

Enua Manu

Climate Change – Vulnerability and Adaptation Assessment

May 14th to 25th 2012



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National Environment Service, Tu'anga Taporoporo, Cook Islands
PO Box 371, Rarotonga, Cook Islands
www.environment.gov.ck

Introduction

This report is a reflection of the impact of Climate Change on the island of Atiu. The information in this report was mainly acquired through a survey of questionnaires and other outside contributions.

This purpose of this exercise was also to collect and collate information to formulate policy statements that would enable us to come up with strategic recommendations that can be implemented at the national and as well at island level.

Enua Manu is one of the five islands identified by the Climate Change Country Team and National Environment Service to complete the collation of baseline data for the Climate Change Vulnerability & Adaptation Assessment (V&A) program. The V&A Team for Atiu consisted of staff from the National Environment Service, Office of the Prime Minister and the Cook Islands Red Cross.

Other islands that have been assessed, through various projects and organisations, are as follows:

Aitutaki	2003
Mauke	2008
Mangaia	2008
Mitiaro	2008
Pukapuka	2008
Atiu	2012
Rakahanga	2012
Manihiki	2012
Penrhyn	2013
Palmerston Island	2013

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The V&A team would like to thank the Mayor, Deputy Mayor, Atiu Island Council members, the Island Secretary, Members of Parliament, leaders and people of Atiu for their time and contributions to making this program a success.

Meitaki

Mr. Vaitoti Tupa
Director – National Environment Services

Ms Mii Matamaki
Senior Environment Officer

PART ONE

Background

Atiu

Atiu Island or *Enua Manu* as it is traditionally known in the Cook Islands, is a raised volcanic island surrounded by steep makatea cliffs that rise between 3 and 6 meters above sea level. Red volcanic inland soils are heavily wooded, with rolling hills rising to 72 meters above sea level.

Characteristics of the island of Atiu	
Type of island	Makatea (Raised Coral)
Location	20 deg S, 158 deg W
Population	1966: 1, 327 1971: 1, 455 1976: 1,312 2011: 481 ¹
Distance from Rarotonga (km)	185 km
Land area (ha)	2693
Highest Point (m)	72 m
Area used for Agriculture (acres)	152.6
Lagoon size (sq. km) and reef length (km)	Fringing reef, 22km

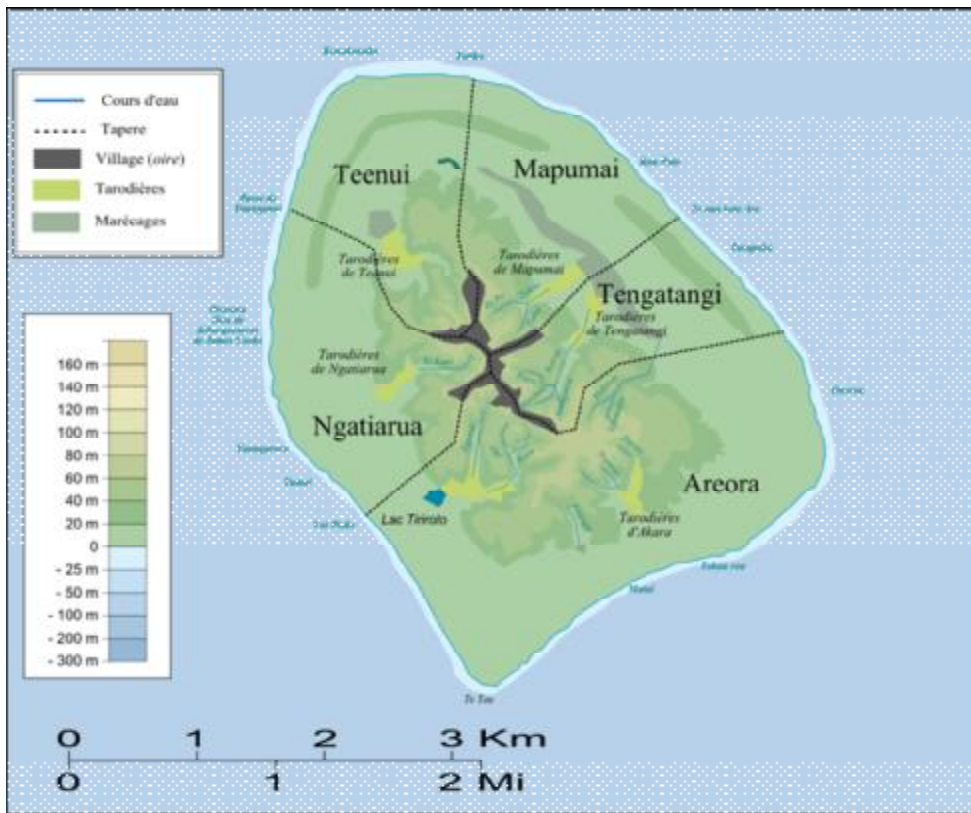


Figure 1: Map of the island of Atiu

¹ Census 2011 Figures

Environment

Atiu is one of 4 (four) raised coral islands in the Cook Islands southern group, along with Mangaia, Mauke and Mitiaro. Atiu is surrounded by a reef from which rise six-metre cliffs of fossilised coral, *makatea* which forms a mile-wide ring around the island, virtually a plateau. Erosion at the inner side of the ring has formed a dip of some 30m into fertile land which gradually rises again to a central flat-topped hill about 70m above sea level. At this point of the island this is where most human habitation is concentrated. The island stands some 4500 m above the ocean floor. The low swampy inland consists of taro plantations, marshes and a lake, *Te Roto*. This fertile area also grows bananas, citrus fruits, pawpaws, breadfruit and coconuts. Also growing around the Makatea Island is Arabica coffee. As is usual with the makatea islands of the southern group, the fossilised coral limestone abounds with caves filled with stalactites and stalagmites. One in particular, the *Anatakitaki* Cave, is inhabited by tiny *kopeka* birds which navigate in the dark using sonar, like bats. There are also freshwater springs found around the island.



Figure 2: Taro plantations inland of Atiu

The airport is constructed of makatea soil, and hosts a total of four to five scheduled flights a week to and from Rarotonga and one through Aitutaki.

Taunganui landing and the wharf services the inter-island shipping that calls in about once a month to offload cargo outside the reef on workboats.

There is a ring road around the island and links into the inland village settlements by feeder and inland roads. But only a few kilometers of roads through the villages are sealed. The road from town to the wharf and airport is two lanes compacted with coral and dirt, and most other roads are dirt tracks with some drainage and limited gravel filling work throughout. Road works activities at the moment are hampered by the quality of heavy duty equipment on the island to sufficiently maintain the roads.

Some houses are connected to the public water mains but are not functioning well. Over 80% of households on the island own rainwater tanks with a holding capacity of 5000 litres. Since 2006 almost all households have rainwater tanks supplemented by tankers refilling from public reservoirs or natural wells on the makatea or boreholes during dry periods.

