

Rapid Vulnerability and Adaptation Assessments of six Communities in Tongatapu, Ha'apai, and Vava'u, Tonga









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Executive Summary

A rapid vulnerability and adaptation (V&A) assessment was carried by a team consisting of the Tonga In-Country Coordinator (ICC) and five assistant officers that were trained in the Tonga sub-regional workshop. The assessment was carried out in three phases. Phase 1 was carried out by the ICC and 3 assistants in Tongatapu, from 17th to the 21st of September 2012. Phase 2 involved the ICC and two assistants in Ha'afeva, from 24th to the 27th of September 2012. Phase 3 also involved the ICC and two other officers in Vava'u from 1st to the 5th of October. Three villages were assessed in Tongatapu, namely Popua, Tatakamotonga and Sopu. Ha'afeva Island was chosen from the Vahelulunga in the Ha'apai group of islands. Tu'anekivale village from 'Uta Vava'u and Ovaka from Vahemotu in the Vava'u group of islands.

The main objectives were to (i) assess the level of vulnerability of the sites identified, (ii) assess the status of the water supply, health and sanitation, food supply and security, energy sources, natural and coastal resources, sources of income, governance and socio-economic well-being (iii) rank these vulnerabilities to determine which three sites will be chosen as demonstration sites from the six being assessed.

All of the sites were assessed as having different levels of vulnerability with regards to the sectors being assessed. Tatakamotonga, Tu'anekivale and Ha'afeva had the most severe cases of erosion, while Sopu and Popua was prone to frequent flooding due to their location as being in a low lying swamp mangrove coastal area. They were also highly vulnerable to food security as they have no land for agriculture and depend only on the market and shops (however they are both located on the fringes of urban areas and are accessible to shops and markets etc.) What makes them vulnerable is their average income per household/week is less than 50TOP to be able to meet all their basic needs and also cater for other essential services such as education and health.

The quality of water was similar in all sites ground water (tap) and rain water tank while Ovaka was the most vulnerable (only rain water tanks) while all other sites had similar results. Water storage and pressure is an issue in Tu'anekivale, Ovaka and Ha'afeva, which is often related to irregular power supply that pumps the ground water for storage and insufficient water tank reservoir.

Sopu had the highest population, with 2,100 persons in 350 households, followed by Popua with 1,894 people in 316 households, while Tatakamotonga had a population of 1761 persons distributed in 301 households. Ha'afeva had a population of 270 with 48 households, Tu'anekivale has 488 persons with 86 households and Ovaka's population is 85 with 21 households. The population of Sopu was an approximate from the Kolomotu'a Town Officer as Sopu is part of Kolomotu'a and is not identified as a separate village in the National Census.

Sanitation practices varied among the six villages with poor management and indiscriminate dumping of rubbish in the coast, vacant and bush land. Management of human waste and personal hygiene was influenced by the availability of sufficient water supply, and fared the worst at Ovaka village. The usage of open pit toilets was still predominant in Ovaka and Ha'afeva while Tu'anekivale had these open pit lavatory as a backup to their flush toilet system.

The six villages visited in this study had a good appreciation and wish to learn about the impacts of climate change, and were willing to take adaptive measures to protect their communities and livelihoods.

1. Introduction

1.1. Background to the USP-EU GCCA Project

The Pacific Centre for environment and Sustainable Development (PACE_SD), USP has been awarded funding from the European Union (EU) Global Climate Change Alliance (GCCA) for addressing climate change adaptation (CCA) in the Pacific. This initiative was established in 2007 by the European Commission with the intention to deepen dialogue and cooperation on climate change, in particular Least Developed Countries (LDCs) and Small Island Developing States (SIDS). These countries are hardest hit by the adverse effects of climate change while they have the least capacity to adapt to those climate impacts. The Pacific component of the Intra-African Caribbean Pacific (PACP) project supports 15 Pacific Island Countries which are Fiji, the Solomon Islands, Vanuatu, Papua New Guinea, Tonga, the Cook Islands, Samoa, Niue, Nauru, Kiribati, Tuvalu, the Marshall Islands, Palau, the Federated States of Micronesia and East Timor. The main components of this project are: (i) Capacity building, (ii) Community engagement and adaptive actions, and (iii) Applied research (PACE_SD, 2011)

1.2. Description of the action

The initial rapid V&A assessment was carried out by a team consisting of the ICC and 3 other officers. These three officers were selected from the local participants from the Sub-regional Climate Change Mitigation and Adaptation workshop held in Nuku'alofa Tonga in August 2012. These officers were a Disaster Management Officer from the Tonga Red Cross Society, Project Coordinator from E-Waste Tonga, and Field Project Officer from the PCIDRR project at National Emergency Management (NEMO) office. Another two Youth officers were used in the outer islands as they were also participants in the sub-regional workshop.

Three villages were visited in the Tongatapu Group, with one village in the Ha'apai Group and two villages in Vava'u. These villages were Popua, Sopu and Tatakamotonga from Tongatapu. Ha'afeva in Ha'apai, Tu'anekivale and Ovaka from Vava'u.

The main objectives were to (i) assess the level of vulnerability of the sites identified, (ii) assess the water supply, health and sanitation, food supply and security, energy sources, natural and coastal resources, sources of income, governance and socio-economic well-being (iii) rank these vulnerabilities to determine which three sites will be chosen as demonstration sites from the six being assessed.

2. Site Descriptions



Figure 1 Map of Tonga

Tongatapu is the main island of the Kingdom of Tonga and the location of its capital Nuku<u></u>'alofa. It is located in Tonga's southern island group, to which it gives its name, and is the country's most populous island, with 75,158 residents (2011Census), 73% of the national population. Tongatapu is Tonga's centre of government and the seat of its monarchy (Wikipedia).

