



Exploring resilience to climate change and other environmental challenges in Samoan communities.

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Explanation of the photograph: A painting of Namu'a Island (off the coast of Aleipata) by a young Samoan whose village was wiped out by the 2009 tsunami (courtesy of the 'Moving on: arts as therapy programme' conducted by Leua Latai, 2010). Instead of showing the ravages of the tsunami, the child illustrates the transformation and renewal of Namu'a. The painting depicts hope, renewal and transformation amid the traumatizing experience of witnessing the death of family members and loss of homes.

Abstract

Climate change could be one of the most significant challenges of this century, and information about how societies have endured difficult times is crucial to the development of survival strategies. The latter is fundamental to the concept ‘resilience’, the latest catchphrase in the literatures of climate change and global policy-making in the early 2000s. Being resilient in the face of climate change is especially important for island societies, which currently face the consequences of rising temperatures, unpredictable rainfall and wind patterns, and sea level rise, yet there is a dearth of academic literature on the subject. To date, the majority of studies have used indicators and methods rooted in Western science and neo-classical economics. These, have, however, been criticized as being locally irrelevant and inadequate to address the dynamic nature and social structures of island communities, and their capacity to adapt.

This study challenges the current paradigm that defines resilience as a return to equilibrium, by using a non-equilibrium cultural ecological lens and interpretivist research design. The non-equilibrium view of resilience sees the social systems of island nations as highly dynamic areas, constantly undergoing persistent change and environmental disturbance. It is exposure to such disturbances that fosters resilience in people. The study found that island societies are resilient because they continue to adapt and survive despite living on small isolated landmasses and being exposed to physical and socio-economic challenges, including climate-related changes. A key argument of this thesis is that to understand the resilience of an island society to climate change requires assessment of islanders’ perceptions and actions in the context of their physical locales and their socio-cultural systems. In the case of Samoa, it was found important to situate participants in their villages and investigate what they say and do in response to their cultural position in Samoan society as well as in their responsibilities and obligations to family, village, church and the nation. This approach revealed Samoans’ detailed understanding, awareness and experience of climate-related changes. More importantly, it enabled greater appreciation of islanders’ multiple and multi-layered connections, to take advantage of opportunities and devise ways of managing, avoiding and reducing the risks associated with climate change. These have already proven vital in enabling Samoans to cope with climate change, and are expected to do so in future. The research findings and approach could be used to assess the resilience of people in other places.

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“Aua nei ia te i matou, le Alii e, aua nei ia te i matou, a ia tuuina atu le viiga i lou suafa, ona o lou alofa ma lou faamaoni”.

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Figure A1 Maps showing the reduced forest areas in Savaii from 1954- 1990
(Source: Ward and Ashcroft, 1998).

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List of Abbreviations

ABM	Australian Bureau of Meteorology
ACEO	Assistance Chief Executive Officer
ADB	Asian Development Bank
AOSIS	Alliance of Small Island States
AUA	Apia Urban Area
CCCS	Congregational Christian Church of Samoa
CDCRM	Community Disaster and Climate Risk Management Programme
CFCs	Chlorofluorocarbons
CIM Plan	Coastal Infrastructural Management Plan
CIMS	Coastal Infrastructural Management Strategy
CRIP	Climate Resilience Investment Programme
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSSP	Civil Society Support Programme
DH and PG	Deutsche Handels und Plantagen- Gessellschaft der Sudsee Inseln zu Hamburg
DFAT	Department of Foreign Affairs and Trade (Kiribati)
DSAP	Development of Sustainable Agriculture in the Pacific
ENSO	El Niño Southern Oscillation
EPC	Electric Power Corporation
FAO	Food and Agriculture Organization
FSP	Foundation of the Peoples of the South Pacific
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit
ICM	Integrated Coastal Management
IFRC and RCS	International Federation of Red Cross and Red Crescent Societies
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
IWPK	International Waters Project of Kiribati
IWSA	Independent Water Schemes of Samoa
JICA	Japan International Cooperation Agency
KAP	Kiribati Adaptation Programme

KOFA	Kiribati Organic Farmers Association
LED	Light-emitting diode
LDC	Least Developed Countries
MAF	Ministry of Agriculture and Fisheries
MAFF	Ministry of Agriculture, Forestry and Fisheries
MFAMR	Ministry of Fisheries Agriculture and Marine Resources
MHTE	Ministry of Housing, Transport and Environment
MHWM	Mean high water mark
MIRAB	Migration, Remittances, Aid and Bureaucracy
MNRE	Ministry of Natural Resources and Environment
MPA	Marine Protected Area
MPPACC	Model of Private Proactive Adaptation to Climate Change
MPND	Ministry of Planning and National Development
MWSCD	Ministry of Women Community and Social Development
NAPA	National Adaptation Programme of Action
NCCCT	National Climate Change Country Team
NEMS	National Environment Management Strategies
NGOs	Non-governmental organizations
NPF	National Provident Fund
NTT	National Task Team
NZIT	New Zealand Institute for Pacific Research
SDS	Strategy for the Development of Samoa
SES	Social Ecological System
SIDS	Small Island Developing States
SIDP	Safer Island Development Programme
SPC	Secretariat of the South Pacific
SPCZ	South Pacific Convergence Zone
SPREP	South Pacific Regional Environmental Programme
SWA	Samoa Water Authority
TTM	Taiwan Technical Mission
UFW	Unaccounted for Water
UN	United Nations
UNDAT	United Nations Development Advisory Team
UNDP	United Nations Development Programme

UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WB	World Bank

Glossary of Samoan terms and phrases

Important note:

- i) Except where the source is identified, the definitions in this glossary are from the author's knowledge.
- ii) The words are listed according to the Samoan alphabetical order.
- iii) Throughout the thesis, a Samoan word or phrase appears first in *italics* and then the English translation follows immediately after in [square brackets]. Within direct quotations by participants, the normal (circular brackets) are used to denote the various behaviour of participants, as well as the tone of their voices.
- iv) 'Single inverted commas' are used to highlight words that were spoken in English by the research participants.

Samoan terms and their meanings

<i>aiga</i>	family
<i>auluma</i>	daughters of the village
<i>autasi</i>	consensus agreement
<i>aumaga</i>	untitled men's group or men without chiefly titles
<i>aloiafi</i>	spark
<i>igoa</i>	name, title
<i>ifoga</i>	ceremonial request for forgiveness
<i>oso</i>	wooden digging stick used to plant taro
<i>umu</i>	traditional Samoan oven made with hot stones
<i>faa</i>	characteristic of or like in the manner of the same kind (Milner, 1966).
<i>faa-aigalua</i>	to have two residences or families
<i>faafeagaiga</i>	pastor or church minister
<i>faaSamoa</i>	Samoan way of life
<i>faalavelave</i>	traditional activities like funerals, weddings and bestowal of chiefly titles
<i>faalelegapepe</i>	public display of fine mats
<i>faamatai</i>	Samoan chiefly system

<i>faamoa</i>	method of fishing involves crushing certain parts of the reef while a fishing net lies await on the other side
<i>faiava</i>	male in-law
<i>fautasi</i>	long boat
<i>fale</i>	house/s
<i>feagaiga</i>	covenant, sister, daughter
<i>fole, gau, pipi</i>	seashells
<i>fono</i>	to meet or meeting
<i>gaoa</i>	rocky
<i>gafatia</i>	endure
<i>gafa</i>	lineage
<i>gafatia</i>	endure
<i>lavalava</i>	sarong
<i>loiloi</i>	planting the taro singly against the side of the hole is an older technique that is still commonly used in this area especially in wet areas closer to the river
<i>lotu</i>	prayer, church service or religion
<i>mautu</i>	solid
<i>malae</i>	an open space in the village where cultural festivities are held
<i>malaga</i>	journeyings
<i>magalo</i>	less brackish and becoming suitable for drinking
<i>matai</i>	holder of a chiefly title or chief
<i>maveve</i>	cracked soil
<i>miti</i>	fermented coconut milk
<i>nofotane</i>	female in-law
<i>nuu</i>	village
<i>paolo</i>	in-laws
<i>pitonuu</i>	sub-villages

<i>polili</i>	removing the tuber of the taro and immediately replanting its top part
<i>pule</i>	authority or person with authority
<i>pulega</i>	management
<i>pulenuu</i>	village government representative or government official
<i>sao</i>	main chiefly titleholder
<i>soalaupule</i>	consensus decision making
<i>suli</i>	heir through blood connection/s
<i>taoto</i>	breadfruit season in May or to lie down
<i>tautai</i>	expert fisherman
<i>tautua</i>	serve or service
<i>tamaitai</i>	unmarried woman
<i>tama tane</i>	son
<i>tapu</i>	taboo, sacred or prohibited
<i>tia</i>	grave or hunting site
<i>tiapula</i>	top part of the taro
<i>toonai</i>	Sunday lunch
<i>tuiefu</i>	dry season planting
<i>tuise</i>	invasive weed
<i>va</i>	space
<i>vaitoaga</i>	crops grown in between harvests
<i>kokoesi</i>	a dish comprising papaya and cocoa

Samoan phrases and their meanings

<i>aiga iinei</i>	family here (Lilomaiaava-Doktor, 2015)
<i>aiga i fafo</i>	family overseas (Lilomaiaava-Doktor, 2015)
<i>Aiga Fia Atiae</i>	families who wish to progress
<i>aiga potopoto</i>	extended family unit
<i>auala galue</i>	work roads usually leading to plantations or inland areas

<i>afioga tutasi</i>	council decree (Tuimalealiifano, 2001), sanction of the village
<i>iuga fono</i>	decision, minutes of a meeting
<i>igoa matai</i>	chiefly title/s
<i>faaaloalo i e matutua</i>	respecting your elders (Lee Hang, 2011).
<i>faaluai le talo</i>	planting taro between rocks- a method of planting taro in stony soils
<i>faletua ma tausī</i>	village group comprising wives of village male chiefs
<i>faamalulu atu</i>	My apologies
<i>faiga faavae</i>	policy, strategy or constitution
<i>fafai le toaga</i>	harvest
<i>faga i se fagavao</i>	sprayed with paraquat (weedkiller)
<i>fagogo</i>	story or stories, story telling
<i>fono a le nuu</i>	village council meeting
<i>fuata mafu i ato seu</i>	breadfruit season that occurs in March (Buck, 1930)
<i>fuata a le tau</i>	breadfruit season that occurs in October (Buck, 1930.)
<i>fuata tu faamanu</i>	breadfruit season that occurs in August (Buck, 1930)
<i>fue lautetele</i>	thick leaf vine
<i>fue saina</i>	mile- a- minute
<i>gagana faaaloalo</i>	formal Samoan language
<i>gagana taatele</i>	everyday Samoan language or common Samoan
<i>Lotu galuega a le Aualofa</i>	Women’s committees of the Latter Day Saints Church
<i>malaga sue tupe</i>	village fundraising trips
<i>mafuta moe afiafi</i>	fellowship, storytelling and sleeping
<i>matai lufilufi mea lelei pe tufa lelei</i>	“...matai who distributes and shares the food and wealth with all the members of the <i>aigapotopoto</i> , leaving nothing for self (Aiono Le Tagaloa, 1992: 121-122).”
<i>mativa faafesagai</i>	means facing each other in hardship/ poverty
<i>Na o taua a</i>	just between us
<i>pae ma le auli</i>	sister or peacekeeper

<i>sui o le malo</i>	village government representative selected from the women's committee
<i>sui o le nuu</i>	village government representative selected from the village council
<i>suiga o le tau</i>	climate change or changes in the weather
<i>tautai alii</i>	chief or lead fisherman
<i>tautai matapalapala</i>	foresighted fisherman
<i>tautai mataalia</i>	alert and watchful fisherman
<i>tau tuputupu</i>	springtime/ growing season
<i>talo mua</i>	first harvest
<i>talo muli</i>	second or final harvest
<i>tino o le aiga</i>	relatives or members of a family
<i>va-fealoai</i>	mutual respect
<i>va tapuia</i>	sacred space
<i>vevela o le lalolagi</i>	global warming

E malu ia te oe aiga, e malu foi oe i aiga. “You carry *aiga* and *aiga* carries you (Liki, 2015: 130).”

E poto le tautai ae sese lana atu i ama. “Although the master fisherman may be very skilled, even he sometimes entangles his catch on the outrigger of his canoe because of the unpredictability of the fish (Latai, 2008).”

E sili ona moe le toa. It is best to let the rooster rest.

E sui faiga ae tumau faavae. “Cultural expression is varied but the spirit of this expression is one and unchanging (Latai, 2008: 66).”

E taliilagi vai o Aopo. Aopo waits for water or catches water from the skies.

Ia ua soli vale mai le maota ma faalavelave mai i feau o le aso. I have inappropriately entered your house and disrupted your daily chores.

Ua aasa le la. The sun is fiercely hot.

Ua amata ona ila tagata i le la. People are starting to ‘really feel’ or, ‘are hurt by’, the heat.

Ua ese mamao le vevela pe a faatusatusa i aso la. The heat is very different if we compare it with previous days.

Ua matua tele le vevela. The heat is greater.

Ua matua ova lava le vevela. The heat is just too hot.

Ua siisii le vevela. The heat is increasing.

Ua ta mu i le vevela. The heat burns.

Malo le soifua ma le lagi e mama Greetings, good life and clear skies.

Na o oe lava lea o le a ou taua atu ai le mea lea. You are the only one I am telling this.

Vaai oe i e tautala i mea ia. Make sure you do not talk about these things.

Chapter One. Introduction: Challenging the notion of ‘vulnerable islands’

1.1 The climate issue and its implications

Climate change has received much attention since 1990, when the first Intergovernmental Panel on Climate Change (IPCC) report concluded that the increase of greenhouse gases from human activities was adversely affecting the earth’s climate. The most recent IPCC report in 2013 stated that greenhouse gases already in the atmosphere will cause further changes to the global climate system for the next 50 or more years. Rising temperatures and sea level rise are forecast to continue. Some regions will experience stronger cyclones, while others will continue to face spells of greater warmth and heavy rainfall. The impacts of these changes should be beneficial to residents of higher latitude regions, where longer growing seasons could become possible. But storms, floods and droughts could also cause havoc, and may subsequently lead to the loss of homes, food and water sources and impact on the health and livelihoods of many communities and individuals.

Scientific authorities have asserted that the smallness of islands enhances the interconnectedness of socio-ecological systems, thus making them vulnerable to the impacts of these changes, and at a faster rate compared with the inhabitants of other environments. The rates of sea level rise in some parts of the Indian and Pacific oceans have been significantly higher than the global average (Meyssignac *et al.*, 2012; Becker *et al.*, 2012; South Pacific Regional Environment Programme (SPREP), 2013; SPREP, 2014). In addition, these regions have witnessed elevated sea surface temperatures (Wilkinson *et al.*, 1999; Alling *et al.*, 2007; Williams *et al.*, 2010) and slightly more intense weather events, particularly during the recent warm and cold phases of the El Niño- Southern Oscillation (ENSO) (Payet, 2005; Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organization (ABM & CSIRO), 2011).

In the Pacific region, the projected increase in air temperatures near the surface will range from between 1°C and 4°C, and associated sea surface temperatures will likely be 1°C to 3°C greater by 2070. Sea level rise is predicted to increase between 0.19 and 0.58 metres by 2100. These changes will be marked by a greater incidence of hot days and nights, irregular rainfall, droughts and stronger cyclones (ABM & CSIRO, 2011; SPREP, 2013).

1.2 Climate change and ‘vulnerable islands’: reviewing current paradigms

Climate change science has shown that the impact of these events is heightened on islands, but there is insufficient information on how island societies are enduring and anticipating climate change. The main reason for this shortage is that the majority of studies in the context of climate change have focused on discussing the vulnerabilities of islands, while neglecting to notice how island societies have been surviving there all this time. The notion that islands are vulnerable to climate change is underlined by three bodies of literature namely; Western science, neo-classical and political studies. Since the 1990s, many scientific studies have contended that physical indicators such as the small size and low elevation of islands make them particularly vulnerable to climate change. The first IPCC (1990b: 6-1) assessment report on climate change stated that “...a 30-50 cm sea-level rise projected by 2050 would threaten low islands, and that a one metre rise by 2100 would render some island countries uninhabitable”. The scientific literature on climate change is largely based on the theory of global warming which is defined as the gradual warming of the earth’s atmosphere caused by emission of heat absorbing greenhouse gases, such as carbon dioxide and methane. “Naturally occurring greenhouse gases such as carbon dioxide, methane and nitrous oxide keep the earth warm enough to be habitable. By increasing their concentrations, and by adding new greenhouse gases like chlorofluorocarbons (CFCs), humankind is capable of raising the global average annual mean surface air temperature (IPCC, 1990a: xiv)”. The term has since been generally used to reflect longer-term changes, such as higher air and sea temperature and a rising sea level (IPCC, 2007).

In addition, neo-classical studies have used macro-economic indicators to emphasize the vulnerabilities of islands. Briguglio (1995) pointed out that the small size, remoteness and disaster proneness of islands, make them particularly vulnerable. Disaster proneness is determined by potential economic damage in relation to Gross Domestic Product (GDP), percentage of population affected and number of deaths caused by natural disasters as a proportion of total population (Briguglio, 1995; Wells, 1997; Atkins *et al.*, 1998; Burton *et al.*, 1993; Crowards, 2000).

Furthermore, the political ecological argument stated that while island communities may have been resilient and adaptable to environmental changes in the past, island societies have been

weakened by the processes of colonization, capitalism and globalization¹. The third IPCC assessment report (2001) which, for the first time, included a specific chapter on islands titled ‘Small Island States’ stated that with limited resources and low adaptive capacity, these islands face the considerable challenge of meeting the social and economic needs of their populations in a manner that is sustainable. The vulnerability of Pacific islands is increasing, due to economic and social changes such as population growth and overcrowding (Spennemann, 1996; Storey and Hunter, 2010; Veiyataki, 1993; 2010), internal and external migration, poorly planned coastal development (Gero *et al.*, 2011; Yamano *et al.*, 2007), unplanned urban growth and land use (Bryant-Tokalau, 1995; Asian Development Bank (ADB), 2012), and environmental and ecosystem degradation including contamination of sub- surface and coastal waters (Englund, 2008). Moreover, social capital, which is a key component in the capacity of a community to respond to crisis situations, is weakening (Campbell, 1990; Sutherland *et al.*, 2001; Veiyataki, 2010). These conclusions became widely used by international and regional agencies and national governments to gauge the vulnerability of islands to climate change. A major part of the literature on island vulnerabilities has been reports prepared by island governments and regional organizations in response to their commitments to the United Nations Framework Convention on Climate Change (UNFCCC) and IPCC. Island nations in the Caribbean and the Pacific oceanic regions were the first to ratify the UNFCCC in the 1990s, and since then have followed the UNFCCC process of identifying and reporting climate change impacts and adaptation. The UNFCCC endorsed process for Least Developed Countries (LDCs), which includes the majority of islands, is the National Adaptation Programme of Action (NAPA). The National Climate Change Country Team (NCCCT) and National Task Team (NTT) deal with the identification of vulnerable areas that urgently need climate change adaptation and reporting these to the UNFCCC. National initiatives like the National Environment Management Strategies (NEMS) and Integrated Coastal Management (ICM) plans in the Pacific Islands emphasize the formulation of policies and strategies for climate change and sea-level rise (Barnett and Campbell, 2010; Veiyataki, 2010).

¹ Political ecologists argue political and economic processes have occurred in the past century resulting in poverty and environmental degradation which have in turn reduced the capacity of these populations to effectively respond to current and future changes. Watts terms the inability of people to cope with environmental changes as ‘structural maladaptation’. His study of famine in rural Hausa communities in Northern Nigeria revealed that households used to have access to land, time tested agro-ecological knowledge, institutions and technologies suited to the characteristics of their hazardous environment, particularly drought. But this adaptive capability, he argues, was eroded by the process of European colonialism and the new social relations of capitalist production in Hausaland (Watts, 1983a; 1983b).

Many authors have challenged the conceptualization of vulnerable island societies based on physical and macro-economic indicators. Viewing islands as small, stable, low-lying and isolated spaces with scarce resources is ‘belittling’ and not only homogenizes, but misrepresents islands and islanders (Hauofa, 1993). Such indicators which have been used to portray islands and islanders as vulnerable are not accurate and do not adequately represent actual vulnerability (Baldaccino and Bertram, 2009; Barnett and Campbell, 2010; Nurse *et al.*, 2014; De Souza *et al.*, 2015) or local coping responses. These criticisms echo Chamber’s concern about how the widely used term “...vulnerability lacks a developed theory and accepted indicators and methods of measurement (1989: 1)”. Kelman and West (2009; 2013) in their critique of the category Small Islands Developing States (SIDS) make the important point that not all islands are similar. The category ‘island’ masks substantial geographical and cultural differences that exist within these places. Papua New Guinea, with an area of 462,840 km² is almost twice New Zealand’s size and could not be considered ‘small’ compared to Tuvalu’s 26 km². In his article titled ‘Introduction: the MIRAB² model in the twenty-first century’, Bertram (2006) emphasized how small Pacific island economies such as those of the Cook Islands, Niue, Tokelau, Kiribati and Tuvalu were coping with global economic changes through “stock flow relationships”. First, the stock of overseas-resident migrants and their descendants, which sustain the flows of remittances and new migrants, and, secondly, the stock of domestic public sector employment- sustained by the flow of aid. Additionally, Bertram argues that being small brings certain advantages, such as being able to form strong networks of mutual support in the face of threats or danger is important, although personality clashes in small communities can often be more corrosive than in larger ones, but solidarity is nevertheless generally easier to establish and sustain in small communities.

The technocratic and top-down nature of scientific methods mainly used in climate change studies, and the majority of country reports to the UNFCCC have been criticized as exclusive in downplaying local knowledge that could inform adaptation strategies. “Climate change has developed its own cadre of experts... and all these people seem to circulate in a science-policy bubble that at times floats far above the places where impacts will be felt and adaptations required...” (Barnett and Campbell, 2010: 179). The majority of country reports to the UNFCCC are mainly scientific evaluations of the vulnerabilities of islands using IPCC

² Economic model proposed by Bertram and Watters in the 1980s to explain how small islands in the Pacific are developing. MIRAB stands for Migration, Remittances, Aid and Bureaucracy (Bertram and Watters, 1984; 1985; 1986).

methods and evaluation criteria that were developed and used in developed countries; for instance, by using remote sensing to monitor physical climate parameters, detailed mapping of topography and bathymetry and running computer models with various data (Kelman and West, 2009). Some studies (Nunn, 2009; Nunn *et al.*, Kuruppu and Livermann, 2011) which have stated that islanders, especially those living in rural communities, have a low level of climate change awareness and do not consider climate change as a local priority. The ultimate goal of most of these studies was to see whether islanders understood the ‘scientific concept’ of climate change. Some have also adopted models used elsewhere to analyse islanders’ perceptions climate change. For example, the Model of Private Proactive Adaptation to Climate Change (MPPACC) (Grothmann and Patt, 2005) used by Kuruppu and Liverman (2011) represents islanders’ perceptions of climate change by focusing on a pre-determined and specific climate change risk. In these studies, climate change has already been pre-defined in scientific and largely ‘reductionist’ terms leaving little room for alternative understandings and interpretations. Such approaches privilege Western knowledge about environmental systems and rarely include information critical to understanding the risks which climate change poses to people in the region, and their capacity to adapt (Kelman and West, 2009; Barnett and Campbell, 2010). Farbotko (2010: 47) argues “...islands imagined as laboratories appropriate the space of an already marginalized population; these are imaginings by cosmopolitans who demand, for various and at times conflicting reasons, that disappearing islands provide tangible manifestations of the statistical abstractions that dominate climate science”.

Moreover, placing emphasis on ‘climate change’ and largely portraying it as a ‘hazard’ ignores the holistic nature of the environment, the opportunities associated with climate change and produces impractical notions of adaptation. Climate change science follows a linear sequence of analysis beginning with projections of future emissions trends, then moving on to the development of climate scenarios, thence to biophysical impact and the identification of adaptation options (Kelly and Adger, 2000). The majority of climate related changes are perceived as hazardous to people and other aspects of the environment, and adaptation is viewed as ‘adjustment’ to reduce the damages of such hazards. Burton and colleagues (1978) describe the ‘adaptability’ of a society as the combination of decisive adjustments where factors such as technology, location, income levels and institutions control the analytical framework and drive the adjustment process. The 2012 IPCC report not only provides separate definitions for adaptation of human and natural systems but gives emphasis

to this idea of ‘adjustment’. The report defines adaptation for human systems as “...the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate” (IPCC, 2012: 5).

Adaptation based on reducing the hazardous impacts of climate change has not been a sustainable solution. The majority of adaptive solutions to reduce the injurious impacts of climate change are largely ‘sectorally based’ (Barnett, 2001). They are similar to ‘command and control’ strategies aim at controlling the variability of a target resource or designed to intervene in key sectors to secure steady yields (Gunderson and Holling, 1995; Holling *et al.*, 1998; Folke, 2006). Infrastructural developments such as seawalls are a common climate change adaptation strategy on islands. However, a number of studies have argued that these have damaged local environments and undermined the livelihoods of some residents through impeded access to food, shelter and water. For example, the construction of a seawall to protect land and infrastructure on one end of Nukufetau atoll in Tuvalu caused the other end to erode (Resture, 2006 cited in Veiyataki, 2010). Also, the construction of the causeway on Tarawa, Kiribati, interfered with the natural flow of currents and is blamed for the disappearance of Bikenman, an islet opposite the causeway (Veiyataki, 2010). Further, pit latrines septic tanks in atolls, especially in built-up areas, perform less effectively than in other places because effluent drainage lines are short due to the small allotment sizes and the porous soil. With high water table, the nutrient-rich waste quickly enters the groundwater causing supplies to be contaminated (Resture, 2006 cited in Veiyataki, 2010). Infrastructural developments have also restricted people’s ability to harvest marine flora and fauna. A consequence is that the vulnerability of communities is enhanced because of the loss of their livelihood resources (Kenny, 2012; McNamara, 2013).

1.3 Considering the ‘resilience’ of island societies

The term ‘resilience’ entered the climate change literature in the early 2000s and has become the latest catchphrase in global, regional and national climate change adaptation strategies including policies of island countries. The concept emerged in ecological studies in the 1970s (Holling, 1973; Holling, 1986; Holling *et al.*, 1998) and evolutionary and holistic understandings of resilience have since been advanced by studies exploring the adaptive capacity of societies (Torry, 1979), regional economies (Grabher, 1993; Grabher and Stark,

1997; Gonzalez, 2006; McGlade *et al.*, 2006; Jackson, 2009; Bristow, 2010; Pike *et al.*, 2010 and Simmie and Martin, 2010) and social ecological systems (Berkes and Folke, 1998; Westley 2002; Gunderson and Holling, 2002; Berkes, *et al.*, 2003; Holling, 2005 and Folke, 2006). In the latter disciplines, theoretical understandings of the concept have shifted from views of resilience based on the achievement of stability or a state of ‘equilibrium’³ (O’Neill *et al.*, 1986; Pimm, 1991; Tilman and Downing, 1994), towards explorations of the dynamic, ‘non-equilibrium’ nature of systems and their capacity to endure change. The concept non-equilibrium means an unstable condition or state and refers to the highly dynamic, unpredictable and complex nature of systems. The notion of non-equilibrium resilience is also reiterated in psychological studies of resilient individuals that ‘thrive’ under adversity (Waller, 2001; Mahoney and Bergman, 2002; Kidd and Shahar, 2008; McElheran, 2011).

This theoretical shift towards appreciating the ‘non-equilibrium’ nature of systems has been slow to occur in the literature which discusses the resilience of islands and continues therefore to limit discussions and explorations of how island societies could endure the likely impacts of climate change. A few studies (Fletcher *et al.*, 2013; Mcmillen *et al.*, 2014) have emerged over the few years which identify the role resilience plays in islands.

Despite this, on the whole, indicators and methods used to assess the resilience of islands are still largely influenced by Western science and neo-classical economics. Briguglio and colleagues (2006; 2009; 2010) proposed a ‘resilience index’⁴ to assess the adaptive capacity of island nations based on indicators of ‘macro-economic stability’ and ‘market flexibility’. In this way, the resilience of an island country is generally assessed by looking at price changes, government fiscal deficit and debt, balance of payments, unemployment rates and exchange rates. The study concluded that there was a strong correlation between GDP per capita and a country’s score or resilience index, and identifies countries with advanced economies registering high scores. This model is similar to the way Briguglio developed his vulnerability index in the 1990s, in which macro-economic indicators such as GDP were used to define and determine the vulnerability of islands to disasters. Recently, the main

⁴ The Mauritius Strategy (United Nations, 2005), paragraph, 81, called for the establishment of a task force to develop a ‘resilience index’, supported by the international community. Such an exercise was carried out by the Commonwealth Secretariat in collaboration with the Islands and Small States Institute of the University of Malta, culminating with the publication of Briguglio, *et al.*, 2006.

components of the resilience index had been revised and included political governance and institutions, social development and environmental management (Briguglio, 2014). Quantitative methods and macro-economic indicators remain a large part of determining these components.

1.4 Research proposition, research questions and strategy

The lack of information regarding the resilience of island societies in the context of climate change helps motivate the general aim of this study which is to improve current understandings of ‘island adaptability and resilience’ in the case of Samoa. To achieve this objective, three key objectives were proposed and implemented. First, this study adapted the non-equilibrium definition of resilience, which has been developed in ecology, psychology and evolutionary economics, to assess the capacity of island communities to adapt to environmental changes, including climate-related changes. Instead of understanding resilience as the degree and timing within which a community can return to ‘stability’ or its pre-shock position after a disturbance, resilience is understood as the ability of the system to evolve with, and adapt to, changes that such events may cause. This definition is predicated on an understanding that the environment is not stable but highly dynamic (Holling, 1973; Holling, 1986; Holling *et al.*, 1998). This perspective is captured in the following quote by Eric Waddell who stated, (2015:329), “reality is not as simple or naïve...rather it is fluid, interacting and constantly evolving; it is openly inquisitive and essentially equivocal.” Researchers have argued that the development of approaches to assess the resilience of communities in general is still at an exploratory phase (Resilience Alliance, 2007; Wilson, 2012). Thus this study further seeks to contribute to the development of theoretically sound and locally relevant approaches which are validated by the residents of islands and which reflect the nature of communities that live there today.