The Island Council advised that a project request to increase the number of water tanks on the island to 400 is still pending approval from the Development Coordination Division (formerly Aid Management Division) of the Ministry of Finance and Economic Management.

Most households are connected to the diesel powered electricity grid, which provides a 24 hours service, however in recent times demand for electricity has increased as a result of increases in the procurement and the usage of electrical appliances. Demand at times exceeds the generating capacity of the island’s generators.

A waste dump has been developed and the Island Council is working with the Island Administration to protect and keep the environment from degradation. Atiu is the first island to be included under the Environment Act 2003. It is also the first island to have regulations passed under the Environment Act, namely the Atiu and Takutea Environment Regulation 2007².

Climate

The climate of Atiu is like other islands in the Southern Cook Islands, sunny all year round with an average temperature from 20 to 26 degrees Celsius. There is limited island specific data for Atiu to monitor climate trends and allow projections. When assessing climate, the Cook Islands are divided into Northern and Southern groups (using Rarotonga and Tongareva (Penrhyn) data stations) because their climates differ substantially due to the large distance between the island clusters and their positions relative to the equator. The El Niño-Southern Oscillation has opposite effects on the Northern and Southern groups. In Rarotonga or the Southern group, El Niño events tend to bring drier and cooler conditions than normal, while in the north El Niño usually brings wetter conditions³.

There is no weather station for Atiu. In 2011 in the month of August, the island of Atiu had the lowest level of rainfall ever recorded since 1992. Roger Malcom of Atiu Villas records monthly rainfall data that dates back to the year 1958. Overall, looking at the data provided by Malcom, there is no significant change in the annual rainfall patterns of Atiu.

Climate trends assessed through recent work under the Pacific Climate Change Science Programme (PCCSP) 2011 indicates a cause for serious concern with increasing temperatures and rainfall, rising sea levels, and increases in the frequency, intensity and duration of extreme events. Here are some of the results⁴:

Conditions	Confidence Level			
	Very High	High	Moderate	Low
Surface air temperature and sea surface temperature are projected to continue to increase	√			
Annual and seasonal mean rainfall is projected to increase				√
The intensity and frequency of days of extreme heat are projected to increase	√			

² Atiu Island Administration, 2009, Te Ata o Mokoero: Atiu Strategic Plan 2009-2014.

³ Government of the Cook Islands, 2011, *Cook Islands Second National Communication under the United Nations Framework Convention for Climate Change*.

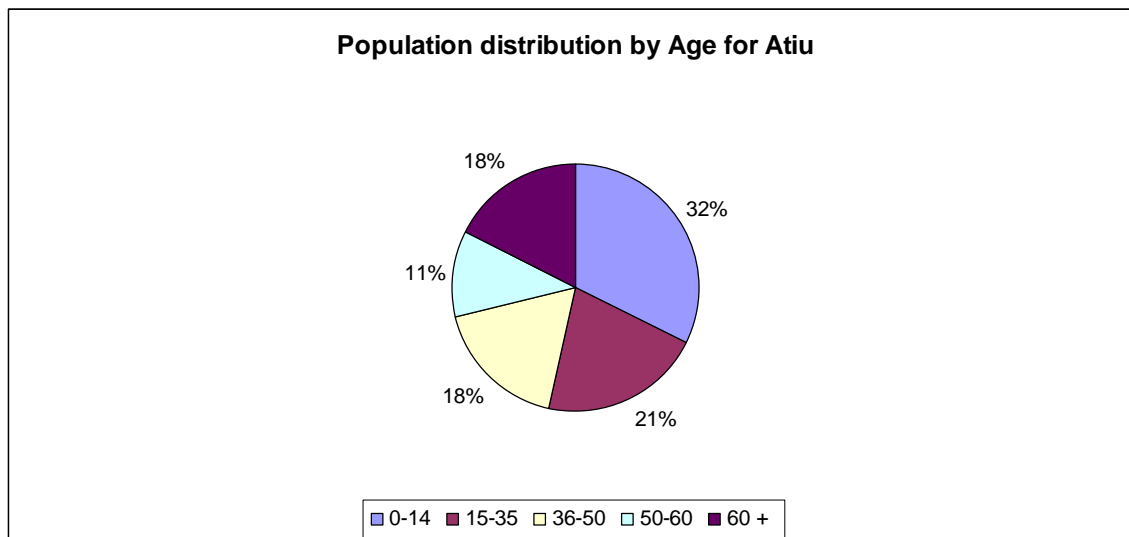
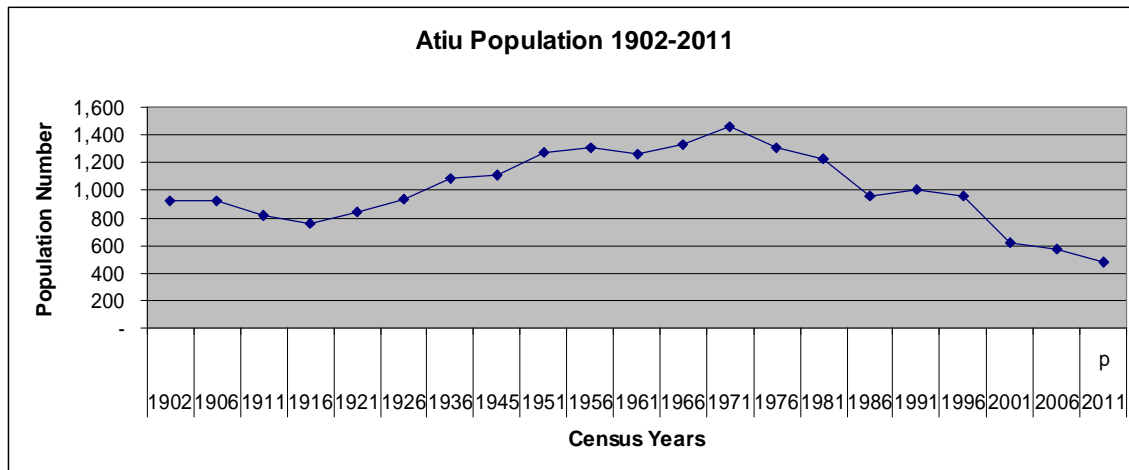
⁴ Australian Bureau of Meteorology and CSIRO, 2011. *Climate Change in the Pacific; Scientific Assessment and New Research. Volume 2: Country Reports*.

