu’ou and Niuatoputapu further North. The islands are diverse, from low-lying atolls to high volcanic islands. [Australian Bureau of Meteorology and CSIRO, 2011] [Tonga Tourism Authority, 2018] [Prime Minister’s Office, Kingdom of Tonga, 2019].

The weather is mostly driven by the El Niño-Southern Oscillation (ENSO). For example, in the capital, Nuku’alofa, the El Niño event brings cooler temperatures during the dry season and a lower rainfall during the wet season. La Niña years brings larger amount of rainfall. Most of the rainfall occurs during the summer months from November to April, which are considered as the cyclone season. Between 1970 and 2015, 73 tropical cyclones passed by Tonga. Temperatures range vastly according to the location of the island groups. [Australian Bureau of Meteorology and CSIRO, 2011] [Government of Tonga, 2018] [CSIRO and SPREP, 2021].

Tonga has the largest remittance percentage of GDP (around 40% of the GDP) when compared to any other country in the world. Typically, large-scale migration of Tongans to Australia, New Zealand and the United States and seasonal worker programmes have provided large amounts of revenue but it created a gap where migrants and seasonal workers might not be present with their families for long periods of time and are not around to help grow food. (The Global Economy, 2018; Government of Tonga, 2018; Travelbans, 2021; The Economist Group, 2021; International Monetary Fund, 2021).

Agriculture is the most prevalent economic activity in the county, which makes up to 17.7% of the Gross Domestic Product (GDP) as of 2020. Squash pumpkin, vanilla and kava are amongst exported agricultural products. Other agricultural products, such as yams, taro, sweet potatoes, and cassava, are primarily a subsistence activity and are consumed locally. Fisheries sector (reef finfish, tuna, shellfish, lobster, and sea cucumber) contributes around 2.9% to GDP. Agriculture and fishing activities are largely subsistence or semi-subsistence with limited commercial-scale activity. Tourism sector is another major contributor to the nation’s economy ranging between 3.2% and 12.1% of GDP as of 2018. In March 2020, COVID-19 pandemic related state of emergency was declared by the government, with the border closed to all foreign nationals, except in special cases where authorisation was granted. The country has accelerated its vaccination programme in preparation for reopening of borders and a renewal of tourism in 2022. [The World Bank, 2020]

1.1 Demographic Characteristics

In 2020, Tonga recorded a total population of 105,697 with nearly 23.1% living in urban areas. Almost three quarters (74%) of the population live on the island of Tongatapu, where the capital of Nuku’alofa is located. The population consists of 50.1% male and 49.9% female including Fakaleitī, i.e., individuals assigned male sex at birth who identify as feminine. Tonga has a relatively young population, with a median age of 22 years, and 29% of the total population aged 15 years and younger. Only 9% of the population is 60 years and older [The World Bank, 2022] [Tonga Statistics Department, 2016] [Tonga Statistics Department, 2021].

From the 2011 Census report, 97% of the Tongan population is of Tongan origin, 1% of part-Tongan origin and 2% of other heritage. The Tongan population is made up of a variety of religions, including the Wesleyan Church (35%), Church of Latter-Day Saints (18.6%), the Roman Catholic Church (14.2%), the Free Church of Tonga (11.9%) and the Church of Tonga (6.8%). All the other religions made up less than 3% of the population. Tonga has been successful in providing education for children between the ages of six and 14, with 98% of the children in this age group attending. However, school enrolment of secondary education was reported at 82.07% in 2015. The enrolment rate in tertiary education was 18.4% in 2020. Females have a higher enrolment rate than males in continuing their education after the age of 15. Tonga has the highest per capita number of PhDs in the world. [Department of Statistics and SPC, 2014] [World Bank Group, 2021] [Trading Economics, 2021] [Analysis & Policy Observatory, 2021] [Include, 2021].

Tonga, unlike other Pacific countries, is a constitutional monarchy. An institutional reform and

democratisation process occurred between 2006 and 2010 in which democratically elected positions increased from nine members to 17 members, and the number appointed by the King decreased from any amount to four. While no women were elected in the 2010 election; one woman was sworn in by the King. In the 2017 election there were 15 women candidates out of the total 86 of which two were elected. In 2021, 12 women registered to contest in the Tonga Elections, but none of them were elected. [Pacific Women in Politics, 2015] [Development Policy Centre, Australian National University, 2021]

1.2 Economic Impact of Disasters

On average, The Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) estimates that annual losses from hazards are equivalent to 4.3% of the GDP of Tonga. Tonga is prone to the hazards such as tropical cyclones, earthquakes, and tsunamis. The recent Hunga Tonga–Hunga Ha’apai undersea volcano which erupted on 15 January 2022 has caused economic damage of USD 90.4 million. Nearly USD 20.82 million was estimated towards damages to the agriculture sector with 80% due to volcanic impact and 20% due to tsunami. [The World Bank, 2022]

The Pacific DesInventar data for Tonga (1833-2014) reveals 85 tropical cyclone deaths and total cumulative damages of USD 246 million. The disaster loss was assessed in more detail in the PCRAFI study, which concluded that Tonga is expected to incur, on average, USD 15.5 million per year in earthquake and tropical cyclone-related losses. [DesInventar, 2022] [PCRAFI, 2014]

During 2018 Tropical Cyclone Gita, nearly 80,000 people were affected and power lines, schools, agriculture, and infrastructure were damaged. With 800 houses destroyed and another 4,000 damaged, TC Gita was one of the most costliest disasters in Tonga with an estimate of USD 164.1 million (i.e., 37.8% of the nominal GDP). During Tropical Cyclone Ian in 2014, almost 70% of the inhabitants of Tonga’s Ha’apai island group i.e., around 5,500 people were affected and caused an economic losses of USD 50 million (11% of the country’s GDP). [Government of Tonga, 2018] [World Trade Organization, 2019] [UNCDF, 2020].

Droughts seriously affect the revenue earnings, livelihoods of people, and food supply, which are mostly exported. During the droughts that took place in 1983, 1998 and 2006, both sweet potatoes and coconuts saw a decrease in growth. This trend was also seen in the many root crops, like taro and cassava, which many people rely on for food. The 1998 and 2014 droughts reduced squash exports by 52% and 69% respectively. In 2021, drought warning was issued in Niuafu’ou, Niuatoputapu and Tongatapu, and Ha’apai as these regions received only 25% of their average monthly rainfall in the month of September. The drought and the impacts of ash cover and ash fall due to the recent volcanic eruption resulted in damages to 30-95% of crops in Tongatapu (depending on the crop and location) [Ministry of Environment and Climate Change, 2012] [FAO, 2022].

1.3 Social Impact of Disasters

Disasters have a large social impact on the population of Tonga. The Hunga Tonga–Hunga Ha’apai volcanic eruption, tsunami and ashfall in 2022 affected more than 85,000 people across the country. Tongatapu, ‘Eua and the Ha’apai group experienced major disruptions to water supplies as the water was contaminated with ashfall. The agricultural sector has been greatly impacted during this disaster, where around 85% of the agricultural households throughout Tonga was affected to some extent. [The World Bank, 2022]

In 2016, during the dry season, Tonga was hit by heavy rains, which caused flooding in the capital. At the Fua’amotu airport, 273 mm of rain was reported which is the highest it has been in the last three decades. The rainfall was accompanied by strong winds that uprooted trees and damaged powerlines, leading to power outages throughout the western part of Tongatapu. Floods in the past disrupted many livelihoods by damaging critical infrastructure and blocking roads.