Secondly, the study developed a conceptual framework to assess the resilience of island societies using a cultural ecology lens. Proponents of cultural ecology not only reposition humans into discussions of environmental changes but apply holistic ideas from ecology and systems theory to understand how humans adapt to their environments (Sauer, 1952; Steward, 1955; Boserup, 1965). Human geographers assert that by engaging with residents of places, one can develop an in-depth understanding of changes which places have experienced and are likely to experience. Husserl’s theory of ‘phenomenology’ [1859-1938] claimed that objects are ‘phenomena of consciousness’, otherwise humans would not recognize them and the

significance of an object lies in its meaning in the human experience (Scruton, 1995; Couper, 2015). ‘Being’ is key to understanding the relationship between people and the world, as human experience is itself an essential part of reality (Heidegger, 1953). Places are “...not only a fact to be explained in the broader frame of space, but... a reality to be clarified and understood from the perspectives of the people who have given it meaning” (Tuan, 1979: 387). Studies by Fletcher and associates (2013) as well as Mcmillen and colleagues (2014) argued the importance of indigenous and local knowledge (ILK) in understanding island resilience and adaptation. The latter group of Pacific academics highlight the critical need for research which interrogates the interrelated areas of local-scale expertise and observations of change with regard to weather, life-history cycles, and ecological processes, customary resource management institutions and practices, and the role of leaders, social institutions, and social networks in the context of disturbance and change. A cultural ecological approach is therefore a powerful way of developing a ‘bottom- up’ understanding of islands, the majority of which are not simply physical spaces but have been ‘lived-in’ places for more than a millennium.

Thirdly, the study identified human derived indicators to assess the resilience of islands. Departing from previous efforts to determine the resilience of island societies using macro-economic indicators, the study’s assessment considered human perceptions and understandings of historical, current and future environmental changes at the local village community level as well as key human survival strategies. In addition, it considered social networks as a ‘binding factor’ bringing other diverse strategies, such as diversification, mobility, mental and spiritual strength, into context.

1.4.1 Research questions

The proposition for this study is:

“Islanders have for centuries had to cope with difficult and unpredictable environments and they have developed a range of coping strategies to strengthen sustainability. Thus, they would be prepared to deal with current and future climate change.”

Two interrelated questions were used to address this proposition;

1. What changes, associated with climate change, do islanders think are currently taking place and which of them are likely to occur in the future?

2. How have islanders coped with previous disturbances including those which are climate-related? What strategies are they currently employing? And, what do islanders want and need to cope with future global warming?

As indicated by these research questions, the study sought to deepen understanding of the resilience of an island society by assessing islanders' knowledge and awareness of climate related changes. Moreover, the study examined survival strategies devised by island residents, at the individual, family and community levels to reduce, avoid and mitigate current and future climate related risks, and to maximize associated opportunities.

1.4.2 Research strategy

As the research dealt with human subjects and related issues, an interpretivist research design was used to develop the research questions and methodology. Qualitative methodologies and interpretive frameworks that capture the world as 'we live it' rather than as 'we abstractly theorize them', are more suitable ways of understanding and appreciating human experiences (Relph, 1981; Tuan, 1991; Allen- Collinson 2011). Qualitative methods such as interviews and focus group discussions were used to gather the research information. Interpretivist processes such as primary and secondary coding were used to create tools to evaluate the research findings and elucidate the resilience of selected island societies from a non-equilibrium perspective. Specifically, secondary coding which involved the combination of content analysis, deconstructing verbal and non-verbal meanings and comparative analysis helped produce templates that can be used to evaluate and present human perceptions of current and future climate-related changes but related survival strategies.

1.5 A glimpse of the field area

The study examines a selection of village case studies from Samoa, a tropical high island country in the Pacific Ocean which was selected simply because it is a collection of islands, undergoing changes similar to many other tropical islands. Samoa has been exposed to the combined effect of tectonic processes, climate change, colonization and globalization and, like many islands, faces the challenge of climate change. Most of the country's infrastructure, population and development work are located near the coast, and its people face similar environmental risks which many other tropical islands experience.

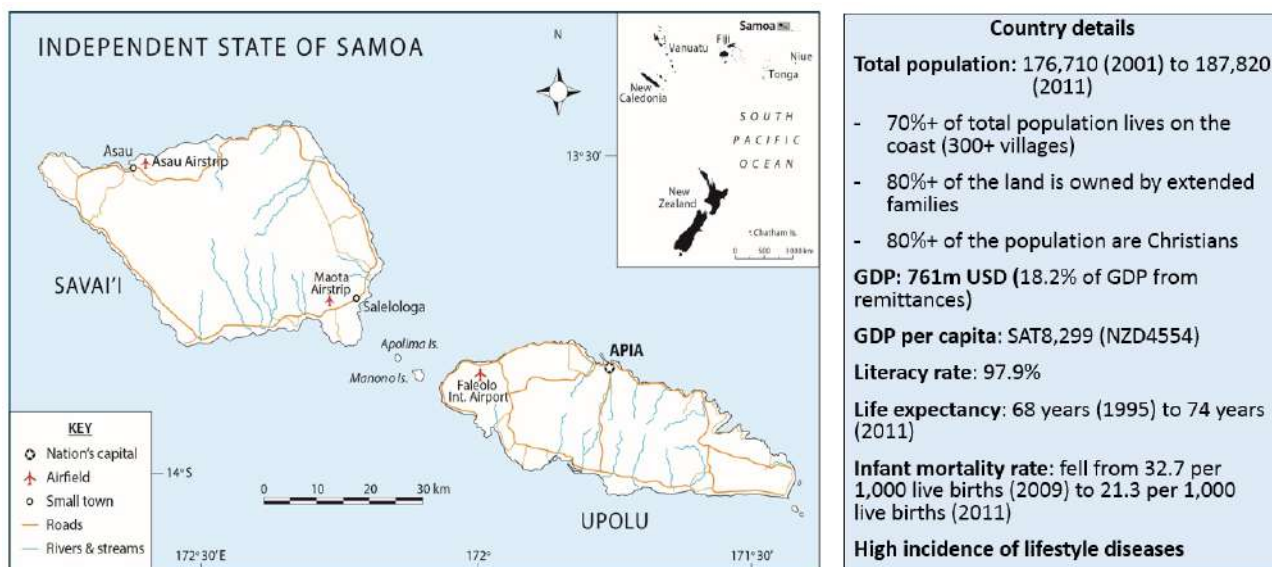


Figure 1.1: Map of the Samoa islands and development indicators (Source: after Nations Online Project, 1998 and Samoa Bureau of Statistics, 2011).

The latest census in 2011 indicated that the population of Samoa increased from 176,710 in 2001 to 187,820 (Samoa Bureau of Statistics, 2011), with more than 70% living in 330 villages along the coasts of the two main islands, Upolu and Savaii (Government of Samoa, 2013). The current discussion of climate change in Samoa is predominantly from a national perspective, dominated by the views of government officers, consultancy firms and civil society workers. Romilly and colleagues (2013) stated that the current framework for climate change responses in Samoa enables the inclusion of local communities particularly in the design of district and village response plans such as Coastal Infrastructural Management plans (CIM Plans), Disaster Management Plans and Community Livelihood Plans. A study by Fletcher (*et al.*, 2013), based on interviews with government workers and experts, stated that traditional coping strategies are consistently being applied as part of response to disasters and climate change in Samoa.

A gap in the literature is the lack of analysis of community resilience to environmental changes. Kenny (2012) suggests that the predominant focus of climate related activities in Samoa since the 1990s has been on vulnerability assessment, with an implicit assumption that identifying and addressing identified vulnerabilities will lead to increased resilience. A study of the village of Saoluafata concluded that this village's capacity to respond to climate change is probably insufficient. Aspects of the social network at Saoluafata such as the extended family and neighbours offering food and labour to those in need may no longer

support the family in future crises (Sutherland *et al.*, 2005). Romilly and colleagues (2013) mention that Samoan communities are saturated with government consultations. Lefale (2010) noted climate related knowledge of Samoans in his work.

Key aspects of Samoan society which are crucial to the assessment of its resilience, and therefore considered in this study include *faamatai* [chiefly system] and the communal nature of resource ownership which is still prevalent today. More than 80% of Samoa's land is still collectively owned (Ministry of Natural Resources and Environment (MNRE): Government of Samoa, 2013) and every Samoan has access to land, either through his or her mother's or father's side. Multiple rights and ownership claims to land based on chiefly titles and kinship connections is a check against individual ownership and control over this very important resource (Tauaa, 2014) although some foreign institutions (International Monetary Fund (IMF), 2012) have perceived this as an obstacle to productive and efficient land use development.

Most *aiga* [families] live a semi-subsistent lifestyle, with some members employed in government ministries and private companies while others are engaged in agriculture, fishing and tourist-related activities. While the contribution of the agricultural sector to the national economy has shrunk from 17% in 1999 to less than 10% in 2010 (Samoa Bureau of Statistics, 2012), it still employs about two-thirds of the national labour force and remains an important source of food and household income (Government of Samoa, 2013). Samoa's farming systems are confined to a few root crops, notably taro, vegetables and fruits that are grown haphazardly on a small scale, plus coconuts and cocoa. Livestock plays an important role, not only commercially, but also for special occasions. 46% of households raise backyard poultry and pigs, and 20% own cattle (Samoa Bureau of Statistics, 2012). Tourism provides direct employment for over 5400 people, which represents approximately 10% of the total workforce. There are over 60 small-scale private and community owned tourist businesses in the country, which provide employment and income generating activities in the areas of transport, communications, agriculture, fisheries, handicrafts, cultural performance, infrastructure, construction and manufacturing (United Nations Development Programme (UNDP) and Global Environment Facility (GEF), 2013). For rural communities, tourism has provided valuable job opportunities, especially for young people, encouraging them to stay in their home communities. Tourism businesses such as beach *fale* (houses) have transformed the shorelines of many parts of Upolu and Savaii.

In the 2011 census, 41% of the working age population were classified as ‘economically active’. An 11% increase from the 2006 census meant more people are in schools or have moved out of the formal labour force and engage in non-economically active activities such as domestic duties. Among the economically active population in 2011- 49% were employed in government ministries and private companies, 34% produced goods and services for subsistence purposes, 8% were self-employed, 6% unemployed, 2% were manufacturing goods for sale and 0.1% were street vendors. The literacy rate for persons between 15-24 years is 97.9, with females being slightly more literate than males. Life expectancy at birth increased from 68 years in 1995 to 74.2 years in 2011. The infant mortality rate fell from 32.7 per 1000 live births in 1995 to 21.3 in 2009 to 15.6 per 1000 live births in 2011 (Samoa Bureau of Statistics, 2011). GDP per capita is SAT8,299 (USD2,714). About 18.2% of GDP is from remittances (2000-2011 average) (Ministry of Finance (MOF), 2012). There is a high incidence of lifestyle diseases among Samoans such as obesity, diabetes and hypertension.

1.6 Structure of the thesis

This thesis contains eight chapters linked by the theme of how islanders’ exposure to previous extreme events, including climate change, might have helped develop a preparedness to cope with future climate change (see Figure 1.2). The thesis begins with this chapter discussing critiques of the climate change literature on islands, mainly rooted in cultural and political ecology and evolutionary economics, which has not only offered insights into the scarcity of information on the resilience of island societies, but why this had occurred. Most studies and policy documents in the context of climate change and islands use Western scientific and neo-classical methods and indicators which generalize islands and islanders as being ‘vulnerable’. A major implication of viewing islands as vulnerable had been the development of externally derived strategies which, in some cases, have compromised the livelihoods of those living on islands. Thus there is a need for a shift towards more nuanced studies that are contextual and demonstrate the dynamic nature of islands.

In Chapter Two, the discussion turns to ‘non-equilibrist’ notions of resilience developed in ecology, psychology and evolutionary economics to develop a theoretical grounding for the argument that island societies are resilient because they occupy challenging environments. This chapter also discusses ways in which the resilience of islands would be assessed by

drawing on relevant indicators and approaches developed in cultural ecological and economic studies of islands. To add weight to the thesis argument, the final section of Chapter Two uses indicators identified in the literature to explore, at a general level, evidence of climate change adaptability in two atoll nations, Kiribati and the Maldives.

Chapter Three provides information on Samoa, where the fieldwork for this study was undertaken. The chapter seeks to portray Samoa as a highly dynamic place by discussing historical changes that have occurred to its physical and human environment. The final part of this chapter discusses crucial elements of Samoan society today which have been incorporated into both the research approach and the study's analytical framework.

The purpose of Chapter Four is to clarify my positionality and discuss the methodologies which were designed to meet both the ethical requirements of Samoan society, where the study is based, and the University of Otago Ethics Committee. The approach was largely qualitative and the research design was interpretive. Using the Samoan language and cultural protocols were a crucial part of gathering information, whilst data analysis and interpretation involved methods developed in other places.

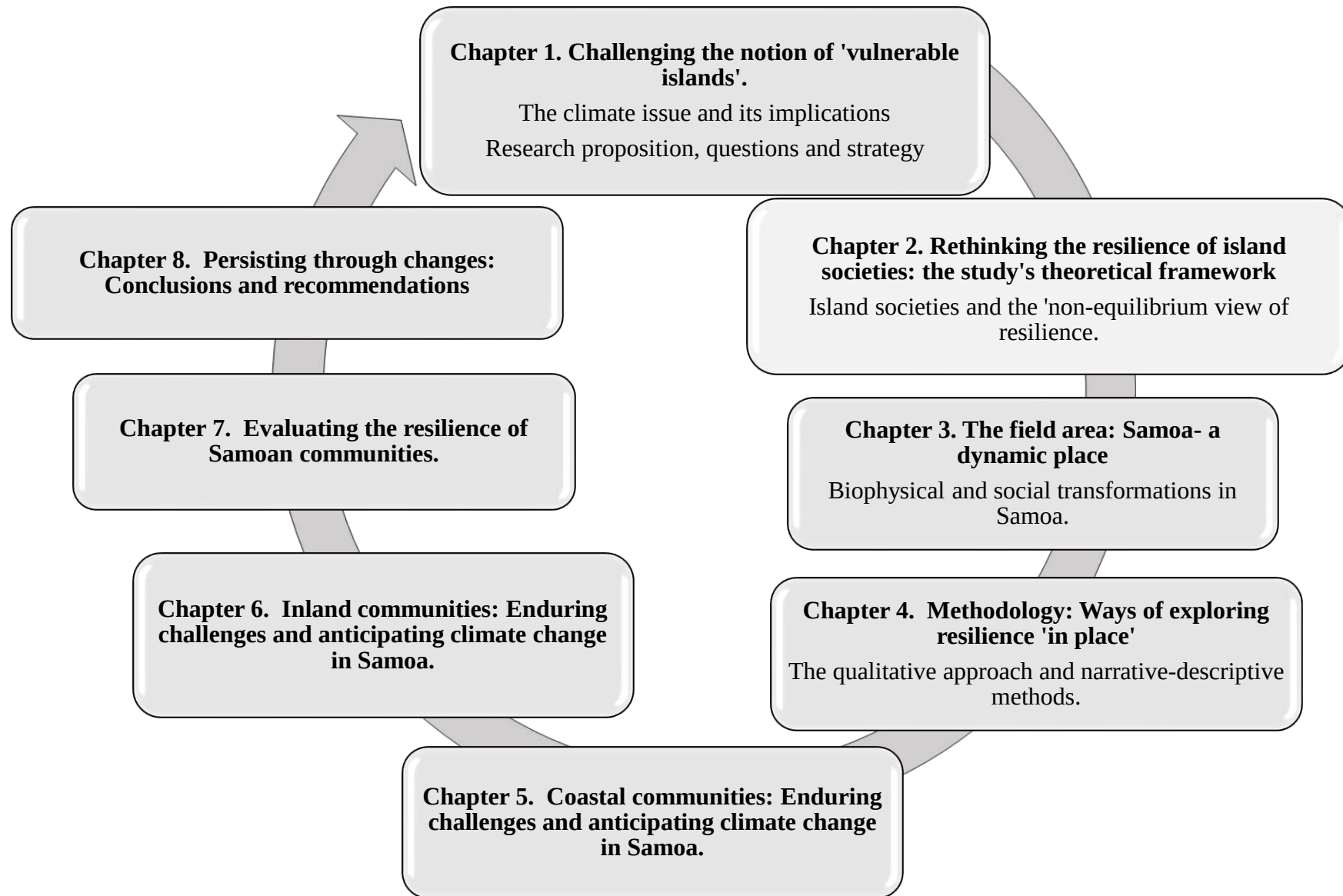
The next two chapters present the findings of the research. Chapter Five explains the results from the four coastal communities that were surveyed, while Chapter Six presents the findings from the inland villages. The results were split into these two chapters in order to allow comparisons to be made at the end of these chapters, after each village case study has been detailed. In both chapters, the findings are organized and presented as case studies where the comments of surveyed participants, maps and photographs enable a culturally situated analysis of their resilience. Each case study explains the physical and human environment and historical changes which the village has endured and residents' perceptions of current and future climate change and related impacts. It then discusses each village's crises management system based on *faamatai* [chiefly system] and plans in anticipation of future climate change. The final part of each chapter presents comparisons evident across the case studies. Grouping the findings under the sections coastal and inland communities proved useful because it made it easier to determine similarities and differences within each chapter as well as across the two results chapters.

Chapter 7 combines the key findings from the results chapters and discusses these in the light of research questions and relevant literature. First, it examines participants' perceptions of climate change across the eight surveyed sites. Second, the chapter discusses resilient behaviour by referring to current coping strategies developed in the study villages and their relevance to enduring future climate change. The last part of this chapter identifies best practices as well as indicates activities and aspects of the system that could ensure the sustainability of the surveyed communities.

Chapter 8 concludes the thesis by revisiting the main argument and the study's methodology. The chapter also outlines the key findings and recommendations for the wider community, government and relevant external agencies. Additionally it explains the contribution of this study theoretically and in terms of its methodological approach. The chapter ends with reflections on the challenges and limitations of the study and possibilities for future research.

The following chapter discusses reviews the main bodies of literature which have informed this study.

Figure 1.2: Structure of the thesis



Chapter Two. Rethinking the resilience of island societies- the study's theoretical framework

2.1 Introduction

As indicated in Chapter One, there is an urgent need for studies to be undertaken in the context of climate change to examine the capacity of island societies to survive future climate change using theoretically sound and relevant definitions, indicators and approaches. The purpose of this chapter is to explain the study's theoretical framework and the indicators that are used to examine the resilience of islands. The first section of this chapter discusses how an equilibrium view of resilience does not adequately capture the resilience of places because it fails to recognize the dynamic nature of the environment.

The chapter also discusses the non-equilibrium view of resilience which informed this study's conceptualization of the resilience of island societies. The 'non-equilibrium' perspective of resilience captures the dynamic nature of individuals and systems, because it shifts one's focus towards exploring how individuals and systems change and adapt over time. This view of resilience recognizes and examines the buffering capacities of systems particularly structures and processes that are inherent within systems which help them endure disturbances. More importantly, the non-equilibrium view of resilience considers the role of disturbances in effecting transformations crucial to the persistence of systems.

The third part of the chapter discusses the theoretical framework for the study. Specifically this section explains how the non-equilibrium view of resilience and a cultural ecological interpretivist research approach could enable a more adequate portrayal of the resilience of islands. It also outlines the indicators of resilient individuals and systems that will be considered in this study's assessment of resilience and how multiple and multi-level connections are a binding factor bringing all of these indicators into context.

Cultural ecological studies, based in the African Sahel, Arctic and the Pacific and Caribbean oceanic regions are used in this section to give weight to this thesis' argument that those living in challenging conditions are highly adaptable. These studies also contributed to the development of the study's research approach and strategy. The chapter ends with a general examination of how atoll nations, such as Kiribati and Maldives have responded to previous

environmental challenges and how these responses were crucial to the development of strategies to cope with future climate change.

2.2 The concept resilience

2.2.1 Equilibrism notions of resilience

Two theoretical views underpin the meaning of resilience. The equilibrium view that prevailed up until the 1970s defines a resilient system by its ability to maintain a pre-existing state, typically assumed to be an equilibrium state, after a disturbance by applying self-correcting forces and adjustments (O'Neill *et al.*, 1986; Tilman and Downing, 1994). Pimm (1991: 13) defines the term as "...how fast a variable that has been displaced from equilibrium returns to it". This definition implied that the more rapidly the system returns to equilibrium, the more resilient it is. It also implies that the more resilient a system is, the less it would change over time even in the face of various shocks (Simmie and Martin, 2010).

The equilibrium view of resilience has been largely criticised as it is based on a neo-classical view of economics based on the achievement of stability and the maintenance of sustained and increasing yields. According to Ludwig and colleagues (1997 cited in Folke, 2006), the equilibrium view of resilience applies only to behaviour of a linear system, or behaviour of a non-linear system in the immediate vicinity of a stable equilibrium where a linear approximation is valid. The equilibrium view focuses on maintaining efficiency of function, constancy of the system, and a predictable world near a single steady state. It is about resisting disturbance and change, to conserve what you have. It is argued that such a view is based on a very unrealistic understanding of the world and its evolving nature (Holling, 1973; Folke, 2006).

Management approaches which are related to the equilibrium view have been described as command and control strategies that are mostly characterized by piecemeal efforts and short term successes. Such strategies aim at controlling the variability of a target resource, for example, controlling certain activities that might lead to declining fish populations or a coral bleaching event. Stability or the return to equilibrium is often described as recovery, where in the case of the latter systems, increasing fish populations or a coral dominated system. Such a view has been criticized as inadequate because controlling one variable of a system, which often fluctuates, leads to changes in variables that operate at temporal and spatial scales, like nutrients or food web dynamics (Folke, 2006). While systems may look similar

to their previous states, they are not the same systems, because they are continuously developing over time. There is so much uncertainty in our understanding of the environment that a simple prediction is always highly suspect and fixing one aspect of a system may trigger a change in another that may lead to the weakening of that particular system (Holling, 1986; Constanza and Folke, 1996). Therefore, such management creates landscapes that become spatially homogenized and vulnerable to disturbances that previously could be absorbed (Holling and Meffe, 1996; Gunderson *et al.*, 1995; Holling *et al.*, 1998).

2.2.2 ‘Non-equilibrium’ perspectives of resilience

The ‘non-equilibrium’ view of resilience emerged in the 1970s and has since refuted the equilibrist notion that systems return to a pre-existing state after experiencing changes or a disturbing event. From this perspective, resilience is seen as the ability of the system to evolve and adapt with changes including those events which may be regarded as disturbances.

A. Evolutionary and complex nature of systems

The non-equilibrium view of resilience emphasizes the evolutionary and complex nature of systems and the important role of ‘disturbances’ in developing the capacity of the system to absorb disturbances and still persist. Through his study of ecological systems Holling (1973; 1986; 1996; 2005; Holling *et al.*, 1998) established that systems are affected by random events and are therefore inherently highly unstable. He recognized the unpredictable and sometimes chaotic nature of the environment where it is difficult to determine the exact course and direction of change. This idea has been repeated in subsequent studies of resilience for example, Grabher and Stark (1997: 535) stated, “...evolution does not proceed along a single grand avenue toward perfection but along multiple paths which do not all lead to optimal change”.

The timing, nature, rate and duration of a disturbance determine the kind of change that occurs. The concept ‘regime shifts’ refers to how systems ‘change’ and how these changes could either be fast or slow, small or big depending on the nature of events the system has been exposed to (Carpenter, 2003; Scheffer *et al.*, 2001; Holling, 2005). Pendall and colleagues (2007) describe dramatic changes as periods of ‘shocks’ and gradual events as ‘slow-burns’. Shocks can be hurricanes or fires, and slow burns include deindustrialization, urban sprawl and sea level rise. Through the process of ‘panarchy’ (see Box 2.1 and Figure

2.1), Holling and colleagues have tried to illustrate how sharp and gradual changes could occur simultaneously on multiple spatial and temporal scales and across scales. For example, a successful innovation that occurs at smaller spatial scales may lead to changes across larger scales, and vice versa (Gunderson and Holling, 2002; Holling, 2005).

Box 2.1: Panarchy

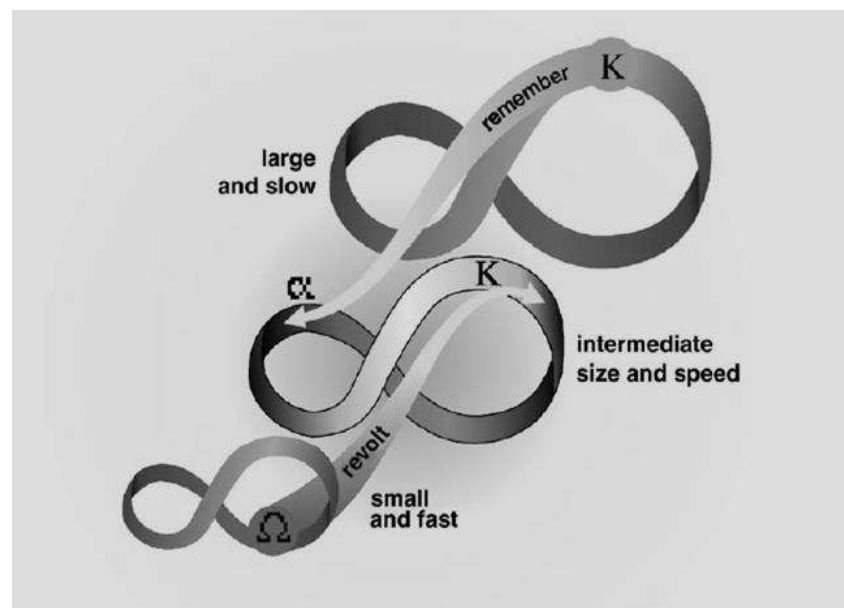


Figure 2.1: Adaptive cycle of development (Source: Gunderson and Holling, 2002).

Panarchy aims “...to capture the way living systems persist and yet innovate... (Holling, 2005: 1). As Figure 2.1 illustrates “...fast and slow, small and big events and processes can transform ecosystems and organisms through evolution, or can transform humans and their societies through learning or the chance for learning (ibid).” Change could advance through ‘forward-loop stages’ characterized by innovation, growth, exploitation, consolidation, predictability and conservation and followed by ‘back-loop’ phases of instability, release, collapse, experimentation, novel recombination and reorganization. At that point, the cycle begins anew, moving once again through the forward loop, albeit beginning from a new starting point. Benefits need not, and generally do not stay in the place where they were created but instead flourish elsewhere. Thus successful local scale innovations might create new opportunities that are absorbed into larger forward-loop learning processes, and become diffused across larger spatial and temporal scales. By the same token, collapse at small scales might contribute to cascades of destabilization and collapse across larger scales. The ability for renewal will strongly depend on the influences from states and dynamics at scales above and below and across time as well (Gunderson and Holling, 2002; Holling, 2005; Folke, 2006).

B. Buffering capacities of systems and indicators of their resilience

Studies using the non-equilibrium view of resilience also emphasize the ‘buffering capacities’ of systems. The concept ‘buffering capacity’ refers to structures and processes, inherent within systems, which enable them to absorb disturbances and still persist (Folke, 2006). The buffering capacities of ecological systems, regional economies and individuals have been

explored in some detail, from a non-equilibrium view, but the discussion of the resilience of human societies in particular places, such as islands, is very limited. For example, connections, networks, relationships or bonds have been described as crucial to the resilience of these systems. Holling (1973) observed that the persistence of relationships and interactions is significant for the resilience of ecological systems. Similarly, a healthy or supporting economy of family, neighbourhood, community and civil society, strong in reciprocity, co-operation, sharing and collaboration in the delivery of essential services, is seen as crucial in studies of regional economies (Grabher and Stark, 1997; Jackson, 2009; Pike *et al.*, 2010) and socio-ecological systems (Berkes and Folke, 1998; Gunderson and Holling, 2002; Berkes *et al.*, 2003; Folke, 2006; Walker *et al.*, 2004). Also, psychological studies have noted how the ‘healing power’ of ‘social bonds’ have enabled many individuals to endure traumatic events (Waller, 2001; Mahoney and Bergman, 2002; Kidd and Shahar, 2008; McElheran, 2011).

Studies on ecosystem resilience stated biological diversity is also essential in the self-organizing ability of systems, both in terms of absorbing disturbance and in regenerating and re-organizing the system following disturbance (Holling, 1973; Folke, 2006). Similarly, diversity and variety has been noted a key buffering factor in studies of regional economies (Grabher and Stark, 1997; Simmie and Martin, 2010; Pike *et al.*, 2010).

Memory, intelligence and flexibility have also been identified in many studies as necessary to the resilience of systems. An integral feature of resilient systems is the ability to learn from previous experiences, and reorganize to meet changed conditions (Barnett, 2001). Memory which refers to the accumulated experience and history of the system provides context and sources for renewal, recombination, innovation, novelty and self organization, following disturbance (Holling, 2001; Barnett, 2001; Holling, 2005; Folke, 2006). Memory is significant to constructing and nurturing adaptive capacity in place, because there is some degree of continuity in the ability of institutions or systems in particular places to interpret and make sense of potentially disruptive forces. The latter is preferable to any simple reactive and/or ‘off-the-shelf’ response (Pike, 2002). Flexible skills and reflexive learning mechanisms have been identified as crucial aspects of this adaptive process (Gunderson, 2000; Adger, 2003; Folke *et al.*, 2003; Walker *et al.*, 2004; Amundsen, 2012; Maclean *et al.*, 2014). Another social attribute which has been identified as important to the development of resilient systems and individuals is intelligence. Gunderson (2000) stated humans are unique

because they are able to create novel approaches to change that can affect the future of the system. Some clever individuals have identified ways to persist within existing structures or have found ways to preserve existing institutions in the face of change. Attributes which are related to intelligence include heightened sensitivity and/or preparedness for rapid and pervasive changes where one would be required to identify appropriate points and moments for intervention (Pike, 2002; Pike *et al.*, 2010).