The intensity and frequency of days of extreme rainfall are projected to increase		√		
The incidence of drought is projected to decrease			√	
Tropical cyclone numbers are projected to decline in the south-east Pacific Ocean basin (0–40°S, 170°E–130°W)			√	
Ocean acidification is projected to continue	√			
Mean sea-level rise is projected to continue	√			

Social

Population

Atiu has five villages – *Teenui*, *Ngatiarua*, *Areora*, *Tengatangi* and *Mapumai*. The total number of occupied dwellings in 1996 was 198, but by 2001 the number had declined to 161, with an average size of 4 persons per household. In the 2011 census the preliminary results shows that the population of Atiu in total is 480 with 233 male and 247 female.



For the household survey that was done by the team from Rarotonga, the number of occupied dwellings 125 and 86 unoccupied. Total population was recorded at 404, 197 females and 179 males. The occupied homes, there are 33 homes with single occupancy and 22 with two person living in it.

History

John Williams of the London Missionary Society came to Atiu in the early days with Tahitian teachers. He left the teachers on the island in 1823, which started to bring the people of Atiu to settle into the centre of the island. The island of Takutea has long been under the control of Atiu.

Local Governance

The Island Council and Mayor are the local authority on the island, elected by the people. Their work is usually overseen by an Island Secretary who is appointed by the National Government but as of July 1st 2013, this position has been restructured with additional powers given to the Mayor supported by a new position of Executive Officer.



Figure 3: Atiu Island Administration Building

Economy

Tourism

Tourism is slowly developing on the island of Atiu. There has been a steady increase in tourist accommodation on the island with the major accommodation unit being Atiu Villas. The table below shows the accommodation units with the available number of rooms and the total number of beds.

Table 1: Number of Rooms and Total number of beds for tourist accommodation in Atiu⁵

1	Atiu Guest house	3 rooms	7 beds
2	Atiu Villas	7 rooms	19 beds
3	Atiu Tour Home stay	3 rooms	6 beds
4	Kia Orana Bungalows	6 rooms	12 beds
5	Kopeka Lodge	5 rooms	10 beds
6	Taparere Lodge	4 rooms	8 beds
		28	62

⁵ Information provided by Tourism Cook Islands, May 2012.



Figure 4: Atiu Tourism Office (centre) with the Atiu BCI Office on the right and the Atiu Environment Office on the left

Local market

There is a local market located at the Areora meeting house that sells local produce every Friday morning, or when there are goods to sell. . Products sold include food such as local dishes of goat meat cooked in tumeric and coconut sauce (*puakanio tarenga*), taro, and *pota* (taro leaves). This is a good way to promote small business enterprise and earn money to help with things in the home. There are also potential for Atiu to export taro to Rarotonga and onwards to New Zealand, however this option is still being explored.

PART TWO

Vulnerability Assessment

Risks and Vulnerabilities

Purpose

The purpose of this community vulnerability and adaptation assessment is to look at climate and disaster related risks that the island community of Atiu is experiencing and is likely to experience in the near future. Through this assessment of vulnerabilities and adaptation options, the people of Atiu can plan for future climate change and disaster risk management.

Objectives

The objectives of this exercise are to gather some information about the vulnerabilities that the people of the island of Atiu are facing with regards to climate change and disaster risk.

Atiu – Climate Change and Disaster Risk Assessment

Step 1 - Summarise the Risks –The initial step is to identify ***event risk*** (i.e. the “risk of occurrence of any particular hazard or extreme event” for example flood, drought, increased hurricane intensity) and ***outcome risk*** (i.e. “the risk of a particular outcome” for example loss of life, loss of income, loss of property, increase in pests/disease, increase in water/vector borne disease). Priority Outcome Risks were marked in RED and Priority Outcome Risks identified by the group were listed.

The mini-workshop was held over two days at the Atiu Catholic Hall. Present were the Island Councilors and community leaders as well as government employees such as Police and Infrastructure⁶. The following is the table of issues that were prioritised by the participants.

⁶ Participants list for the two mini-workshop days.



Figure 5: Critical Infrastructure of Atiu

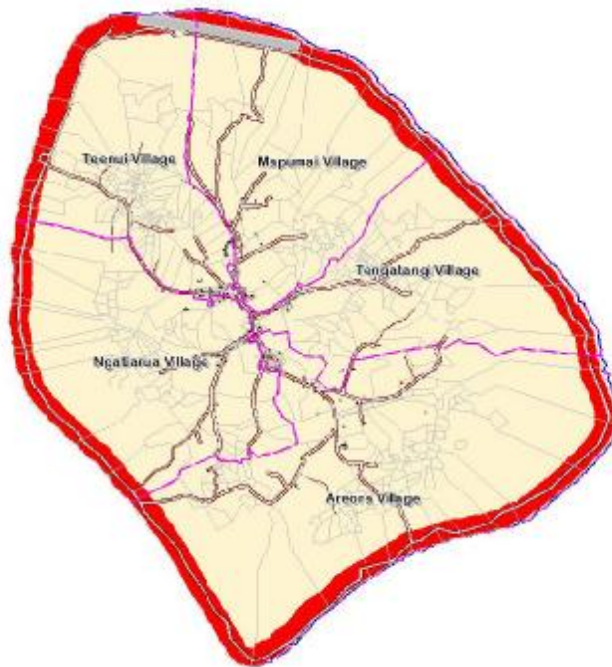


Figure 6: Atiu Coastal Vulnerability

Event Risk	Outcome Risk
NOTE: Following outcome risks listed in SNC and JNAP DRM CCA	
Climate Change	
<p>1. Sea level rise and storm surge-</p> <ul style="list-style-type: none"> Ø A rise in sea level of 1 meter by 2100 Ø Increase in storm surge events inundating up to 4.5 meters above mean sea level. 	<ol style="list-style-type: none"> 1. Damage to drainage/flow of water from inland to sea (taro swamps to the sea) blocked 2. Loss of coastal land – note: this could also be a human influence 3. Damage to coastal infrastructure – airport/harbour – from flooding and sea level rise 4. Increased salinity and flooding of low lying agricultural areas– salt water intrusion into taro planting areas, the southern part of the island where the lake is. 5. Increased incidents of coastal erosion of the little beach area that Atiu has 6. Increased salinity of freshwater table 7. Degradation of coastal habitat and biodiversity including fish nursery 8. Impacts on traditional livelihood and culture 9. Impact on economy and loss of investments especially on coastal infrastructures 10. Loss of access to fishing areas due to sea level rise
<p>2. Changes/variations and increase in local and national temperatures regimes</p> <ul style="list-style-type: none"> Ø Increase of between 1.5 and 3.5 degrees, more hot days and warm nights particularly in Southern Group 	<ol style="list-style-type: none"> 1. Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming; invasive species causing disease on the plants 2. Heat stress impacting productivity as people will not be able to work 3. Increased incidents of coral bleaching 4. Impact on ecosystems (marine, terrestrial and aquatic) 5. Impact on food – will rot quickly due to the heat causing further problems to the health of people 6. Impacts on marine and terrestrial biodiversity - migratory and distribution changes 7. Emergence of tropical diseases including skin infections. 8. Impact on vector borne disease (water quantity, demand, quality) Increase in diarrhea related illness especially for babies. 9. Key economic sector losses (agriculture)