The island is 257.03 km² (260.48 km² with neighboring islands) and rather flat, as it is built of coral limestone. The island is covered with thick fertile soil fertilized with volcanic ash from neighboring volcanoes. At the steep coast of the south, heights reach an average of 35m gradually decreasing towards the north. Tongatapu is highest in elevation around the villages of Fua'amotu and Nakolo with a height of 65m.



Figure 2 Map of Tongatapu with assessed sites circle in red.

North of the island are many small isolated islands and coral reefs which extend up to 7 km from Tongatapu's shores. The almost completely closed Fanga'uta and Fangakakau Lagoons are an important breeding ground for birds and fish as they live within the mangroves growing around the lagoon's shores. The lagoons were declared a Natural Reserve in 1974 by the government. (Wikipedia).

2.1. Popua Village



Popua Village is located at 21°09'S and 175°09'W, with an average elevation of less than 1 meter is one of the sites most severely affected by flooding due to inundation from inter-tidal changes. Recent road development exacerbated the problem as it lacks a proper drainage system where the roads effective block the flow of rain water back to the sea, thus turning the homes into swimming pools. The most pressing issue for Popua is the fact that they are vulnerable to extreme whether events such as tropical cyclones, storm surges, as well as tsunami due to their physical locations. There are no safe evacuation routes for Popua other than having to exit towards the coast where they are heading towards danger instead of away from it. Food security for this village is a major issue when over

90% of the people have no land for plantations or farms. These people migrated from the outer islands or rural areas to live permanently in Popua for social and economic reasons. Popua is a difficult village as there are debates as to its existence in the first place. But the fact of the matter is its population increases every year with 1894 people and 316 households in the 2011 Census. This population increase is putting more pressure on an already vulnerable area.

2.2. Sopu



This village is located at 21°07′S and 175°13′W with an average elevation of less than 1 meter. There are about 350 households with about 2,000 people. The main source of income is fishing, vegetable garden, public servants, private sector and remittances. Over 90% of the population has no land for faming/plantations. Most of people migrated from the outer islands and from the rural villages to live closer to Nuku'alofa. Therefore, they still get most of their food from their original homes (mostly from the outer islands). It is similar to Popua. But Sopu is part of Kolomotu'a literally means Old Town which is considered to be part of the greater Nuku'alofa urban area. The problem facing Sopu is very much the same as that of Popua. In order to build your homes you must first fill up the area with coral

rocks and topsoil first. Even though Sopu has the same problem as Popua, it has accessible route in times of incoming natural disasters such as tropical cyclone, storm surge and Tsunami.

2.3. Tatakamotonga Village



This village is located at 21°10'S and 175°07'W, on the eastern district of Tongatapu. Tatakamotonga has 301 households and 1761 people. Their main source of income is farming, fishing, civil servants, tapa making and handicrafts. The reason for Tatakamotonga's inclusion in this assessment is due to its unfavorable soil type and regular occurrence of typhoid cases.

Ha'apai is a group of islands, islets, reefs and shoals in the central part of the Kingdom of Tonga, with the Tongatapu group to the south and the Vava<u>'</u>u group to the north. Seventeen of the Ha'apai islands are populated.

Pangai is the administrative capital village of the Ha'apai Group and is located on Lifuka Ha'apai consists of 51 islands directly beside the Tonga Trench. The archipelago lies between the 200 km north of Tongatapu and 130 km south of Vava'u. Seventeen of the islands are inhabited, including the main islands of Lifuka and Foa. The two main islands in the archipelago are Pangai on Lifuka



Figure 3: Map of Ha'apai Group

(where Salote Pilolevu Airport is located) and Ha'ano. A total of 6650 people live on the islands Ha'apai (Census 2011).

2.4. Ha'afeva Island



Ha'afeva is a small island in the Ha'apai group of Tonga located at 19°57'S and 174°42'W, but still the main island of the Lulunga archipelago. Kolongatata is the name commonly given to the village on Ha'afeva and is a reference to Ha'afeva's exposure to strong winds. The Island has a population of 270 people (Census 2011).

Ha'afeva is located 42 km southwest of Pangai in the Ha'apai group of islands at Latitude (DMS) 19°56' 60 S and Longitude (DMS) 174° 43' 0 W.(Wikipedia, The Free Encyclopedia, WWW).

Ha'afeva has a health clinic with a nurse and a health officer to serve the Lulunga district, it also holds the district officer, and its own town officer for local government officials and duties. It has

a primary school with most of the main church denominations. There is an Electrical Power Generator run by diesel which normally operates from 7pm to 12/1 am. The main source of water is rainwater, while ground water supplement for washing and bathing. Some small boreholes with hand pumps still operate only as a source of drinking water for the pigs and livestock.

Vava'u is an island chain of one large island and 40 smaller ones in Tonga. Vava'u rises 204 m above sea level. The capital is Neiafu, which is the second largest city in Tonga, situated at one of the best harbours of the world, the Port of Refuge (Puatalefusi or Lolo-'a-Halaevalu).

The Vava'u group measures about 21 km from east to west and 25 km from north to south. Vava'u had 14,936 inhabitants at the 2011 census with total land area of 121 km². 4,045 lived in the capital Neiafu. The main island of Vava'u is 89.74 km², the second largest island in Tonga.