C. The role of disturbances to developing buffering capacities and effecting transformations

Exposure to changes or disturbances is seen here as crucial to developing resilience as it allows the system to ‘probe its boundaries’ and develop response mechanisms/ buffering capacity. Moreover, exposure to disturbances could enable transformation of the system or its parts. Echoing Holling’s ideas, Berkes and Folke (1998; Folke, 2006), in their studies of social-ecological systems, stated resilience concerns the opportunities that disturbances create in terms of the recombination of evolved structures and processes, renewal of the system and emergence of new trajectories. Here, instability and unpredictability can induce resilience or the capacity to persist. The adaptive and learning capacity of individuals, groups and institutions causes them to ‘self-organize’ in response to disturbances (Westley, 2002). In this sense, resilience provides adaptive capacity that allows for continuous development, like a dynamic adaptive interplay between sustaining and developing with change (Gunderson, 2002; Walker *et al.*, 2004; Folke, 2006).

The term ‘punctuated equilibrium’ in studies of regional economies refers to the role of ‘periodic shocks’ or instabilities in pushing a regional economy beyond its current limits (McGlade *et al.*, 2006; Simmie and Martin, 2010). Commonly cited examples include the reconfiguration of the coal and steel complex in the Ruhr, Germany, towards clean coal and environmental technologies (Grabher, 1993), the restructuring of traditional industries in the Basque Country of Northern Spain, and consumption-oriented urban regeneration in Bilbao (Gonzalez, 2006).

Psychological studies (Waller, 2001; Mahoney and Bergman, 2002; Kidd and Shahar, 2008; McElheran, 2011) have also revealed the importance of disturbance, struggle and pain in the development of a person’s character. “Adversity and hardship may provide motivation, knowledge, and wisdom needed for future success. Traumatic times can clarify and prioritize

what is most important in one's life and they can provide insight into the acquisition of life goals" (Mahoney and Bergman, 2002: 204). McElheran (20th April, 2011) said,

"I often describe the process of recovery as transformation, equivalent in many ways to the evolution of the caterpillar into butterfly, it is the struggle to re-emerge that is crucial in the process of transformation. Without the struggle, the new entity will not appear... often something more meaningful and potentially beautiful can be obtained if achieving it involves challenge and struggle".

2.3 The study's theoretical framework

2.3.1 Conceptualizing the resilience of islands from a 'non-equilibrium' view

Perspectives of resilience in ecology, evolutionary economics and psychology have provided useful insights that have informed understandings of resilience and provided the theoretical grounding for the research. As stated in Chapter 1, this study adapted the 'non-equilibrium' view of resilience in its assessment of island societies because it provides a more realistic depiction of the nature of systems as well as environmental changes. The non-equilibrium view recognizes the dynamic nature of systems and the importance of time and spatial scales in contextualizing such changes. Thus, in this study, island societies are treated as socio-ecological systems and their adaptability to climate change is assessed within the context of other current changes. Understanding the resilience of island communities, from a 'non-equilibrium' view requires the knowledge that climate is part of the environment which is continually evolving across space and over a time continuum. Climate events have always interacted in complex ways with other biophysical and human elements to change the character and appearance of the environment at various spatial scales and will continue to do so.

Furthermore, the non-equilibrium view also emphasizes the important role of experiencing disturbances in developing the buffering capacities of systems to endure future disturbances. Using the non-equilibrium view of resilience is therefore significant in the context of islands and climate change as it enables the researcher to think beyond the restrictions of a 'vulnerable islands lens' and explore how islands are taking advantage of opportunities created by environmental changes including climatic events. By recognizing that the impacts of climate change are heightened on islands, the scientific literature has established that islands are highly unstable and are therefore 'non-equilibrium' systems. The political ecology literature which spells out the various political, socio-economic challenges comes to a similar conclusion. Cultural ecological studies (as discussed in the next section) have

provided historical evidence and insights which prove that human societies living in extreme environments are highly dynamic, employing various survival strategies. Thus, it is reasonable to argue that island societies are therefore highly resilient, rather than vulnerable, because they are constantly exposed to various disturbances. According to Baldaccino and Bertram (2009: 144) “...small states are much more supple and flexible, since they are in principle expected to accommodate change practically all the time”. Even though some authorities have argued that the ‘crisis effect’ of past environmental changes on islands such as Rapa Nui in the Pacific Ocean (Easter Island) (Bahn and Flenley, 1992 cited in Barnett, 2001; Nunn, 2007) the majority of island communities have historically been able to adapt and survive into the current century. Compared to communities in Africa, those living on islands in the Indian and Pacific Oceans were found to have a comparatively high capacity to adapt to environmental changes, including to past climate-related events (Barnett and Campbell, 2010; Cinner *et al.*, 2012).

2.3.2 Cultural ecology: the significance of social indicators, the holistic approach and ‘place’ in assessing the resilience of islands.

A. Human adaptability and related indicators

The investigation used a cultural ecological lens and an interpretivist research design which considered the resilience of islands an element of an interconnected and evolutionary system of physical and social processes operating at a specific locale. The cultural ecological approach was used because of several important reasons. First, cultural ecology repositions humans into studies of the environment. Here, investigations of resilience emphasize social rather than physical indicators of resilience. This study’s indicators of resilience are discussed later in this section. Secondly, this approach recognizes the adaptability of human societies. The notion that ‘humans have the capacity to adapt’⁵ and survive environmental changes is used to challenge the deterministic and hazards- based nature of Western science

⁵ The cultural ecological approach emerged out of anthropology and has since applied ideas from ecology and systems theory to understand how humans adapt to their environment. In this perspective humans are as much a part of the ecology as any other organism. Steward (1955), an anthropologist, envisioned cultural ecology as a methodology for understanding how humans adapt to their environments. Carl Sauer (1952) examined how beliefs and institutions in a culture regulated its interchanges with the natural ecology that surrounded it and raised the importance of addressing historical changes. Ester Boserup (1965) similarly argues the ability of cultures to survive and adapt through technology and culture. Sauer’s school was criticized for being unscientific and later for holding a reified conception of culture. Since then many others such as Karl Butzer and David Stoddard have also contributed to the field (Couper, 2015).

and the related notion of vulnerability of traditional societies which underpins the literature on climate change and islands.

B. Holistic and place based methods

In addition, the cultural ecological approach was employed because it asserts the importance of holistic and place based methodologies to exploring how human societies adapt. Cultural ecological studies (discussed next) assert that it is the interconnectivity or the combined role of structures and processes which buffer societies from disturbances and which have ensured their survival. The role of 'place' is equally significant in this study because it provides context which is crucial to understanding the adaptability of societies. Humanistic geographers in particular, have argued place as a unique entity because it is imbued with meaning constructed by human experiences. To understand a place, one must consider and appropriately evaluate such meanings (Heiddeger, 1953; Tuan, 1979; Relph, 1981; Tuan, 1991). Scholars such as Tuan (1979; 1991) emphasize the inclusion of speech and the written word in our study of places. For instance, narratives and related ways of interpreting meanings are crucial to the gathering and presentation of human-derived information. Humanistic approaches and interpretative methods (discussed in Chapter 4) are therefore used in this study as they are crucial to developing a deeper understanding of places.

A number of researchers have demonstrated the significance of using a holistic approach as well as localised knowledge and concepts in providing an in-depth understanding of how human societies living in harsh environmental conditions adapt. Studies of communities such as those in Africa and Arctic regions have indicated how managing the environment, flexible skills and learning mechanisms, social networks and diversifying livelihoods have enabled traditional communities to adapt under harsh environmental conditions, including climate related events. "Negotiating the rain, managing biodiversity, integrating animals, working land harder and diversifying livelihoods" are key adaptive strategies to endure drought in many communities close to the Sahel desert in Africa (Mortimore, 1989; Mortimore and Adams, 2001). In Canada's Western Arctic, the Inuvialuit people of Sachs Harbour survive through diversification and being flexible in the way they hunt and acquire food during challenging times. Drawing on traditional knowledge these people survive by switching species to hunt, and adjusting the time, location and process of hunting. Social networks exist for sharing food and other resources (Berkes and Jolly, 2001; Berkes and Dudgeon, 2003).

Other scholars, mainly working in the Pacific region, have also claimed the importance of holistic methods and local concepts in providing a more realistic portrayal of island societies and how they survive. For example, the following studies describe how islanders survive through the combination of mobility, social networks and related capital. Codrington (1863: 8, cited in Campbell, 1990) in his study of islands in Vanuatu, noted that “it is the custom in the Banks Islands for men to have in other places single friends with whom they are connected by mutual good offices. Such a *pulsala* considers himself bound to provide food and lodging for his friend when he visits him, and will assist him in any way he needs it; and in return expects the same good treatment when occasion offers”. Keesing (1934: 30) made similar observations about Samoa, commenting:

“Prestige comes through the generous distribution, not the accumulation of wealth. The ceremonial life and such crises as birth, marriage and death provide many appropriate occasions for such distribution. This, however, takes the form of reciprocal exchanges, so that none need be the poorer...my chief gives me goods and entertainment today, knowing that when the appropriate occasion arises I will return him my wealth and service”.

Some of these works describe alternative understandings of scale as well as emphasize the ‘circulatory’ nature of human movements within and outside islands. In his study of the Enga’s response to frost in New Guinea, Waddell (1975) identified a sequence of responses which progressively occurred at three different levels of Enga society and spread over geographical space. Occupying the highlands of New Guinea, the Enga groups deal with frosts by planting food gardens on the bottom lands and in small forest clearings on the hill slopes. In times when frosts increased in severity, the Enga shifted to grow and find food in other places where they had established connections. The study showed the multi-level nature of Enga social connections. The Enga belong to and identify with a specific locale but are not limited by these physical boundaries.

Chapman and Prothero (1985; Chapman, 1985a) considered the constant interchange of Melanesian peoples between diverse places and different circumstances. It is evident that, irrespective of the length of time that an individual spends away in town or in other destinations, there is a continuing commitment to the natal community is manifested in the flow of letters, goods and gifts and the return flow of cash remittances. Absent individuals make frequent visits to fulfil their social obligations in family or kinship groups, and to participate in traditional or other ceremonies and festivals. Chapman (1985b) further noted that the ambiguity and volatility in people’s movement requires one to seriously consider

notions of ‘permanence’ and ‘impermanence’ as well as the meaning of home and its abandonment. Watson’s description of peoples’ movement in northern Tairora, New Guinea used the analogy of a “...moving sea of more or less rooted, or more or less rootless folk” (1985 cited in Chapman, 1985b: 430). He further stated,

“One could liken the settlements to sandbars in a slowly swirling pool of humanity. Each sandbar is frequently lapped by ripples and now and then washed by a wave that sweeps away some, occasionally all of the people who occupy it...Another wave meanwhile might wash up new people...” (Watson, 1985: 16).

Hauofa (1993) fervently reiterated these alternative views of scale, place and movement in his conceptualization of Pacific islands as ‘Oceania’, ‘a sea of islands’, where Pacific islanders traversed even the few large gaps that separated their island groups. From one island to another they sailed to trade and to marry, thereby expanding social networks for greater flows of wealth. Hauofa stated,

“Evidence of conglomerations of islands with their economies and cultures is readily available in the oral traditions of the islands concerned, and in blood ties that are retained today. The highest chiefs of Fiji, Samoa and Tonga, for example, still maintain kin connections that were forged centuries before Europeans entered the Pacific...(page 9). Fiji, Samoa, Tonga, Niue, Rotuma, Tokelau, Tuvalu, Futuna, and Uvea formed a large exchange community in which wealth and people with their skills and arts circulated endlessly...”(154).

In a similar way, Lilomaiaava-Doktor (2015) refers to the Samoan concept of *malaga* [journeyings] as the cultural imperative that connects the Samoan *aiga iinei* [family here] with *aiga i fafo* [family overseas]. She argues that the embodied and social nature of *malaga* cannot be presented as polar opposites, for they are mutually interdependent.

Many studies have noted this interplay of island social networks, mobility and capital and how it had sustained island societies over time and space. Island societies have expanded internationally with remittances from islander diasporas, such as Pacific communities in New Zealand, Australia and the United States, supporting economic life in the islands which have been particularly crucial to islands enduring natural disturbances such as cyclones and tsunamis (Bertram and Watters, 1985; Campbell, 1990; Fauolo, 1993; Hau'ofa, 1993; Campbell, 1998; Barnett, 2001; Bertram, 2006).

Agricultural diversity and various techniques for growing, storing and preserving food have been noted in many studies (Buck, 1930; Watters, 1958; Waddell, 1975; Campbell, 1990).

Agroforestry is a distinguishing characteristic of the earliest agriculture in the islands and is still an important component of contemporary atoll landscapes, even in the urbanized settings of houseyard and urban gardens (Thaman, 1990; 1995; East and Dawes, 2009; Thomas, 2002; Thomas, 2015). According to Thaman (1990: 3) “...all traditional agroforestry systems, from the highlands of Papua New Guinea to the smallest atoll countries, exhibited a high degree of interspecies diversity, incorporating a wide range of cultivated and protected indigenous and exotic species”. The diversity of plants serves multiple purposes to the islanders. It ensures that during tropical cyclones and other events, the likelihood that all species in one location would be heavily damaged would be reduced.

‘Occupational multiplicity’ is another aspect of diversification that has been observed amongst islanders. According to Baldaccino and Bertram (2009), longitudinal studies of islanders reveal individuals who respond to shifting opportunities in different stages of their lives. Studies of Caribbean economies (Comitas, 1963; Frucht, 1967, Bennell and Oxenham, 1983) revealed that islanders avoid rigid specialization. Instead they would pursue several occupations, either simultaneously or successively, and in a variety of places (Frucht, 1967; Trouillot, 1988). Such activities would often comprise both paid and unpaid labour, ‘petty commodity production’, subsistence fishing or farming and home working. “Individuals, households or business units strategically spread their risks, not in spite, but because of the small economy’s overall macro-dependence on one or a few, exogenous sources of income” (Baldaccino and Bertram, 2009: 145).

Other survival strategies include the capacity of islanders to ensure their safety through monitoring and anticipating, even predicting, changes in the weather through the behaviour of animals, plants and other physical elements of the environment (Lefale, 2010; Hetaraka, 2012). To ensure sustainability of resources, islanders have, for centuries, observed *tapu* [sacred places] which restrict the use of certain species of animals at certain times (Grimble, 1933; Zann, 1990; Johannes and Yeeting, 2000).

The arrival of Christianity in the region has seen the Church becoming entrenched in the social systems of most Pacific island communities. Therefore it is important to consider that faith and involvement in religious communities are an important coping strategy for many. Churches play an important role in community life and have been heavily involved in preparing communities for disasters in countries like Vanuatu and Samoa. For example,

through provision of mental and spiritual support to endure traumatizing experiences, the development of disaster evacuation plans, and providing shelter and emergency centres during cyclones and tsunamis (Fauolo, 1993; Fletcher *et al.*, 2013).

C. Indicators of resilience used in this study

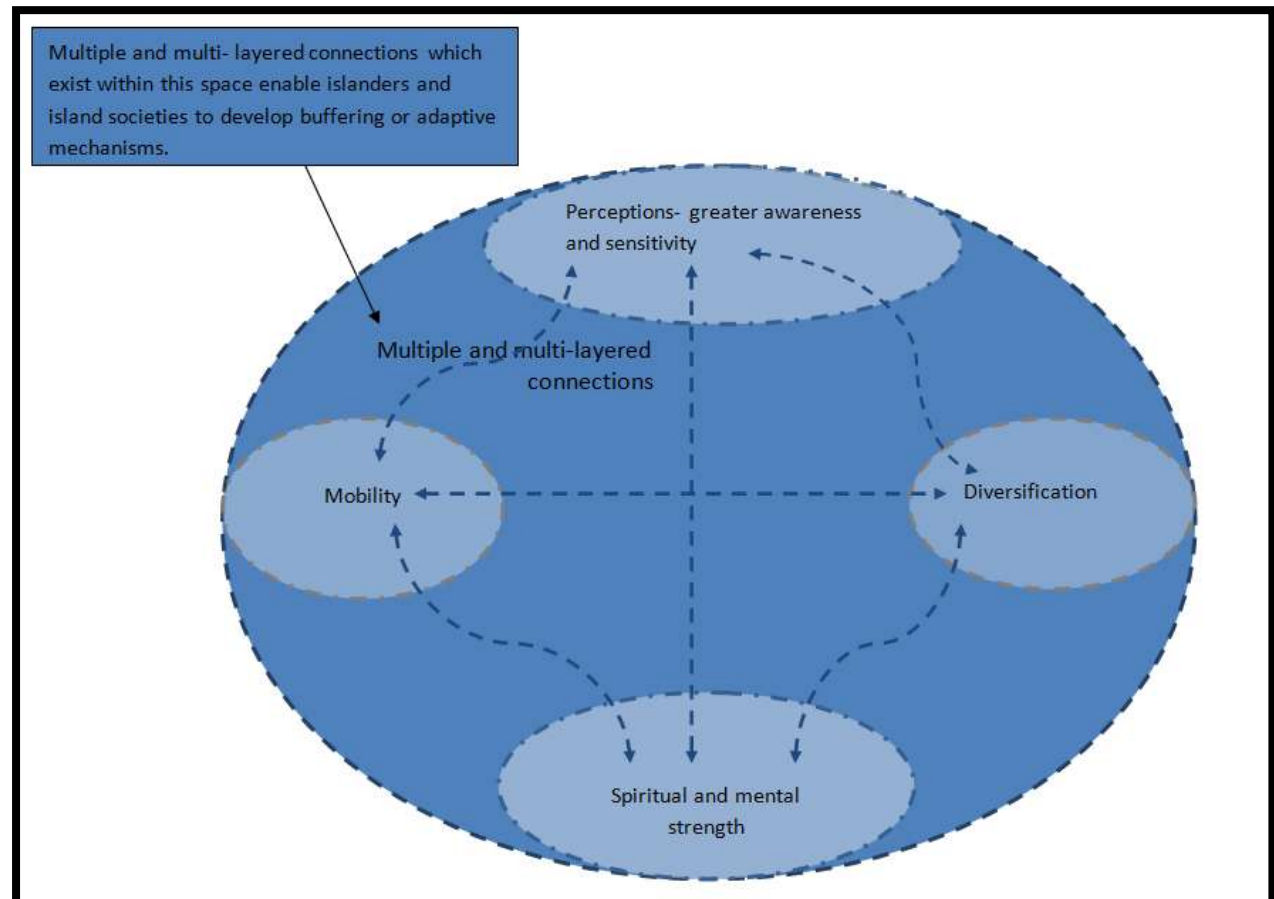


Figure 2.2: The indicators of island resilience used in this study and how they are conceptualized.

The five buffering processes or indicators of resilience, used in this study, derive from a re-interpretation of processes identified in resilience-based studies of ecological systems, regional economies, social- ecological systems and individuals as well as cultural ecological studies of particular places such as Africa, Arctic and the Pacific (discussed in the previous section). These are:

- greater awareness and sensitivity to changes
- mobility
- diversification
- multiple social and place-based connections and
- spiritual and mental strength.

As illustrated by Figure 2.2, these indicators are perceived as inter-connected rather than isolated from each other. More importantly the study argues the significance of connections as a binding factor bringing all other strategies into context. The conceptualization of islands and the indicators of island resilience is based on ideas proposed in the works of selected scholars such as Waddell (1975), Chapman and Prothero (1985), Watson (1985), Hauofa (1993), Comitas (1963), Frucht (1967), Bennell and Oxenham (1983), Baldaccino and Bertram (2009); McMillen (*et al.*, 2014); Lilomaiaava-Doktor (2015) and many others as discussed in the previous section. Locally derived understandings of space and scale employed in these works challenge the notion of ‘small and vulnerable islands’ and enables this investigation to show islands as ‘lived social spaces’, which are both dynamic and complex. Key ideas such as the multiple and multi-level nature of islander connections and related notions of ownership and access to resources (individual, family, extended family, village, nation) and the circulatory nature of human movements within and outside islands inform this study’s understanding of key concepts such as social connections, mobility, diversification. As evident in the previous section, a few studies have focused on islanders’ awareness and sensitivity (Lefale, 2010; Hetaraka, 2012) as well as spiritual and mental strength (Fauolo, 1993; Fletcher *et al.*, 2013) but these studies do not directly refer to these as indicators of island resilience and this investigation aims to explore the current and future significance of these aspects to island resilience.

2.4 Resilience of islanders to climate change: experiences on atolls

Low lying atolls are among the harshest environments in the world, yet the islanders have been engaged in a long-term process of adaptation over these centres, for more than 2,000 years, which evidently has provided some capacity to face up to the magnitude of present challenges. This section generally describes how I-Kiribati and the Maldivians have been responding to environmental challenges including climate-related impacts in recent years.

2.4.1 Kiribati

I-Kiribati⁶ settled and live on atolls⁷ in the Pacific that are of an average elevation above sea level of less than 3 metres. The three main island groups are the Gilbert Islands, Phoenix

⁶ I-Kiribati denotes people that belong to Kiribati.

Islands and Line Islands. The total land area is approximately 800km² (Thomas, 2009). The soils on the islands derive from coral materials and are shallow, highly alkaline and coarse-textured, so fertility mainly depends on organic matter and recycling of plant nutrients. Rainfall is variable and prolonged drought is common. There are no surface streams on these islands. Rainfall soaks through the porous surface soil creating a layer of often slightly brackish water floating on top of higher- density saltwater (Thaman, 1990; Thomas, 2009). Current climate projections for Kiribati include rising temperatures, annual and seasonal mean rainfall increases, greater intensity and frequency of extreme hot days, greater intensity and frequency of days of extreme rainfall, incidence of drought, sea level rise and ocean acidification (Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organization (ABM and CSIRO), 2011). In addition, there have been issues of overcrowding reported in Tarawa and lack of employment opportunities for the majority of the population that reside there (Kidd and Mackenzie, 2012). Economic measurements of poverty, which focus on paid employment and per capita income, have led to conclusions that 22% of I-Kiribati in 2014 were living in basic- needs poverty with Kiribati being ranked 121 out of 187 on the Human Development Index (Department of Foreign Affairs and Trade (DFAT), 2014).

People have survived in Kiribati despite the challenges they face. The number of I-Kiribati living on the islands has increased since the 1930s and has continued to grow in the past decade: 92,533 in 2005 (National Statistics Office: Ministry of Finance, 2007) and 103,058 in 2010 (National Statistics Office: Ministry of Finance, 2012). South Tarawa is the seat of government and the main commercial centre. This is also where the majority of the population lives. While South Tarawa is experiencing rapid population growth, many outer islands are witnessing population decline (Thomas, 2009). Many outer islands subsist and obtain cash through fishing, agriculture, cutting copra and making and selling crafts. Agricultural production was best in the Line Islands due to greater availability of land and the increasing number of settlers in recent years (Thomas and Tonganibeia, 2007). Many outer islands are well endowed with marine resources with estimated annual per capita fish consumption rates among the highest in the world (Gillett and Lightfoot, 2001).

⁷ Kiribati consists of 33 atolls and table reefs spread over an area of 3 million square kilometres (Thomas, 2009). Kiribati was colonized by the British in 1916 and later transferred to New Zealand in 1926. The islands became independent in 1971 (Connell, 2012).

Evidence shows a merging of traditional and modern ways of sustaining livelihoods. In the extended household network, the complementary roles of different members of households and broader family networks are vital for survival. In many families, one or two people may have formal employment, while other individuals undertake supplementary activities like informal income generation, contributing to unpaid chores or fishing and gathering for household consumption (DFAT, 2014).

The traditional social network of *kainga* [kin groups] and the cooperative systems of communal land ownership and *bubuti*⁸, the practice of asking for help, such as for materials and favours, have enabled most people to survive challenging times in the past. These forces are still prevalent today (DFAT, 2014; Kidd and Mackenzie, 2012). The communal land tenure system enables all members of the *kainga* to claim rights to land and to access resources in times of need (Alkire, 1978; Thomas, 2015). The majority of I-Kiribati also engage in village and church-related commitments and depend on these institutions for assistance in times of need (DFAT, 2014; Kidd and Mackenzie, 2012).

Social networks have also enabled diversification of food and water sources and related techniques. Up until the mid- 1900s, the usual way of accessing water is through the digging of wells or water is collected from coconut palm fronds and trunks, as well as empty giant clam shells. Coconut water and toddy (coconut sap) also provided additional nutrients (Thomas, 2015). But in the past century people have adapted modern materials to collect water. For example, many households now use concrete cisterns or empty oil drums, and have installed rainwater harvesting systems such as water tanks (see Figure 2.3). Various ways of ensuring a clean and adequate water supply are evident at the household level, such as boiling water, putting sugar in water, and cleaning and maintaining water harvesting systems. In some areas, alternative water sources have been developed by village communities in partnership with external agencies. In 2014, four new water tanks were built by Buariki community members to serve the Buariki and Tengata villages on the northwestern end of Tarawa. The tanks were provided by the University of the South Pacific in partnership with the European Union. Before the water tanks arrived, the villages had depended on water from two wells and rainwater was collected in drums (Cantieri, 2014).

⁸ Traditional affluence was discouraged and equality maintained through ostracism, shaming and sharing surplus wealth (Kuruppu, 2009). *Bubuti* system is the key to maintaining equality implicitly providing those in need with informal social protection- those with a surplus were required to share it with extended family members- non refusable request (Kidd and Mackenzie, 2012).



Figure 2.3: Different parts of an I-Kiribati household water harvesting system (GWP Consultants Limited, 2011).

I-Kiribati have evolved and diversified both their food crops and their methods of crop cultivation under the harsh conditions. What exists today is the combination of older and more recently introduced crops and related planting techniques. Agroforestry, which is a distinguishing characteristic of the earliest agriculture in the Pacific islands, is still a prominent feature of the Kiribati landscape, even in urbanized settings. Over the past centuries, introduced food plants such as the staple giant swamp taro or babai *Cyrtosperma chamissonis* and pandanus or te kaina *Pandanus tectorius* breadfruit or te mai *Artocarpus altilis*, and the native fig or te bero (*Ficus tinctoria*) have been incorporated into a matrix dominated by the coconut palm *Cocos nucifera* (Thaman, 1990). I-Kiribati have also selected and improved a variety of tree and root crops, as exemplified by nearly 200 different cultivars of pandanus and over 20 varieties of swamp taro, differing in quality and age at maturity (Luomala, 1974; Ali and Asghar, 1987; Thaman, 1990). Fruit trees such as papaya, banana and lime are also commonly found (Thaman, 1990).

Despite accelerated urban growth rates in South Tarawa, food producing trees have remained a prominent component of the urban landscape in many homegardens. Traditional food trees

such as coconuts, papaya, breadfruit, pandanus and the native fig still exist in many densely populated areas. ‘True taro’, which is grown mainly for its corms or leaves, is commonly found planted in wet conditions along drains, near water taps or washing areas. Perfumed plants are also important for flower headbands and garlands, which are widely sold to people to wear at work, or for dances at local hotels and other festivities (Thaman, 1995). In the mid-1980s, other fruits and vegetables developed by the Agricultural Division within the Ministry of Natural Resources Development (MNRD), in cooperation with the Foundation for the Peoples of the South Pacific (FSP), were added to the mix of plants found in homegardens (Peduzzi, 1999). Vegetables such as the Chinese cabbage have taken on a new level of cultural importance in place of more traditional foods such as *babai* in urban areas. The difficulty of planting *babai* has meant that plates of fresh vegetables at celebratory events are increasingly accepted as a sign of wealth and social status (Kunzel, 1996). A study by East and Dawes (2009) showed that homegardening is increasing significantly, largely due to the promotion of homegardens and organic composting systems by donor organizations.

I-Kiribati have developed multiple techniques of planting and compost enabling the growth of their food crops on shallow and highly alkaline soils. An older method of planting consisted of pits excavated down to the brackish water lens for the cultivation of the giant swamp taro te babai (*Cyrtosperma chamissonis*). This is still seen in inland and wetter parts of islands where the water lens is thicker (Thomas, 2015). However, the pits must be excavated through as much as 1.5m of hard conglomerate and limestone to reach the freshwater lens. Baskets of pandanus or coconut leaves are commonly made, into which the shoot is planted, or in which the fertilizer or mulch are administered to the plants in the pit. The young shoots in the bottom of the pit are planted in holes about 0.3m deep and mulched and fertilized with black topsoil from stands of *Guettarda speciose*, *Scaevola sericea*, and other plants and a variety of leaves, some of which are specially prepared for the purpose, using traditional techniques. Leaves used for fertilization and mulching in order of importance are; te kaura *Sida fallax*, te uri *Guettarda speciose*, te ren *Tournefortia argentea*, te mai or breadfruit *Artocarpus spp*, te wao *Boerhavia repens* and, to a lesser extent, species such as te kaura ni Banaba *Wollastonia biflora*, te kanawa *Cordia subcordata*, te kiaou *Triumfetta procumbens* and te kiaiai or te rao *Hibiscus tiliaceus*. These leaves, with the exception of *Sida fallax*, are mixed with other plant waste, particularly old pandanus leaves and coconut refuse, black topsoil, and occasionally ground pumice *te uuan*, and applied green or dried to the basket surrounding the plant or placed in the pit near the plant. Te kaura

leaves are rarely placed in the pit before drying, as their fermentation produces heat which can either kill or harm te babai. The leaves are generally dried in the sun on mats and then taken to the pit in baskets, commonly mixed with other leaves, black top soil, and sometimes pumice; the mixture is then stirred to inhibit the formation of mould (Thaman, 1990).