Increasing rainfall and migration to the swampy areas of the capital have facilitated the spread of the Zika virus, chikungunya virus, as well as Dengue fever – of which there were outbreaks in 2014 and 2016. Drought has also led to saline intrusion into safe underground drinking water supply in Tongatapu.. This has further exacerbated the spread of disease and sickness.

Gender based violence is prevalent in the country, especially following a disaster. During TC Gita, women

and girls reported “feeling unsafe” in the evacuation centres due to the lack of lightning, inadequate sanitation facilities, and lack of separate sleeping facilities. Also, tensions and conflicts between men and women in households were reported during a disaster due to lack of electricity, income, shortage of food and water, household duties and caregiving responsibilities. [CARE, 2018] [IFRC, 2018] [PICAP, 2020]

2. Disaster Risk Profile

2.1 Governance and Institutional Mechanism

National Disaster Council (Cabinet) is the supreme governing body established with three national level committees (i.e., National Emergency Management Committee (NEMC), the National Emergency Operation Committee (NEOC), and the National Emergency Recovery Committee (NERC)) to provide disaster governance support in Tonga (Figure 1). The Emergency Management Act 2007 mandates the Cabinet and its committees “for providing overall coordination and strategic direction for the ongoing strengthening and of Tonga’s disaster management arrangements”. [Government of Tonga, 2021]

NEMC is responsible for making policy decisions, coordinating the emergency management activities, approving, and reviewing the National Emergency Management Plan, and supporting District Emergency Management Committees (DEMC). NEOC is responsible for activating ministries and organisations during response phase, coordinate with relevant ministries, Nongovernment Organisations, and community groups, conducting initial damage assessment, and managing disaster relief requirements including collecting, prioritising, and distributing the relief items. NERC is responsible for coordinating the recovery and rehabilitation activities following a disaster, conduct detail damage assessment, and coordinating the emergency relief operations. [Government of Tonga, 2020]

District Emergency Management Committee and Village Emergency Committee (VEC) are established in Tonga to develop and implement effective emergency management at the district and village levels.

Tonga Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC) is responsible for managing disaster risks and improving climate resilience in Tonga. National Emergency Management Office (NEMO) under the MEIDECC is responsible for managing emergencies and coordinating risk reduction activities in the Kingdom of Tonga and serves as a secretariat for the three emergency committees at national level. [Government of Tonga, 2021] [NEMO,2022]

Tonga Fire and Emergency Services (TFES) established by the Government of Tonga under Ministry of Tonga Fire and Emergency Services is responsible for providing fire, rescue, and emergency services for the country. The newly established Emergency Response Division under TFES provides rescue, relief, and recovery services during disasters. [TFES, 2022]

Tonga Meteorological Services (TMS) under the MEIDECC is the national meteorological services of the country. TMS provides regional and national services on weather forecasts, climate summaries, and satellite imagery. Aviation weather services provides pilot briefings, METAR (METeorological Aerodrome Report), TAF (Terminal Area Forecast), ARFOR (Area Forecasts), SIGMET (Significant Metrological Information), Coast Watch services, and access to numerical models for meteorological and climatological purposes. The six stations TMS operating are located at all the airports. Fua’amotu HQs operates on a 24-hour basis [TMS, 2022]

National Climate Change Coordinating Committee (NCCCC) formerly known as National Environment Coordinating Committee (NECC) under the MEIDECC was established to provide high-level oversight, policy guidance and direction, and coordinate climate change related activities. [Government of Tonga, 2018]

During emergencies, Tonga uses the cluster system which was created under the coordination structure of the NEMO in 2015. Currently, there are 10 clusters (Coordination, Essential Services, Emergency Shelter and Non-Food Items, Safety and Protection, WASH, Economic and Social Recovery, Education, Reconstruction, Food Security and Livelihoods, and Communications) which are all led by relevant ministries with the assistance from international and regional organisations. Although the clusters were created in 2015, they were activated during the 2018 Tropical Cyclone Gita event. [CSFT, PIANGO, HAG, 2019] [Government of Tonga, 2015]

Donors and partners such as Asian Development Bank (ABD), European Union, China, Australia, Japan, New Zealand, United States Agency for International Development (USAID), World Bank, United Nations Agencies, Pacific Community (SPC), Secretariat of the Pacific Regional Environment Programme (SPREP)

and others assist in the form of technical assistance, financial support, capacity building, etc., to build resilience against climate change and disaster risks in Tonga. [Green Climate Fund, 2018]

Ministry of Land and Natural Resources is responsible for urban development. The Planning and Urban Management Agency/National Special Planning Authority Office leads the policy and guidelines for urban development. The Tonga Water Board (TWB), Waste Authority Limited (WAL) and Tonga Power Ltd. (TPL) are three public enterprises playing major roles in urban development. Urban resilience has linked PUMA with the country’s disaster risk reduction and climate change institutions, and they need to work closely to ensure greater resilience for Nuku’alofa. The National Special Planning Authority Advisory Committee (NSPAAC) has been developed, and under the Asian Development Bank (ADB) supported Nuku’alofa Urban Development Sector Project (NUDSP) project, will ensure strengthening of NSPAAC and its functions.

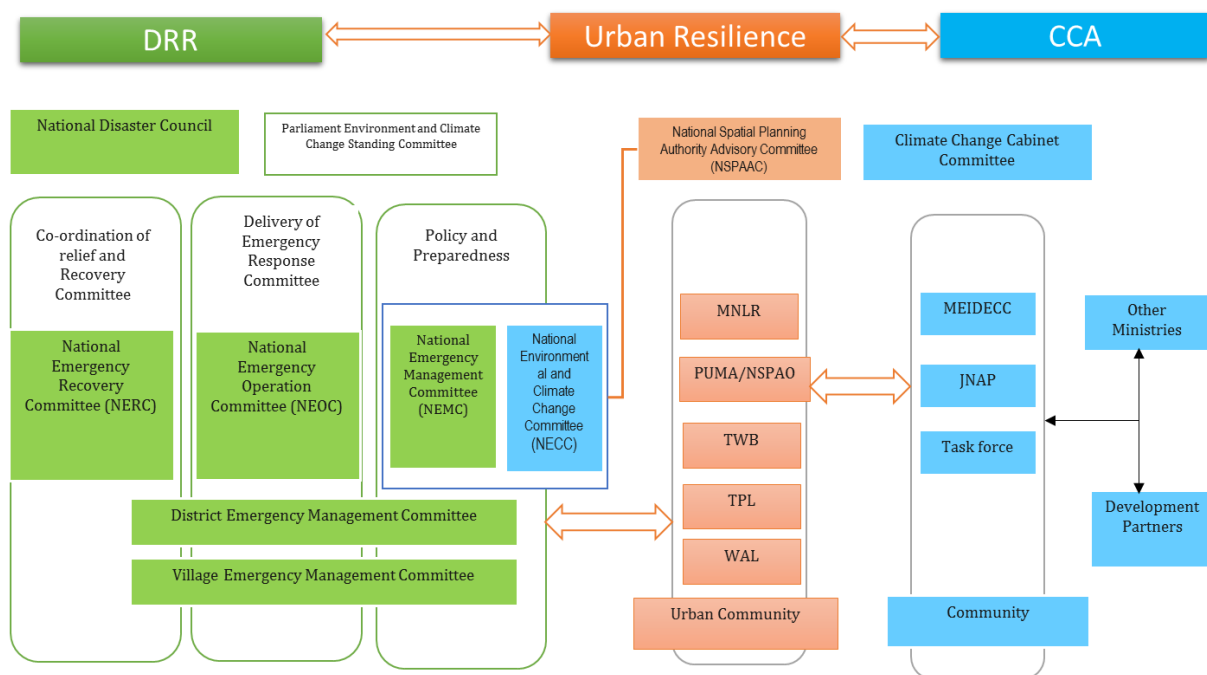


Figure 1: Structure of disaster management in Tonga [NEMO,2022]