Vavau is a coral reef with superior oblique in the north up to 200 m high cliffs. On the south side of the island group is dissolved into many small islands and waterways. The largest of these waterways, the fjord-like Ava Pulepulekai channel extends 11 km inland from the harbor of Neiafu, the capital. The Vava'u Island is a raised platform of coral cliffs on the north coast and a low and irregular coastline south that opens in



a complex network of channels, bays and islands forming one of the best protected natural harbors in the Pacific (Wikipedia, The Free Encyclopedia, World Wide Web).

2.5. Tu'anekivale Village



Tu'anekivale village is located at 18°37'S and 173°55'W, on the far eastern part of the main island of Vava'u. The village is located on a sloping part of the island that is high towards the North and North Easts while gently sloping towards the south and southwest to a shallow lagoon with very dense mangrove forests. There are 86 households with 488 people living in this village. The main source of income is mat weaving and livestock (pigs). The main source of water is rain water tanks and ground water (tap water) for washing, bathing, cooking etc. A diesel powered water pump supplemented by a solar powered one, pumps the ground water to 3000 liter storage cement tanks on a ten meter stand high up on the north eastern part of the Village.

Water is then distributed from these storage tanks to the rest of the village below. The soil type of Tu'anekivale is characterized as poor in fertility and vulnerable to prolonged periods of drought.

2.6. Ovaka Village



Ovaka village is the only village on the island of Ovaka located at 18°44'S and 174°05'W. The island is one of the inhabitant islands on the outskirts of the Vava'u group. There are 21 households and 85 people on the island. There is a primary school with two teachers. The churches include the Free Wesleyan Church of Tonga and Free Church of Tonga and Church of Tonga. Their main source of income is making mats and fishing, although their fishing ground has been declared a Special management area to be protected for conservation and food security purposes.

3. Methodology

The V&A was conducted using the PACE-SD rapid assessment technique (Limalevu, pers.com). This assessment targeted water sources and supply, health and sanitation, food supply and security, energy sources, local governance and disaster management plans, sources of income, natural resources, coastal areas and impacts of extreme weather events. Meetings were organized with respective town officers and youth leaders who participated in our previous sub-regional workshop. Organizing an appropriate time for the town officers and some representatives from the community to conduct the assessment was done earlier. Field observations were also taken especially with regards to the focus areas above. Water samples were also taken of community water sources mainly ground water and rain water tanks. Pictures were also taken as evidence of the areas and things we visited.

3.1. Water quality assessment methods

Water samples were taken from randomly selected water tanks and tap water of the sites investigated. Standard Hydrogen Sulfide (H₂S) ready-made test tubes (obtained from the Institute of Applied Sciences, The University of the South Pacific) were used to do qualitative tests for the water quality, using mineral water (locally bottled water) as a control. The test samples were left for a maximum period of 72 hours, during which time the change in color of the water indicated the level of contamination (no color change: water is safe to consume; light milky to grayish in color: water shows signs of contamination and is unsafe to consume; black in color: water is contaminated and unfit for consumption).



From left to right: The Ovaka community hall rain water tank; Tongata'eapa plastic rain water tank; and Ha'afeva ground water source.



From left to right: Popua Primary School; Tu'anekivale ground water source; Tatakamotonga water source

3.2. Interview of key informants

Key informants were interviewed to obtain the necessary information for this assessment. These key informants were selected from key personnel in the community, such as the town officer, district officer, women group leaders, youth leaders, key members of the various village committees.



From left to right: Ovaka men during our kava drinking session and interview; Popua Village committee members; Tatakamotonga Town officer.



From left to right: Sopu Town officer and women reps; Tu'anekivale Town officer and Town committee members; Ha'afeva community.

3.3. Field Observations

A field observation was carried out to verify the information given by the key informants upon their interview. This observation were necessary to see firsthand the various sectors, take photos as evidence and have a feel of what it is like to be living in these communities.



From left to right: Ha'afeva Diesel Power station; Ha'afeva dried bêche-de-mer (sandfish); subsistence mix-cropping in Ovaka



From left to right: Dried pandanus in Ovaka; building new homes in Popua; semi-commercial monocropping at Tatakamotonga.



From left to right: Tu'anekivale soil erosion; Ovaka ground water well; Ha'afeva Coastal Management Sign board

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3.4. Focus Group interviews

Group interviews were conducted especially with women groups as they are often busy weaving mats all day. So we organized a time to conduct a group interview with the women only to get their perspectives on the issues. Some Villages we had some of their leaders, both male and female in one roof and conduct interviews with them on the different sectors and they could all contribute to answering the questions that were relevant to them. In remote villages we conducted some interviews while drinking Kava with both the elderly and young men in the evening.



From left to right: Ovaka men; Popua women: Tu'anekivale women

4. Issues

4.1. Water Supply and Security

4.1.1 Ha'afeva, Ha'apai group.

Ha'afeva's ground water source is located in the center of the settlement area itself which lies in a SW to NE



direction along its southeastern coastal area. It is surrounded by homes and piggeries which is not very safe. The well is being sealed with cement to safeguard from contamination from the surrounding area, but it is too close to homes and leakage into the water source is possible as it is not located on an elevated site and the well is very shallow.



This is an old well they used to pump into a 3000 liter elevated water tank reservoir located about 100 meters



south of the well on higher grounds. Solar panels were installed to provide power for the pumps during the day. It is no longer working and needs maintenance. Electric connections are used when power is on from 7pm-12am at night.



Rainwater harvesting and private wells make up other sources of water for Ha'afeva. Rainwater tanks are the most important as they provide the most reliable source of clean and safe water for drinking and other domestic uses. However, most of the old cement tanks need maintenance or gutters and roofs that are too old and needs maintenance. Private wells are only used for livestock. Some large buildings such as churches do not have a rainwater tank thus leaving the run-offs go to waste.