Using coconut husks, dried leaves and chicken manure, farmers are able to successfully grow crops ranging from vegetables to fruit trees. Another widely used method involves a simple backyard composting technique known as the ‘banana circle’, which is used to compost organic waste and grow bananas (see Figure 2.4). In the banana circle, a shallow pit is dug above the groundwater lens, lined with cardboard and then filled with organic matter. A ring of bananas is then planted around the pit. Households place their organic waste in the middle of the pit, which in time breaks down and fertilises the bananas. Laundry water is also used to water the bananas and further fertilize soils (South Pacific Regional Environment Programme (SPREP), 2003 cited in East and Dawes, 2009).

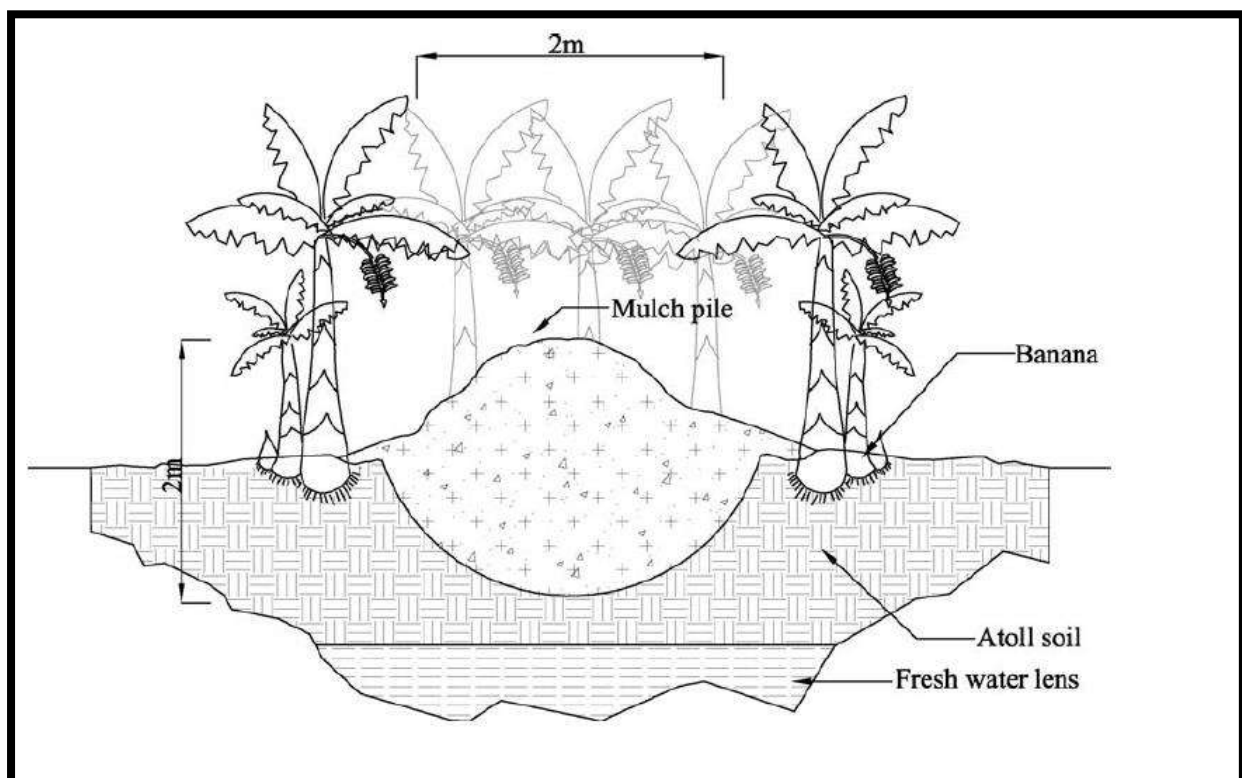


Figure 2.4: The ‘banana circle’ shown here is one method of composting and growing bananas in Kiribati (East and Dawes, 2009).

Recurring attempts by donor and quasi-government organizations, for example, Taiwan Technical Mission (TTM), Foundation of the Peoples of the South Pacific (FSP), Development of Sustainable Agriculture in the Pacific (DSAP), Kiribati Organic Farmers Association (KOFA) and the International Waters Project of Kiribati (IWPK), in South Tarawa- focused on the increased cultivation of a vegetable understorey and compost based waste management in homegardens. These organizations promote the value of homegardening by undertaking a range of activities, including holding competitions and supplying training, equipment and seedlings to local gardeners (East and Dawes, 2009).

The Kiribati government, like many other island governments, has been active in developing climate related policies at the national level. According to Kurrupu and Liverman (2011), Kiribati commenced formal adaptation planning in 1995 after ratifying the United Nations Framework Convention on Climate Change (UNFCCC) Treaty and was an early member of the AOSIS (Alliance of Small Island States). Since then, Kiribati has initiated two national adaptation programmes, the Kiribati Adaptation Programme (KAP) and National Adaptation Programme of Action (NAPA). Whilst NAPA awaits funding approval from the Global Environmental Facility (GEF), the KAP has been in operation since 2000 and is in its second phase. Climate change has been mainstreamed into national policies such as the National Development Plan, Climate Change Adaptation Policy Statement and Strategy 2005, Draft National Climate Change Framework 2010 and the Draft National Integrated Environment Policy 2011. Kiribati is also leading a ‘whole-of-island’ approach to climate change adaptation and disaster risk management. The island of Abaiang, north of the main island of Tarawa, has been identified by the Government of Kiribati as a pilot site where community resilience to climate change and natural hazards will be addressed in an integrated fashion across all sectors of social and economic life. The approach promotes better coordination between community, local and national government and donor-funded projects (SPREP, 2013; SPREP, SPC and GIZ, 2016).

Population mobility has been very much part of contemporary Kiribati as it was during pre-European contact times and has largely been a means of diversifying income and enhancing social resources. Evidence shows there were visits from other Pacific islands, such as Samoa during pre-European contact (Alkire, 1978), which still continue today, between the islands.

Formal migration schemes⁹, which occurred from the 1930s to the 1980s were required for various reasons, including population growth and density, mining and natural events, and have resulted in I-Kiribati living in other Pacific islands, such as the Solomon Islands and Fiji. Other examples of mobility are evident in I-Kiribati seeking work opportunities overseas (Borovnik, 2006). Seafaring, fishing and the seasonal worker programmes in Australia and New Zealand provide the bulk of offshore employment, and remittances are the most important source of income in Kiribati. I-Kiribati seafarers send home approximately US\$9.5 to 10.5 million annually in remittances (ILO, 2006) to help meet basic needs and social obligations. I-Kiribati communities which now exist on other Pacific islands, and in the neighbouring countries of New Zealand, Australia and the United States could provide opportunities for those who may want to relocate due to climate change¹⁰.

2.4.2 The Maldives

The Maldives comprises a chain of 26 atolls in the Indian Ocean. The islands are scattered over an archipelago of more than 800km long. Most of the islands are inhabited with 131 islands having fewer than 1,000 people (Ministry of Housing, Transport and Environment (MHTE), 2009). Nearly 80% of the country is at one metre or less above sea level (Pardasani, 2006). Sea level has been rising at a rate of 1.7mm per year. Climate projections state a possible decrease in the total amount of rainfall, but increasing intensity of rainfall, increase in temperature and increasing intensity of extreme events, mainly cyclones (MHTE, 2009). Most islands experience a shortage of drinking water during several months of the year (Kaly *et al.*, 2002).

The Maldivian people have also shown remarkable resilience in the face of these challenges. Most residents are familiar with natural disasters caused by rough weather conditions, especially during tropical monsoons, when they experience natural disasters of various magnitudes almost on an annual basis (*ibid*). The majority of households are semi-subsistent

⁹ In the 1930s, more than 700 people were resettled from the Gilbert Islands to the Phoenix Islands due to overcrowding on the main island chain. Twenty years later, these people, and others from the Gilbert Islands, were relocated to the Solomon Islands, after recurrent drought. Resettlement of Banaba residents started in the late 1940s. From the early twentieth century, Banaba island was mined for phosphate. By the end of the 1930s the island had become almost uninhabitable so the British colonial government forced the resettlement of Banabans to Rabi island in Fiji. Rabi now has a population of around 5,000. In 2005, Fiji granted citizenship to the residents of Rabi. Although citizens of Fiji, Rabi islanders still hold Kiribati passports, remain the legal owners of Banaba and are represented on the parliaments of both Kiribati and Fiji (Connell, 2012).

¹⁰ In 2016, President of Kiribati Anote Tong reiterated his previous requests for international assistance towards the possibility of resettling I-Kiribati people because they are vulnerable to climate change.

with fishing and the cultivation of fruits and vegetables being the most important activities (Ministry of Planning and National Development (MPND) and United Nations Development Programme (UNDSP), 2006 cited in Fulu, 2007; Shabau, 2008). Income is also received by employment, mainly in the tourism industry and the operation of home-based small businesses such as the manufacturing of wooden articles, cork, straw and plaiting materials; production of materials from coconut leaves; processing and preservation of fish and fish products and sewing of clothes (Asian Development Bank (ADB), 2015). Most men engage in fishing activities and craftwork, while women play a significant role in agriculture and fish processing. A variety of crops such as vegetables, fruits, tubers and plantation crops are cultivated in home gardens (Lufty, 1995 cited in Amira, 2009). Hydroponics farming has also been introduced, producing melons, cucumbers, chillies, herbs and lettuce even at the household level (Ministry of Fisheries Agriculture and Marine Resources (MFAMR), 2004). People previously depended on shallow wells to access the groundwater lens for drinking water, however, 90% of the atoll households now use rainwater as their principal source of drinking water. In Male, 100% of the population has access to piped desalinated water. Following the 2004 tsunami, 38 islands have been provided with desalination plants, which are being operated daily or on an emergency basis (Marcu *et al.*, 2015).

The country's population has continued to grow, from 298,968 in 2006 (MPND, 2007) to 341,256 in 2014 (Ministry of Finance and Treasury, 2014). In the early 1970s the Maldives was one of the poorest countries in South Asia. Today, it has the highest per capita income in the South Asia region since 1995 (ADB, 2015). An upper middle income small island economy that graduated in 2010 from the list of Least Developed Countries (LCD). GDP per capita was USD275 in 1980, but has increased 25 times up to USD6657 per capita in 2012. However, there is high inequality in terms of regional disparities. Fishing and tourism are the most significant economic activities- fishing is the highest single generator of employment and tourism is the highest contributor to the national GDP (Marcu *et al.*, 2015).

The Maldivian people have survived previous disturbances mainly due to the presence of social networks at the local, national and international level which have enabled mobility and diversification. “Although geographically the islands are widely dispersed, the country is connected by bonds of language and religion which have proved helpful to many who were affected by the 2004 tsunami. Everyone speaks Dhivehi and is required by law to be Muslim. Islam is integral to the Maldives and is woven into many aspects of daily life, particularly

matters related to the family” (Fulu, 2007: 846). In 2004, the island group was affected by the Boxing Day tsunami which killed more than 100 people and displaced around 12,000 people (World Bank *et al*, 2005 cited in Fulu, 2007). Immediately after the tsunami, many survivors sought refuge either in the homes of their relatives or friends, parents’ friends and fellow Maldivians in nearby islands (Fulu, 2007; Waheed and Shakoor, 2015). For example, those who were displaced from Kandholhudhoo Island were scattered in temporary shelters over five different islands in the Raa Atoll for up to four years. Thirty two families displaced from Kandholhudhoo Island relocated to Alifushi Island where they first lived with host families, and later transferred to transitional shelters built by the government and external agencies such as the International Federation of the Red Cross and Red Crescent Societies (IFRC and RCS) (IFRC and RCS, 2007).

Assistance from government and international aid agencies such as IFRC and RCS¹¹ and United Nations (UN) agencies were crucial in rebuilding displaced communities after the tsunami. The remoteness of the islands delayed initial responses by these agencies, however, water storage tanks and desalination plants were provided after a few months. Temporary shelters were also built with each unit having electricity, a bathroom and flush toilet and a kitchen area with a gas stove (Government of Maldives, 2005 cited in Waheed and Shakoor, 2015). Many fishing communities received assistance such as fishing boats, engines, refrigerated containers and fishing equipment (Food and Agriculture Organization (FAO), 2011). In addition, a psychosocial assistance programme was initiated to help survivors with assistance from local NGOs and international partners (Schepeer *et al*, 2006 cited in Waheed and Shakoor, 2015). According to Waheed and Shakoor (2015), people returned to a life of normalcy more quickly due to the aid and support received from international agencies.

In April 2006, the Maldivian government, in partnership with the IFRC and RCS, began to build new sites for those who were displaced by the tsunami. The government revealed Dhuvaafaru Island in Raa Atoll in March 2009. Formerly an uninhabited forest, the entire island was raised through reclamation and a new village built for the 4,000 survivors from Kandholhudhoo (IFRC and RCS, 2007; Vince 2009 cited in Sovacool, 2012). After three years, and at a cost of USD32 million, 600 houses, three schools, an island administration block, an auditorium, a health centre and a sports stadium were built, together with a power

¹¹ Included in this project were the Red Cross societies of America, Canada, Japan, New Zealand, Australia, Germany, Hong Kong, and United Arab Emirates (IFRC and RCS, 2007).

plant, sewage system and roads. The IFRC and RCS has also been closely involved in training community members to maintain the island's infrastructure. Two groups of volunteers now look after the island's powerhouse, water and sanitation systems. Each home has been equipped with a 2,500-litre rainwater harvesting tank and roof guttering (Talbot, 2012).

Displaced persons were not passive recipients of assistance rather they actively participated in ways to ensure they survive and overcome their challenges. Fulu (2007) mentioned how Maldivian women cared for families and communities and set up communal kitchens, cooking in shifts for the displaced populations on each island. Some members of host families on Alifushi Island stated that displaced people from Kandholhudhoo Island reciprocated their kindness by giving them palm and coconut. Financial assistance from the United Nations Development Programme (UNDP) Livelihoods South South Grants Facility enabled some to access seedlings in order to plant again to support their families. Some farmers on Vaikaradhoo and Kalaidhoo, whose crops were completely destroyed by the tsunami, were planting crops again two years after the tsunami. A visit by IFRC and RCS members eight years after Dhuvaafaru Island was settled revealed transformations had been made by the residents. For example, extensions and modifications had been made to the two bedroom houses that were originally built. Some families had created spaces for small shops. In addition, many small gardens had been planted. The island, which had originally been cleared of its vegetation, now has many trees (Talbot, 2012).

Washeed and Shakoor (2015) argued that the speed of democratic change in the Maldives had a great deal to do with the international attention it received following the tsunami. The political landscape of the country was transformed from a centralized autocracy to a democratic multi-party government. In 2008, a new constitution was passed by parliament, for the first time incorporating a full Bill of Rights and introducing separation of powers. Under this new constitution, the first elections were held in October, 2008. Under the leadership of the UN and with the aid of many countries, Maldives has been fully equipped with early warning systems which are now fully operational (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2006 cited in Waheed and Shakoor, 2015). In addition, a Disaster Management Act was developed in 2006, and according to Pardasani (2006), a Disaster Management Center is in place whose mandate includes receiving and disseminating information to various agencies to ensure timely action. The Maldives

complies with the Hyogo Framework for Action¹² with inter-agency co-operation, and there is now a better and more centralized information collection and dissemination system (Washeed and Shakoor, 2015).

Like Kiribati, Maldives as a country has played a prominent role in international climate change discussions during the last decades. It is party to a large number of international environmental treaties, an active member of the SIDS group and the current chair of AOSIS in the UN. Since 1987, Maldives has been an untiring voice on the world stage, urging the international community to take climate change and global warming more seriously (Waheed and Shakoor, 2015). All three Presidents since then have raised the climate change concerns of the Maldives internationally. The national government is taking the initiative to build new spaces termed ‘artificial or designer islands’ for their people within the island archipelago through its Safer Island Development Programme (SIDP) and the Maldives 7th National Development Plan. One such island, Hulhumalé in Malé Atoll, is set to house 100,000 people, many of them climate refugees, by 2030 (Sovacool, 2012). Hulhumale in Male Atoll is reclaimed from the sea by converting a natural coral reef and lagoon into a 2km² city. Sand ridges were repeatedly levelled during land reclamation. The dredging took five years and cost \$32 million (Sovacool, 2011). In addition, various projects have looked at the development of renewable energy sources. For example, energy efficient air conditioning and the development of solar power for 121 islands. In line with its Low Carbon Development Strategy, the harbour and streetlights in Male were recently replaced with highly efficient LED lighting (UNDP Risø Centre and Ministry of Environment and Energy, 2014).

2.5 Conclusion

As indicated by the research questions in Chapter 1, this study seeks to deepen understanding of the resilience of island societies by assessing islanders’ knowledge of climate related changes and coping strategies. This review has outlined the extent to which the combination of the non-equilibrium perspective of resilience and a cultural ecological approach could be productive in shedding light on ways in which contemporary island societies are enduring challenges and anticipating future climate change. The literature, referred to in this chapter, has highlighted that systems, including human societies, are dynamic. The role of

¹² An international strategy to promote a strategic approach to reducing vulnerabilities and risks to hazards.

disturbances is considered crucial, rather than only detrimental to the development of resilience. Cultural ecological studies provide evidence that societies have developed ways to survive in what are considered highly challenging environments. These insights have informed this study's conceptualization of the resilience of islands as indicated in the study's proposition stated in Chapter One. The indicators of resilience systems that have been identified in this review have been used by this study in its assessment of the resilience of island communities, for example, connections or social networks, perceptions or greater awareness and sensitivity, diversification, mobility and spiritual and mental strength.

As described in this chapter, this study considers the importance of developing a holistic research approach and using local concepts and ways of knowing to conceptualize the indicators that have been identified in the literature. The studies which are based on the Pacific and Indian Oceanic regions have been particularly informative in this regard. Many scholars such as Comitas (1963), Frucht (1967), Waddell (1975; 2015), Chapman (1985a; 1985b); Chapman and Prothero (1985), Watson (1985), Hauofa (1993), Baldaccino and Bertram (2009); McMillen (*et al.*, 2014) and Lilomaiaava-Doktor (2015) not only emphasize the importance of holistic research approaches but they have also demonstrated that local concepts and ways of knowing could enlighten our understanding of island societies and how they survive. Such ways of knowing and related approaches have enabled a discussion of how Kiribati and Maldives are adapting to climate change amidst the challenges they are facing. Atolls are among the harshest environments in the world, yet I-Kiribati and the Maldivians have managed to survive there over many centuries. The following chapter discusses the field area for this study and the key aspects of Samoan society that are embodied in both the research's approach and analytical framework.

Chapter Three. The Field Area: Samoa- a dynamic place

3.1 Introduction

As indicated in previous chapters, this thesis aims to assess the capacity of island societies to cope with future climate change. It argues that islanders have for a long time managed to endure environments that are challenging and unpredictable by developing a range of strategies to ensure sustainability. This chapter discusses the characteristics of Samoa, where the fieldwork for this study was undertaken. As mentioned in Chapter One, Samoa was selected because it faces many of the challenges most islands experience. In addition, my interest in Samoa was strengthened by the fact that I am Samoan and have a deep personal interest in related issues. Samoa has often been described as the most politically and socially stable island in the Pacific. While this speaks some truth when Samoa is compared to other islands which face warfare and political coups, the description is not wholly true when we closely examine the physical and socio-political aspects of the island group. The first part of this chapter discusses the physical characteristics of the islands and related processes, mainly climatic and tectonic events, which have continually shaped the country's environment.

The second section of the chapter focuses on the human influences that have occurred in the past two centuries. First, it provides a snapshot of Samoan society, its institution of *faamatai* [chiefly system] and related networks and survival strategies that were employed by Samoans up until the 1800s. Secondly, it explains some of the significant changes which have occurred to *faamatai*, as well as to the physical landscape since the 1800s. The flexibility of *faamatai* is demonstrated in how it has managed to effect connections with imposed institutions such as Christianity and centralized national institutions which have since been established. Moreover *faamatai* practices remain significant at the village level in contemporary Samoan society.

The final part of this chapter discusses how these structural changes and exposure to environmental challenges had prompted greater awareness of climate change and adaptation efforts at the national level. The chapter concludes by highlighting the holistic approach taken in this thesis to conceptualize the roles of individuals and communities in the prediction of, and response to, environmental risks in Samoa.

3.2 The biophysical setting

The Independent State of Samoa is located between latitudes 13° 15'S and 14° 5'S, and longitudes 171° 23'W and 172° 48'W. It has a west-northwest to east-southeast orientation (Government of Samoa, 2002) a total land area of 2,934 square kilometres. The island group comprises four inhabited islands namely Savaii, Upolu, Manono and Apolima, and several nearby islets adjacent to their coasts (Ministry of Natural Resources and Environment (MNRE): Government of Samoa, 2013) (see Figure 3.1).

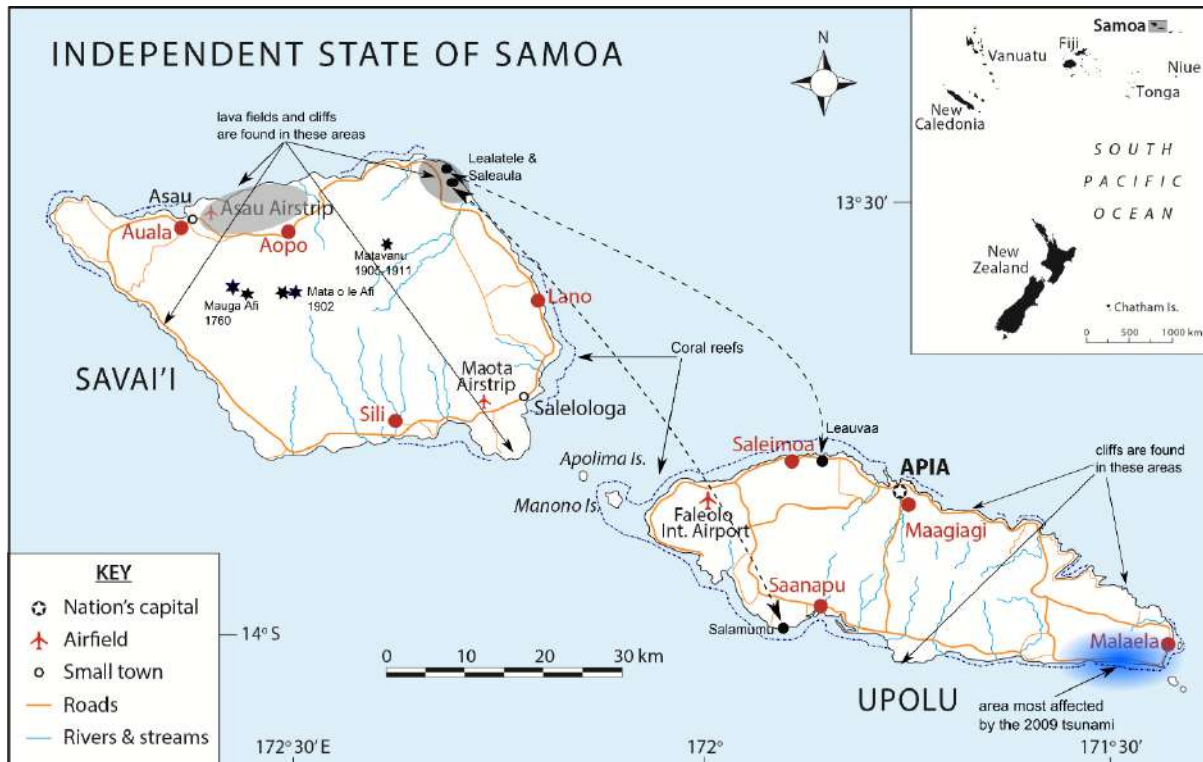


Figure 3.1: The Samoan islands have been affected by various natural and human influences (source: after Nations Online Project, 1998).

Samoa's biodiversity is characterized by more than 720 species of native vascular plants and six vegetation types (Whistler, 1992). Rugged and mountainous topography that is covered with lowland, ridge and montane rainforests characterize the interiors of both Savaii and Upolu (Ward and Ashcroft, 1998). Cloud forests are found only on the highest elevated areas of Savaii. Drowned valleys and impounded river and stream mouths sustain a variety of wetlands along the sheltered coastlines of the main islands. Littoral forests, consisting of shrubland, pandanus scrub and herbaceous strands, exist just above the mean high water mark (MHW). Herbaceous species dominate coastal marshes, while woody plants occupy mangrove and swamp forests. Upolu, being geologically older, is home to most of these wetland communities (Whistler, 1992). Coastal wetlands and littoral forests are major fish

breeding and nursery sites. The endangered hawksbill turtle and 16 species of seabirds breed in Samoa. In addition, the marine environment supports many threatened invertebrates including the coconut crab and several corals and clams. 991 species of fish were recorded in a survey in the 1990s, including 890 inhabiting shallow water or reefs, 56 living in deeper waters and 45 pelagic species (Park *et al.*, 1992).

3.2.1 Biophysical drivers of environmental changes

A. Tectonic processes

Samoa's proximity to the active boundary of the Pacific and Indo-Australian plate that lies just south of the island group exposes the islands to earthquakes, tsunamis and volcanic eruptions which continually transform the islands. The latter activities have influenced the country's reef systems, soil and water sources which are important to peoples' livelihoods. Both historical and recent volcanic activity smothered with lava most of the islands' inshore coral reefs, as evident on the north-western and southwestern sides of Savaii. According to Ward and Ashcroft (1998), volcanic flows from the Matavanu eruption in Savaii between 1905 and 1911 flowed from an inland crater to the coast, in places filling the lagoon and over-spilling onto the fringing coral reef. This is evident by the lack of reefs on the southwestern side of the island (see Figure 3.1). Currently, the coral reef area in Savaii is only 277 sq km (Walsh and Paton, 2003). The extant reefs are typically barrier reefs, separated from the shore by natural lagoons two kilometers wide in some locations, with a depth of one to three metres. Living sections of the barrier reefs seen today were the result of upgrowth since fringing reefs were drowned by submergence, as evident along the cliffed coastline on Upolu's north-eastern end. Over 200 species of corals, and approximately 915 fish species, have been reported to occupy the reefs and waters of the island group (Goldin, 2003).

Holocene subsidence, caused by the mass of the volcanic rocks in the archipelago, resulted in cliffed shorelines on the two main islands. On Upolu, cliffed shorelines occur along the north-eastern side and at the margin of a late Holocene lava delta along the south coast. On Savaii, cliffed shorelines are found on the northern and western sides of the island (Kear and Wood, 1959) (see Figure 3.1). The widest and most extensive lagoons face the gently sloping lands of northwest Upolu and the eastern half of Savaii (Ward and Ashcroft, 1998).

Variations in age and degree of weathering of olivine basaltic rocks which are dominant on the islands have produced soils of differing age and type, with many being porous, shallow

and clayey in texture. At first, the basaltic parent material produced fertile soil, however, the warm wet climate of the islands results in soil progressively losing their bases and become more acidic. As a result, the most fertile soils are the youngest, but these tend to be shallow and rocky, while the more weathered and deeper soils are often less fertile (Wright, 1963).

Surface water is restricted on the islands because the young basaltic rocks are highly permeable, and almost all the rainfall that is not lost by evaporation and transpiration seeps deep into the ground. Little is left as run-off, except in the older, more weathered rock formations. Permanent rivers and streams are restricted almost completely to areas of Fagaloa and older Salani rocks, and in the case of the latter formation, streams and rivers often fail to reach the sea. Most of the rainwater eventually returns to the sea from the groundwater by way of innumerable coastal springs. Such springs vary in flow from a few gallons a minute to that of a small river depending on the size of opening in the rock. The water usually emerges close to high-tide mark. Villages in Samoa have long depended to a very great extent upon these springs for their water supply, but since this water tends to be salty at high tide, alternative sources are preferred for the major supply, with the coastal springs remaining as a standby. Western Savaii is the region characterised by the worst water supply. All coastal springs are poor and salty at high tide, except for those at Asau, Falealupo and Taga. In Eastern Savaii, water carriers walk literally miles for drinking water, and often must make their journeys correspond with low tide in order to obtain fresh water (Fox and Cumberland, 1960).

Volcanic eruptions have also influenced human settlement patterns. In 1760, the Mauga Afi volcanic eruption destroyed the sites of several villages on the north-western coast of Savaii, causing the relocation to inland areas of some villages such as Aopo. The flows during the 1760 eruption covered an area of 190 square kilometres on the northwestern part of Savaii. There are no accounts of any deaths, but arable land was destroyed and Aopo was surrounded and partially destroyed by lava flows. Mata o le Afi volcano on the north-western part of Savaii erupted in 1902, but only affected areas surrounding the mountain ridge. Matavanu, which erupted from August 1905 to November 1911, destroyed large areas of arable land and several villages such as Satapatu, Malaeola, Salago, Toapaipai and Saleaula. Like previous eruptions, no deaths were reported (Taylor and Talia, 1999). Parts of most villages shifted inland, while some families in Lealatele and Saleaula were relocated by the German colonial

administration and settled in Upolu. Families from Lealatele settled at Leauvaa, while those from Saleaula resided at Salamumu (see Figure 3.1).

Many tsunamis occurred before 1900, but the most recent one hit the south coast of Upolu in September 2009 which affected the coastal part of twenty villages (see Figure 3.1). An earthquake of 8.0 magnitude, which occurred 190 kilometres southwest of the island group at a depth of 33 kilometres, triggered tsunami waves that reached more than 14 metres in height and inundated a zone stretching up to 400 metres inland along on the south coast of Upolu. Many sections of the coastline were eroded and coastal vegetation destroyed (Intergovernmental Oceanographic Commission of UNESCO (UNESCO- IOC) Tsunami Survey Team, 2009). 143 people were killed and the majority of villagers affected have now resettled in inland parts of the affected villages.