In 1997, Tonga published the National Disaster Management Plan and Emergency Procedures which establishes the roles and responsibilities of NEMO and NEMC. The Emergency Management Act 2007 published by the Government of Tonga is a legal framework to manage emergencies and disasters. As the current Act focuses only on responding to an event rather than identifying and preventing or minimising disaster risk beforehand, the Government of Tonga approved a Cabinet submission for policy changes. The new Act will include an integrated approach for disaster risk management, which covers emergency preparedness, emergency response and recovery phases of disaster risk management. [Government of Tonga, 2021]

The key governance and institutional frameworks in Tonga are outlined in Table 1.

Legislation/Policy	Scope	Purpose
Disaster Risk Management Bill 2021	National	The Act is to establish a coherent legal, institutional and regulatory framework for planning and management of disaster risk reduction and preparedness activities before a disaster occurs, coordinating emergency response during a disaster; and facilitating disaster recovery work following a disaster.

Legislation/Policy	Scope	Purpose
Emergency Management Act 2007	National, local	Provides guidance on roles and responsibilities of the Government of Tonga, in the event of disaster with pre-identified groups to support the Kingdom of Tonga's relief and recovery efforts and building resilience.
National Emergency Management Plan 2020	National, local	Provides a framework through which holistic and comprehensive emergency management can be undertaken in the country. It sets out roles and responsibilities of NEMC, NERC, NEOC, DEMC, and VEC.
Tonga Meteorology Act 2020	National, local	An act to establish of the Tonga Meteorological Service. It presents detailed roles and responsibilities of staff and the communication arrangements for dissemination of Meteorological and Ocean information and warnings.
Tonga Strategic Development Framework 2015-2021	National, local	Builds off the first Strategic Development Framework to build a more integrated planning and budgeting system such as concentrating on the income inequality in the country.
Tonga Energy Road map 2010-2020	National, local	Provides goals from the government to reduce greenhouse gas emissions and reliance on imported oil by improving access and efficiency of renewable energy.
Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP2) 2018	National, local	To build on the first JNAP by implementing the six policy objectives of Tonga in hopes of allowing for a coherent, cooperative, and strategic approach to develop resilience building actions.
Tonga National Infrastructure Investment Plan 2013-2023	National, local	Outlines the government's goals in economic infrastructure such as attention to climate change adaptation and disaster risk management aspects of infrastructure development.
Tonga Climate Change Policy 2016	National, local	Climate change and disaster risk reduction by strengthening risk management, low carbon development, and strengthening response and recovery to disasters.

Table 1. National disaster and climate risk reduction policies, plans and legislation in Tonga

2.2 Hazards and Exposure

World Risk Index 2021 classified Tonga as the third country most at risk to natural hazards and climate change. Four islands in Tonga have active volcanoes with a history of volcanic eruptions and heavy ash fallout. Most of Tonga's volcanoes, including Tofua, Fonualei, Late and Hunga, are located in an arc that runs parallel to and about 50 km west of the chain of low coral limestone Tongan islands south-north from Tongatapu to Lifuka and Vava'u. The Hunga Tonga–Hunga Ha'apai volcanic eruption, tsunami and ashfall in 2022 that hit the country affected around 85,000 people, more than 600 buildings were either completely destroyed or partially damaged, and extensively impacted crops, livestock, and fisheries. [World Bank, 2022] [Tonkin+Taylor, 2022]

The Southwest Pacific is a part of the Ring of Fire and accounts for a large percentage of the world's earthquakes, and Tonga is along a major subduction fault line between two large tectonic plates. Due to the geographical location, more than 65% of world's deepest earthquakes are experienced in Tonga and the Tongan islands with a volcanic origin or with active volcanoes. Since 1986, more than 10 major earthquakes with magnitude 7.0 on Richter scale and several minor earthquakes with lower magnitude occur in this region. The 1977 Tonga earthquake is considered one of the most destructive earthquakes, which measured 8.0 on Richter scale. [Tonkin+Taylor, 2022]

As mentioned above Tonga lies along a subduction fault line between two tectonic plates, which causes frequent earthquakes and undersea landslides with the potential to generate tsunamis. Also, earthquakes that are relatively shallow in the earth's crust are more likely to cause a tsunami than those that are very deep. Historically, around 20 tsunamis have affected a large number of islands in Tonga with the majority of them

being small (<1 m) with little recorded damage. The 2011 Japan earthquake (9.0 magnitude) generated 17.8 cm wave heights in the Tonga region. In 2009 an offshore 8.1 magnitude earthquake generated a tsunami that struck Tonga, killing nine people, and destroying around half of the houses on the island of Niuatoputapu. The greatest single risk to the country would be an earthquake with magnitude more than 8.8 in the Tonga Trench, 100 km east of Tonga. Such an earthquake could cause a tsunami of the same size as the 2004 Andaman-Sumatra. [Tonkin+Taylor, 2022] [WTO, 2019] [Matangi Tonga Online, 2021].

On average, Tonga experiences 17 tropical cyclones per decade, with most occurring between November and April, and more frequently during El Niño years. From February 1970 to January 2020, 72 tropical storms have passed the Nuku'alofa within a 300 km radius. Nine storm-related impacts have severely affected Tonga in the last 40 years, which equates to a storm impact roughly every four to five years, a very high frequency. The PCRAFI estimates that Tonga is likely to sustain USD 9.5 million in damages due to cyclones annually. Tropical cyclone frequency is projected to decrease in the South-East Pacific Ocean basin in the 21st century with moderate confidence. Nearly two-thirds of all projections show either no change or a decrease in tropical cyclone formations [Australian Bureau of Meteorology and CSIRO, 2011] [Government of Tonga, 2018] [WTO, 2019] [The World Bank, 2015] [Tonkin+Taylor,2022].