4.1.2 Tu'anekivale, Vava'u group



Ground water cement tank reservoirs are broken and leaking, while the pipes that transport the water into the homes are old and most of them may be leaking. Water pressure in some parts of the village is not strong enough thus water is not running at most times.

Most of the church halls and buildings have rain water tanks that the community can access. However, some of these tanks may need to be maintained as well as the gutters. Some of the

individual cement water tanks needs maintenance or are totally broken and needs replacing.

4.1.3 Ovaka, Vava'u Group



Rain water harvesting is the only source of clean and safe water supply for the Ovaka community. They are still waiting on a project to install their ground water supply system. They were on the verge of running out of

water before the rain arrived together with our rapid assessment team thus saving them from having to revert to using an old ground water well they used before in times of droughts. Some of the

tanks are old as well as gutters and roofs needs maintenance. Large buildings such as halls and churches have rainwater tanks, but they need to be maintained and may also need to install more tanks for drought periods.



4.1.4 Sopu, Popua and Tatakamotonga (Tongatapu)



The three communities in Tongatapu do not have water issues as they have not experience any periods where they had no water. Both Popua and

Sopu have access to water from the Nuku'alofa source. Their issue is more to do with water pressure as more and more people are using the same source every day.

Tatakamotonga on the other hand have a very good ground water supply system just

recently installed. They all recognize the need to install more rainwater tanks in community halls or large buildings as reservoir for periods of drought.



4.2 Water Quality Tests

Table x: Results of the Hydrogen Sulfide (H₂S)

Popua, Tt	Results							
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs
18-09-								
2012	PWS 01/12	Kitchen tap	Mr Sione Uta	treated	1405hrs	Α	С	С
18-09-		Water						
2012	PWS 02/12	tank(cement)	Mr Sione Uta	untreated	1410hrs	Α	В	С
-								
Tatakamo	tonga, Tt					Results		
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs
			Town officers					
19/09/12	TWS 01/12	Тар	home	treated	1305hrs	Α	С	С
		Water tank	Town officers					
19/09/12	TWS 02/12	(cement)	home	untreated	1310hrs	Α	В	С
Sopu, Tt						Results		
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs
			Town					
20/09/12	SWS 01/12	Тар	Officers Tap	treated	1620hrs	Α	В	С
			Free					
			Wesleyan					
20/09/12	SWS 02/12	Water tank(plastic)	Church	untreated	1615hrs	Α	Α	Α

Ha'afeva, Hp							Results		
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs	
9/25/2012	HWS 01/12	Тар	Mr He'ehau	treated	0830hrs	А	С	С	
9/25/2012	HWS 02/12	Water tank(cement)	Mr He'ehau	untreated	0840hrs	А	В	с	
Tu'anekiva	le, Vv					Results			
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs	
10/2/2012	TWS 01/12	Тар	Tatofi He'ehau	Untreated	0930hrs	A	с	С	
10/2/2012	TWS 02/12	Cement Water tank	Tatofi He'ehau	Untreated	0932hrs	A	В	С	
10/2/2012	TWS 03/12	Plastic water tank	Tatofi He'ehau	Untreated	1000hrs	A	А	А	
Ovaka, Vv						Results			
Date	Sample #	Source	Location	Treatment	Time	24hrs	48hrs	72hrs	
3-Oct 2012	OWS 01/12	Water tank	S 18°44.661' W 174°05.690' (private home)	Untreated	0946hrs	В	с	С	
3-Oct 2012	OWS 02/12	Contaminated Well	S 18°44.724' W 174°05.610' (in the plantations)	Untreated	0950hrs	С	С	С	

*Results: A-Water is safe to consume [No color change]. B - Water shows signs of contamination [light milky to grayish], C – Water is contaminated do not consume [black in color]

The results above highlighted the variable quality of water resources at the six sites investigated. Water samples were taken randomly from different location and not necessarily from the source, especially with ground water source. However, the result showed that most of the tap water sampled was contaminated while rain water tank showed that cement tank were more likely to be contaminated compared to plastic tanks. The most alarming results were Ovaka where both rainwater tanks and the well were in a bad state. They are not using the well, but the water tanks needs cleaning or boiled before consumption. This may be due to the fact that they just recovered from a mild period of drought as we arrived. The result shows that water quality is not that much different around the kingdom, as the two main sources are ground water and rain water. The quality of the water is determined by the way they are being maintained and cared for in each community. This can be investigated further in the detail V&A assessment.

4.3 Health and Sanitation

4.3.1 Household and Population Structure

The number of households and population structure for the six communities are shown in figure X below.



Figure x: Number of Households and Population Structure of the six communities that were assessed



4.3.2 Health

Health in this context refers to the 'absence' or 'presence of diseases' in the communities that were assessed. This refers especially to diseases that will be affected directly by Climate Change impacts. To be more specific water-borne and vector borne diseases were identified as being the most likely to be affected by climate change.

4.3.3 Sopu, Popua, and Tatakamotonga



A report on the water-borne and vector borne disease cases in the past three years were obtained from the Ministry of Health on Popua, Sopu and Tatakamotonga. Interestingly, Popua had the highest cases of Diarrhea, gastroenteritis pres infectious and also rash and skin diseases, while Tatakamotonga had the most number of Typhoid cases since 2009. Sopu

had the only case of dengue fever in the past three years with 2 cases recorded in 2009 as shown in figure 8 and figure 9. This report however, confirms the NPAC initial decision to include Tatakamotonga on the basis of health and sanitation, especially with regular occurrence of typhoid and other water-borne and vector borne diseases.