B. Climate processes

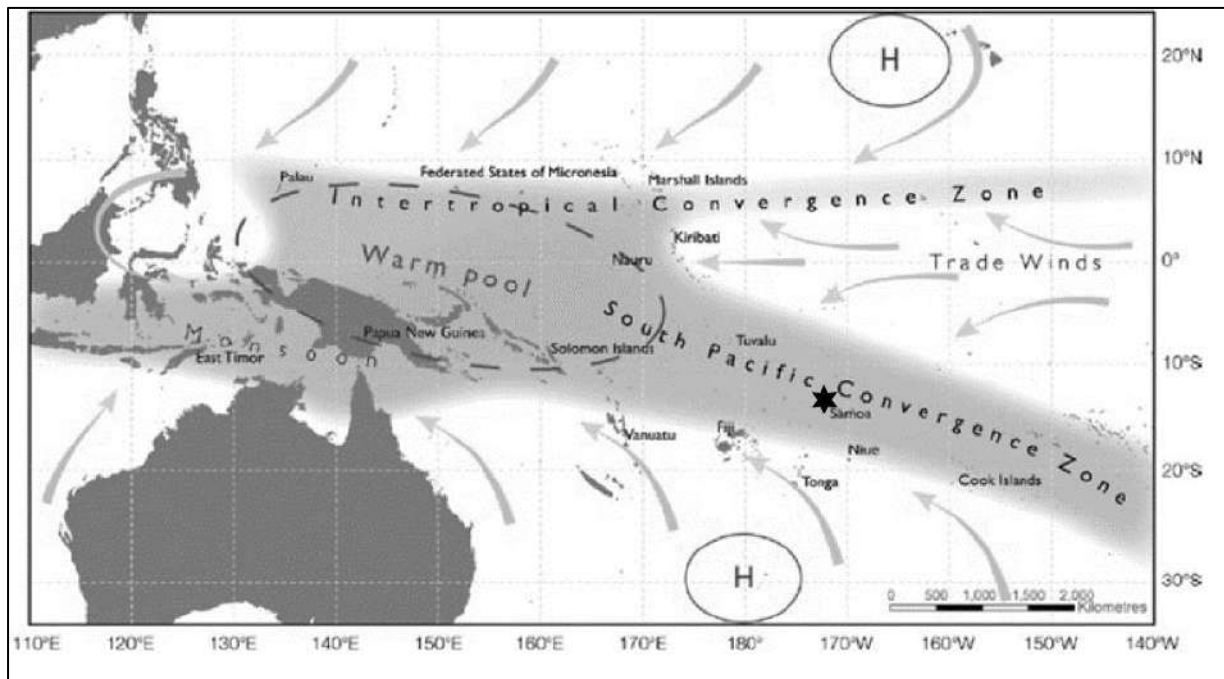


Figure 3.2: Samoa's climate is influenced by the South Pacific Convergence Zone (SPCZ) (Source: Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organization (ABM and CSIRO), 2011).

Samoa's location in the mid-Pacific results in its tropical climate being marked by a distinct wet season from November to April and a dry season from May to October. The average annual rainfall is 3,000 mm, with 75% of the precipitation falling during the wet season. The

average monthly temperature ranges between 22°C and 30°C, with little seasonal variation, due to Samoa's equatorial situation (Government of Samoa, 2002). The South Pacific Convergence Zone (SPCZ) which lies between Samoa and Fiji during the wet season greatly influences rainfall patterns (see Figure 3.2). There is significant year to year variability in rainfall, which is strongly influenced by the El Niño Southern Oscillation (ENSO)¹³ cycle comprising El Niño and La Niña episodes. El Niño refers to the warming of the tropical Pacific Ocean east of the dateline which causes abnormal sea surface temperatures, periodic sea level rise and frequent tropical cyclones. For Samoa, El Niño events bring wet seasons that are drier than normal. La Niña refers to the cooling of the tropical Pacific Ocean east of the dateline. La Niña events cause wetter and cooler than normal conditions in Samoa (ABM and CSIRO, 2011).

1. Long term climate change

Samoa, like many other Pacific islands, was affected by the 'Climatic Optimum'¹⁴, characterised by a rise in temperature and sea level between AD650 and 1200. This was followed by the Little Ice Age that occurred between AD 1220 and 1510. The transition period between the Climatic Optimum and the Little Ice Age is known as the AD 1300 event, which involved rapid cooling and a fall in sea level (Wilson *et al.*, 1979; Nunn, 1995; 2000). Observations of long-term climate change have concluded that due to global warming the temperature and sea level had started to rise again. The specific amount of the current temperature increase for Samoa is not stated in the country's climate change reports but according to the ABM and CSIRO (2011), all updated temperature records from Pacific island observation stations show warming over the past 50 years with trends mostly between 0.08°C and 0.20°C each decade. Due to increasing temperatures, sea level around Samoa has also risen by 4mm since the early 1990s, and water temperatures started to increase by approximately 0.08°C per decade from.

¹³ The cycle is caused by natural periodic fluctuations in sea surface temperature and air pressure in the equatorial Pacific region with time-scales of about two to seven years.

¹⁴ This period was characterised by degradation of most reefs and water sources which sustained Pacific island communities. According to Nunn (2000) as sea level fell during the transition period, water tables also fell, causing a reduction in available groundwater which may have had severe effects locally, particularly in alluvial and coastal lowlands, although these would have been offset at particular times by increased precipitation. These changes would have killed off what were for local people the most productive parts of coral reefs, depriving them in many parts of the Pacific from sustenance which had become an important part of their diets. Nunn further suggests this may have caused conflict, even warfare in many Pacific communities, as well as a shift of settlements inland. There is a lack of specific information available of the impact of such events on Samoa, although Kramer (1901) mentions that the Tongan invasion of Samoa occurred around AD1200 which confirms that there was conflict around this time in Samoa.

The rise in temperature has also contributed to the evolving nature of other aspects of Samoa's climate mainly rainfall, dry spells and tropical cyclones. Moreover, this has intensified the occurrence and impacts of ENSO. El Niño events have brought wet seasons that were drier than normal and more frequent cyclones while La Nina events have caused wetter and cooler conditions in Samoa. Flooding has occurred frequently during La Niña events. Between 1969- 2010 tropical cyclones were most frequent in El Niño years (16 cyclones per season) and occurrences in La Niña and neutral years were less frequent (10 cyclones per decade) (ABM and CSIRO, 2011).

The latest climate change projections suggest enhanced risks on several fronts in Samoa. Sea-level around the island group is projected to rise between 5 and 15 centimetres by 2030 (ibid) and by 36 centimetres to 2050. In addition, there is the likelihood of an increase in the intensity of tropical cyclones, rainfall and dry spells. Recent government reports have stated that there has been significant variation in rainfall amounts in the past 20 years (MNRE: Government of Samoa, 2010). Dry spells that tend to affect the island group during the middle of the year have also become more frequent. Further, acidification of Samoan seas is likely to occur and is likely to cause decreased calcification in coral and other marine organisms threatening their future survival (Ohde and Hossain, 2004). The latter claims are strengthened by recent observations which have shown that the saturation state of aragonite in the surrounding waters of the island group has declined from about 4.5 in the late 18th century to about 4.1 ± 0.1 in 2000 (ABM and CSIRO, 2011).

Sea level rise, combined with human related factors, have recently featured in the changing character of coastal processes in Samoa mainly through storm surges during cyclones and the occurrence of king tides. These in turn have exacerbated coastal erosion. These events have also slightly increased seawater intrusion into underground water aquifers and coastal springs, as already experienced by many coastal communities (MNRE: Government of Samoa, 2013).

2. Extreme climate events

According to the Samoan report to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010, there has been an increased frequency of short bursts of heavy rainfall due to global warming (MNRE: Government of Samoa, 2010) which have contributed to more intense flooding in recent years. Areas that are located close to rivers

and streams, such as the Apia Urban Area have been frequently affected by flooding in recent decades. Floods have occurred in 1939, 1974, 1975, 1982, 1990, 1991, 2003, 2006, 2008 and 2012 (MNRE and GHD Limited, 2013). However, in recent years the combination of shorter heavier rainfall, reduced forest cover and poor quality infrastructure have caused flash flooding such as that affecting parts of Upolu island during Cyclone Evan in December, 2012 (discussed later in this section). With heavy rainfall and winds reaching up to 90 knots, Cyclone Evan killed 5 people and displaced 4,763 people, causing widespread damage to the island's water and electricity facilities, roads and vegetation (Government of Samoa, 2013).

There has also been an increase in hot days, droughts and forest fires. Droughts are most notable in the north-west regions of the two main islands and at times have been associated with forest fires. In Asau, there were major forest fires during the dry seasons of 1982/83, 1997/98, 2001/02, 2002/03, 2011/12, 2008, 2010 and 2014 due to dry spells, reckless burning and loss of forest cover (ABM and CSIRO, 2011; MNRE: Government of Samoa, 2013). Rising temperatures, plus other factors (such as increasing demand for water supply and hydropower generation, pipe leaks and high consumption rates in non-metred areas¹⁵), have also caused water resources to be vulnerable during low periods of rainfall. Government and media reports in the 1990s and 2000s documented the worsening trend in water supplies and related this to global warming. Catchments at Afiamalu, Tiavi and elsewhere that supplied the AUA were experiencing greater evaporation in 2012 compared to six years earlier. During the dry season any water taken from these sources was muddy. The Acting Chief Executive Officer of the Ministry of Natural Resources described that the latter challenges are related to a changing climate. He said, "... at the end of the day, water availability is initially a function of climate, through rainfall; climate is changing with patterns presenting less rainfall or a lot of rainfall within a short period" (cited in Siona, 2012).

Many cyclones have hit the country in the past, with the most memorable events occurring in 1889, 1966, 1990, 1991 and 2012. However, the occurrence of cyclones Ofa and Val in 1990 and 1991, respectively, marked an increase in the strength and severity of these events (Ward and Ashcroft, 1998). On 2-3 February 1990, Cyclone Ofa brought northerly and westerly winds of up to 60 (110 km) knots, gusting up to 90 knots (166 km/hr). Cyclone Val (5- 9 December, 1991) was the strongest cyclone to hit Samoa in the past century, with its winds

¹⁵ See Chapter 6, Section 6.3.

reaching 260 kilometres per hour, far exceeding the winds of Ofa in the previous year. As it approached Samoa, Val was travelling at about 20 kilometres per hour on a south-easterly course. It then slowed to 10 kilometres as it neared Savaii and veered a south-west course as it passed over the island. It then curved northwards and remained stationary for about 6 hours before moving away from the island group in a south-easterly direction (see Figure 3.3) (National Disaster Council: Government of Samoa, 1991).

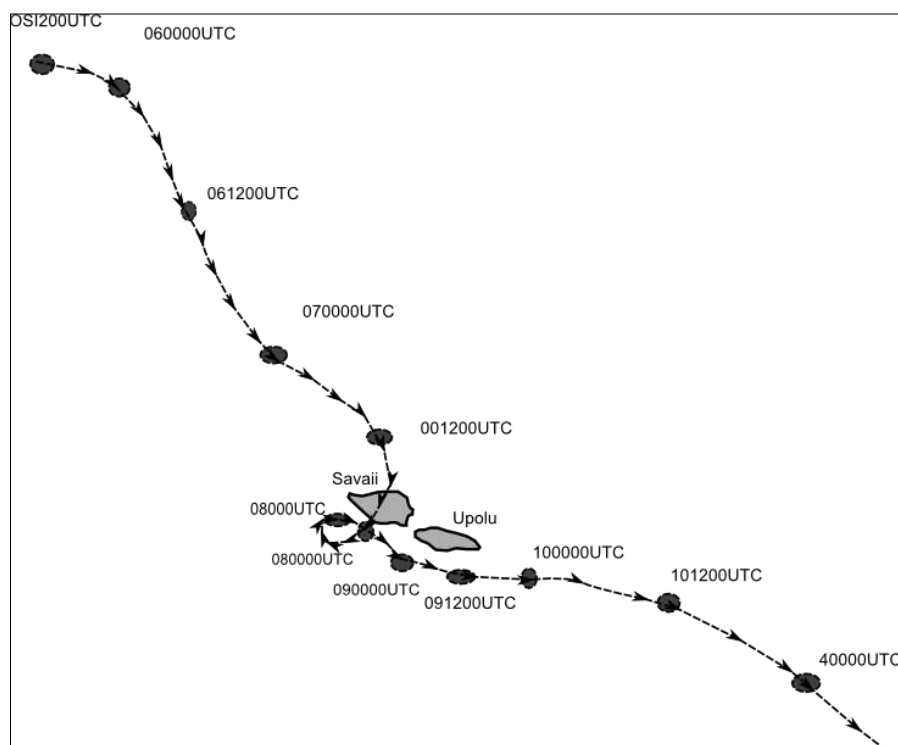


Figure 3.3: The path of Cyclone Val, 5-9 December, 1991 (Source: after National Disaster Council: Government of Samoa, 1991).

Cyclones have greatly contributed to the transformation of coastal and inland areas of the islands, and this had been particularly noticed in the past twenty years. During Cyclone Ofa (1990), for example, high seas eroded the coasts of northern Upolu and northern Savaii and deposited rubble banks on the fringing reefs of northern Upolu (Crawley, 1992). Coastal vegetation was also removed, further decreasing the stability of the coast and damaging beaches and coastal cliffs. Inundation by the sea left a widespread ground cover of coral debris, which destroyed lawns, gardens and trees. Saltwater poisoning of the trees that survived the high winds is still common along the northern coast of Upolu (Rearic, 1990). Cyclone Val which occurred the following year and was much stronger, intensified the impacts of Cyclone Ofa. Many wetland areas, especially herbaceous marshes along the northern and eastern shores were badly damaged by salt water incursion during Cyclone Val (Schuster, 1993). Coral reefs throughout the country were also seriously degraded (Zann,

1991). Some fisherfolk living on the northern coast of Upolu shifted to land-based activities after Cyclone Val due to the dramatic loss of marine resources that previously supported their livelihoods. Forests and their associated bird and animal life also suffered much damage. Leaf and branch loss was severe in Upolu forests, and landslides occurred on steeper land following the accompanying heavy rain. Forests on the western end of Savaii were also severely damaged. A survey of the forests after Cyclone Val showed that 45% of Savaii's remaining merchantable timber trees were blown down (Division of Forestry, cited in Ward and Ashcroft, 1998). After the cyclones, log exports were banned and logging was restricted to areas which suffered 80% or more damage in order to reclaim as much as possible of the fallen timber while allowing less damaged areas to recover to some extent (Ward and Ashcroft, 1998) (see Appendix 1).

Other cyclones that have recently occurred include Cyclone Heta in 2004, Cyclone Olaf in 2009 and Cyclone Evan in 2012. Cyclone Evan was relatively localised to the south-western and central parts of Upolu island, but it brought heavy rainfall that caused flash flooding in parts of Upolu (Government of Samoa, 2013). The duration of heavy rainfall in recent years has also impacted on water quality. In 2012, heavy rainfall during Cyclone Evan caused landslides and damaged government- owned pipes and reservoirs at Maagiagi. This led to flash flooding on December 13 that destroyed populated parts of Wellington and nearby areas along the Vaisigano River.

Flooding has previously affected these areas,¹⁶ but government reports have indicated that the increasing frequency and short duration of heavy rainfall which was associated with global warming and increased density of human settlement of the Vaisigano River banks in the past two decades had exacerbated the severity of this particular flood. The rainfall recorded at Afiamalu and Alaoa during Cyclone Evan was significant and fell in a high intensity storm. Total rainfall in the Vaisigano Catchment Area was 467mm, compared with an average of 200mm elsewhere in the country. Total rainfall two days prior to the flash flood exceeded 170mm, saturating soils and making them less able to absorb rainfall on December 13. This led to extensive land-slides in the upper catchment, which caused large amounts of silt and many logs to flow downstream. These, together with the flood water, destroyed the

¹⁶ Government records show flooding at Vaisigano in 1939, 1974, 1990, 2001, 2006 and 2012 (MNRE and GHD Ltd, 2013)

Samasoni and Alaoa hydropower stations¹⁷, Alaoa head-pond and water treatment system, gauging station, pipelines and peoples' homes (MNRE: Government of Samoa, 2013; MNRE and GHD Ltd, 2013). Cyclone Evan also destroyed food crops and farms in central and south Upolu. Cocoa trees and fruit trees, such as mango, rambutan, citrus, and avocado, were also destroyed. Much of their production was lost because they were at their productive peak when the damage occurred. Banana patches were flattened and the fruit of breadfruit and mango were scattered everywhere (Government of Samoa, 2013).

3.3 The human setting

The Samoa islands were first settled more than 3,000 years ago and up until the time of European contact, Samoan society was based on *faamatai* (discussed in detail in the next section), with communal fishing and subsistent agriculture sustaining peoples' livelihoods (Wilkes, 1852; Turner, 1884; Krämer, 1901; Buck, 1930; Watters, 1958).

3.3.1 Samoan society before the 1800s

A. *Faamatai* [Samoan chiefly system]

The organization and governance of *aiga* [extended family unit] and *nuu* [village] in Samoa is based upon *faamatai*, a framework that ensures participation by all related members (see Figure 3.4). Each Samoan family comprises *matai* [holders of chiefly titles], *tama tane* [sons], *feagaiga* [daughters], *paolo* [in-laws] and children. The *sao* [main chiefly titleholder] is the head of the *aiga*. In the Samoan context, *pule* [authority] over resources is held in the chiefly title, yet the person who holds that title is only the trustee or caretaker (Aiono Le Tagaloa, 1992; Vaai, 1999).

All family members have specific roles and responsibilities, which are carried out daily and especially during traditional activities such as funerals, weddings and bestowal of chiefly titles. The notion of *suli* [heir through blood connection] means every family member has a right to become a *matai*, upon the agreement of all of the other *suli*. According to Aiono Le Tagaloa (1992: 122), "...the holder of the matai title is either male or female, very young or old, wealthy or poor, western-educated or not... The only prerequisites are that the matai be a true heir of the matai title and that he or she be the unanimous choice of all the heirs".

¹⁷ *Fale o le Fee* power station had already been out of operation before Cyclone Evan.

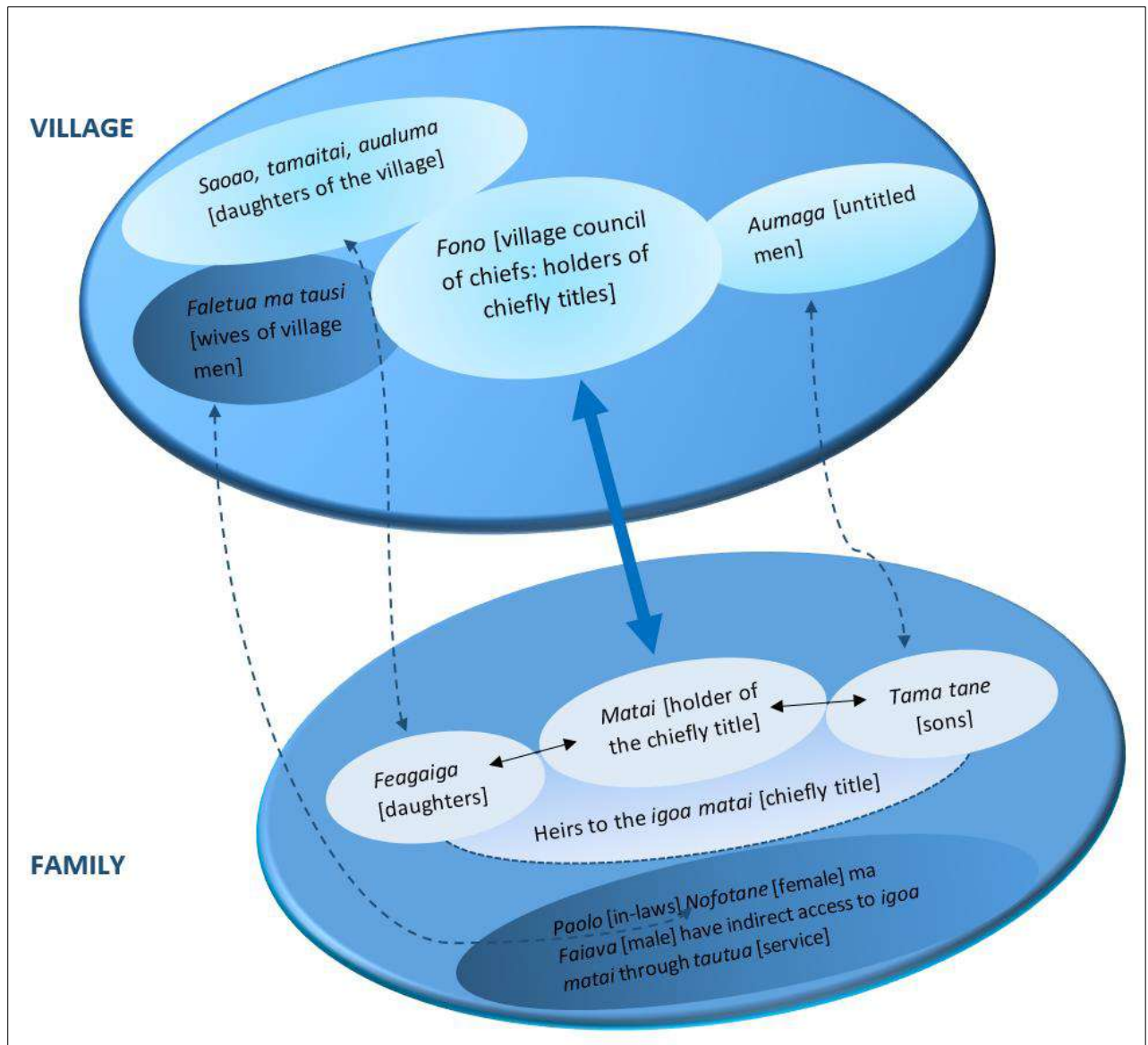


Figure 3.4: Faamatai in the early 1800s (Source: after Aiono Le Tagaloa, 1997).

The organization and governance of the village mirrors the situation at the extended family level. The village is managed by the *fono* [village council], a decision-making body consisting *matai*. Access through blood connections to the *matai* ensures that the authority of the village council is neither supreme nor separate (see Figure 3.4). These connections guarantee a voice for opinions through the family member who holds the title when he or she stands to represent her or his family in a village council meeting. The societal groups that constitute the *faamatai*, notably the *aumaga* [untitled men] and *aualuma* [daughters of the village] are integral, connected through blood and impact upon decision making that occurs at the centre rather than at the top. All groups play a role in the process of government and in the provision of goods and services (translated from Aiono Le Tagaloa, 1997). According to

Meleisea (1987: 18), *faamatai* ‘made economic individualism impossible’ because the system insists on “...respecting the autonomy of the village and the equality of family members”.

Soalaupule [consensus or consultative decision making] and *autasi* [consensus agreement] are central to decision-making in *faamatai*. Both concepts signify the holistic nature of the system and how it enables the inclusion of everyone in the decision-making process. *Soalaupule* refers to the importance of every member of the council being included in the process. Therefore, a decision is not final unless all members of the council agree. Time does not control such deliberations. “Rather the emphasis is on agreement and assurance so that all parties are satisfied. The discussion of an issue...can be postponed for another day if some members do not agree, as in the saying *E sili ona moe le toa*” (Latai, 2008: 64). The ultimate decision is that ‘sanctioned’ by the village council (Meleisea, 1987), *afioga tutasi* [council decree] (Tuimalealiifano, 2001). Issues such as recognition of land claims, boundaries and fishing rights become effective by the agreement of the *fono*. ‘Outsiders’, notably *nofotane* [female in-laws] and *faiava* [male in-laws] of village residents are not directly involved in the decision making process. Their opinions could only be voiced through their spouses and children (Latai, 2008).

Suspension from village *fono* activities and banishment from the village are the two main forms of disenfranchisement. “In the first form, detractors are cut off from participation in local governance but are allowed to remain on their land and in their houses. The second form is... dislocation from the village” (Tuimalealiifano, 2001: 319). According to Meleisea (1987), banishment was, short of being killed, the ultimate traditional punishment. It was reserved for offences that made it impossible for the village to tolerate the presence of the offender. In most cases, when a *matai* was banished, his entire *aiga* was sent into exile with him. Refuge is usually sought in another village where relatives live. There, they take on refugee status until, after certain obligations had been met, such as *ifoga* [ceremonial request for forgiveness], they can be re-admitted to their home village. In some cases, exiled families can request to become incorporated into the host village through titles of refugee origin.

B. *Va-tapuia*: A set of behavioural codes

Va-tapuia [sacred space] is a set of behavioural norms which dictates Samoan interactions with each other and the physical elements of the environment. Tamasese (2007: 18) refers to the literal meaning of *va-tapuia*;

“...*tapu-ia* [sacred] *va* [relationship] between man and all things animate and inanimate...implies that in our relations with all living things, living and dead, there exists a sacred, a life force, beyond human reckoning”.

These norms give rise to the principle of *va-fealoai* [mutual respect] that signifies culturally appropriate behaviour (Aiono Le Tagaloa, 1996; Tamasese, 2007). *Va-tapuia* governs the way decisions are made in the *aiga* as well as in the *fono*. It influences activities such as food division and distribution, sleeping and sitting arrangements, and language usage in the home as well as in public places. *Va-tapuia* establishes limits and boundaries between old and young, sister and brother, titled and untitled, pastor and church members (Lilomaiaava-Doktor, 2015: 68). These are explained further in the next section of the chapter.

Va-tapuia also governs the use of resources. It can be argued that the sacred, *tapu-ia*, that Tamasese (2007) refers to reflects how awareness of *va-tapuia* engenders attitudes that accept and respect the limits of human knowledge in relation to the physical environment. It is this awareness that leads to the development of a precautionary attitude similar to that advocated by the notion of sustainability in Kay and Adler (1999). *Sa* [taboo], as related through oral traditions protected vulnerable species and sacred spaces, and prevented the exploitation of forests, marine areas and water sources. *Sa* relates to forbidden spaces (Tamasese, 2007). For example *sa*, relating to the legend *O le vao sa o le Tuifiti* [sacred forest of the Tuifiti], prevented people from exploiting the forested area on the outskirts of the village of Fagamalo, Savaii. *Sa* relating to the water source called *Mata o le Alelo*, which features in the legend of Sina and the eel, forbids excessive noise and splashing while swimming. The word *vasa* [ocean] draws on the notion of *va-tapuia* and how it extends to the open ocean. The ocean was once forbidden to most people except for the *tautai* [skilled fisherman]. Most people fished within the lagoon area but the *va* between people and ocean hinted at the dangers one party posed to another, and signified protection of the untrained fisherman as well as the resources (Latai, 2008).

Faamatai and *va-tapuia* ensured survival of Samoan society through existing social connections and reciprocity, as well as the careful use of resources.

C. Human activities before the 1800s

A simple form of shifting cultivation, that was more sedentary than transient, characterized pre-European land use. Watters (1958) commented that the Samoan method of cultivating taro revealed particular attention to factors that ensured continuing productivity in the area's

soil. Samoans recognized the youthful nature of the lava rock that dominates their environment and knew that it produced immature soils. Stoniness has always been the main limiting factor to cultivators of the yellow- brown clay loams. In its timing, and as a process, burning was not merely a device to clear the land. Rather, the burning of organic matter and the heating of the soil surface produced easily assimilated plant nutrients at a time when taro was ready for planting. Absence of evidence for devastated areas in early written accounts suggests that the negligent use of fire was uncommon. Burning took place at the right time, and not too late in the dry season. To clear the land, bark was first burnt off the trees which were permitted to stand until they, too, became dry. They were then cut down and used as fuel. Any reduction in organic matter by burning was balanced by the gradual decomposition of tree trunks and debris that survived the burn, only to decay in the following wet season. Taro was occasionally grown in swamps, which are common between the hills and raised beaches. Several early visitors believed that the neat taro ponds were artificial, and that Samoans had developed a system of irrigation like other Polynesians. In fact no irrigation was done: the ponds were natural and the channels were drains (ibid).

Taro planting was successive: when a plant was pulled out of the ground, the top was cut off and the leaves removed. The *tiapula* [top part of the taro] was planted in a hole made by the *oso* [wooden digging stick] about a foot away from the old one. The *oso* is jabbed into the ground with both hands and the soil loosened to create a deep and large hole in which the *tiapula* is placed. Weeding was common, but only around each taro hole. A mulch of dead vegetation was spread over the ground between plants to keep down weeds. Just before the taro reaches maturity, weeding stops. Though competition from weeds was harmful to the taro crop, they helped keep over drained soils moist, and on steep slopes a mat of weeds limited soil erosion. Taro was planted in the rainy season, from November to January according to the region. Some foresighted *matai* planted in December instead of November, in view of the fact that tropical cyclones were most common in January. A later planting meant that the taro plants would be too small to be harmed by the storm (Krämer, 1901, Watters, 1958).

The sea was the main source of protein for Samoans (Krämer, 1901), and the lagoon was a special preserve, with the *fono* managing any activity that occurred there. The lagoon was continuously combed in every conceivable fashion, from simply groping between rocks with bare hands through using simple tools such as traps, nets and hooks. The habits and movements of preferred fish species have been studied by generations of expert fishermen

who led communal fishing expeditions (Wilkes, 1852; Buck, 1930). Communal fishing activities ensured the availability of marine resources amongst villagers, as well as the sustainability of those resources for future generations.