Flooding from heavy rainfall along with cyclonic storms occurs every four or five years in the country. There have been numerous events within recent years which demonstrate flood prone areas and areas susceptible to flood related damage. The historical rainfall data show a decreasing trend in the annual and wet season rainfall; however, there is ambiguity around rainfall projections due to inconsistencies in models. Even with the uncertainties, majority of the projections suggest a decline in dry season rainfall and an increase wet season rainfall by 2090. [PCCSP, 2014] [Tonkin+Taylor, 2022]

Temperature in Tonga has been increasing at a rate of 0.100C per decade since 1950, which is consistent with the global pattern of warming. Future projections indicate that annual average air temperature and sea surface temperature is most likely to increase between 0.30C to 1.1C by 2030, 1.0C to 1.8C by 2055, and 1.9C to 3.3C by 2090. This can result in an increase in the number of hot days and warm nights with a decrease in cooler weather. [PCCSP, 2014] [Tonkin+Taylor, 2022]

Due to the below normal levels of rainfall in dry season and increase in temperature, Tonga is prone to drought conditions. Major droughts occurred in 1983, 1998, and 2006 are linked to the El Niño events. In 2021, The TMS has issued a drought alert for Niuatoputapu. Under a low emissions model, the frequency of drought would increase slightly from seven to eight times every 20 years to seven to eight times every 20 years by the end of the century. However, these findings switch when looking at a high emissions model. Under the high emissions model, drought is expected to decrease from eight to nine times every 20 years to six to seven times every 20 years by 2090. All emission models show that the frequency of severe drought will be occurring every 20 years. [PCCSP, 2014; Tonkin+Taylor, 2022]

The increase in temperature of ocean water and melting glaciers and ice sheets due to global warming causes the sea level rise. Since 1993, there have been a 6 mm increase per year in sea level in Tonga, which is far greater than the global average i.e., 2.8mm to 3.6mm per year. The sea level rise is forecasted to increase by 9-12 cm by 2030, 19-27 cm by 2050, and 44-100 cm by 2100 in Tonga under all emission scenarios (Figure 2). [PCCSP, 2014] [NASA, 2022]

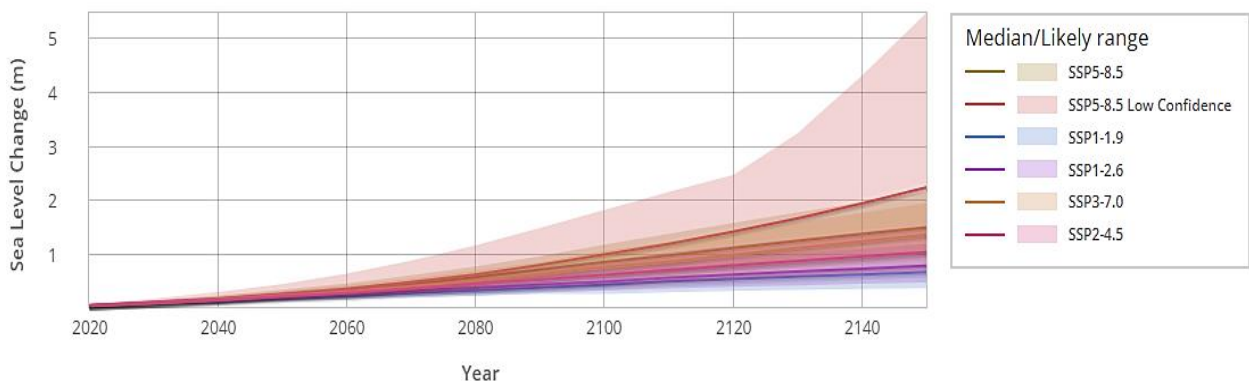


Figure 2. Observed and projected relative sea level change near Tuvalu [NASA, 2022]

In 2019, Tonga experienced measles outbreaks, where more than 600 confirmed or suspected cases of measles have been identified. Since January 2020, there have been more than 11,100 COVID-19 cases with 11 deaths (as of May 2022). Overall, the Kingdom of Tonga is a great example of the results of systemic risk and compounding and cascading impacts of hazards. Figure 3 presents the impacts of compounding and cascading hazards in Tonga (an example of Hunga Tonga–Hunga Ha'apai volcanic eruption, tsunami and ashfall).

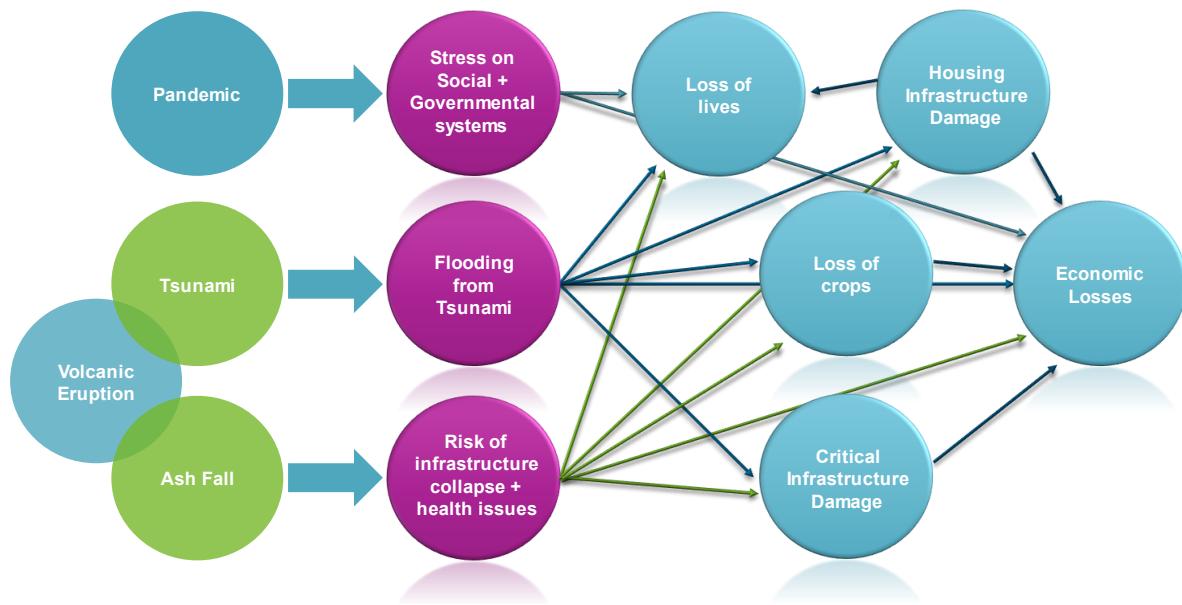


Figure 3: Cascading, compounding, and complex impacts [Tonkin+Taylor, 2022]

2.3 Physical Vulnerability

The coastal nature of settlement patterns in Tonga exposes communities and infrastructure to a high degree of impact from sea level rise, storm surges and coastal flooding, as they are located within 100 metres of the coast and, in places are less than 5 m above sea level. Tongatapu is a low-lying coral atoll, with the highest point only 65 metres above sea level at the south-eastern part of the island. Nuku'alofa is only 1–2 metres above sea level. The major port facilities in Nuku'alofa are likely to be under serious threat if sea level rises as predicted. For example, a 0.5m rise of sea level would inundate approximately 16% of the existing Nuku'alofa port area. The low-lying areas are also under stress (e.g., loss of land) because of increase in population and urbanisation, which may force people (displacement) living alongside the coastline to move inland or on high islands. [Tonkin+Taylor, 2022] [IDMC, 2021]

A significant portion (nearly 66,200 acres) of agricultural land in Tonga is not being used for food cultivation. The fertility of the agricultural land that is used is getting declined due to the increase in population pressures and land pressures for urban development. [Tonkin+Taylor, 2022]

Between 2008 and 2020, disasters have triggered about 18,000 displacements in the country. Weather-related events such as tropical cyclones are the main triggers of the displacements. The 2018 Tropical Cyclone Gita affected around 80,000 people (80% of Tonga's population), completely destroyed 800 houses, and partially damaged nearly 4,000 houses. During this event, around 4,500 people were accommodated in more than 100 evacuation centres, which caused difficulties for emergency and response operations. [IDMC, 2021]