	<p>increasing poverty.</p> <ol style="list-style-type: none"> 10. Increasing energy demand (cooling, refrigeration). 11. Bacteria breeds in hot conditions at this will worsen Bacteria increase will lead to new and severe diseases. 12. Possible 13. cold snaps in summer to increase illness for sudden changes in the weather 14. Changes in migration and breeding patterns of birds and fish, especially tuna. 15. Wind direction change will spread air borne viruses and bacterial and amplify diseases. 16. Wind and current patterns will be affected. 17. When temperature becomes cooler, mosquitoes will fly slower, if warmer they fly further. 18. Pollination will be affected e.g. coconut flowers 19. There will be an abundance of sand flies. 20. Normal fruiting seasons will change or shift. 21. The flowering process for pineapples will cease during hot weather. 22. The disruption of bacteria processes will occur in septic systems.
<p>3. <i>Changes in rainfall patterns</i> -</p> <ul style="list-style-type: none"> Ø an increase in precipitation especially during the wet season in the Southern Group Ø incidences of extreme rainfall are likely to occur more often and with increased intensity. 	<ol style="list-style-type: none"> 1. Impact on human health from water and vector borne diseases 2. Reduced tourism attractiveness, and economic losses from productive sectors, food insecurity, natural resources for handicrafts etc 3. Increased incidents of crop diseases affecting food security – the livelihoods of pigs and goats 4. Increased runoff, sedimentation, & salinity affecting water quality and availability – pot holes and muddy roads making access difficult 5. The availability of water in general for drinking and bathing 6. Impact on aquatic ecosystems 7. Blockage and damage to water infrastructure and drainage 8. Increased incidents of flooding – sometimes disrupting sports events 9. Increased prevalence of invasive species
<p>4. <i>Increased climate variability</i> –</p> <ul style="list-style-type: none"> Ø Changes in seasonal temperatures, timing of rainfall, 	<ol style="list-style-type: none"> 1. Impact on agricultural productivity and food security – mangos and oranges: seasonal changes and reduced fruit quality. Livestock also.

	<p>2. Impact on terrestrial and marine biodiversity (pollenators-bees etc, migratory species, growing cycle, food chain)</p> <p>3. Impacts on tourist arrivals and duration of stay</p>
<p>5. More severe weather events (droughts, rainstorms, heat waves, and category 4/5 cyclones) -</p> <ul style="list-style-type: none"> Ø Increase in frequency, intensity and duration of extreme events (floods, droughts and storm surges) Ø Increase in intensity of cyclones (i.e. more category 4 and 5 cyclones) in annual average of 1.6 cyclones in the Southern group, and annual average of 6 cyclones in the Northern group Ø Increase in wind intensities between 5-10% by 2050 	<p>1. Loss and damage to agricultural infrastructure and crops affecting food security</p> <p>2. Increased incidents of loss of human life and injuries/illnesses</p> <p>3. Increased costs for recovery, impact on economy and reduced ability to attract foreign investment</p> <p>4. Increased incidents of damage to infrastructure</p> <p>5. Impact on coastal ecosystems (wave damage, erosion)</p> <p>6. Increased incidents of loss and damage to ships and fishing boats</p> <p>7. Increased incidents of water pollution and damage to water infrastructure</p> <p>8. Impact on water quality/quantity and availability (storage)</p> <p>9. Increased damage to terrestrial and aquatic biodiversity</p> <p>10. Increased incidents of water and vector borne diseases</p> <p>11. Stress and social disruption – family members leave for income earning activities, stress on family members</p> <p>12. Disruption of education and social services, affecting already vulnerable groups like disabled, youth, and women</p> <p>13. Increase incidence of fire due to droughts and loss of vegetation after cyclones</p> <p>14. Cumulative impacts on health service delivery</p> <p>15. Increase internal migration</p> <p>16. Increase cost and service delivery</p> <p>17. Increase dispersal of invasive species</p> <p>18. Increase demand on emergency shelters</p> <p>19. Impacts on livelihoods, culture and way of life</p> <p>20. Increase demand for desalinisation plants</p>
<p>6. Increased incidents of ocean acidification</p>	<p>1. Impact on marine biodiversity and resources including migration of fishery resources</p> <p>2. Impact on coral growth and fish nurseries</p>
<p>7. Increased levels of Green House Gases (GHGs)</p>	<p>1. Increased incidents of ocean acidification</p> <p>2. Impacts on human health: respiratory/asthma</p>
Disasters	

8. <i>Hazardous substances spillage</i> (oil and petroleum products; e-waste becoming a problem, petrol bowser near homes)	<ol style="list-style-type: none"> 1. Smoke – causing bad odour: burning of plastics/power generator 2. Long term impacts on terrestrial and marine biodiversity, food security 3. Impacts on tourist arrivals and attractiveness of tourism product
9. <i>Bush Fire</i> – NOT A PRIORITY	<ol style="list-style-type: none"> 1. Loss of life and injury 2. Loss of and damage to property and livestock 3. Impact on terrestrial biodiversity 4. - Impact on human health (increase in respiratory illness and stress)
10. <i>Epidemics</i> (Dengue fever, cholera)	<ol style="list-style-type: none"> 1. Loss of life 2. Impacts on productivity – people cannot work as they have fallen ill 3. Impacts on health service delivery – doctors and nurses may become patients as well
4. <i>Geo-physical hazards</i> (tsunamis)	<ol style="list-style-type: none"> 1. Impact on terrestrial and marine biodiversity 2. Loss of life and injury 3. Loss of and damage to property and livestock 4. Impact on human health (increase in respiratory illness and stress) 5. Impact on economy

Step 2 – Estimate Risks - Using the summary of risks to the relevant sector developed under *Step 2*, the Atiu Community Leaders will undertake an estimation of the following key elements of risks (if possible by location), namely:

Estimate the **Severity of the Impact (Event and Outcome Risks)**

- In the context of climate change adaptation, the Atiu Community Leaders could choose to include non-financial criteria such as the loss of life, effect on GDP, impact on social capital and quality of basic services, environmental impacts or any other relevant measure that is suited to best expressing the potential impacts in measurable terms.
- The Atiu Community Leaders developed an impact severity rating scale appropriate to the risk scenarios (*event* and *outcome*).

TABLE 2 a: Direct Impact Rating Matrix

Event *Sea level rise and storm surge-*
Outcome *Damage to drainage/flow of water from inland to sea (taro swamps to the sea) blocked 8/11*

Impact Severity	Social			Economic				Environmental			
	Displacement	Health	Cultural aspects	Loss of livelihood	Property loss house/land	Final loss crop/land/livestock	GDP loss	Air	Water	Land	Biodiversity/ecosystem
Very low											
Low	X							X			
Moderate		X									
High			X				X		X	X	X
Very high				X	X	X					

The following are the top 25 priority risk that was identified by the Community Leaders. The ratings for the “high” and “very high” occurrence of severity were recorded for the purpose of determining areas of high impact.