3.3.2. Changes to Samoan society since the 1800s

A. 1830s: European missionaries and integration of Christianity into *faamatai*

The arrival of missionaries and adoption of Christianity in the 1830s created a new group of people who held honorary positions of high status in the village, but outside *faamatai* (see Figure 3.5). When the missionaries arrived they brought in local residents from other villages as pastors, and this selection method is still practised today. The formal Samoan word for pastor is *faafeagaiga*, with the prefix *faa* meaning characteristic of or like in the manner of the same kind (Milner, 1966), relating the relationship between pastor and village to that between a brother and a sister. The sister in the Samoan context is the *feagaiga* [covenant and/ or agreement] relating to the *va-tapuia* between a brother and a sister (Latai, 2008; Latai, 2015).

In a similar way *va-tapuia* between the pastor and the village demands caution and mutual respect. The pastor is an outsider, so he does not sit within the circle of the *faamatai* of the village he ministers to, though out of respect it is common that the opinion of the pastor will be sought to smooth out any conflict that may arise in the council. This is similar to the role of the sister as the *pae ma le auli* [peacekeeper in the *aiga*]. This does not mean that a pastor is fated to exclusion. He is a participant in the *faamatai* of his home village, where he is an untitled man (see Figure 3.5). But, the creation of *faafeagaiga* role saw the failure of Christianity to penetrate *faamatai*. While religion has become a central part of Samoan society, churches exist as separate entities in the village with existing mechanisms for information flow and interaction with village councils (Aiono Le Tagaloa, 1986; 1996b; Latai, 2008; Latai, 2015). In any given village, whether there are two or seven different churches, village councils accord the same protection, status and respect to each of those ministers.

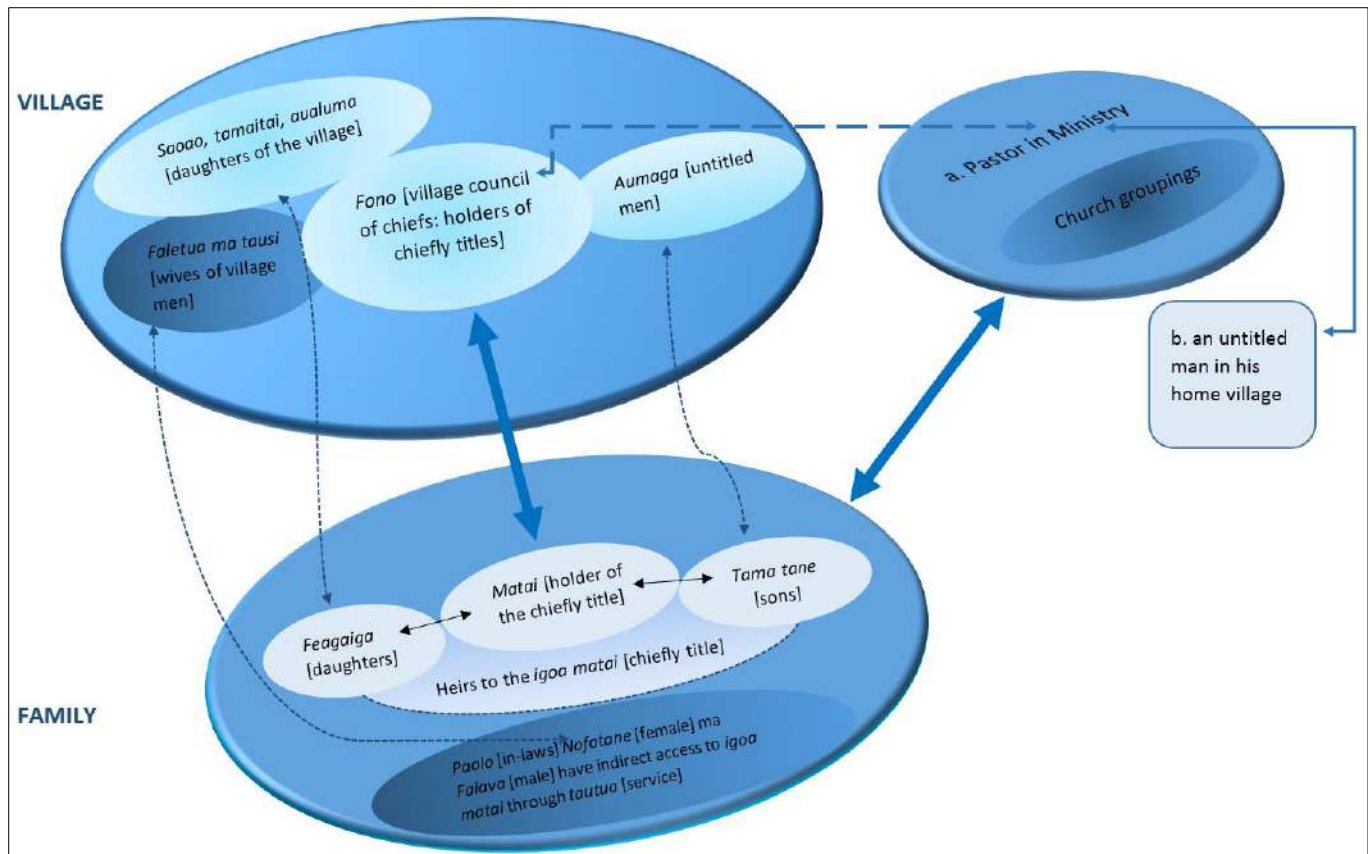


Figure 3.5: Position of the pastor in traditional Samoan society (a) in the village he ministers, and (b) in his home village (Source: after Latai, 2008).

B. 1900- 1961: Establishment of colonial governments- Germany (1900- 1914) and New Zealand (1914- 1961).

In addition to missionaries, colonial administrations of Germany and New Zealand were established and led to the creation of a centralized national governance system. Between 1830 and 1900 Germany, Great Britain and the United States competed to establish spheres of influence and control in Samoa. This period of actively competing influences was succeeded by the colonial administrations of Germany from 1900 to 1914, and New Zealand from 1914 to 1961 (Vaa, 2006). Economic interests dominated the next chapter of colonial control, as Germany brought traditional authority under central rule and capitalized on the country's resources. In February 1900, the municipal organization of Apia was abolished, and German centralized rule penetrated to the sphere of the village council. The appointment of Samoans as *pulenuu* government officials in this new German government enabled a centralized bureaucracy to penetrate *faamatai* (Meleisea, 1987: 54), where a member of the village council now had responsibilities to the colonial regime. This is vastly different from the situation in *faamatai*, where the matai is loyal to his *aiga*, the source of his authority. The

role of *pulenuu* still exists today. The establishment of the Land and Titles Commission (in 1903), later the Land and Titles Court (in 1937), saw authority over land given to an external agency that operated according to German law (Aiono-Le Tagaloa, 2009). This conflicted with the caretaker role that lies with the holders of *igoa matai* who make up the village council. The court became the first institution to effectively legalize traditional processes involved in the conferring of titles and regulating land transfer in Western Samoa. Instead of relying on the traditional style of consensus, the court decided what was to be done when conflict arose. Contrary to holistic notions of *soalaupule* and *autasi*, this system ensured the governor had a strong, even deciding, voice in the processes involved in *matai* title conferring and land transfer (Meleisea, 1987; Vaai, 1999). These changes continued throughout the New Zealand administration from 1914 until 1962.

Even though colonization established a centralized government which adopted a legislated approach to resource use and management and created *pulenuu* government officials within village councils, *faamatai* largely influenced activities at the village level (see Figure 3.6). Studies of Samoan material culture conducted in the early 1900s noted the flexibility of *faamatai*, in that while it allowed for variations these would eventually be accommodated and subsequently submerged in the resilient and ongoing culture. Most activities at the village level in the 1900s (Buck, 1930; Keesing, 1934) were largely similar to the situation observed during the period of initial European contact (Wilkes, 1852; Turner, 1884; Krämer, 1901; Watters, 1958).

C. Human activities since the 1800s

1. Activities similar to the 1800s

Buck's (1930) study of cultivation in the early 1900s revealed older techniques of planting taro were still being used by most Samoans. Most were still using the *oso* as the main planting tool. He further observed localised techniques for instance in wet areas, such as along a stream or wetland, the *tiapula* is planted singly against the side of the hole which is kept patent. This practice is termed *loiloi*. In dry stony, soils such as those found at Asau on the northwest coast of Savaii, taro is grown in shallow holes made between stones. This practice of making holes between the stones is referred to as '*faaluai le talo*'. The five main varieties of taro grown were *talo Manua*, *talo Niue*, *talo mangasiva*, *talo tanga* and *talo pulaau*. Dry season crops such as yams were planted between June and August. Early planting was in May or June. This could lead to inferior, pimpy skinned tubers if the rainfall

was under average, but would permit harvesting in December before the hurricane season begins (January to March) (Watters, 1958). *Tuiefu* planting, in dry soils is commonly practiced during the dry season, particularly in the drier north-western parts of the islands. Four breadfruit seasons were observed- *fuata mafu I ato seu* [March], *taoto* [May], *fuata tu faamanu* [August], *fuata a le tau* [October] (Buck, 1930).

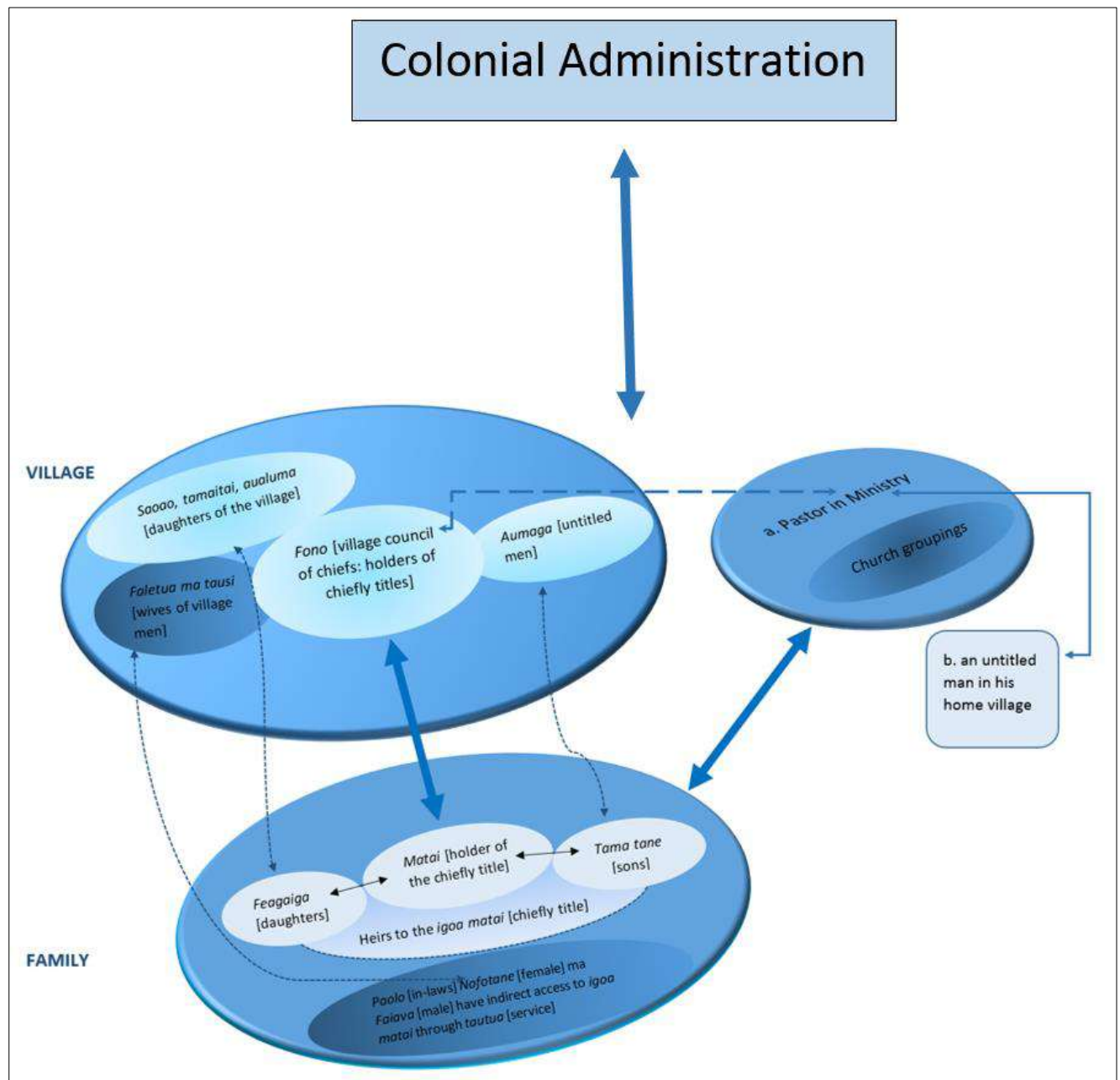


Figure 3.6: Faamatai was maintained at the local level although subordinated in national governance during German and New Zealand colonial rule (Source: after Latai, 2008).

2. Transformations

i) Growth of coastal settlements and commercial plantations

In contrast to Buck's observations, other studies revealed major transformations were occurring in other parts of the country due to European colonization. Davidson (1969) claimed the arrival of whalers, traders, settlers and missionaries in the 1800s triggered the subsequent shift of village settlements from inland sites to the coasts. These contributed to the extensive clearance of coastal forests. By the 1840s, 96% of Samoa's population lived in village settlements situated close to the sea (Watters, 1958).

Forested areas, particularly on the northern coast of Upolu and western parts of Savaii, were also cleared for commercial plantations. Alienation of land to European settlers in the mid-1800s subsequently led to the removal of forests and the establishment of cotton¹⁸, coconut¹⁹, cocoa, coffee and banana plantations and cattle farms. Two American companies, Central Polynesian Land and Commercial Company of California (Fox and Cumberland, 1962), and the German firm J.C.Godeffroy and Son, which later became the Deutsche Handels und Plantagen- Gessellschaft der Sudsee Inseln zu Hamburg (DH and PG), purchased some 10,000 hectares between 1869 and 1872 for cotton plantations (Keesing, 1934). Frank Cornwall, a British national, cultivated coconut, cotton and banana plantations at Magia, Fasitoo-uta and Faleula (north Upolu) in the late 1870s and early 1880s. According to Ward and Ashcroft (1998), areas that were occupied by forests and mixed crops planted by Samoans were replaced by large plantations which employed wage labour and engaged in mono-cropping of long term tree crops (see Figure 3.7).

In the 1900s Weber, the local Godeffroy agent and manager, acquired valuable estates at Vaitele in the Faleata district close to Apia, on which he developed coconut plantations. The Mulifanua plantations in the west and Vailele in the east of Upolu became the ends of a belt in which plantation production was concentrated. Here were most of the great corporation estates: the coconut plantations of the DH and PG at Vailele, Vaitele and Mulifanua, and the Magia Plantation, as well as the cocoa and rubber plantations of the Upolu Cacao and Rubber Estates Company (Fox and Cumberland, 1962). Frank Cornwall also had plantations at

¹⁸ Throughout the 1880s, cotton remained the chief agricultural product and the principal source of export income for the Samoan archipelago (Fox and Cumberland, 1962).

¹⁹ Copra and cocoa became the main exports in the early 1900s (Meleisea, 1987).

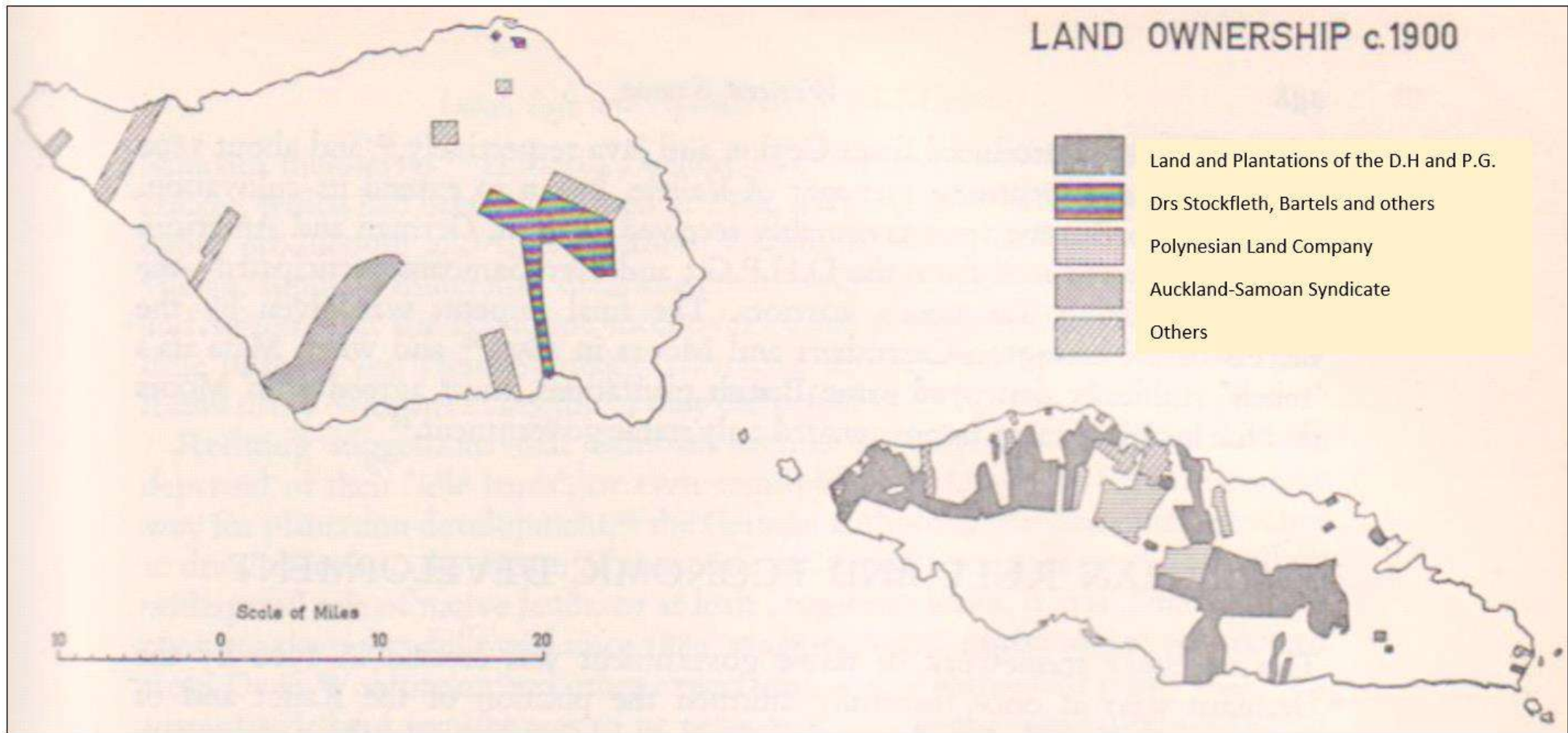


FIGURE 3.7: Land alienated to foreign companies in the 1800s and 1900s were converted to commercial plantations and farms (Fox and Cumberland, 1962: 147).

Masamasa in Asau on the northwest coast of Savaii and Lata on the isolated southwest coast of Savai'i.

Cash crop production and infrastructural development continued when New Zealand took over administration of the colonies in 1914. In 1926, the four major coconut plantations became Dominion property and were renamed the New Zealand Reparation Estates (Fox and Cumberland, 1962). Commercial planting of coconut and cacao continued on these lands up until the mid- 1960s when export of these products started to decline (Samoa Bureau of Statistics, 2012). Commercial crops were also widely grown on customary lands. Between the 1920s and the 1950s, bananas became a significant export product with most banana crops grown on customary lands, on the northwest of Upolu. The expansion of roads in the south and north-eastern regions of Upolu in the 1950s fostered the growth of the banana industry. It also intensified the clearance of forested areas for plantations. By the 1950s, bananas accounted for 62.5% of Samoan exports to New Zealand. Ward (1959: 123) stated that “land use maps of some 20 villages indicate that, with interplanting, 30% of the agricultural area was in bananas in 1955- 1956”. However, in 1955 and 1956, the ‘bunchy top’ (a virus disease spread by the aphid *Pentalonia nigronervosa*) spread rapidly in southern Upolu and was one of the causes of a marked drop in production in the latter year (ibid). The banana industry remained a small farmer industry and dominated agriculture until diseases and nematode buildup led to the decline of banana exports in the 1980s (Samoa Bureau of Statistics, 2012). Since then, there had been a decline in intensive cash cropping particularly on government owned lands. When Samoa became independent in 1962, the New Zealand Reparation Estates were transferred to the Samoan government and became known as Western Samoa Trust Estate Corporation (WSTEC) land. Since then, some of these lands such as Vaivase, Tulaele, Tiavi, Vailele and Vaitele, have been sold as freehold land, while others have been used for government projects such as Faleolo Airport and Mulifanua Wharf. In addition, commercial plantations were adapted and widely used by Samoans on customary owned land by the end of the colonial period. Most family lands were cleared as families engaged in the commercial production of coconut, cocoa and bananas up until the mid-1960s, and then shifted to taro and ava throughout the 1970s and 1980s. The shift was due to hurricane, diseases and market problems (Fairbairn, 1993; Paulson and Rogers, 1997).

ii) Infrastructural development

The development of roads was important to the expansion of commercial plantations and this was initiated by the German colonial regime in the early 1900s. The first road linked the plantations east and west of Apia to the port and endowed the existing plantation belt with superior communications. Prison labour and a small number of Chinese coolies were employed on road construction. By 1914 a post road ran the length of northern Upolu, while bridle roads crossed the island south of Leulumoega and linked parts of the south coast. On Savaii, Salailua in the southwest was connected by a post road to Matavai in the northwest. Planters were encouraged to construct local connections, which is how northwest Upolu developed a close web of routes, making Samoa the ‘best- roaded’ of all German possessions (Fox and Cumberland, 1962). Also occurring between the 1920s and 1950s was the development of reservoirs to supply water and develop hydro power electricity for Apia and surrounding areas. A number of water intakes were established and in the 1970s, three hydro-power schemes: Samasoni, Fale o le Fee and Alaoa, were built along the Vaisigano River, whilst Alaoa and Fale o le Fee (no longer in operation) are located within Maagiagi. In addition to these, a number of water intakes, such as the reservoir and water treatment centre at Alaoa, were developed and are currently operated by the Samoa Water Authority (SWA) to provide water supply (see Chapter 6, Figure 6.2)²⁰.

Other activities included the development of infrastructure throughout the 1970s and 1980s. Roads and shipping services for Savaii Island were completed in the 1970s, fuelling the development of the timber industry in Samoa. At the same time, reclamation and seawall protection was undertaken in the Apia area. However, most of these, as well as water and electricity infrastructure, were destroyed by the 1990s cyclones. The task of rebuilding these infrastructure started in the mid-1990s²¹ and has intensified over the past two decades due to the availability of external funding.²² Road upgrades and the building of seawalls as well as housing construction, mangrove harvesting and sandmining has changed the character of the

²⁰ The agreement to allow water resources at Maagiagi to be exploited/used for power and drinking water supplies for the wider urban area occurred when the area was administered by the Moataa village council. The decision made sense because the pipelines transported water and electricity to the wider Apia area including Moataa and Vaiala who traditionally own this land.

²¹ Roads were upgraded and rebuilt as part of the recovery strategy from the 1990s cyclones. Two rehabilitation programmes were funded by the International Development Agency in 1993 and the Asian Development Bank in 1997.

²² SIAM project (2000- 2001 and 2006- 2007) funded by the World Bank and the Government of Samoa- project aimed to develop and protect infrastructure such as roads, seawalls, electricity and telephone poles.

coastlines and mangrove areas particularly in Upolu and northern parts of Savaii (Zann, 1991; Richmond, 1992; Boon 2001; Latai, 2008).

iii) Commercial deforestation

Rapid population growth particularly in the 1950s and 1960s led to the increased clearance of forested areas for settlements, agriculture and other commercial purposes. Fox and Cumberland (1962) reported mangrove deforestation and reclamation of mangrove areas for settlements. Clearance was also evident inland of Apia at the time of independence in 1962 as the government and churches leased and sold some of their lands as freehold to Samoans. Commercial deforestation, which occurred between the late 1960s and 1980s, led to the clearance of native forested areas on the north-western part of Savaii (see Appendix 1). Areas that were logged, mainly in Savaii, were replanted by the Forestry Division with foreign tree species mainly mahogany, eucalyptus and teak (Sesega, 2009). These, and the remaining native forested areas, were heavily damaged by the Big Fire of 1983 in Savaii and the 1990s cyclones. Since then, major reforestation programmes had commenced.

iv) Pests and diseases

The taro leaf blight *Phytophthora colocasiae* in 1993, and the arrival of the giant African snail *Achatina fulica* in 1994, destroyed the country's major export and staple crop. Taro cultivation was mostly based on one variety, talo Niue and became a major export crop up until the 1990s having replaced cocoa and coconut. In 1993, taro exports to NZ from Samoa had a value of SAT9.5 million, representing 60% of exports that year (McGregor *et al.*, 2011). A year later, taro production fell by over 95% and its export value dropped to only USD53,000 (approx. SAT140,000) (Chan, 1994). Within 2 years of the beginning of the blight, only 200 farmers were growing taro and supplies on the local market in 1994 were only 1% of the supplies in 1993. This damage to the country's staple food resulted in a shift to imported foodstuffs, primarily to rice as a staple (Amosa and Samson, 2012; Samoa Bureau of Statistics, 2012).

D. 1960s onwards: Political independence and the resurgence of *faamatai*

1. Recognition of *matai* titles and customary ownership of land

The national framework that existed at the time of political independence in 1962, and related changes that followed thereafter, fostered greater recognition of *faamatai* in national governance. In 1962, a Westminster-based government was established with the Head of

State, executive, parliament, judiciary, finance and the public service. At the same time, the District and Village Government Board, which comprises senior chiefs from around the country, served as a mediator- advisor between the central government and village councils (Toleafoa, 2006). In addition, Samoa's electoral system accommodated the country's traditional political districts. The Samoan suffrage, or the Samoan way of voting, means *matai* who are the elected representatives of all the heirs of *matai* titles, are the ones eligible to stand for election into government or parliament. The village council validates that the intending candidate has rendered service to and is recognized by the village²³. A *matai* with several titles from different villages may choose the parliamentary constituency associated with the village for which he or she stands (Meleisea *et al.*, 2015). Up until 1990 *matai* were the only ones eligible to vote²⁴ (Aiono Le Tagaloa, 1992). According to Soo (2012) the provision under the Electoral Act (1963, 1991) that only *matai* can be candidates for parliament's 47 seats, indirectly legalises the existence of village governments.

The Samoan Constitution, which became the basis of national law, acknowledges the importance of the Samoan custom, *matai* titles and the customary ownership of land. The preamble and Article 11 of the Constitution refers to custom as a source of law. Article 100 under part IX of the Constitution, refers to *matai* titles, while Article 102 prohibits the alienation of customary land (Government of Samoa, 1960). Article 102 states, 'No alienation of customary land. However, should there be a move to alienate, then two thirds of the people whose names appear on the Samoan electoral roll (i.e two thirds of the *matai*) must vote to pass such an alienation (Aiono Le Tagaloa, 1992)'. Matters relating to *matai* titles and authority of *matai* titles over customary land are dealt with at the Lands and Titles Court. *Matai* titles, customary lands and related disputes are registered at the court. The inseparable connection between chiefly titles and land and communal ownership of resources, whereby an individual cannot claim ownership of the chiefly title and related lands, had restricted further alienation of land. While commercialism and centralization established the

²³ "Even though a *matai* is rendered legal when it is officially registered in the Lands and Titles Court, it is the village government that legitimises it. The Land and Titles Court only registers a new title after the traditional title- conferring ceremony (at which the village government plays the most important role) has taken place. It is the traditional prerogative of a village to accept (or reject) a new title-holder from being a member of its council of *matai*...the village council may deny the new titleholder entry to the village council by refusing to participate in the title- conferring ceremony (Soo, 2012: 134)."

²⁴ "In 1990 Tofilau Eti's government decided to change the qualification of the voter on the electoral roll by giving the right to vote to everyone over 21 years of age. Within *faamatai*, this wish, to give everyone over a particular age to vote and stand for office, is irresponsible in the extreme, and tantamount to giving to the young and uninitiated the august task of steering the ship of state (Aiono Le Tagaloa, 1992: 130-131)."

notion of individual ownership and subsequently led to the alienation of some land in the 1800s, about 80% of the land still remains under customary authority.

2. *Faamatai* within the national governance framework

Significant efforts towards integrating *faamatai* into the national governance framework were made in the 1990s with the enactment of the Village Fono Act 1990 (Village Council Act). The Village Fono Act provided for the exercise of chiefly authority in accordance with Samoan custom and to recognize the primacy of village rights. The act recognizes and empowers village councils to develop and enforce village rules regarding the development and use of village resources such as lands, sea and water sources and the maintenance of hygiene in the village. In addition, to direct any person or persons to do any work (as defined under the Act) required for the village. The act also empowers village councils to impose punishments when village rules are breached. Punishments normally include fines paid in money, fine mats, live animals or food, and imposition of orders for an offender to undertake work on village land. The punishment is levied against the *matai* of the family of an offender, who is held responsible for the conduct of his *aiga* in the village. In most cases, all members of the family would assist, by giving whatever they can afford to the offender in paying the fine. It is also common practice to exclude from participation in village governance a *matai* who does not abide by village rules. The legislative powers of the village council are limited because everyone in Samoa is bound by national criminal and civil laws. Disputes over matters of customary law are normally taken to the Samoa Lands and Titles Court. In extreme cases, village councils may order an offender to leave the village, but if taken to court the civil courts will usually over-rule such orders on the grounds of individual or human rights under the Constitution (Meleisea *et al.*, 2015: 23)²⁵.

In 1995, the Internal Affairs Act was passed which aligned local village government to central government via the establishment of the Division of Internal Affairs²⁶ (see Figure

²⁵ The Samoa Law Reform Commission report stated that while the Act gives powers to village councils, it does not specify how they should exercise those powers. Village councils cannot have unfettered powers to make decisions without consultation and proper processes (would there have been an assumption that they would act according to custom and traditions which are based on the latter process of consultation). The key to reforming the act is to introduce concepts such as consultation. The way in which village councils make their decisions can no longer be arbitrary and unilateral. They must abide by the rules of natural justice.