Around 34,000 buildings and 36,000 hectares of major crops are exposed to the impacts of natural hazards and climate change. Nearly USD 2.8 billion is estimated towards replacing, rebuilding, and relocating the exposed buildings and crops. Assessments have revealed that poor compliance and enforcement of the building code played a crucial role in the degree of devastation experienced during TC Gita. Only a few buildings were designed to withstand category 5 cyclones or severe earthquakes. While construction has transitioned from traditional materials and styles to more modern forms of construction using concrete and roofing, the skills and expertise needed to build with newer building materials is lacking. [WTO, 2019] [Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communication, 2018] [Fakhruddin, Reinen-Hamill, & Robertson, 2019]

There is no centralised reticulated sewerage system in the country and the public are served by on-site facilities, which could potentially introduce pathogens and nutrients in the surrounding environment under future climate-induced droughts. New buildings within the Nuku'alofa's urban area have only a piped sanitation system, which is intended to flow to the communal soak-away in the middle of the CBD. The communal soak-away acts via soil absorption. Effluent passes through different layers of soil before infiltrating the ground water. Residents of this area are using wet-type septic tanks which also use the soil absorption method. Many septic tanks do not discharge their effluent into the soil absorption system at all, but let it seep onto the ground surface around the septic tank. Also, the poor drainage systems and a lack of integrated flood management has potential to worsen the flood situation in the low-lying areas [The World Bank, 2022] [Tonkin+Taylor, 2017].

The mangrove ecosystem resource has been damaged by unsustainable development and uses, including dredging, reclamation and domestically raised pigs. The mangrove areas have significant uses for local people, being traditionally exploited for construction wood, and the gathering of crabs, fish and firewood. Clearing of mangrove forests, construction of inappropriate seawalls, depletion of sand on beaches, continued land reclamation for town allotments from the shrinking mangrove forest in and around the Fanga'uta lagoon all pose a serious threat to the mangrove ecosystem. Coastal encroachment will lead to pollution of the lagoon as a result of waste disposal. The damage can be traced back to the lack of effective land use planning and inequality in land allocation. [Tonkin+Taylor, 2017]

2.4 Socio-economic Vulnerability

A high degree of social and economic shock is experienced in the country during disaster years, where above 40% of the population is impacted during a typical disaster year. The population distribution in Tonga renders the outer island population vulnerable to hazards and climate change. Due to their remoteness and lack of affordable and frequent shipping and flight routes, accessing outer islands and providing them with development and technical support is difficult. [Fakhruddin, Reinen-Hamill, & Robertson, 2019] [The World Bank, 2022]

Geographically isolated like other small island developing states, with limited natural resources, narrow production and export base, households in Tonga have limited economic opportunities. Vulnerable and informal employment and substance economic activities are common in the country. In the outer islands and rural areas, subsistence farming, fishing, copra production and handicrafts contribute to household income generation. More than 85% of the households is involved in some form of agricultural production, carried out mostly on a subsistence basis. Extreme poverty is rare in the country, however, around 27% of population is considered living below poverty line. Impacts of climate change and natural hazards tend to disproportionately affect poor people and workers in the informal economy as they are exposed to hazards and have limited resources to cope during a disaster. [Ministry of Finance, 2019] [PICAP, 2020].

Around 70% of the adults in Tonga receive remittances from family members living overseas (as of 2016). About 19% of Tongan households also reported remittances as the main source of income for their household. Generally, more rural households than urban households reported remittances as their main source of income. In 2018, remittance was estimated to be more than 40% of GDP. Dependence on remittances makes the country vulnerable to economic shocks or changing socio-economic conditions abroad in terms of ability for families to send funding home. [PICAP, 2020]

Tourism industry in Tonga is the largest single source of export earning but contributes only 3.2% of GDP (as of 2018). The increase in intensity of storms and increase in temperature and frequency of extreme weather events could seriously impact the tourism sector, as it is based on nature and dependent on the coastal environment. TC Gita has caused extensive economic damage to the tourism industry by damaging infrastructure (mostly accommodation). Though Tonga is less exposed to the collapse in tourism than other tourism-exposed Pacific countries, COVID-19 coincided a time of significant fiscal stimulus and decline in domestic revenues.

Tonga's economic reliance on agriculture and tourism, makes the island nation especially vulnerable to disasters caused by natural hazards and external shocks in the global market. The results of border closure due to COVID-19 and the impacts of TC Gita has pushed Tonga's economy into recession. [ADB, 2017] [ADB, 2021] [Tonga Statistics Department, 2018] [Government of Tonga, 2018] [World Bank, 2021]

[Australian Government, 2021].

In Tonga, both men and women participate in paid work, and the labour force penetration rates are around 81% and 66% respectively. There are also significant differences in wages earned by men and women: women on average earned 47% less than men in similar positions. Majority of men tend to migrate abroad (mostly to Australia and New Zealand) as seasonal labours, and others involve in commercial agriculture, offshore fishing, and construction. Women undertake activities such as production of handicrafts, planting and sale of cash crops, utilisation of coastal fisheries, and managing small retail outlets. In the outer islands of Haapai, Vavau, and Niua groups, more than 50% of the income is generated through handicrafts (mainly through weaving). Women are also responsible for taking care of the family members and for assisting community and church activities. Overall, activities such as weaving and creating handicrafts are reliant on natural resources (mulberry and pandanus trees) and are vulnerable to the natural hazards and climate change. [PICAP, 2020] [The World Bank, 2021]

While Tonga has made some progress in integrating gender into its national policies, it is one of only three countries in the world that have not signed or ratified the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW). Tonga has no domestic violence, sexual harassment, human trafficking, sex tourism or family legislation in place. Tonga has no minimum age of sexual consent; hence statutory rape is not a crime. The legal definition of rape is limited to acts amounting to sexual intercourse, and the common law rules which require proof of physical resistance to establish lack of consent is still applied. The defence of the reasonable belief that a victim was of legal age of consent is still allowed as well. The constitution and judiciary also do not offer women any protection from sexual harassment at the workplace. The combination of limited economic opportunities, low levels of representation, and limited legal protections exacerbate the already diminished roles of women in disaster risk response and management in Tonga. [UN Women, 2013] [Hedditch & Manuel, 2010] [UN Women, 2021]

2.5 Cultural Vulnerability

Cultural heritage is a critical component of the Tonga's identity and has a significant function for social cohesion. Tonga's culture of sharing between families and within communities, acts as a social protection mechanism during emergencies. Communities have well established routines for assisting others in needs, especially elderly and people with disabilities during an emergency event. [Magee et al., 2016]

'*Fale*' is the traditional house of Tongans, mainly built using wood, thatches, and ropes. *Falefaha'iua*, *Fale fata*, *Falefakamanuka*, *Falefakafisi*, and *Falepouono* and *Falepouvalu* are other traditional shelters (mostly based on *fale*) that have cultural significance in the country. In 2014, TC Ian damaged nearly 1130 western-style houses, while the *fale* remained unaffected. *Fale* is considered both more storm resistant due to its design and more easily rebuilt. The construction practices and architectural knowledge on traditional *fale* has almost disappeared due to western construction practices and lack of transfer of knowledge and skills [Robinson et.al., 2017] [Paula, 2016] [Shelter Cluster, 2019]

Churches and town halls serve as emergency/evacuation shelter during disaster events. Often churches support in undertaking assessments (e.g., needs assessment, damage assessment) due to their close relationship with community members. Churches and town hall are vulnerable to the impacts of climate change and natural hazards and may be overwhelmed by large-scale, long-term, or frequent events [Government of Tonga, 2018] [PICAP, 2020]