Tatakamotonga are fortunate to have a health center with a doctor and a nurse to provide health services for their own community and Hahake District.

4.3.4 Ha'afeva (Hp), Ovaka (Vv) and Tu'anekivale (Vv)

A health report could not be obtained on the status of water-borne and vector borne diseases from the outer islands sites of Ha'afeva, Tu'anekivale and Ovaka. However, through our interviews and direct observation of these villages, they indicated they do not have cases of water-borne disease or vector borne diseases occurring in their area. This report still needs to be obtained to confirm whether they are telling the truth. Popua, Sopu and Tatakamotonga had responded in a similar fashion, but when obtaining the report it was not the same as the answers we received from the interviews.

Tu'anekivale and Ovaka have no health center, and the nearest health center is in the neighboring village or island. Ha'afeva is fortunate to have a health center with a doctor and a nurse to provide health services for the community and the islands with in this group.

All six villages indicated that the most prominent diseases are non-communicable diseases (NCD) such as diabetes, high blood pressure, cancer and heart diseases. This is related to the food sources that people consume, such as processed foods, fatty, salty and sweets dominate the foods on the table of almost every family.

Figure 8:

Water-borne diseases by village

His			Date Range:1/01/2009 – 30/09/2012					
		09	10	11	12	Total		
ALLERGY UNSPECIFIED	Popua	0	1	0	0	1		
	Total	0	1	0	0	1		
DENGUE FEVER [CLASSICAL	Sopu	2	0	0	0	2		
DENGUEJ	Total	2	0	0	0	2		
DIARRH & GASTROENTERITIS	Popua	5	3	5	1	14		
PRES INFECTIOUS	Sopu	2	4	2	3	11		
	Tatakamotonga	1	3	3	3	10		
	Total	8	10	10	7	35		
RASH AND OTHER NONSPECIFIC	Popua	0	0	1	0	1		
SKIN EROF HON	Total	0	0	1	0	1		
TYPHOID FEVER	Tatakamotonga	0	0	5	3	8		
	Total	0	0	5	3	8		
Total		10	11	16	10	47		

Report developed by Health Information Services Report Author: Slulolovao Moleni norised by: Slone Hufanga

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Figure 9:



4.3.5 Sanitation

"Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces. Inadequate sanitation is a major cause of disease world-wide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal". http://www.who.int/topics/sanitation/en/

4.3.5 Solid and Liquid Waste



Indiscriminate dumping of solid waste was still evident in all six communities. Although, Popua, Sopu and Tatakamotonga in Tongatapu have access to a

modern state of the art waste management system there are still evidence of indiscriminate refuse dumping of solid waste on vacant land in both the village and in the bush allotment, as well as near the coast.



Septic tanks are a concern in lowflooding and incoming tides through tanks that are leaking or not



lying areas such as Popua and Sopu as regular sea water inundation can flood the septic properly constructed which causes major

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health concerns for the community.



Open pit toilets are still widely used in most of these villages. They are especially prominent in the outer islands especially Ovaka, Ha'afeva and Tu'anekivale. This is an issue with water sources as most of these villages don't have running water for 24 hours 7 days a week. However, in villages with running water there are still households with open pit toilets, where the issue is being able to afford a flush toilet system.

4.4 Food Resources and Security

4.4.1 Popua and Sopu

Popua and Sopu are in the same category when it comes to food resources and security. Over 90% of the population has no tax-allotment (land for crops and livestock). They rely heavily on the market and shops to provide their daily food. Unless you have a regular income it would be very difficult to secure food. The majority live of the coastal resources, that is fast depleting due to commercial fishing interests and overfishing using unsustainable fishing practice..

4.4.2 Tatakamotonga and Tu'anekivale

Tatakamotonga, and Tu'anekivale have isssues with the soil type as it becomes very infertile with droughts. Soil has been exhausted with unsustainable farming practices. Many of the tax allotments are left unused. Tu'anekivale have issues with livestock damaging their crops due to lack of fencing material to protect their crops.

The use of machinery is evident in Tatakamotonga as large areas are being cleared for commercial crops, such as peanuts, water melon, squash, sweet potatoes, taro, yams, cassava, etc.. Planting of one type of crop for commercial reasons are practiced widely in Tatakamotonga then mix-cropping and other traditional type of farming where a variety of crops are planted not only to sustain food security but also good for the soil and less vulnerable to pests and diseases. Heavy reliance on machinery and chemicals to boost their productivity has come at cost for the soil and the environment.

Tu'anekivale practices cooperative farming as Church group members. Each church has their own plantations where church members plant their own yams, taro, banana and variety of crops on the same piece of land. They will harvest it in time for church conferences and then it will provide them with food crops for the rest of the year until the next planting seasons. It is easier for the church to fence one piece of land and maintain it as a group then to plant your own individual crops in your own land that has no fence.

4.4.3 Ha'afeva and Ovaka

Ha'afeva island and Ovaka have similar situation. They are both small islands with small population where they do not have to worry about buying or selling their crops. They just plant enough for their daily needs. There is plenty of arable land in these two islands for the people that reside there, to plant crops for their food security.

They still practice traditional methods of farming such as mix-cropping, as they are not pressured to sell their crops in the market. The majority of their coastal areas have been declared a Special Management Area, where the community has been given the authority to manage their inshore coastal zone. Some parts are totally banned while other areas they can take only enough for their needs and not to be sold or over used.