²⁶ Tauaa (2014) stated that a longstanding issue with the establishment of the Internal Affairs Division relates to the way it is subsumed under the Ministry of Women Community and Social Development. She recommended setting up a Ministry entirely dedicated to internal affairs and local government rather than having village councils as a division under Women and Community.

3.8). Mediators mainly the *sui o le nuu* [village council representative] and *sui o le malo* [women's group representative] report to government and vice versa through this Division. A representative for young people also exists. Holders of these positions are nominated by members of the council and women's committee. They are paid an allowance and report to the Division of Internal Affairs (Latai, 2008; Tauaa, 2014; Meleisea *et al.*, 2015).

Amendments to further strengthen the role of the village councils were proposed in the Village Fono Amendment Bill 2015. The proposed amendments would give legal recognition to the authority of the village council to protect Samoan customs and traditions, and to safeguard village traditions, norms and protocols. The Bill covers the following:

- a) Granting of a specific power to impose curfews and banishment
- b) The inclusion of limited jurisdiction over those living in government, lease or freehold land located within village lands
- c) The provision of specific power to Village Fono to make their own *faiga faavae* or *iugafono* and register them at the Ministry of Women, Community and Social Development in order for them to be recognized by the Court. However the registration of *faiga faavae* or *iugafono* does not necessarily mean that they are consistent with the Constitution;
- d) The requirement to consult and obtain the approval of the Village Fono before any building or activity can be undertaken- e.g. a shop or a new church. If the *Alii* and *Faipule* decline the proposed activity or building, the decision can be appealed to the Land and Titles Court under section 11 of the Act (Government of Samoa, 2015).

The proposed provisions will strengthen the definitions of village authority in relation to defining *faiga faavae* village council policy and procedures to be followed in making *iugafono* village council decisions. If the Bill receives ministerial approval it will be debated in parliament.

Village by-laws are being prepared under the Good Governance Project of the Internal Affairs Division of the MWSCD. As of April 2015, 20 villages are working with the Internal Affairs division to write their by-laws. An important part of this process is that village councils are receiving assistance in enhancing understanding of their roles and responsibilities according to the constitution and the current legal system. Consultations that were held with the village councils discussed some village council practices and procedures which have been contrary to the law. For example, the practice of reporting offences to the village council before the police and banning of females to become matai. Extreme cases that have occurred include the violent removal of people and their properties from Falelatai and Fagaloa (Meleisea *et al.*, 2015).

Village councils were also advised that villagers who are being fined or otherwise punished should be allowed to present their side of the story to the council. Moreover, village councils should register their members and document their decisions within a formal process for the registration of village by-laws. The registrar for the by-laws would have the authority to accept or reject the by-laws based on compliance with best practice guidelines provided. Only the sections of the by-laws which are compliant with the constitution would have the full power of the law. The finalized by-laws must be approved, with signatures, by the four main social groups in the village (*Meleisea et al.*, 2015).

Both the Village Fono Amendment Bill 2015 and registration of village by-laws signal an opportunity for Samoan individuals and communities to re-invigorate *faamatai* and its principles of *soalaupule* consensus decision-making and *va-tapuia* at the *aiga* and village levels. Moreover, to empower individuals to take ownership and responsibility of resources within their jurisdiction and participate in related decision-making processes regarding their use or protection.

3. *Faamatai* at the village level

Most contemporary studies of Samoa indicated that *faa-matai* remains largely intact with village councils operating autonomously. Aiono Le Tagaloa (1992: 132) stated,

“But in the heartland of *faamatai*, i.e. the *fono a le nuu* and the social groupings of the *tamaitai*, *aumaga*, and *faletua ma taus*, confidence in the ability of the *faamatai* to cope, to survive and continue to maintain peace within each village, district, and island, remains strong and persistent”.

Extended families, the village councils, untitled men’s groups, women’s committees and churches are still central aspects of Samoan village life. Fauolo (1993) and Paulson (1993) stated the important roles these groups played during and after the 1990s cyclones in directing replanting and expansion of food crops, rebuilding of houses and village clean-up. The strength of these networks was also demonstrated by the quick and proactive response to the 2009 tsunami. The structure of land ownership and customary land rights enabled families to relocate to family land and many were able to start rebuilding immediately after the tsunami (International Federation of Red Cross and Red Crescent Societies (IFRC and RCS), 2011).

Many religious denominations have developed structures according to the village model. For example, most churches have women’s committees, church committees, youth groups and

Sunday schools. Most members of the villages are part of these groups and participate in their daily and weekly activities.

Today, the majority of Samoans still *tautua* [serve] their family. Remittances from immediate and extended relatives living on freehold land and abroad connect villages to the outside world. These relationships are cultivated through caring, giving, reciprocating and participating in every social-cultural obligation such as funerals, bestowal of matai titles, weddings, dedication of church buildings, and fund raising activities. Samoan pride and loyalty to family, church and village are demonstrated whenever there is a village fund-raising call for the building and dedication of a new church, church hall, and pastor's residence, or any major village project. Anecdotal evidence suggests numerous *malaga sue tupe* village fund-raising travels to New Zealand after cyclone Heta (2008) and Evans (2012) for various village projects ranging from new church buildings to schools and a *fautasi* [long boat] for the Teuila and Independence boat race. The large Samoan diaspora overseas has contributed significant changes to people's consumption patterns, social expectations and taste for modern goods (Macpherson, 1985; Macpherson, 1988; ILO 2006; Macpherson and Macpherson, 2009; Tauaa, 2014). Samoans living overseas can observe, comment and exchange views with Samoans in Samoa due to technological innovations such as facebook, twitter, emails etc and support communities in difficult times.

An emerging trend is that more Samoan women have taken up *matai* titles. A growing number of Samoan women hold Chief Executive and Assistant Chief Executive Positions in the public and private sector and the majority of them have matai titles. It is not a prerequisite for the job, but it is an indicator of their status (heir) in the Samoan social organization (Aiono Le Tagaloa, 1986; Latai, 2015; Meleisea *et al.*, 2015). There have been families who have also conferred titles on people who do not live in the village to recognize their achievements, elicit contributions to family activities, or to link overseas, urban and village branches (Toleafoa, 2006). Titles have also been given on an honorary capacity, without playing the local leadership roles of a *matai* [chief] who resides in the village: for example, UN Secretary General Ban Ki Moon. In other known cases where there is a shortage of capable males in the family, the females (if they are reluctant to take up the title) and the family would decide to give the title to their husbands to acknowledge the latter's *tautua* [service] to the family. Hence, there are numerous cases where *faiava* [male in-laws] are *matai* in their spouse's families. There are limitations to titles that are given to those who are not heirs. *Faiava* would still carry out his normal roles and responsibilities within the

family even though he is a *matai*. After he passes away the title remains within the spouse's family.

Studies of Samoa's material culture reported that despite widespread changes in techniques and materials, people still operate within the framework of *faamatai* and enduring traditions. According to Neich (1985:6) "...most Samoans still work with a strong mental concept of the traditional artefact...often with a resurgence in the popularity of older forms...he is able to select and generate a 'performance' best suited to changing external circumstances". Some old techniques are being forgotten, but in many cases people are aware and knowledgeable about the old techniques, while making the conscious choice to employ more modern and more convenient, streamlined techniques. Samoans have proved repeatedly that they are able to appreciate and capitalize on the advantages of new crop species, technologies, and market opportunities. Some villages have adopted new crops and techniques and have achieved very high levels of agricultural production, which suggests that there is nothing inherent in their organization that leads to an inevitable resistance to innovation (Macpherson, 1988; Macpherson and Macpherson, 2009). Lefale (2010), in his study of traditional Samoan knowledge regarding weather and climate, concluded that Samoans have an extensive knowledge of cosmology, which they use extensively to predict environmental changes, including changes in climate and weather.

3.4 *Faamatai* within contemporary Samoa and implications for developing resilience to climate change

3.4.1 *Faamatai* and national climate change adaptation

Changes which have occurred in the past centuries have seen the resurgence of *faamatai* characterized by a merging of centralized national institutions and *faamatai* at the local level (see Figure 3.9). This was crucial to the development of responses to future climate change. Since the 1990s, climate change has been high on the national agenda and there have been many efforts by the government towards environmental management and disaster preparedness. This commitment is evident in not only national reporting and ratification of various global and regional conventions relating to climate change, but incorporating these principles into national planning frameworks (see Table 3.1) (Romilly *et al.*, 2013). A National Climate Change Country Team (NCCCT) and National Task Team (NTT) were established and helped prepare Samoa's first communication to the UNFCCC in 1999 (Government of Samoa: Department of Lands, Surveys and Environment (DLSE), 1999).

In the 2000s, the availability of external funding enabled the government to develop a framework of strategies, plans and governance structures to develop and coordinate climate change adaptation and mitigation activities. The Global Environment Facility (GEF) through UNDP funded the preparation of Samoa's National Adaptation Plan of Action (NAPA) in 2005. The NAPA provided an overview of climate change impacts and vulnerabilities, identifies adaptation strategies and outlines the process used to select and prioritise specific adaptation projects for priority sectors. The areas that were prioritised included securing community water resources, reforestation, rehabilitation and community forestry fire prevention, climate health cooperation programme, climate early warning system, agriculture and food security sustainability, zoning and strategic management planning, CIM-Plans for highly vulnerable districts, conservation programmes in highly vulnerable marine and terrestrial areas of communities, sustainable tourism adaptation. GEF funded the implementation of adaptation projects in key economic sectors, including agriculture, health, forestry, tourism and coastal communities. These projects provide a mix of policy advice, capacity building, early warning systems, community demonstration activities and knowledge management (Ministry of Natural Resources, Environment and Meteorology (MNREM), 2005).

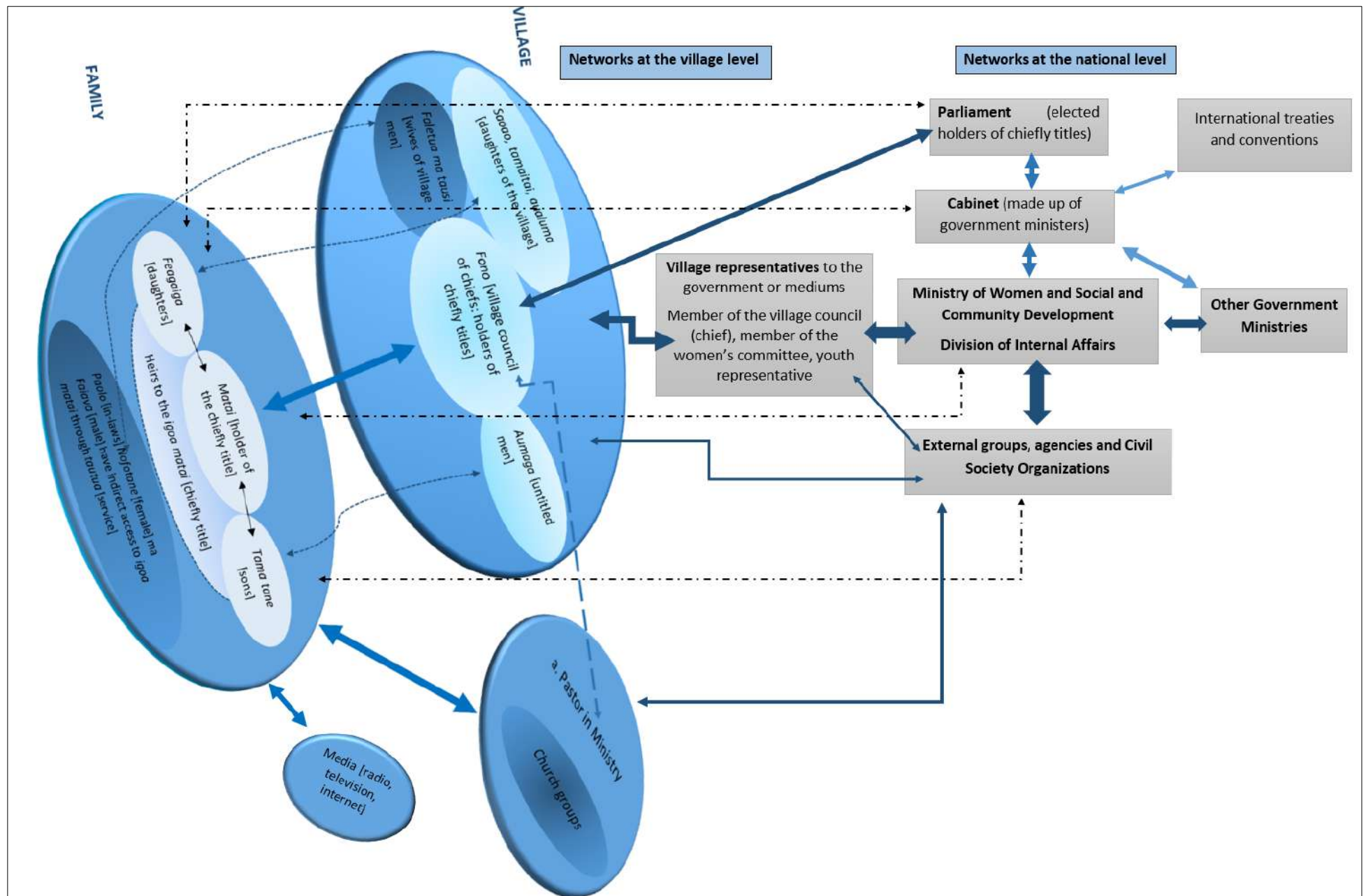


Figure 3.9: Resurgence of *faamatai* where multiple and multi-layered connections are evident between village and nation-wide institutions.

Table 3.1: Timeline of climate change activities by the Samoan government.

1992	Samoa signed the United Nations Framework Convention on Climate Change (UNFCCC)
1993	Samoa's State of the Environment report stated concerns for climate change. Provided the broad framework of priority issues and actions for environmental management in the country (MNRE, 2013).
1994	Samoa ratified the UNFCCC Treaty. Developed its first National Environmental Management Strategy (NEMS) in which one of the 12 recommended policies was 'responding to climate change. Since then, various climate change projects have been initiated, including the First National Communication Report, the Capacity Building for the Development of Adaptation Measures pilot project (MNRE, 2007)
1998	Samoa signed the Kyoto Protocol to the UNFCCC (ratified it in 2000)
1999	Samoa's first communication to the UNFCCC. Identified 5 primary areas of vulnerability to climate change. Agriculture, human health, biodiversity, coastal environments and water. Outlined several adaptation actions. This led to the setting up of the National Climate Change Country Team (NCCCT) and National Task Team (NTT) and the development of National Adaptation Programme of Action (NAPA).
2000	Samoa ratified the Kyoto Protocol to the UNFCCC. The Coastal Infrastructural Management Strategy (CIMS) project began and ended in 2007. A CIM Strategy was developed and is now a national level policy. CIM-Plans were also prepared for each of the 41 districts (283 villages) in the country. Community concerns, including climate related ones, were listed in these documents.
2005	The development of National Adaptation Programme of Action (NAPA) and the NAPA Task Team to identify urgent and immediate climate adaptation needs. Nine areas were identified and became GEF funded projects. Securing community water resources, reforestation, rehabilitation and community forestry fire prevention, climate health cooperation programme, climate early warning system, agriculture and food security sustainability, zoning and strategic management planning, CIM-Plans for highly vulnerable districts, conservation programmes in highly vulnerable marine and terrestrial areas of communities and sustainable tourism adaptation.
2006	The government endorsed Hyogo Framework of Action in Kobe and joined other Pacific islands in developing the Pacific Regional Framework for Action for DRR and Disaster Management 2005- 2015
2007	National Policy of Combating Climate Change was developed. The policy outlines Samoa's response to climate change and provides a national framework to mitigate the effects of climate change. This policy was implemented by the MNRE climate change project unit. By 2010, the expectation is that a new Climate Change section would be created within the Meteorology Division to manage climate change programmes The Samoa Disaster and Emergency Act 2007 was passed. Also led to the National Disaster Management Plan (practical application of DRR and linkages to other sectors). The plan facilitated the coordination of Government, Private sector, NGOs, financial institutions, academic institutions, religions and communities- their mandated roles within planning for, preparing to, responding and recovering from any form of disaster (part of mainstreaming)
2008	2008- 2012- NEMS was superseded by the Samoa Development Strategy, National Climate Policy and NAPA. Climate change was incorporated into the national development plans. The SDS for this period mentioned climate change under priority area 3: public sector

	management and environmental sustainability. Goal 7: Environmental sustainability and DRR. In the SDS before then (2005-2007) environmental management was not mentioned as it was dealt with separately- came under NEMS.
2010	Samoa's second national communication to the UNFCCC (MNRE, 2013). The Community Disaster and Climate Risk Management Programme (CDCRM) was developed for the government of Samoa through the Disaster Management Office under the Ministry of Natural Resources and Environment in 2010 with the financial assistance from UNESCO. The CDCRM programme is a unique tool developed to facilitate the delivery of disaster and climate risk management programme for all villages in Samoa. 2010- 2015 Community Sector Plan (Ministry of Women): Objective 4- climate resilience and community preparedness (page 230 of Bentin et al, 2013)
2011	The CIM Strategy was reviewed and revised to include reef-ridge area. Plans proposed for the Climate Resilience Investment Programme (CRIP). Areas of intervention identified in the CRIP include the following sectors: roads and highways, agriculture, fishing, forestry and tourism, flood protection, participation and civic engagement. The thematic focus of the CRIP is climate change, especially in the context of biodiversity, other environment and natural resources management, sustainable livelihoods, sustainable infrastructure, disaster risk management, and water resources management. The CRIP describes two major investment projects, enhancing the climate resilience of the West Coast Road (Apia to Airport), and enhancing the climate resilience of coastal resources and communities.
2012	2012-2016 25 district CIM Plans implemented under the United Nations Adaptation Fund. 2012-2016- Samoa Development Strategy Priority area 4: Environment Key outcome 13- environmental sustainability Key outcome 14- climate and disaster resilience
2014	2014- 2018 Pilot Project for Climate Resilience funded by the Climate Investment Funds and the World Bank would implement 16 district CIM-Plans. A major part of this project is 'climate proofing' a 30km road between Apia and the Faleolo Airport. This is related to the CRIP project proposed in 2011.

In 2007, the National Policy of Combating Climate Change was developed and provided a national framework for climate change adaptation and mitigation of Samoa's contribution to global greenhouse gas emissions (see Figure 3.10). The policy was drafted to implement Samoa's international obligations under the UNFCCC and Kyoto Protocol. The National Policy Statement on Climate Change (2007) and NAPA (2005) are implemented by the climate services and climate change sections under the Meteorology Division of MNRE. The Ministry serves as the secretariat for the National Climate Change Country Team (NCCCT). The NCCCT, the key members of which are the CEOs of relevant government ministries, is the key coordination mechanism for Samoa's response to climate change (MNRE: Government of Samoa, 2010; 2013; Romilly *et al.*, 2013). The Ministry of Finance has been

recently designated as the National Implementing Entity for the Adaptation Fund. Environment has become one of the priority areas in the 2012-2016 SDS. The key outcomes of this priority area are environmental sustainability and disaster risk reduction. The Strategy highlights the importance of integrating climate change and disaster risk management into national and sector plans to ensure that appropriate response mechanisms become part of the national development framework (Ministry of Finance (MOF), 2012).

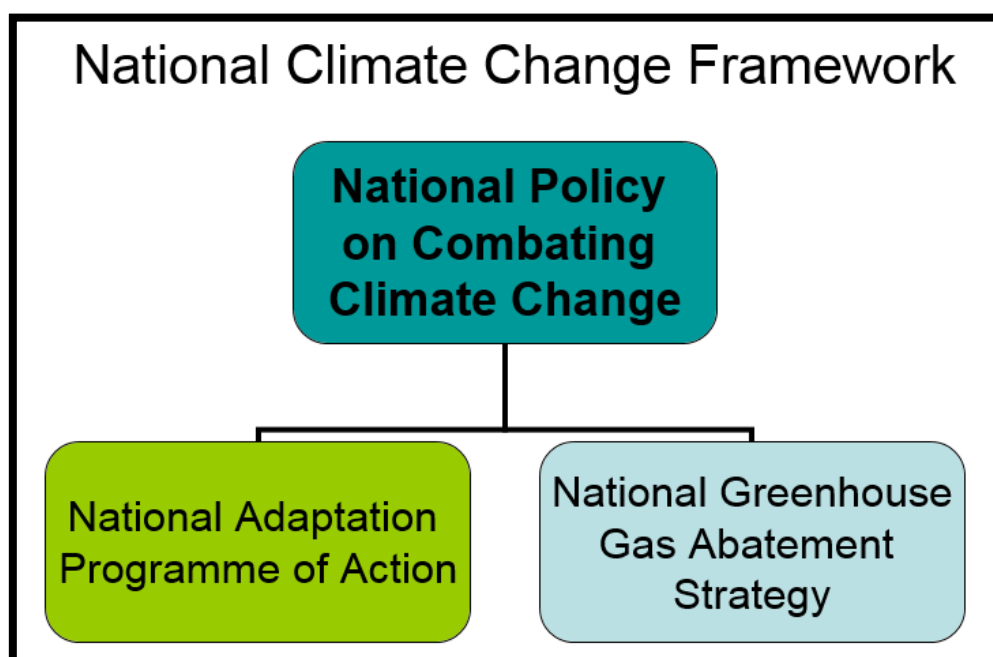


Figure 3.10: Samoa's framework for national climate adaptation (Source: Conaty, 2007)

The shift to a management framework that includes local villages was evident in the development of the Coastal Infrastructural Management Strategy (CIMS) 2001 and district CIM Plans, 2001-2007. The Samoa Coastal Infrastructure Management Strategy (2001 updated in 2007) defines national and local priorities for coastal management and sets policies and implementation methods for disaster risk reduction and climate adaptation measures. CIM-plans exist for each of the 41 districts (283 villages) in the country which state community concerns most of which relate to climate change and some proposed adaptation methods (Latai, 2008; Daly *et al.*, 2010). In 2011, the CIM Strategy was reviewed and revised again to include the whole reef-ridge area.

Many reports have noted the growth of government initiatives to enhance community adaptability to climate change in recent decades. Strategies undertaken by MNRE as part of

the CIMS project included the building of seawalls, upgrading of roads, development of coastal hazard maps and replanting of mangrove areas (Latai, 2008; Daly *et al.*, 2010; Williams and Faasau, 2015). In the past few years, the ‘Climate Resilience Investment Project (CRIP)’ funded by the Climate Investment Funds (CIF) and the World Bank (WB) has been proposed. A major part of this project is the construction of a 30 kilometre road along the inland parts of northern Upolu to connect Apia and Faleolo airport (see Table 3.1). The project would also implement strategies proposed in the CIM plans of 16 selected districts. In 2015 the East Coast inland route was completed. This 5.2 kilometre road runs from Samusu to Lalomanu, connecting the inland parts of villages on the southeast coast of the island and facilitating movement of those that had shifted inland due to the 2009 tsunami (Romilly *et al.*, 2013). Efforts towards disaster management include activities by the Disaster Management Office such as tsunami evacuation drills, identification of evacuation routes for coastal villages, installation of warning sirens and first aid training. The government through the MNRE and the Ministry of Agriculture and Fisheries (MAFF) also helped establish village fish reserves (King and Faasili, 1999), Marine Protected Areas (MPAs), mangrove and wetland conservation areas, forest reserves (both on village and government lands), turtle conservations and tilapia farms in a range of villages.

Furthermore, there have been a range of government programmes to develop livelihoods. These include weaving programmes and annual *faalelegapepe* [public display of fine mats] conducted by the MWSCD for village women. MAFF has helped develop food supplies by providing assistance to some villages to develop vegetable gardens, plantations and farming and fishing activities. These activities culminate with the ‘Agriculture and Fisheries Shows’ for farmers which are held twice a year on both Upolu and Savaii. Taro breeding programmes, developed in partnership with regional agencies, have produced significant results since the taro blight. New varieties of taro were introduced in 1994 and subsequent years. Among those early varieties introduced were the popular *talo fili* from Phillipines (PSB-G2), Palau varieties (P1-20) including the popular *talo polovoli* (*Ngerruuch*), *talo tie-dye* (*Toantal*) and *talo failuau* (*Pwetepwat*) from the Federated States of Micronesia. In 2003 *talo taamu* and *talo lauiila* were introduced. Later on, Samoa 1 and Samoa 2 were bred locally and are now also grown (Taylor and Iosefa, 2013).

3.4.2 Conceptualizing the resilience of Samoan individuals and communities within *faamatai* structures

The previous section has demonstrated that contemporary Samoan society is characterized by the multi-layered arrangement of extended families, villages and churches, as well as government and external agencies (see Figure 3.9). Therefore, in order to gain a deeper understand of the resilience of Samoans to climate change, one must conceptualize them within the context of these social layers which I propose ‘buffers’ the individual during environmental challenges. This approach as illustrated by Figure 3.11 situates the Samoan, and his or her perceptions and actions, within the context of his or her extended family, villages, church and nation. The approach is informed by the Samoan concept *gafatia* [endure], which speaks of a person’s or a community’s ability to deal with and endure challenges. *gafatia* provides a more in-depth understanding of non-equilibrist nature of Samoan beliefs associated with one’s capacity to cope with challenges. The term can be split into two terms *gafa* [lineage] and *tia* [hunting ground or ancestral burial place] which hint at the Samoan association of endurance with lineage and means of survival. Moreover it is grounded on previous socio-cultural studies (Aiono Le Tagaloa, 1997; Liki, 2015; Lilomaiaava-Doktor, 2015) which have highlighted the holistic and evolving nature of Samoan society and interdependent ‘kinship networks’ “...within which the individual is nurtured or cocooned” (Liki, 2015: 130).

Figure 3.11 is an expression of a traditional structure whereby the individual is at the centre of a set of complex social connections. The system is not hierarchical and highly flexible and there are complex interactions within the circles and between the circles. A resilient system is where all of these layers are present and are working harmoniously. Once born, a Samoan becomes heir to family chiefly titles and has automatic access to lands on both his or her mother’s and father’s side. At different stages of the individual’s life, he or she would gain membership to village groupings such the untitled men’s group or women’s committee. Once the individual takes on a chiefly title, they would become a member of the village council and may run as a parliamentarian for the district. Any individual may develop more connections and links by participation in the related activities of whichever groupings they are a part of. These sorts of people are family elders, youth leaders, church ministers, parliamentarians, government representatives, government officers, chiefs and school principals. As illustrated by the concentric rings (see Figure 3.11) these connections buffers

the individual from any challenges that may arise. There is a choice for the individual to maintain or sever these connections should they wish.

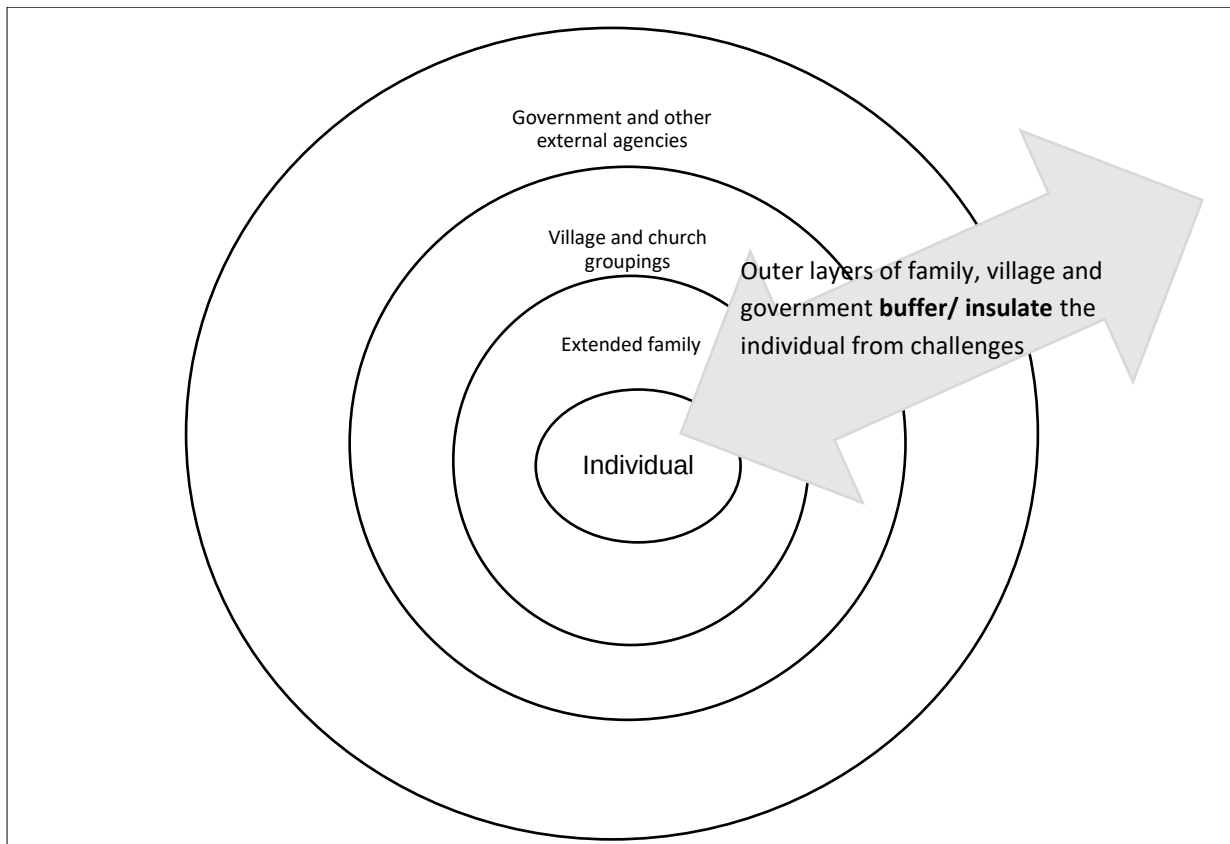


Figure 3.11: The ‘individual within *faamatai*’. Social connections ‘buffer’ the individual from external challenges.