Even though Tonga society is patriarchal, women in Tonga have traditionally held high social status within Tongan society because of the 'fahu' system (i.e., elder sister acts as the family matriarch and oversees wellbeing of siblings, nieces, and nephews, and has the highest levels of respect at all formal and informal occasions) within families. However, gender equality is an ongoing challenge in the country, as traditional values, and cultural norms place men in the decision-making roles in public and at house. Women are mostly excluded from the planning and decision-making processes at all levels of governance. Also, *women do not have the legal right to own an estate and rarely own allotments*, as they usually live on the properties owned by their husbands or male family members, but they can hold leases. Approximately 20% of leases in Tonga are held by women, and an increasing trend is reported. [PICAP, 2020] [The World Bank, 2021]

3. Progress in Sendai Framework for Disaster Risk Reduction

To illustrate the government's will and commitment to protect the population and the country from future disasters, the following sections shed light on Tonga's progress in disaster risk reduction as guided by the global policy frameworks: Sendai Framework for Disaster Risk Reduction. This section is organised by four priority areas of SFDRR, in which focused actions are required within and across sectors by states at local, national, regional, and global levels.

Priority 1. Understanding disaster risk. Understanding disaster risk means understanding vulnerability, exposure, hazards, environment, and capacity.

Government of Tonga in collaboration with international non-governmental organisations, development partners, and other agencies conducted and published assessments on the county's vulnerabilities and available strategies to prevent or minimise the impacts of disasters. In 2020 and 2021, a multi-hazard climate and disaster risk assessment was conducted by ADB and Government of Tonga reports the identification of risk areas and communities in Tongatapu island. Around 28,000 buildings, 26,000 power infrastructure, 500 water assets, and 1,200 kms of roads were assessed against the impacts of natural hazards and climate change. The assessment is expected to lead to the development of safer areas and investments away from the high-risk area. [ADB, 2021]

The SPC's report on "Adaptation options and community strategies" assessed the Lifuka Island's shoreline change, groundwater resources, oceanography, the shallow-water marine habitat, and beach sediment composition and transport to understand the impacts of climate change. Sea level projections until the end of the century were presented to show the houses and infrastructure that are most likely to be affected in the island. Hazard zones were determined, and potential adaptation strategies were developed based on the consultations with community. [SPC, 2014]

The Pacific Islands Meteorological Strategy (PIMS) 2017-2026 provides the development priorities of the Pacific Island National Meteorological and Hydrological Services (NMHSs). PIMS sets out the strategic context and direction for strengthening NMHSs. Besides, the Government of Tonga is planning to build resilience and upgrade systems including regional early warning systems, computer systems, data-basing and so forth for improving risk modelling capacity in the county. [SPREP, 2017] [Tonkin+Taylor, 2017]

Priority 2. Strengthening disaster risk governance to manage disaster risk. Strengthening national policy and legislation to coordinate effective disaster risk reduction and disaster risk management is an important aspect to managing disaster risk. In 1997, Tonga established the National Disaster Management Plan and Emergency Procedures which establishes the roles and responsibilities of NEMO and NEMC.

Tonga is the first country in the South Pacific region to develop a Joint National Action Plan for Climate Change Adaptation and Disaster Risk Management (JNAP). In 2018, the Joint National Action Plan 2 for Climate Change Adaptation and Disaster Risk Management 2018 - 2028 was published on the foundation of the first JNAP. It highlights the importance of leadership, involvement of government agencies, and the role of private sector and civil societies for building resilience in Tonga. [Government of Tonga, 2018]

Priority 3. Investing in disaster risk reduction for resilience. Government of Tonga has been investing in disaster risk reduction by allocating funding to MEIDECC for implementing resilience building projects in the country (Ministry of Finance and National Planning, 2019). In 2021/22 financial year, MEIDECC was allocated around USD 74.02 million for implementing development projects. The major projects under MEIDECC are GCF (Green Climate Fund)-ADB Tonga Renewable Energy Project, GCF Tonga Coastal Resilience Project, Japan Nationwide Early Warning System (NEWS), WB Pacific Resilience Program (PREP). [Government of Tonga, 2021]

In 2020, ADB announced its support to upgrade the Queen Salote International Wharf in Nuku'alofa

by contributing USD 45 million to improve its resilience towards disaster risks and climate change. In 2022, New Zealand Government announced USD 4 million as financial assistance to improve the water supply and sanitation for the vulnerable households in Tonga following the volcanic eruption and tsunami impacts. ADB offered USD 1 million grants to assist the country as a response to community transmission of COVID-19. [RNZ, 2022; ADB, 2021]

GCF assisted Tonga in implementing renewable energy under the Pacific Islands Renewable Energy Investment Program by contributing USD 29.9 million to assist the country to move away from fossil fuel toward renewable energy. [GCF, 2022]

The United States government, through the USAID is providing nearly USD 1.1 million to boost the capacity of Tongan communities to prepare for and mitigate the impacts of disasters caused by natural hazards, particularly for the most marginalised members of the community. This two-year project will work with the Tongan National Council for Churches to support nearly 9,000 people across 27 most remote communities of the country. [U.S. Indo-Pacific Command, 2021]

Priority 4. Enhancing disaster preparedness for effective response to “build back better” in recovery, rehabilitation and reconstruction. Many disasters have impacted the people living in Tonga and caused damages to the infrastructure. For example, after TC Ian made landfall in 2014, houses and critical infrastructure were damaged significantly. The Government of Tonga, the World Bank, the Global Facility for Disaster Reduction and Recovery (GFDRR), with additional funding from the Africa Caribbean Pacific-European Union Natural Disaster Risk Reduction Program (ACP-EU NDRR) worked together to assess the extent of damages caused by TC Ian and to implement a recovery programme to strengthen the housing and transport infrastructure in the country.

A post-disaster needs assessment and socio-economic assessment of the affected households was conducted as a part of this work. The assessment led to best practice on housing recovery and reconstruction, public grievance systems, and capacity building on safe home construction. In total, around 1,000 households received support on housing reconstruction, repairs and retrofitting through the Tonga Cyclone Reconstruction and Climate Resilient Project and infrastructure, such as roads, airports, and ports in Ha’apai received rehabilitation [The World Bank, 2014].

Through Pacific Disaster Resilience Program, ADB is supporting several countries in the Pacific region, including Tonga, with USD 10 million as a contingent disaster financing grant for early recovery and reconstruction activities following disasters triggered by natural hazards. (ADB, 2021)

Japan International Cooperation Agency (JICA) is installing disaster communication system through nationwide early warning system throughout the country including the two Niuaus. The project includes radio communications for disaster management agencies, early warning sirens, loudspeakers and remote activated radios. In April 2021, additional assistance was announced by the Japanese Government towards this project. The Project is in progress with a Grant Aid Assistance from the Government of Japan with an original worth of USD 25 million, and an additional assistance of USD 1.9million. [MEIDECC, 2019] [Embassy of Japan in the Kingdom of Tonga, 2021]

UNDRR launched a four-year project: Strengthening Hydro-Meteorological and Early Warning Systems in the Pacific (CREWS Pacific SIDS), partnering with World Meteorological Organization and the World Bank. The project has five outcomes: improved governance, enhanced product development and accessibility, enhanced service delivery, enhanced communication and awareness programmes on early warning services, and improved integration of gender including people living with disabilities. It targets small islands developing states including Tonga. [WMO, 2018]

Following the volcanic eruption and tsunami in 2022, Tonga Prime Minister confirmed that a total of USD 240 is required to fund the Hunga Tonga–Hunga Ha’apai Recovery and Resilience Building Plan 2022-2025. Housing Recovery, Food Security and Livelihood, Tourism Industry and Public Infrastructure are the four key priorities in the recovery plan. [PINA, 2022]

4. Coherence with Sustainable Development Goals and The Paris Agreement

4.1 Strategic Coherence

Strategic coherence explores whether disaster risk reduction and climate change adaptation are explicitly addressed jointly or if there is an aim to strengthen the relationship and linkages between the two fields (UNDRR, 2020).