The traditional practice of food preservation is hardly practiced in these communities nowadays. They are now accustomed to refrigeration and ice making machines to preserve their fish catch and food crops. But electricity supply does not operate 24/7 in the outer islands. There is a need to preserve traditional knowledge of farming, fishing and food preservation as Climate Change Impacts may affect their lives in ways that disruptions will occur to the things that they have become accustom to today. With irregular power supply of electricity they may still need to use the traditional methods of preserving fish and crops especially with the impacts of climate change such as more extreme whether events can cause power cuts.

4.5 Energy Sources

Firewood is still very prominent in all the six villages when it comes to source of energy for cooking. This is followed by gas, kerosene, and lastly electricity. In places like Popua and Sopu, where there is lack of trees and forest to provide firewood this is not sustainable. Ha'afeva, Ovaka, Tatakamotonga and Tu'anekivale have an abundance of firewood for their cooking.

For lighting, Ovaka is currently installing solar penals in each household to provide them with lights and other electricity needs. Ha'afeva have a Diesel powered Electricity Generator that only operates from 7pm to 12am. The cost of diesel is expensive to sustain their electrical needs.

The rest of the villages are connected to the power grid. So they have power 24/7 unless there is a blackout or technical failure in the grid.

4.6 Disaster Risk Management

Some of the villages indicated that they had already developed a Disaster Risk Management Plan, for example Popua and Ovaka indicated they had already got a Disaster Management Plan, but it's not very effective as the committee members are too busy with other things or has not been implemented.

In all the six communities they identified the churches and halls as the main evacuation centers in times of disasters. The Church of Latter Day Saints was the most prominent one as their buildings are very strong, and they also have good facilities such as bathrooms, kitchen, water tanks etc. They are also the only church that has welfare system for its members where they will stock food, water and basic items needed in times of disasters.

They have all indicated the need to have a good disaster management plan and evacuation centers for their community as most of these village locations are very vulnerable to extreme natural event such as tropical cyclones, storm surges, tsunami etc. They indicated the need to have these plans in place and also train their community on how to implement the plan to reduce the impacts of these extreme natural events in becoming disasters.

4.7 Coastal Area

In all the six communities we assessed, the coastal areas were being impacted already to some degree. There was evidence of coastal erosion in all the sites. However, the communities that were most impacted due to their vicinity to coastal areas were Popua, Ha'afeva, and Sopu.

Popua and Sopu are both located on lowlying coastal mudflats. These areas are on average 1 meter above sea level. Some parts of these two villages are less than 1 meter above sea level. Inundation is a daily occurrence with regular inter-tidal changes.

4.8 Community Needs

Most of these communities showed a good level of interest in the project and have expressed their full support and cooperation if they are chosen as demonstration sites. However, Popua, Tu'anekivale and Ha'afeva were highly interested and showed a high level of commitment and assistant in our rapid assessment. These three communities have been identified earlier and preselected by our NPAC to represent Tonga to the Stakeholder meetings of the USP EU GCCA project in Suva in July, 2012. But, this was the first time for us to visit these communities to conduct the rapid assessment to determine the final three demonstration sites for Tonga.

5. Results

The level of vulnerabilities assessed is summarized in Table 1-7 below for Popua, Sopu, Tatakamotonga, Ha'afeva, Tu'anekivale and Ovaka villages. Specific issues developed from these are discussed more in details in Section 4.

Popua Village

Village	Criteria	Sectors Assessed	Level of Vulnerability	Comments
		Water Resources	2	Have access to ground water (tap) and rain water tank 24/7. Need maintain and have more community rain water tanks
	Level of Vulnerability related	Health & Sanitation	4	Diarrhea and water-borne diseases have been recorded – exposed septic tanks needs attentions, indiscriminate dumping of waste, waterlog homes
	to livelihood sectors	Food resources and food security	5	No arable lands for these communities – less than 5% have access to agricultural land, small plots of vegetables and fruit trees in backyard
		Energy sources	3	fuel wood is quickly depleting, cutting down of mangroves and coastal forests. Access to power grid providing for lighting and cooking as well.
	Level of vulnerability to tropical cyclone	Types of Housing	2	≥60 - <80% are of modern cement or properly constructed wooden houses
_		Foreshore elevation	5	<3m
Popua		Village elevation	5	>50%(<3m)
	Level of Vulnerability to	Reef system	1	Presence of fringing and barrier reefs
	flooding, storm surges & SLR	mangrove protection	4	Scattered
		ave dist. of houses from shore	5	1 - < 5m
		ease of relocation	5	No land to relocate to at all
	l evel of Adaptability related to	Income per household	3	<\$50 per week
	livelihood sectors	Predominant type of Economic systems	2	Subsistence to semi-commercial
	Level of Community Need		3	Externally-driven projects but with some contributions from the community
	Level of Community Interest		5	Very interested
	Feasibility of the project		2	Population is high/focus on one or two areas.

Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability	Very high vulnerability
Value	1	2	3	4	5

Table 2: Tatakamotonga, TongatapU

Tatakamotonga Village

Village	Criteria	Sectors Assessed	Level of Vulnerability	Comments
	Level of Vulnerability related to livelihood sectors	Water Resources	2	low vulnerability – ground water access 24/7. Need maintain existing community water tanks – in halls etc.
		Health & Sanitation	4	Cases of Skin diseases & Typhoid, open pit toilets
		Food resources and food security	3	More than 90% have access to arable land. But soil type is vulnerable to drought. Too much emphasis on commercial farming – mono cropping
		Energy sources	3	Sufficient fuel wood for cooking and access to gas. Access to power grid – lighting is not an issue.
	Level of vulnerability to tropical cyclone	Types of Housing	2	≥60 - <80% are of modern cement or properly constructed wooden houses
	Level of Vulnerability to flooding,	Foreshore elevation	3	5 - <7m
	storm surges & SLR	Village elevation	3	>50%(5 - <7m)
٩		Reef system	1	presence of both fringing and barrier reefs
0		mangrove protection	4	Scattered
		ave dist. of houses from shore	3	10 - < 15 m
		ease of relocation	2	
	Level of Adaptability related to livelihood sectors	Income per household	3	<\$50 per week
		Predominant type of Economic systems	2	subsistence to semi-commercial
	Level of Community Need		3	externally driven with some contribution from the community
	Level of Community Interest		3	moderately interested
	Feasibility of the project		2	low feasibility - due to high population numbers
Villearak				

Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability	Very high vulnerability
Value	1	2	3	4	5

Table 3 : Sopu, Tongatapu Sopu Village

Village	Criteria	Sectors Assessed	Level of	Comments
			Vulnerability	
	Level of Vulnerability related	Water Resources	2	Access to urban ground water source, need rainwater harvesting
	to livelihood sectors	Health & Sanitation	4	skin disease cases identified, diarrhea & dengue fever cases
		Food resources and food security	5	rely on market and shops - no land for crops, home vegetables & fruits
		Energy sources	3	fuel wood & gas for cooking
	Level of vulnerability to tropical cyclone	Types of Housing	2	≥60 - <80% are of modern cement or properly constructed wooden houses
	Level of Vulnerability to	Foreshore elevation	5	<3m
	flooding, storm surges & SLR	Village elevation	5	>50%(<3m)
		Reef system	1	Presence of fringing and barrier reefs
Sopu		mangrove protection	4	Scattered
		ave dist. of houses from shore	3	10 - < 15m
		ease of relocation	4	Major constraints
	Level of Adaptability related to livelihood sectors	Income per household	3	<\$50 per week
		Predominant type of Economic systems	2	Subsistence to semi-commercial
	Level of Community Need		3	Externally-driven projects but with some contributions from the community
	Level of Community Interest		4	Interested
	Feasibility of the project		2	population is too high

Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability	Very high vulnerability
Value	1	2	3	4	5

Table 4: Ha'afeva, Ha'apai Island Groups Ha'afeva Village

Village	Criteria	Sectors Assessed	Level of	Comments
			Vulnerability	
	Level of Vulnerability	Water Resources	2	tap water (unsafe location-unreliable pumps) – water tanks in large buildings
	related to livelihood	Health & Sanitation	2	Open pit toilets,
	sectors	Food resources and food security	3	Moderate, SMA – coastal resources,
		Energy sources	3	power is not 24 hours - firewood for cooking
	Level of vulnerability to tropical cyclone	Types of Housing	4	≥20 - <40 % are of modern cement or properly constructed wooden houses
	Level of Vulnerability to	Foreshore elevation	5	<3m
	flooding, storm surges &	Village elevation	5	>50%(<3m)
	SLR	Reef system	1	Presence of fringing and barrier reefs
		mangrove protection	5	None
Ha'afeva		ave dist. of houses from shore	5	1 - < 5m
		ease of relocation	5	No land to relocate to at all
	Level of Adaptability related to livelihood sectors	Income per household	3	<\$50 per week
		Predominant type of Economic systems	2	Subsistence to semi-commercial
	Level of Community Need		3	Externally-driven projects but with some contributions from the community
	Level of Community Interest		4	Interested
	Feasibility of the project		5	high feasibility due to small population #

Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability	Very high vulnerability
Value	1	2	3	4	5

Tu'anekivale Village Vulnerabilities

Village	Criteria	Sectors Assessed	Level of Vulnerability	Comments							
Tu'anekivale	Level of Vulnerability related to	Water Resources	3	Ground Water storage and pressure	<u>)</u> -						
	livelihood sectors	Health & Sanitation	2	Open pit toilets, cooking facilities (patio)							
		Food resources and food security	4	lack of both marine and crops - fruits ar fertile soil	plenty and livestock – low						
		Energy sources	2	Cooking still rely heavily on fuel wo	od – plenty						
	Level of vulnerability to tropical cyclone	Types of Housing	3	≥60 - <80% are of modern cement or properly constructed wood houses							
	Level of Vulnerability to	Foreshore elevation	2	7 - <9m							
	flooding, storm surges & SLR	Village elevation	1	>50%(>9m							
		Reef system	3	Presence of fringing reef only							
		mangrove protection	1	Heavily Dense							
		ave dist. of houses from shore	1	> 20m							
		ease of relocation	1	Easily							
	Level of Adaptability related to livelihood sectors	Income per household	3	<\$50 per week							
		Predominant type of Economic systems	2	Subsistence to semi-commercial							
	Level of Community Need		3	Externally-driven projects but with some contributions from the community							
	Level of Community Interest		5	Very interested							
	Feasibility of the project		4	Feasible – moderate population							
Vulnerability K	ey										
Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability Very high vulner							
Value	1	2	3	4	5						