Number	Outcome Risk	Social	Economic	Environmental	TOTAL
1	Damage to drainage/flow of water from inland to sea (taro swamps to the sea) blockage	1	4	3	8
2	Loss of coastal land – note: this could also be a human influence	1	4	3	8
3	Damage to coastal infrastructure – airport/harbour – from flooding and sea level rise	2	4	3	9
4	Increased salinity of low lying agricultural areas that are inland also flooding – salt water intrusion into taro planting areas/goats in the area: the southern part of the island where the lake is.	0	0	1	1
5	Impact on agricultural productivity and food security – fruit plants may not be viable as the	3	4	3	10

	heat is overwhelming; invasive species causing disease on the plants				
6	Heat stress impacting productivity as people will not be able to work	3	4	3	10
7	Impact on human health from water and vector borne diseases	3	4	2	9
8	Reduced tourism attractiveness, and economic losses from productive sectors, food insecurity, natural resources for handicrafts etc	0	4	0	4
9	Increased incidents of crop diseases affecting food security – the livelihoods of pigs and goats	2	3	1	6
10	Impact on agricultural productivity and food security – mangos and oranges: seasonal changes and also its quality is not as good as it used to be. Livestock also.	0	0	0	0
11	Impact on terrestrial and marine biodiversity (pollenators-bees etc, migratory species, growing cycle, food chain)	0	1	2	3
12	Impacts on tourist arrivals and duration of stay	0	2	0	2
13	Loss and damage to	3	4	4	11

	agricultural infrastructure and crops affecting food security				
14	Increased incidents of loss of human life and injuries/illnesses	3	4	3	10
15	Increased costs for recovery, impact on economy and reduced ability to attract foreign investment	1	4	0	5
16	Increased incidents of damage to infrastructure	3	4	4	11
17	Impact on marine biodiversity and resources including migration of fishery resources	0	0	1	1
18	Impact on coral growth and fish nurseries	0	0	1	1
19	Increased incidents of ocean acidification	0	2	1	3
20	Impacts on human health: respiratory/asthma	0	1	1	2
21	Smoke – causing bad odour: burning of plastics/power generator	1	4	4	9
22	Loss of life	3	4	1	8
23	Impacts on productivity – people cannot work as they have fallen ill	3	4	2	9
24	Impacts on health service delivery – doctors and nurses may become patients as well	1	2	1	4
25	Impact on terrestrial and marine biodiversity	0	1	2	3

From the top 25, a list of 13 immediate priorities was able to be identified. These priorities were then carried over to step 3 to look at the frequency and probability of the event occurring in the next 5 years.

Step 3 - Estimate Frequency or Probability of Event

The Group estimated the frequency or probability of an event identified in the relevant reports, based on their expert judgement.

Frequency/Probability Rating (based on climate change risks that are likely to occur during the next 5 years)

Climate Change Risk	Very Unlikely to Happen 1	Occasional Occurrence 2	Moderate Frequent 3	Likely to Occur Often 4	Likely to Occur Regularly 5
CC risks from risk scenario – Step 2 (deal with each separately)	Not likely to occur during next 5yr period	May occur sometime but not during next 5 yr period	Likely to occur at least once during next 5yr period	Likely to occur several times during next 5 yr period	Happened often and will happen again during next 5yr period

Evaluate the Risk - Based on expert judgement by the leaders, identified risks were examined in terms of costs (*Note: costs were qualified not quantified*), benefits and acceptability, considering the needs, issues and concerns of stakeholders. The purpose of this evaluation was to give consideration to:

- Ø ranking the risks from “least severe” to “most severe” from the analyses completed in previous steps and the perceptions of the stakeholders;
- Ø estimating the costs of potential losses;
- Ø assessing the acceptability of the risks.

The Group will compare levels of risk and acceptability of risk scenarios by reviewing the data that has been recorded during the risk estimation process.

Event + Outcome Risk	Frequency/Probability Rating
Sea level rise and storm surge + Damage to drainage/flow of water from inland to sea (taro swamps to the sea) blockage	4
Sea level rise and storm surge + Loss of coastal land – note: this could also be a human influence	3
Sea level rise and storm surge + Damage to coastal infrastructure – airport/harbour – from flooding and sea level rise	4
Changes/variations and increase in local and national temperatures regimes + Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming; invasive species causing disease on the plants	4

<i>Changes/variations and increase in local and national temperatures regimes + Heat stress impacting productivity as people will not be able to work</i>	3
<i>Changes in rainfall patterns + Impact on human health from water and vector borne diseases</i>	2
<i>Changes in rainfall patterns + Increased incidents of crop diseases affecting food security – the livelihoods of pigs and goats</i>	4
<i>More severe weather events + Loss and damage to agricultural infrastructure and crops affecting food security</i>	4
<i>More severe weather events + Increased incidents of loss of human life and injuries/illnesses</i>	3
<i>More severe weather events + Increased incidents of damage to infrastructure</i>	3
<i>Hazardous substance spillage + Smoke – causing bad odour: burning of plastics/power generator</i>	5
<i>Epidemics + Loss of life</i>	2
<i>Epidemics + Impacts on productivity – people cannot work as they have fallen ill</i>	2

Step 4 – Identify Priority Risks and Vulnerable Communities –

Based on the outcomes from Steps 1-3, the Group identified the top three priority risks, and identified districts/communities that are vulnerable to the top three priority risks affecting their sector.

Event + Outcome Risk	Three Most Vulnerable Communities - areas
More Severe weather events: increase incidents of damage to infrastructure 11	4 – All three villages, roads, power poles, sloping lands, airport, Wharf and buildings (public and private)
More Severe weather events: loss and damage to agricultural infrastructure and crops affecting food security 11	4 – Wetlands, swampy areas – all communities have all these areas.
Change/variations and increase in local and national temperature regimes: Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming; invasive species causing disease on the plants – TE VERI E KAI ARA I TE RAU O TE TARO 10	4 – Planting areas
Change/variations and increase in local and national temperature regimes: Increased Heat stress impacting productivity as people will not be able to work 10	3 – Entire island
More Severe weather events: Increase incidents of loss of human life and injuries/illness 10	3 – Entire islands community
Sea level rise and storm surge: Damage to coastal infrastructure – airport/harbour/picnic houses – from flooding and sea level rise 9	4 – airport and wharf, picnic houses

Changes in rainfall patterns: Impact on human health from water and vector borne diseases 9	3 – near people’s homes
Hazardous Substances: burning/burying/disposal of hazardous wastes 9	5 – some illegal dumpsites
Sea level and storm surge: Loss of coastal land/beach/vegetation 8	3 – all beach areas on Atiu
Sea level rise and storm surge: Damage to drainage/flow of water from inland to sea (taro swamps to the sea) blockage 8	5 – drainage sites from the inland to the sea
Epidemics (dengue fever/cholera): illness/loss of life 8	4 – whole island
Changes in rainfall patterns: Increased incidents of crop diseases affecting food security – the livelihoods of pigs and goats 6	4 – Wetlands, swampy areas – all communities have all these areas.