Tonga is the first country in the Pacific region to develop a Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management (JNAP) in 2010. Government of Tonga updated their JNAP in 2018 (JNAP 2) with latest risk information and climate change adaptation and disaster risk reduction initiatives. Objective 1 of JNAP 2 is to “mainstream climate change and disaster risk management approaches into government legislations, policies, and plans at all levels”. JNAP 2 is strongly aligned with Sendai Framework for Disaster Risk Reduction, Kyoto Protocol, Paris Agreement, Tonga Strategic Development Framework 2015-2025 (TSDF) and Sustainable Development Goals (SDGs). The policy is to be implemented by identified ministry agencies and local partners, nongovernment organisations, private sector, village and community groups, and donors and development partners looking to identify, assess, reduce, and manage risks by focusing on accountability, sustainability, equity, community focus, and collaboration. [Government of Tonga, 2018]

Tonga Strategic Development Framework 2015 - 2025 (TSDF) main outcomes are aligned to the 17 SDGs and underscores the approach to sustainable and inclusive growth. National Outcome C of TSDF emphasis on gender equality by having “a more inclusive, sustainable and empowering human development with gender equality”. Besides, climate change and disaster risk are mainstreamed in this policy. [Government of Tonga, 2015]

According to Voluntary National Review in 2019, Tonga has chosen to prioritise social protections and human rights with a focus on vulnerable groups. To fully inform policy changes and interventions, the government has utilised advanced statistical techniques to enable poverty reporting that is inclusive of smaller island communities and developed a robust multidimensional poverty measure which is reliable, valid and contextually appropriate. With non-communicable diseases and communicable diseases ongoing and the prevalence of non-communicable diseases increasing, Tonga is also committed to the continuation of Universal Health Coverage and striving for nationwide coverage and access to quality healthcare services. Equal opportunities for all, especially marginalised groups including access to employment, leadership opportunities and social services, is recognised by the Tongan government. Education already has regulations in place to be inclusive to all students with a need to strengthen access to vocational training and accreditation to meet international standards [Government of Tonga, 2019].

Tonga is also prioritising energy efficiency services and committing to SDG 7 for affordable, reliable, sustainable, and modern energy as a key catalyst to sustain economic growth. Diesel fuel has made up around 10% of the GDP and 15% of national imports. The goal to reduce electricity network losses to 11% of total electricity generation was achieved in 2017 and has achieved 10% of the 50% share of renewable energy target by 2020 (Kingdom of Tonga, 2019). Furthermore, Tonga is looking to reduce its greenhouse gas emissions by 10% through implementation of renewable energy and energy efficiency programmes [Department of Climate Change, MEIDECC in consultation with the JNAP on CCDRM Technical Working, 2016] [PCREEE, 2018]

Based on the analysis presented in the Table 2, Tonga’s national policies and plans are mostly coherent with the global frameworks.

Sectoral Aim	Policies with Linkages to Sendai Framework for Disaster Risk Reduction	Policies with Linkages to Sustainable Development Goals	Policies with Linkages to the Paris Climate Agreement for Environment
National Development	Tonga Climate Change Policy	Tonga Climate Change Policy	
	Tonga Strategic Development Framework Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP2) National Emergency Management Plan	Tonga Strategic Development Framework National Emergency Management Plan National Women's Empowerment and Gender Equality Tonga policy and strategic plan of action: 2019–2025	Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP 2) Second Nationally Determined Contributions (NDC)
Environmental Protection	Environment Management Act 2010	Tonga Agriculture Sector Plan 2016-2020 Tonga Strategic Development Framework	Tonga Agriculture Sector Plan 2016-2020 Tonga Strategic Development Framework
Disaster and Climate Risk Reduction	Tonga Strategic Development Framework Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP 2) National Emergency Management Plan	Tonga Strategic Development Framework National Infrastructure Investment Plan 2013-2023 Tonga Climate Change Policy National Emergency Management Plan National Women's Empowerment and Gender Equality Tonga policy and strategic plan of action: 2019–2025	Tonga Climate Change Policy
	Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP 2)	Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP 2) Tonga Strategic Development Framework National Women's Empowerment and Gender Equality Tonga policy and strategic plan of action: 2019–2025 Health Promotion Act (2007)	Tonga Strategic Development Framework Tonga Climate Change Policy
Vulnerability Reduction	Environment Management Act 2010 Tonga Strategic Development Framework	National Biodiversity Strategic and Action Plan -Fifth Report Tonga Strategic Development Framework	National Biodiversity Strategic and Action Plan - Fifth Report

Table 2. Synergies between the national policies, plans and frameworks by sector

4.2 Conceptual Coherence

Conceptual coherence explores how countries link disaster risk reduction and climate change adaptation conceptually, through the concept of risk and resilience. [UNDRR, 2020]

Risks of climate change and natural hazards are jointly addressed in the JNAP 2 (2018-2028) and TSDF (2015-2025). The vision of JNAP2 is to build resilience in Tonga to the impacts of climate change and disaster risks, and to protect and safeguard its citizens. Tonga's JNAP 2 describes the impact on women, LGBTQI, persons with disabilities and health issues, along with other socio-economic factors. Besides, vulnerabilities, socio-economic factors that create the risks, synergies, and distinctions between disaster risk reduction and CCA are available in majority of the national policies and plans. [Government of Tonga, 2018] [Government of Tonga, 2015]

4.3 Operational Coherence

Operational coherence looks at measures and activities which bring together disaster risk reduction and climate change adaptation practices and to which extent planning is cross-sectoral. [UNDRR, 2020]

JNAP 2 place a strong emphasis on coordination, leadership, and good governance and promotes a shared approach between JNAP Secretariat, ministries and local partners, private sectors, and other stakeholders. JNAP 2 promotes inclusion and empowerment of women, girls and LGBTQI, persons with disabilities, elderly, youth, children, and other marginalised people. Also, JNAP 2 contains a detailed action plan that outline specific activities, means of verification, indicators, and lead coordinating agencies. [Government of Tonga, 2018]

4.4 Institutional Coherence

Institutional coherence analyses whether coordination between climate change adaptation and disaster risk reduction is envisioned and if and how institutional arrangements support coherence. [UNDRR, 2020]

In Tonga, the disaster risk management activities are coordinated by NEMC, whereas NCCCC and Parliament Standing Committee on Climate Change play crucial roles in ensuring that climate change considerations are considered by Government and coordinated. JNAP Secretariat was established from JNAP 1 with a team leader, climate finance officer, and climate change officer. Although the roles and functions of JNAP Secretariat is to manage and coordinate all climate and disaster activities in Tonga, there are no personnel for managing disaster risk reduction activities. However, there are plans to employ "Disaster Risk Management Officer" based on JNAP 2. Overall, there is limited institutional coherence in Tonga to manage disaster risk reduction and climate change adaptation activities. [Government of Tonga, 2018]