Table 6: Ovaka, Vava'u Island GroupsOvaka Village Vulnerabilities

Village	Criteria	Sectors Assessed	Level of Vulnerability	Comments				
Ovaka	Level of Vulnerability related to	Water Resources	4	only rain water with one well (water project in the pipeline)				
	livelihood sectors	Health & Sanitation	3	Open pit toilets, cooking facilities (patio)				
		Food resources and food security	2	Food resources are sufficient both land and marine(SMA)				
		Energy sources	4	Solely fuel wood (cooking) - SOLAR under construction (lighting)				
	Level of vulnerability to tropical cyclone	Types of Housing	4	≥20 - <40 % are of modern cement or properly constructed wooden houses				
	Level of Vulnerability to flooding,	Foreshore elevation	3	5 - <7m				
	storm surges & SLR	Village elevation	2	>50%(7 - <9m)				
		Reef system	1	Presence of fringing and barrier reefs				
		mangrove protection	Na					
		ave dist. of houses from shore	1	> 20m				
		ease of relocation	1	Easily				
	Level of Adaptability related to livelihood sectors	Income per household	3	<\$50 per week				
		Predominant type of Economic systems	2	Subsistence to semi-commercial				
	Level of Community Need		3	Externally-driven projects but with some contributions from the community				
	Level of Community Interest		4	Interested				
	Feasibility of the project		5	Highly feasible with a low population				

Description	Very low vulnerability	Low vulnerability	Moderate vulnerability	High vulnerability	Very high vulnerability
Value	1	2	3	4	5

Table 7: Overall Results for the Six communities

XI	Microsoft Excel - rapid assessment population stats & matrix													?]	×																	
-	A	В	С	D	E	F	G	H		J	K	L	M	N	0	P	Q	B	S	T	U	¥	V	X	Y	Z	AA	AB	AC	AD	AE	
2		Rapid assessment Point system Result																														
3	Village	Criteria 1: Current Level of Vulnerability Related to livelihood Sectors												ors	-	Criteria 2: Current Level of Adaptability related to livelihood sectors				Criteria 4: Level of Community Interest	Criteria 5: Feasibility of the project	total	Criteria 6: Vulnerability of the community to cyclones	Criteria 7: Vulnerability of the commun surges and projected sea level rise f				unity to flooding and or storm a for coastal communities.				
4		1.1 Water Resources 1.2 Health & Sanitation								1.3 Food resources & security 1.4. Env					ıy Sources		2.1. Level of income per household	2.2. Predominant type of economic sustem	3.1. commitment to addressing climate- induced related stresses in past community projects	4.1. For the proposed project	5.1. Approximate cost of funding per site		8.1. Categorisation of the types of housing sturctures in the community	7.1. Foreshore elevation (estimation above normal high tide)	7.2. Village elevation (estimation above normal high tide)	7.3. Reef system	7.4. Mangrove protection	7.5. average distance of shoreline to first row of houses along	7.6. Ease of relocation to higher ground without socio- economic and	oultural constraints		
5		Rain month/per yr	Water sources	Discharge rate	Vector-borne cases	water-borne cases			es	Subsistence (land/marine)	total land arealperson	Relative soil fertility	Relative productivity of Marine	Basic Energy Sources for lighting	Basic energy source for cooking	n																
6					Dengue cases	Diarrhoea cases	Skin	diseases Typhoid	Cholera																							
7	Popua (Tt)	2	1	2	1	4	3	1	1	5	5	5	4	2	3	39	3	2	3	5	3	16	2	5	5	1	4	5	5	2	6	<u>}</u>
8 5	sopu (It)	2	1	2	3	3	2	1		5	5	5	4	2	3	39	3	2	3	5	3	16	2	5	5		4	3	4	2	6	3
9 1	latakamotonga (Tt)	2	1	2	1	2	2	5		3	3	4	4	2	3	35	3	2	3	3	2	13	2	3	3		3	3	2	1		
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10		3	3	•						3	3	•	•	2	3	34	3	2	3	5	5	17	3	2		3					2 40 2 41	2
13	Jvaka (vv)	3	•	9		-	-		•••	2	3	4	٤	•	•	34	3	2	3		9		•	3	-	3	па		-	•	<u> </u>	
14	ulnerabiltity Key																															
15	Description	Very Iow vulnerability	Low vulnerability	Moderate vulnerability	High vulnerabilitu	Very high vulnerability																										
16	Value	1	2	3	4	5																										
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18 /	Adfaptive Capacity	Key					-	+	\vdash							-															-	- 1
19	Description	Very low adaptive capacity	Low Adaptive Capacity	Moderate Adaptive Capacity	High adaptive capacitu	Very high adaptive capacitu																										
20	Value	1	2	3	4	5																										
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6. Overall Results

- Based on the findings from the rapid assessments
- The sites rankings were as follows:
 - 1. Ha'afeva (54)
 - 2. Popua (51)
 - 3. Sopu (47)
 - 4. Tatakamotonga (39)
 - 5. Ovaka (38)
 - 6. Tu'anekivale (37)
- Highest number indicates most vulnerable sites

7. General Conclusion and Recommendation

Two options for the final 3 sites.

Option 1: One site from each group of Islands (Tt, Hp, Vv)

- 1. Ha'afeva (Ha'apai)
- 2. Popua (Tongatapu)
- 3. Tu'anekivale (Vava'u)
- Rationale for not selecting the other 3
 - Sopu is very similar to Popua and is difficult to demarcate from the rest of Kolomotu'a (urban area).
 - Tatakamotonga has a high population to be feasible for this kind of adaptation work
 - Ovaka has several projects currently being implemented and in the pipeline to improve some of the sectors that we found to be vulnerable.

Option 2:Sites based on their size and location being in a rural/outer island setting

- Ha'afeva
- Ovaka
- Tu'anekivale
- Rationale
 - All three sites have a relatively small population and are in a rural settings which is ideal for Climate Change adaptation project of this kind and scope. These three sites are also highly feasible given the kind of budget we a dealing with to be able to have a meaningful impact on the whole community.

*Factors such as the presence of similar projects were also considered when selecting these sites. We also looked at the islands with less opportunity from other donors as well as avoiding any duplication.

8. References

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