Step 5 – Identify possible intervention options to address priority risks

From the prioritised event and outcome risks, the most vulnerable communities were identified before proposed policy options were introduced and discussed.

Risks from the Survey

Vulnerabilities

There are many vulnerable sectors in Atiu. These are namely, Agriculture, Water, Health, Biodiversity, Tourism, Energy, Communication, and Waste.

Agriculture

Taro

As a staple food for the island, Atiu has many taro plantations which are found in the interior of the island. About 95% of the Atiu population plants this root crop, mainly for subsistence purposes however they do sell any excess taro in the local market or export it to Rarotonga. Some problems faced by the household as mentioned in the surveys are impact of invasive species on these plants.

Coffee

One of the things that Atiu is known for is the Atiu Coffee. This was introduced back during the missionary days and remained to be a local crop on the island. Branded and well known as “Atiu Coffee” it has been successfully marketed and sold as far as Germany. There are currently two active farmers that plant coffee and sell on the local market. This crop would begin to wane as there is limited labor and requires many hours to process and package. Even then, we cannot beat other larger countries that are producing coffee at a much cheaper rate and higher volume.

Livestock

Most of the domestic livestock that households look after are pigs and goats. There are also a large number of wild pigs and goats that roam the island and sometimes cause destruction to the people’s agriculture farming. New initiatives to procure and install wire fencing to protect the people’s gardens from wild pigs have been undertaken. Some of the problems faced by the households with their livestock is the impact of mosquitoes on pigs which can cause them to suffocate.

Others

Atiu used to be a pineapple production island back in the 1960s until early 1980s. This came to an end when New Zealand closed its borders to Cook Islands pineapples. Just as recent as 4 years ago, pineapple was revived to supply the local market mainly in Rarotonga for the tourism industry.

Water

Water is a very important commodity for all as having good water quality is essential for life. In August 2011, the island of Atiu experienced water shortage. Due to very low rainfall, water was sourced from community water tanks or from the school water tanks to cater for the households. Some people also utilized the freshwater springs.

During the survey, it was found that there were approximately 164 household water tanks. It was also found that the different occupancy number per households had a range of water tanks, for example, there were single occupant households that have water tanks with capacities ranging from 800 litres to 30000 litres, and households with eight occupants that only have a 5000 litre tank. So while water tanks may be present, they may not be of sufficient capacity to cater to the number of occupants in a household.

Health

The health of people is very important for a developing economy. Atiu people are known to have a higher incidence of diabetes amongst men caused by the high consumption of home-made brew (bush beer). At the time of the survey, there were only two patients in the Atiu Hospital. The high dependence on processed foods will result in the increase of non-communicable diseases.



Figure 7: Atiu Hospital

Biodiversity

Atiu is also known as the “land of the birds” - *Enuamanu*. The different varieties of birds such as *Rupe* (Pacific Pigeon), *Kura* (Lorikeet), *Kakerori* (Rarotonga Flycatcher), *Kopeka* (Atiu Swiflet), *Kota'a* (Frigate bird), and many others. Despite the ongoing development on Atiu, the island is covered in lush green vegetation. As the main settlement is concentrated within the center of the island, this has allowed for the rich coastal vegetation to be retained, apart from the airport and wharf sites. There are areas of rich flora and fauna which has been reserved for ecotourism, with tourist walking and sight-seeing tracks. There are many natural resources on Atiu that make the island what it is today.

Resources for arts and crafts are also at risk. These coastal resources that are picked and used by the women and children of Atiu to adorn costumes and so forth are at risk of disappearing also with the impacts of climate change.



Figure 8: Coastal Resources for handicrafts

Energy

Atiu is powered by a diesel generator that relies heavily on imported fossil fuel. Telecom communications station has solar panels for back-up purposes. Like all other outer islands, there

is a strong incentive to move towards building renewable energy mainly solar power. At this stage, efforts have been made to improve and increase energy efficiency through initiatives such as changing to energy efficient light bulbs.

Communication

Atiu has telecommunications access and has expanded out from just dial up to broadband internet service as well as mobile services. It has its own television station based within the Telecom Building that is operational 24 hours a day. It receives Sky TV from Fiji. Atiu has its own local radio station that is operated from the Telecom Building. It more or less delivers community notices heard mainly in the morning or late evening for a small fee.



Figure 9: Atiu Telecom Station that also has the Atiu Radio station

Waste

There is no proper landfill on the island, which makes the amount of imported goods and recyclable materials to the island an area of concern. There is very little control over disposal of litter and waste. Leaders on the island need to be proactive in locating and establishing a site for this purpose. During the survey, evidence of e-waste thrown on the side of the road was seen. Failure by the relevant agencies and community leaders to address this area will lead to a much more health and hazard crisis.

PART THREE

Community Adaptation Plan

Adaptation Options/Policy intervention

<p><i>More Severe weather events: increase incidents of damage to infrastructure 11</i></p>	<p>Review and strengthen the building code⁷ to look at climate proofing infrastructure developments – provide anchor for buildings and domestic houses⁸.</p> <p>Funds to help during and after extreme events – like a relief or contingency fund</p> <p>Assessment of the derelict homes and/or buildings to look at pulling them down as they pose a threat</p> <p>Plan for regular maintenance/replacement of power poles.</p> <p>Capacity building for maintenance of infrastructure</p>
<p><i>More Severe weather events: loss and damage to agricultural infrastructure and crops affecting food security 11</i></p>	<p>Look at climate resilient plants that are nutritious</p> <p>Calendar for planting during seasonal changes – i.e., types of fruits, vegetables, crops to plant during wet rainy period. Alternatively, fruits, vegetables and crops to plant during dry periods.</p>
<p><i>Change/variations and increase in local and national temperature regimes: Impact on agricultural productivity and food security – fruit plants may not be viable as the heat is overwhelming; invasive species causing disease on the plants – TE VERI E KAI ARA I TE RAU O TE TARO 10</i></p>	<p>Look at climate resilient plants that are nutritious</p> <p>Control of invasive species</p> <p>Training of heads of households/village leaders about the changes/what happens, what to do about it</p>
<p><i>Change/variations and increase in local and national temperature regimes: Increased Heat stress (elderly, youth, women) impacting productivity as people will not be able to work 10</i></p>	<p>Early warning systems to be put in place for extreme temperatures;</p> <p>Community inventory and updated data for response plan – such as number of people in all villages, location of disabled and elderlies;</p>
<p><i>More Severe weather events: Increase incidents of loss of human life and</i></p>	<p>Early warning system to be put in place for cyclone, tsunami⁹ and man-made disasters –</p>

<i>injuries/illness 10</i>	<p>aircraft accidents.</p> <p>Community evacuation plans to be drawn up; Disaster preparedness plans for the community</p>
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At a more general level, there is a general capacity building needed to up skill the workers on the island to carry out their own duties. Furthermore there is a need for technical support and funding to help the people of Atiu.