4.5 Financial Coherence

Financial coherence explores whether and how funding strategies and investments bring together disaster risk reduction and climate change adaptation. [UNDRR, 2020]

Tonga has established a revolving funding of USD 5 million with the support of ADB to finance joint climate change adaptation and disaster risk reduction activities directly to communities on a competitive basis. Before creating this fund, communities were dependent on two separate funds for disaster risk reduction (i.e., national emergency fund) and climate change adaptation (i.e., national climate change fund). [ADB, 2021]

JNAP 2 (2018-2028) includes a detailed financial cost for implementing each objective and its sub-objectives. However, a costing for implementing goals, actions, and objectives of the TSDF (2015-2025), Updated NDC, and National Climate Change Policy (2016) are not available. [Government of Tonga, 2018] [Government of Tonga, 2015] [Government of Tonga, 2020] [Government of Tonga, 2016]

5. Challenges and Future Priorities

5.1 Challenges for Disaster Risk Reduction Implementation

As a remote island nation, with a limited resource base, Tonga is considered physically vulnerable to the impacts of climate change and natural hazards. There is a conscious attempt to build back better in Tonga, but the complex land management system hinders this concept, and it may not be achievable unless land management issues are resolved in Parliament. The Building Code was developed in 2005 and revised in 2018, but it is not enforced strictly. Although early warning systems and preparedness measures that were put in place during Tropical Cyclone Gita in 2018 resulted in zero lives lost, but the lack of strict enforcement of building codes and poor physical infrastructure caused extensive damages to the built environment. For example, power supply infrastructure was damaged on ‘Eua and Tongatapu islands affecting more than 18,000 people. [Government of Tonga, 2018] [PRIF, 2021] [Tonkin+Taylor, 2017].

An overarching constraint on the kingdom’s ability to reach its climate and development goals is its limited human, technical, and financial capacity. The capacity of Tonga’s public sector is inadequate, as there are only a few qualified public servants, and it has limited systems, processes, data, and information to effectively implement the disaster risk reduction and climate change adaptation activities [International Monetary Fund, 2020].

Sectoral policies act independently without the benefit of an overarching policy framework to integrate them. Limited collaboration is taking place in the absence of such a framework. There are visible gaps in links with other Government agencies. Informal links are in place but are not fully utilised or functional. The MEIDECC currently has a huge mandate, involving integrating several portfolios. Despite the growing urgency associated with climate change, continued impacts of natural disasters, and Tonga’s high-risk classification, there is still a lack of understanding and awareness of these issues throughout Government. The consequence is that a focus on building resilience, and ensuring that maladaptive developments are not being implemented, are lacking in most of the corporate planning and budgeting in Government ministries. [Tonkin+Taylor, 2017]

NEMO leads and coordinates the overall post-disaster rehabilitation and recovery efforts. Currently, NEMO is well-coordinated in Tonga. However, there is a need to build awareness and capacity within disaster management agencies at district and village level, to broaden practices, and to pay special attention to rehabilitation and recovery activities. Also, the cluster system is currently not mentioned in any of the significant national emergency management plans such as the National Emergency Management Plan or the Emergency Management Act. [Tonkin+Taylor, 2017] [Tonkin+Taylor, 2019]

Despite good severe weather forecasts and warnings by TMS, the population does not fully understand the information communicated to them often resulting in an inadequate response. The Geo-hazards monitoring, and visualisation tools are limited in number and also need upgrading to better monitor and visualise geo-hazards, and to ensure continuity of operations by mirroring capabilities outside of high-risk zones. There is a need to strengthen the capability of national tsunami warning centres to undertake impending threat assessments.

Development pressure in Nuku’alofa is increasing because of population growth. The existing urban infrastructure is already insufficient to meet the demands of the current urban population. Land for urban expansion of Nuku’alofa is limited to peripheral agricultural and ecologically sensitive areas, placing development pressure on existing marginal areas within Nuku’alofa such as Sopa and Popua, which are low-lying, subject to frequent flooding during periods of heavy rain and storm surge, and have significant numbers of poor households. [Tonkin+Taylor, 2019]

5.2 Priority Areas of Work

The following priority areas are suggested based on the vulnerabilities, challenges, and other contributing factors that are identified in this report:

Investing in sustainable urban infrastructure: Investment in sustainable urban infrastructure is required, with focus on building disaster and climate change resilience. Upgrading of existing infrastructure is being undertaken through the Nuku'alofa Reconstruction Project and the Integrated Urban Development Sector Project.

Strengthening telecommunication infrastructure: Tonga has limited capacity to disseminate rapid alert notifications during an emergency. The Hunga Tonga–Hunga Ha'apai in 2022 exposed fragility of telecommunication infrastructure, where the critical submarine cables were cut-off. Developing a Unified Messaging Systems (UMS) can broadcast messages using standard protocols (Common Alerting Protocol) and infrastructure (internet, mobile phones) that are available in the country. UMS can be tailored to the Tongan context and will allow systems to interlink with the messaging broker to write, publish, subscribe, and disseminate warnings through all media.

Developing Standard Operating Procedures: There are no standard operating procedures to carry out response work and evacuation centre operations. With the ongoing pandemic and the 2022 Hunga Tonga–Hunga Ha'apai volcanic eruption, tsunami and ashfall events, standard operating procedures need to include actions for dealing with the cascading, compounding, and complex impacts.

Facilitate private sector engagement: Developing private sector links to encourage the integration of risk into business planning and decisions and establishing public-private partnerships between government and companies could enhance cost efficiencies as well as deliver greater impact for public disaster risk management initiatives.

Conduct comprehensive risk assessment: There is a need to carry out a comprehensive risk assessment for all the islands in Tonga, which include assessment of hazard, vulnerability, exposure, and adaptive capacity. Conducting vulnerability assessment and development of risk mapping with land zoning could help communities to understand the risk and prepare accordingly. With advance LIDAR (Light Detection and Ranging) data and technology in Tonga, this could be easily developed.

Improve community preparedness: Community awareness and engagement in particular preparedness activities are limited in Tonga. Public education and awareness on disaster risks and its reduction measures such as increasing update of disaster risk information and knowledge through campaigns, social media and community/village level plans are important for overall preparedness. Also, establishing and strengthening the capacity of Village Emergency Management Committee (VEMC) may support in developing and implementing the Village Emergency Management Plan (VEMP). VEMP clearly defines the roles and responsibilities of VEMC members, includes disaster risk reduction actions, preparedness activities, and a response plan to follow before, during, and after an emergency.

Standardise safe evacuation shelter: Safe shelter requires having a safe place to go and for people in particular, women, girls, and people with disabilities to feel safe in that place. The Government of Tonga has recognised that there is no standard system to identify what constitutes safe shelter and there is a lack of shelters for any natural disaster. A standardisation that identifies and defines a safe shelter is essential for cyclones, flood, coastal inundations and tsunami.

Develop M&E framework for disaster risk reduction project monitoring: There should be a unified, web-based and geographically referenced monitoring system accessible to all implementing agencies, local governments, private sector, civil society organisations and development partners to ensure transparency and accountability. The system should provide up-to-date relevant information on the reconstruction process, highlight gaps and overlaps and enable stakeholders to strengthen coordination in their interventions. The data tracking system must be able to harmonise and build on existing government systems. Interoperability of systems and data sharing mechanism shall be considered.

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