Conclusion and Recommendation lessons learned

The trip was very productive and the team was well received by the people of Atiu. The general overview of the people on how they perceive Climate Change and Disaster Risk Reduction is that it is a topic which they are well aware of. This is a result of the effective campaign by the Atiu Red Cross branch to promote and bring awareness to the people. At the time of the survey, the newly established subsidiary of the Atiu Red Cross called “Kura Rangers” was responsible for climate change related activities such as ‘tree planting’.

Much of the interests of the people were on Tsunami. This was brought about as a result of the tsunami that has impacted on Japan and our near neighbors in Samoa. As a result of the request, a full session on Tsunami events, warnings and appropriate response was undertaken by Emergency Management Cook Islands and Red Cross members who were part of the survey team.

From the findings, the infrastructure sector was highlighted as one area that requires more attention. This called for the review of building codes, putting overhead power cables underground to minimize power cuts during cyclone periods and removal of unoccupied dilapidated buildings.

For the agriculture sector, it was recommended that a calendar for planting be developed so that the people are fully aware the best type of fruit crops to be planted throughout the year. There were also discussions on introducing climate resilient crops.

Increase of water storage and conservation measures were also another sensitive topic that was highlighted from the survey. The installation of more filtration water systems was highlighted as a priority need. Whilst there are community water tanks still in existence, they are defunct and the survey and the meetings called for a rehabilitation of these community water tanks to increase the islands storage capacity.

In order to promote public safety during cyclone seasons, early warning systems were requested. This resulted in the installation of a siren for the Island. There was also call for disaster plans to be reviewed, updated and endorsed by the local Government.

The team felt that there was a greater need for capacity building and community awareness on Climate Change and Disaster Risk Reduction. This would allow for a more sustainable and safe community.

Meitaki ranuinui.

Annex. 1

1. Copy of survey questionnaire



Atiu Vulnerability and Adaptation Assessment

Cook Islands Red Cross Society and the Office of the Prime Minister

Questionnaire completed by:

Date: ___/___/2012

House number: _____ Power Connection: _____

Household Questions

A. Ingoa; Name of Informant(s): _____ Contact Number:
 i. Landline: _____
 ii. Mobile: _____
 iii. Email: _____

B. Tare numero tangata; Number of Occupants _____

C. Household data:

Name	Gender (M, F)	Age 60+ 16-60 5-15 Up to 5	Relationship e.g. father/mother /daughter/grand child	Occupation	Special Need

D. How many years

_____ s have you lived on this island? _____ Years Whole Life

Questions about Food and Agriculture

E. What are your main foods (list)? _____

F. What Percentage are imported foods _____

G. Have you ever had a food shortage?

H. Do you preserve any foods? Yes No

I. If yes, what foods (list)?

J. How do you preserve them (describe, e.g. drying)?

Food Storage	%	Number of appliances
Refrigerator		
Freezer		
Imported Dried/Canned		N/A
Local Preserved		N/A
Other		N/A

Questions about Food Preparation

Main Cooking Fuel	%
Firewood	
Gas	
Electric	
Other	

Questions about Farming and Livestock

	% Agriculture	% Fishing
Subsistence/Domestic		
Commercial		
Other		
None		

Livestock Activity	Est. Number	Tether/Roam
Chickens		
Pigs		
Goats		
Cattle		

K. Value of farm (if applicable): \$ _____

L. Where is your growing activity Close to Household Away from Household

M. Do you own the land or is it family owned? (Lease, freehold or verbal agreement)

N. How many parcels/lots do you have animals on? Or are they mixed together: _____

O. What crops do you grow?

Crops	Names	Currently Growing
Vegetables	_____	_____
Root crops	_____	_____
Fruit	_____	_____

Would you describe the soil where you plant as healthy? _____ -

P. Do you see any pests and diseases on your crops?

Q. Do you or your household use/apply any of the following on any of the crops grown?

- | | |
|---|--------|
| a. Inorganic Fertilizers | YES/NO |
| b. Organic Fertilizers | YES/NO |
| c. Compost & animal manure | YES/NO |
| d. Agricultural chemical i.e. Weedicide/Herbicide | YES/NO |
| Fungicide | YES/NO |
| Insecticide | YES/NO |

R. Did you or your household use improved varieties i.e. pineapple and taro etc? If YES where did you get them? (Agriculture, private sector or personal).

S. Did you or your household engage in any following selected agricultural activities?

- | | |
|--|--------|
| a. Bee keeping for Honey Production | YES/NO |
| b. Hydroponics crop production | YES/NO |
| c. Floriculture | YES/NO |
| d. Handicrafts e.g. carving, basket making etc | YES/NO |

T. Where is your Livestock activity Close to Household Away from Household

U. How long have you been engaged in livestock farming? _____

V. Have you faced any problems concerning livestock diseases? _____

W. Have the livestock numbers changed in the last 10 years? If YES, increased or decreased and what was the reason for this?

X. Where do you do your fishing? Lagoon Reef Over the reef/Ocean

Y. How often do you go fishing?

Questions about Water Supply

Z. Major source of Drinking Water

Tick box and indicate water source

Public System Only	Community System Only	Public and Community	Bottled	Catchments, Tanks, Drums	Well/Borehole	Springs

AA. Do you have piped water into the house? Yes No

BB. Do you have a water tank(s)? Yes No

CC. How many water tank(s)? _____

DD. If yes, what material is it made from

Plastic	Metal	Concrete	Other

EE. How big is it (in litres)? _____

FF. Is your roof suitable for catching rain? Yes No

GG. If yes, how extensive is the guttering to catch the rain?

1. All around the house
2. Half of the house
3. A single spout (guttering-piece)
4. Pump from tank to house

HH. What actions do you take to cope with water shortages?

II. Do you reuse any water e.g. from washing machine, shower, cooking, dish washing etc?

Yes No

JJ. If yes, what do you use this water for? _____

Do you have a washing machine? Yes No

KK. If yes, What type – Automatic Wringer

Questions about Energy Use

Appliances that are being used by the household (Disaster Preparedness):

Appliance	Number	Often Used		Number	Often Used		Number	Often Used
Generator			Light fittings:			Motorbike		
Compressor			Strip Fluro CFL			Car/Truck		
Radio			Incandescent			Boat with Engine		
Battery Charger			Halogen			Boat no engine		
						Bicycle		
						Other equipments: farming etc		

Hazard Preparation

Questions about Waste

LL. What type of toilet (s) do you have

Type	How many	Location In/out	How many
Pour flush			
Flush			
Long drop			

MM. What happens to wastewater?

Tick box and indicate what happens to waste water				
Waste Water Disposal	Septic Tank	Open	Waste Treatment System (Type)	None

NN. How do you get rid of your rubbish?

Waste Disposal	%
Hole	
Collected	
Open Burning	
Other	

Questions about changes in your environment

OO. What changes have you noticed on your island over time?

PP. What do you think caused these changes?

QQ. Have you noticed any changes to the vegetation over time? Yes No
If yes, is it more vegetated now than 10 or 20 years back? _____

Questions about Shoreline Changes

RR. Have you seen any shoreline changes over time?

Yes No

SS. What do you think caused the changes over time that you have seen?

.....
.....

TT. Are you aware of any initiative(s) and/or actions to address the changes?

UU. Have you noticed any changes to your livelihood after changes to the shoreline?

What have been these changes? Kua tau ai ainei toou oraanga ngutuare no tei tau ai te turanga o te tapataa tai?

.....
.....
.....

Recommendations for community action? Tetai uatu manako

.....

What does climate change mean to you?

.....

2. Participants List to mini-workshop



NATIONAL ENVIRONMENT SERVICE
TU'ANGA TAPOROPORO
COOK ISLANDS



ATIU ISLAND RISK ASSESSMENT MAY 14TH-25TH 2012

Participants at the mini-workshop held on the Island of Atiu at the Catholic Hall

- Day 1: Wednesday 16th May 2012

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
PUNA RAU	TELECOM ATIU	33680, 33146	
RANGI TATUANA	RED CROSS ATIUS. ADMIN.	33 269(LK) 33-063(HM)	
TEIRA JR KEA	NGATIARIA COUNCIL GENERAL MANAGER	33-003 33-172	
MARANA IRIKE	POLICE	33-120	
KEA HENEY	ENVIRONMENT	33-356	
PAIERE MOKARA	TU'ANGA TAPOROPORO WRITER	33-034	
K. H. H. H.	Pastor	04-02-45	
MICHAEL BEARD	Plant	33013	
MOANA MINGI	ATIUS. SECRETARY	33180	
TAKI VAINEPOTO	ATIUS. RED CROSS	33134	
V. MOKARA	COMMERC. T.	35263	
IRA MOKARA	ISLAND SECRETARY	33219	
MAAMARI	HAKI	33265	
APII TORIO	MANAGER INFRA	33169	
PERI TOUNA	C.R.	33-144	
MAARA TAUFI	MANAGER ATRU, ATU	33118	
TANGATA VAINEPOTO	Justice	33-410	

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ATIU ISLAND RISK ASSESSMENT MAY 14TH-25TH 2012

Participants at the mini-workshop held on the Island of Atiu at the Catholic Hall

– Day 2: Thursday 17th May 2012

Name/ Ingoa	Village/Organisation	Contact (phone number/email address)	Signature
TEMEMOKA MOKOEA	TEENU. CICC.	33180.	<i>[Signature]</i>
KAU. HENRY	ENVIRONMENT	33-356.	<i>[Signature]</i>
APU PORIO	ENERGY MANAGER	33-169	<i>[Signature]</i>
PUNA RAU.	TELECOM ATIU	33-680 33-146	<i>[Signature]</i>
KOOPAKA K.	Pastor	33-448 84-91-1995	<i>[Signature]</i>
VANE VAREOA	COUNCIL T.	33-263	<i>[Signature]</i>
TEURA IRE KEA	HEALTHCARE COUNCIL ENERGY MANAGER	33-008 33-172	<i>[Signature]</i>
NGAMARI	ARIKI.	33-265	<i>[Signature]</i>
TANGI VANEPEAO	ATIUREDCROSS	33-134	<i>[Signature]</i>
PAIERE MOKOEA	TOURISM AECO	33-034	<i>[Signature]</i>
TANGATA VANEPEAO	JUSTICE	33-410	<i>[Signature]</i>
MAARA TAIRI	MANAGER AGRI. AIA	33-118	<i>[Signature]</i>
RANGI TATUAVA	ATIUREDCROSS ATIUS.ADMIN.	33-269	<i>[Signature]</i>
Piri TOUNA	CR	33-144	<i>[Signature]</i>
TANGATA EDWARDS	SOCIAL WELFARE	33-054	<i>[Signature]</i>
INA MOKOEA	ISEC	33-269	<i>[Signature]</i>

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6. Cook Islands Tourism Office

List of Contributors

- (i) Mii Matamaki
- (ii) Mac Mokoroa
- (iii) Reboama Samuel
- (iv) William Tuivaga
- (v) Anna Tiraa-Passfiled
- (vi) Ina Mokoroa
- (vii) Taoro Strickland
- (viii) Tangata Vainepoto
- (ix) Paiera Mokoroa
- (x) Rouru Toki
- (xi) Louisa Karika

ISLAND FACT SHEET – ATIU

Physical features	Island Type: Makatea (raised coral), fringing reef 22km Elevation: Highest point, 72metres Proximity: 185 km from Rarotonga Area used for agriculture: 152.6 acres Land area: 6654 acres Settlements: 5 villages: Teenui, Mapumai, Tengtangi, Areora, Ngatiarua
Demographics	Population: (2011) 481 Households: 125 occupied, 86 unoccupied
Environment	<ul style="list-style-type: none"> • Low swampy inland • Plantations around the populated interior • Presence of caves
Health	<ul style="list-style-type: none"> • Hospital with a Doctor • High levels of NCD's
Local Economy	<ul style="list-style-type: none"> • Taro plantations, Atiu Coffee • Handicrafts
Air Transport	Regular weekly flights from Rarotonga and also through Aitutaki
Sea transport	Cargo shipment about once a month
Road transport	Ring road around the island Feeder and inland roads Sealed road are mostly around the settlements areas
Water Supply	HH water tanks or Community water tanks
Solid Waste	No proper landfill
Electricity supply	Diesel powered electricity grid 24 hours electricity service
Telecommunications	<ul style="list-style-type: none"> • No newspaper, public notice boards used • FM Radio station that can pick up AM Radio station in Rarotonga, and is able to produce local material • Satellite TV • Email & Internet facilities accessible using broadband. • Mobile service available
Cyclone shelters	Community Halls

KEY ISSUES – ATIU

Issues	
Environment preservation	Threat to the local Biodiversity from invasive species Atiu and Takutea Environment Regulation 2007
Economic development	Tourism Industry Agriculture Industry