Those who may leave the sites of their families will always have the same rights and responsibilities as the ‘individual’ located at the heart of the system. “One is born as kin and remains as kin regardless of one’s changing circumstances in life... kin... defines belonging and underpins rights and access to support and resources within the kinship network. The relationship also guarantees economic and social security...in difficult times, as in *e malu ia te oe aiga, e malu foi oe i aiga* [you carry *aiga* and *aiga* carries you]” (Liki, 2015: 130). However in leaving, there is a possibility of getting detached and losing connection to the centre, to family, identity, belonging and place. Therefore as discussed in the previous section, evidence shows a continuous effort by many to maintain these connections.

3.5 Conclusion

This chapter has demonstrated that Samoa is a highly dynamic place. Its physical landscape had not only evolved due to biophysical but also human related changes. All of these had continuously posed challenges to the residents in the past 200 years. In response, Samoan

society and its institution of *faamatai* [chiefly system] demonstrated resilience in the face of these changes. The system had adapted connections to external influences such as Christianity and the German and New Zealand colonial administrations, while at the same time retaining its original structures of the extended family and village council. As indicated in the final part of the chapter, these structural changes, as well as exposure to environmental challenges, would be crucial to the development of resilience to climate change. Evidence shows there have been government efforts to develop a coherent national framework where climate change is integrated in all its sectors. Furthermore, there is evidence of commitment towards implementing a range of activities to minimize environmental risks as well as ensure sustainable livelihoods. A holistic approach to assess the resilience of Samoans to climate change is proposed and is described at the end of the chapter, considering the structural changes that have occurred to *faamatai* in the past two centuries.

Chapter Four. Methodology: Ways of exploring resilience ‘in place’

4.1 Introduction

This study aims to enhance our understanding of the resilience of island societies in the context of environmental changes triggered by global warming by examining the perceptions and strategies of (sampled) community residents within the places they live. Two interconnected questions were developed to address the main research proposition which states:

“Islanders have for centuries had to cope with difficult and unpredictable environments and they have developed a range of coping strategies to strengthen sustainability. Thus, they would be prepared to deal with current and future climate change.”

The first question stated: What changes, associated with climate change, do islanders think are currently taking place and which of them are likely to occur in the future? This question aimed at investigating islanders’ (in this case Samoans) perceptions of climate change in light of other triggers of environmental change they may have experienced. The second research question, ‘How have islanders coped with previous disturbances including those which are climate-related? What strategies are they currently employing? And, what do islanders want and need to cope with future global warming?’, was asked to determine resilient behaviour.

A key objective of this chapter is to explain the author’s positionality in the research and then describe and justify the qualitative methodology and interpretive research design. The chapter will briefly describe the sites that were investigated for this research and explain the methods and selection of research participants. It will also discuss the implementation phase of the study, the ethical procedures followed and the data collection which was undertaken. The fieldwork was conducted, over a period of four months, in Samoa. Accordingly, epistemological assumptions of Samoan society, such as patterns of individual and group behaviour, values, cultural protocol, understandings of knowledge and its value, ownership in the research process will also be discussed.

Further, it will comment on how the gathered information will be analyzed and presented. Insights on the concept of ‘phenomenology’ (Heidegger, 1953; 1971; Relph, 1976; 1981) and ‘narrative-descriptive’ approaches (Tuan, 1975; 1977; 1979; 1991) have informed the development of methods to analyse and present the research findings. They encourage the use of intensive forms of description and literate interpretations of gathered information. These processes are grounded on humanistic ideas which recognize the importance of ‘not

just' including the human dimension into studies of the environment, but specifically directs our attention to ensuring human speech and actions are properly used to bring to light "...the *quality* (the personality or character) of place" (Tuan, 1991: 694).

4.2 My value position

It is important to consider a researcher's positionality, as this will impact on the research process and findings. 'Positionality' is defined as "...the perspective shaped by the [researcher's] race, class, gender, nationality, sexuality and other identities" (Mullings, 1999: 337). As human identity is not fixed, it is argued that a researcher's positionality will shift and change throughout the course of his or her research. For example, a researcher working with individuals or communities may find that there is a slippery space between being an outsider (someone different from the research participant or a stranger to the community), and an insider researcher (someone who is connected to the research participant or the community) (Skelton, 2009; Relph, 1976). Such was my experience in this study.

The fact that I am Samoan makes me an insider. But being Samoan did not mean that the research was easier, or that there were no challenges. The following quote by Waddell (2015: 341) sums up my feelings about the realities of conducting research in my home country and amongst my people. He stated,

"The process of acquiring a PhD.. must ensure that we emerge 'changed, troubled, respectful of those whom we have met'. This transforming experience will determine not only what we learn, but it will also nourish ties of friendship with and loyalty to those who so generously shared their knowledge with us and welcomed us into their homes and lives...truth is out there, based on experience, clothed in respect, delivered with dignity and acquired with humility. When I speak of fieldwork, I don't mean some kind of clinical or professional act- 'the collecting of data'- but rather a lived and shared experience, looking from the inside, from the local, out to the world; thereby sharing feelings, expectations, joys, pains and the continuing presence of the past".

My age, gender, cultural and marital status largely influence the way the research is conducted. I am a married 36-year old Samoan woman who has resided there since birth. Over the course of my life, I have lived in eight different villages in Samoa (one in Savaii and seven in Upolu) and have worked in two educational institutions. These experiences have created multiple personal connections with various people in the country who were helpful in the seeking of participants for this study. Furthermore, being an insider- researcher meant that I was privy to intimate information that required good linguistic and cultural skills for understanding local norms, values and expectations. I was able to engage with the research

participants in their own language and was aware of the cultural protocols I had to consider. To a certain extent, I could anticipate how Samoans would react to certain issues and could tell, through non-verbal cues such as laughter and eye-contact, when someone is serious or ‘just pretending’. Therefore, before asking questions that I knew could be sensitive to some participants, I would explain why the question would be asked. This avoided instances where participants would say what they thought I wanted to hear, or tell ‘tall tales’ and jokes to avoid answering. Being Samoan also enabled me to relate to and encourage the participants to share their experiences by relating my own, acknowledging that I understand what they are talking about, and talk openly about issues that concerned them.

On the other hand, being Samoan demands that I practice and maintain Samoan values of being respectful to those older than me. I learnt while growing up in Samoa that there are many facets of one’s Samoan identity and each carries certain expectations. For example, being a pastor’s daughter, a *feagaiga* [sister] and a wife means being respectful and acting gracefully in the presence of other people, especially those whom I have not met before. This ‘respect’ must be reflected in the way I dress, walk, sit, talk and eat- these are described in detail later in this chapter. Much of what I had learnt from my parents when I was growing up and confirmed in various situations outside the home was very useful in establishing rapport with research participants and conducting the interviews. During exchanges with research participants there were times where I had to probe further and observe more keenly because the participants expected me to know their experiences, simply because I was Samoan.

In addition, the task of undertaking a project where peoples’ time and knowledge were shared rather than granted, meant that I was expected to reciprocate in the normal Samoan way. This meant preparing gifts and giving short speeches after interviews and meetings of focus groups. Engagement in research is not part of a community’s daily routine and made me an outsider. Before entering the villages I sought assistance from my relatives, work colleagues, friends, and former students. Even though I had been to the villages before, I always requested a local villager to act as a guide and accompany me around the village and to sites I wanted to visit. Being less than familiar with the local village environment and most of the research participants meant that I depended on these people.

Field observations and triangulation of data helped to strengthen the validity of the information. Drafting multiple versions of this chapter, so that the research methodology and

design is clear and properly justified, is one way I have tried to minimize bias. Writing about my positionality forced me to reflect and reveal aspects of myself which may clarify why certain procedures were taken in gathering information for this study. It required me to reflect on the validity of methods that were used to gather, interpret and analyse the information.

How do I separate my own personal beliefs and experiences from those of my research participants, and how am I sure that what they said are properly presented in this thesis? It is difficult to answer these questions, as I believe my perceptions and experiences would always influence the way I interpret the study findings. This belief also resonates in the reflections of many Pacific researchers and scholars. For example, Liki (2015: 126) contends that one's values and beliefs particularly in the importance of family and communities cannot be removed when conducting research. Rather, they should be used to inform the way we conduct research and interpret study findings. She stated,

“... the worlds of academia and kinship are enmeshed within us. A sense of responsibility to our families and communities encompasses a commitment to employ our cultural thinking in scholarship. Thus what anchors us in our cultures can also guide our scholarship. Our enquiries can reflect the lived experience of the communities *in us* and the cultural thinking that *we live* and that travels with us”.

4.3 Rationale for using a qualitative approach

This research employed a qualitative approach to data collection by seeking to gather details about the attitudes and experiences of Samoan communities with regard to human resilience in the face of climate change in Samoa. Qualitative methods such as face-to-face dialogue and discussion were needed [if I was] to answer questions about how Samoan communities coped with climate change and whether they felt able to withstand future climate-related risks. Unlike positivism and related quantitative methods, which seek to measure and impose a single version of reality or truth, qualitative research is rooted in the humanistic principle that reality is socially constructed. Phenomenological analysis which is an integral part of the qualitative approach seeks to understand human experiences of phenomena (Heidegger, 1953; 1971; Relph, 1976; 1981). The ‘real’ existence of an object is irrelevant to phenomenological analysis, as the significance of an object lies in its meaning in our experience (Couper, 2015). Winchester stated (2010: 7-8) “the experiences of individuals and the meanings of events and places... constitute part of a multifaceted and fluid reality”.

Since these experiences are common to almost everyone they are intersubjective and must be understood as not merely individual, but as part of the basic spatial context of all cultural groups (Relph, 1976).

Employment of qualitative methods also allowed me to gather information from a predominantly oral society. Before the arrival of Europeans in the 1800s, cultural life in Samoa relied on the power of the spoken word: through oratory, chants, songs, dances and rituals. Recent researches have observed that “... the Samoan people, especially elderly people, are always keen to share or divulge their knowledge, but they will do so only when they meet in person or interact with the researcher” (Lee Hang, 2011: 79). Dialogue and face-to-face interactions that generate in-depth responses and detailed descriptions are more likely to achieve a deeper understanding of individuals and communities (Sarantakos, 1993; 2005).

4.4 Selection and justification of study sites

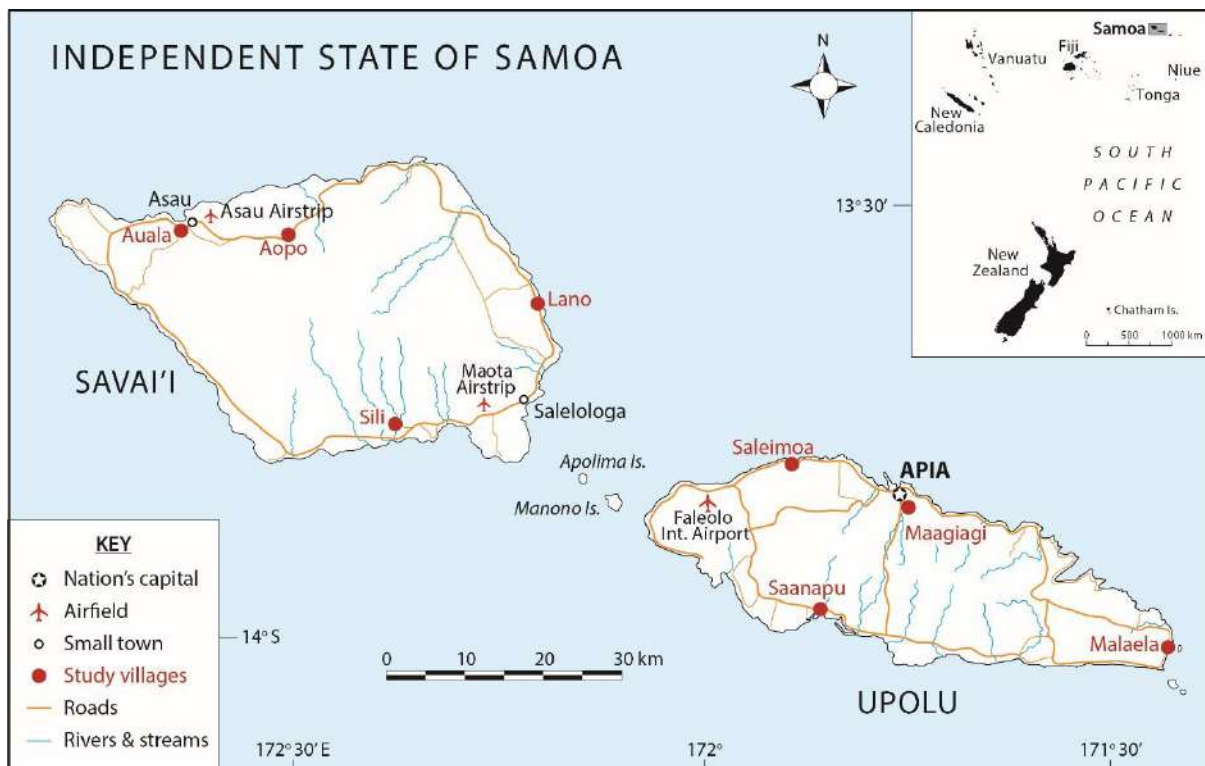


Figure 4.1: The eight sites selected for the investigation (Source: after Nations Online Project, 1998).

The aim was to select different types of settlements to ensure that the information gathered is representative of all communities in the country. Site selection involved the two main islands of Samoa, inland and coastal areas, small and large communities and the capital city.

Saleimoa, Saanapu, Magiagi and Malaela were selected from Upolu island, while Sili, Lano, Auala and Aopo were selected from Savaii. Sili, Aopo, Saanapu and Magiagi are inland villages, while the others are coastal (see Figure 4.1). Detailed explanations of these villages are given later in Chapters 5 and 6.

Being able to demonstrate variations in community adaptive responses and capabilities would add depth and richness to the information gathered. So, before conducting the fieldwork, I drew a table to map out the villages and their differences in location, size and environmental conditions so the study findings could demonstrate different levels and types of risks (Table 4.1). There is a high degree of cultural, linguistic and religious uniformity in the country, therefore these aspects were of secondary importance in the selection of the sites. Most people speak Samoan and they are members of various Christian religions. Regardless of where they are located, most households are semi-subsistence, meaning that in each household there are people engaged in both commercial and traditional employment.

Table 4.1 Possible risks that selected sites will be experiencing.

	Coastal villages				Inland villages			
	Saleimoa	Malaela	Lano	Auala	Maagiagi	Saanapu	Sili	Aopo
Climate related risks								
sea level rise								
short heavy rainfall								
coastal erosion								
coastal flooding								
storm surges								
gale force winds								
salinization of freshwater								
drought								
greater flooding								
bush and forest fires								
Key								
coastal sites								
inland sites								
Impacted by risks								

4.5 Research methods

Semi-structured interviews were conducted with key community informants, government officers and members of regional and civil society organizations. Focus group discussions were held with community leaders and young adults aged 18 years and older in the

communities selected. Two or three focus group meetings were held at each site and each focus group comprised six or seven participants.

4.5.1 Semi-structured interviews with key informants

Semi-structured interviews were used to gather information from such key informants as community leaders, members of the village, and officers from governmental and other organizations working in the area of climate change. As with a formal interview, this is a verbal interchange between two people: in this case the researcher and the research participant. This interaction was mostly face-to-face, but with the development of technology many researchers have used telephone and computer-mediated interviewing as a result of which direct access to the participants has disappeared. Semi-structured interviews remain popular in qualitative research, because they enable the researcher to gain insights into the different meanings, opinions and experiences of members of a social group (Dunn, 2010).

Semi-structured interviews were used because they allow planning and flexibility in the data collection process. This technique uses an interview schedule, comprising fully-worded questions prepared in advance, but as interviewer I was not restricted to asking only these. There may be an opportunity to ask follow-up or more probing questions during the interview itself (Bogdan and Biklen, 1998). The flexibility of the semi-structured interview also provides scope for participants to discuss each issue or theme in their own way. Participants were invited to contribute ideas which they felt were significant and relevant to the issues.

4.5.2 Focus group discussions

Focus group discussions were held with youths, women and farmers in the study sites. Focus groups were face-to-face discussions (Smithson, 2000) between three or more participants that usually produced agreed accounts about proposed topics. These sessions also enabled participants of similar background or characteristics to share their knowledge and participate in generating a collective response to the questions posed. Talking and listening to each other during a focus group discussion encourages participants to think more deeply and reflect on their own views and knowledge. During a focus group, participants do not simply agree with each other. Sometimes they disagreed, questioned each another, and tried to convince others of the validity of their own viewpoint (Kitzinger, 1994; Myers, 1998). There is, however, the possibility for participants to develop ideas collectively and advance their priorities and perspectives (Chambers, 1994; Smithson, 2000).

While this method was chosen with youth in mind, it was also used to gain information from women and farmers because the collective development of ideas and shared knowledge would strengthen the information gathered. Younger²⁷ Samoans have the tendency to be nonverbal, unquestioning and silent, particularly in the presence of elders (Day, 1981; Moli, 1993; Tanielu, 2004). The cultural value of *fa'aaloalo i e matutua*, [respecting your elders] is perhaps the most common and best known of the cultural factors that underpin this silence (Lee Hang, 2011). Focus groups can encourage the participation of people who may fear speaking, or who believe they may not have anything interesting to say. Focus group discussions also provide a space for such people to talk openly and share information as they would be among their peers. There is safety in numbers and people feel more comfortable expressing their views.

4.5.3 Field observations

Another method to supplement interviews and focus group discussions was field observation. It involved short walks with participants and taking photographs. Field notes were made for sites referred to during the interviews, as well as to gain a deeper understanding of the issues experienced by the participants. Some of these are examples of participatory research methods described by Chambers (1994).

4.5.4 Analysis of policies and grey literature

Textual analysis of climate related documents produced by the Samoan government, regional and international agencies and non-governmental organizations was undertaken. These materials included policies and legislation, as well as community-related documents such as district Coastal Infrastructural Management (CIM) plans, sustainable village plans, village disaster risk plans and maps. In addition, grey literature, such as unpublished versions of policies and community-related documents, was analysed (see Table 4.3 later in this Chapter).

4.6 Research participants and sampling procedures

4.6.1 Key informants

Community participants included chiefs, government representatives in the village, pastors, school principals, youth and elders. Selection of key informants at the local level ensured a variety of people undertaking different roles and responsibilities in their families, churches and villages is included (see Table 4.2).

²⁷ This includes those up to thirty years old.

Table 4.2 Roles of selected key informants.

Key informants	Role
1. <i>Matai</i> [chief]	Holder of a chiefly title and representative of the family in the village council
2. <i>Pulenuu</i> [government representative]	A chief selected by government and the village council to act as a conduit. In all the sites that were investigated the holders of these positions were male
3. <i>Sui o le malo</i> [female government representative]	Female conduit between the government and the village
4. Religious leader	Pastor/ minister of religion in the village
5. Elder	A person usually over 60 years old and held in high regard due to age and experience
6. Youth	A person between 18 and 30 years old

Holders of chiefly titles were included because of their roles as decision-makers both in their families and in the village. Their responses were expected to provide insight into the processes involved in local environmental management and the implementation of related activities. The study also considered elderly participants who were mostly above 60 years old. These people were selected because they would have experienced changes to *faa-Samoa*, from when they were young until now. Most would have lived during the colonial period in Samoa and would provide some interesting insights of environmental conditions at that time. An elder in Samoan society may belong to any of the social groupings acknowledged above, but the elders selected to participate in this research were mainly widows and widowers, those married into the village and untitled men. This was to widen the sample to include village residents under-represented in other categories. The selection of young people drew mainly from those between the ages 18 and 30 and included people not represented in other categories.

Government representatives would be chiefs who sit in village councils or members of womens' committees. Each receives an allowance from the government in return for service. Any project that might affect the village, whether proposed by the government, or by any other external organization, would go through these representatives. Their employment

enables them to comment knowledgeably on relationships between government and village councils.

A pastor is always an outsider in the village, but he plays a crucial role in village matters. At times, pastors are brought into council discussions when conflict arises, and the respect in which they are held usually sees the issues resolved. Most village chiefs are also part of church committees so they also interact with the pastor in that context. The selection of pastors for interviews was based on the dominant religious group in each place. These participants were expected to offer an outsider's perspective of village activities and their decision-making processes.

Persons with specific skills and knowledge of the local environment, such as those engaging in land and sea-based activities, were also considered. For instance, farmers, tourist operators/ owners of tourist beach *fale* (houses), fisher-folk and traditional healers. Farmers might talk about observed changes in the local environment and the impact of weather patterns and sea level rise on the land, as such changes can affect how and when they plant their crops and the time before harvest. Recognition of the multiplicity of roles that Samoans can play at any one time also proved crucial in gaining deeper insight into the views of groups that may be under- represented in the study, as well as matters raised by the participants during interviews. By asking questions about the participant's background I was able to explore their roles and seek additional perspectives on the topic. In many instances, a chief is not only a chief, but also a businessperson, a former government officer, or a parent. Some elders are chiefs, or were educators, pastors, or pastor's wives. Some pastors had previously been government officers, principals or chiefs. Government representatives may be chiefs in their own right, or simply members of the community. Because most participants hold multiple roles, they can observe and discuss issues from more than one perspective.

4.6.2 Other informants

The other participants were selected from government ministries, regional organizations and civil society organizations. These people are currently involved in climate change activities at the national and community levels and can offer an outsider's perspective of communities that they have worked in. Fifteen interviews were held with people working in the Ministry of Natural Resources and Environment (MNRE), the Ministry of Women, Community and Social Development (MWSCD), Ministry of Agriculture and Fisheries (MAFF) and the Samoa Bureau of Statistics. Also included are individuals who work in regional

organizations like the South Pacific Regional Environment Programme (SPREP) and civil society organizations such as the Civil Society Support Programme (CSSP) and the Independent Water Schemes of Samoa Association (IWSA).

4.6.3 Sampling procedures

A combination of purposive and snowball sampling methods (Sarantakos, 2005) was used to select the key informants. The sampling process was different for each site because my knowledge and familiarity of the communities varied with each of the villages. For some of the sites, the first phase of sampling started with the identification of potential participants with the help of acquaintances that I made whilst growing up in Samoa: relatives, school friends, work colleagues and former students from the villages of Saleimoa, Maagiagi, Malaela and Saanapu. These people helped me to identify potential participants from the social groupings that I wished to interview such as elders, chiefs, young adults and community members who are fisherfolk and traditional healers. At the other sites, sampling began after discussions with acquaintances and relatives who are working as religious leaders, or who have worked there in government projects and programmes, Auala, Aopo, Sili and Lano. Some of these people accompanied me on my site visits.

The second phase of the investigation involved snowball sampling where members of the community that I planned to interview gave me the names of other village residents who could be invited to participate. In some villages, the religious leader was interviewed first, and this person then helped me to identify village elders and government representatives and told me where they could be contacted. By visiting their homes, talking to them about the project, and ascertaining whether or not they were able to participate in the investigation, I could gauge who was best suited for the research. After an initial round of site visits, people were selected from each site, depending on their availability, roles and knowledge of climate change responses. The aim was to ascertain the resilience of community members to climate change, by identifying and investigating environmental changes that are significant to these people and their communities, and documenting their responses in the form of coping mechanisms and adaptive strategies.

4.7 Data collection and ethical considerations

A period of four months (from August 2014 until November 2014) was spent gathering information in Samoa. The first round of interviews and focus groups was held between

August and November 2014. Interviews were one-on-one, while focus groups involved mostly four or five participants discussing questions given out at the beginning of the session.

4.7.1 Planning the interviews and focus groups

Careful planning and preparation were undertaken to ensure the research is properly conducted. These factors were part of the application for ethical clearance submitted to the University of Otago Ethics Committee. All field communication for this research, including interviews and focus group discussions, were in the Samoan language. A Samoan version of the schedule of open-ended questions had been prepared and was taken to the interviews. Extra questions were developed for farmers and fisherfolk expected to have content-specific knowledge relevant to the study (see Appendix 2).

The interview and focus group documents were reviewed and revised several times in both English and Samoan to ensure that the questions were sufficiently clear for participants to understand, and that they would yield data that could be used to answer the overall research questions. Instead of using the phrase *suiga o le tau* [climate change] that is commonly used by the government in its consultations, I chose to focus specifically on the concept of ‘global warming’ and translated this into the Samoan phrase *vevela o le lalolagi* [global warming] which I then used in my study. The first question asked the participants to simply talk about the heat and whether they have noticed any changes. The reason for doing this is because I wanted participants to think about patterns of heat they have experienced, rather than what they have learnt from external sources. Moreover, I did not want to associate my study with government consultations on climate change in case that skews the participants’ responses. Scientific terms like ‘ocean acidification,’ that might be unfamiliar to some participants, were carefully defined and described in commonly spoken Samoan so the participants would understand. Piloting the interview schedule and the question guide for the focus groups was useful because it enabled me to remove unnecessary questions and re-arrange the order of the questions asked.

Selected individuals were approached in person and invited formally to be interviewed or to take part in the focus group discussions. The invitation letters were prepared in Samoan then translated into English for ethical approval, and participants were given a Samoan version of the invitation for their records (see Appendix 3). Regarding informed consent, oral permission was sought, as this was more appropriate in the Samoan context where it is considered offensive to request a signature, particularly from key members of the community

such as elders, religious leaders and holders of chiefly titles. The Samoan version of the consent forms was also given to the participants for their records. These items were clearly explained to participants before interviews were held. All participants were advised that the information gained was entirely confidential and that they would remain anonymous in the thesis. Moreover, they had the choice to cease participation in the project at any time without disadvantage to themselves. Lastly, they were informed that all transcripts and recorded material would be electronically stored in a safe place and analysed in a codified form.

Face-to-face meetings with religious leaders of the community were arranged to explain the intention of the study and to formally invite their participation and that of youth groups. There were also separate meetings held with the government representatives of some villages to organize focus groups of women and farmers. The Samoan versions of the formal invitation letter and the plan for the focus group discussions were explained during the initial face-to-face meetings with the leaders (see Appendix 3).

As a Samoan, the process of gathering information required knowledge and practice of cultural protocols. These protocols, including the appropriate dress and language spoken at particular situations, are learnt by attendance at cultural events, observing, listening and asking one's elders in the privacy of the home. Simply, a younger person is expected to respect one who is older. The range of participants, in terms of seniority, warranted attention to mode of speech, personal behaviour, and approach during interviews and focus groups. I was aware that as informants, research participants are in a powerful position as they can refuse or provide insufficient information or even dictate how the research is conducted. Thus it was crucial to demonstrate respect and humility throughout the data collection process and observe cultural protocols.

4.7.2 Conducting the interviews

A. Time and space

Organizing a friendly and comfortable space for an interview empowers participants to speak freely (Vaiotele, 2006) and encourages inter-accountability. The interviews and focus groups were held in places selected by the participants. Most interviews were held in the homes of the participants. In the case of government officers and representatives of organizations the meetings were in their workplaces. A few participants chose to come to my home or my place of work, and I met and spoke with others in church halls, community open *fale*

[houses], in plantations and on farms, under a shade tree or beside a river. The focus groups also met in similar places, although some took place at the homes of government representatives and church leaders, while others were held at church halls, my home or place of work, tourist *fale* and out in the open.

Being able to speak with participants and observe them in their homes, where they work, and at their churches added depth to the information that was gathered. The interviews and focus groups conducted with farmers and fishermen often started at their homes, then we would walk, or in some cases drive, to their plantations or the places where they fish, and continue the interview or discussions there. These visits were very useful because I was able to see more of their world. I was able to see demonstrations of the planting and farming methods that the participants are currently using and areas where people fish and what might change in the future.

The length of time for an interview ranged from one to two hours. This was also the case for most of the focus groups, although three to four hours were spent with farmers and fishermen because these sessions involved visits to their plantations or the places where they fish. Interviews were mostly held during the day, while focus groups were mostly scheduled for the afternoon or evening after eight o'clock when family prayers and meals were finished. Most people were available then and the cooler air allowed people to sit close together and talk.

B. The process of interviewing

Better understanding of language and cultural protocols assisted me to gain the confidence of participants, and fostered relationships of trust necessary for exchange of information with them. In Samoa, the type of language and cultural protocols used depended on the situation one encounters. In most of the key informant interviews it was important to keep a balance between *gagana faaaloalo* [formal Samoan language] and *gagana taatele* [everyday Samoan]. I normally started off with a brief salutation in formal Samoan such as *malo le soifua ma le lagi e mama* [greetings and good life and clear skies]. This was followed by another common Samoan statement *Ia ua soli vale mai le maota ma faalavelave mai i feau o le aso, faamalulu atu* (this is also repeated at the end of the interview session) which expresses one's humility and appreciation of the acceptance of the invitation to enter. I would then introduce myself, my villages in Samoa and the purpose of my visit and enquiry. Greetings were more formal in the case of introducing the study to focus groups, as these

were usually held during Sunday youth and included more than one person. In some of the latter, the introduction included reciting the village's honorifics and acknowledging the presence of village and church leaders.

It was always good to express humility, respect and honesty at the beginning of an interview in order to gain the trust of the research participants. Time was taken to clarify the research objectives, answer the participants questions and request permission to write notes and record the interview on a dictophone. After all this had been done I would switch to *gagana taatele* and request them to talk about their lives and normal experiences in the village. This would be followed by more specific though very 'short' and 'open-ended' follow-up questions.

Listening intently and keenly observing body language and moments of silence were very important parts of the interview process. I paid particular attention to the participant's changes in posture, gestures, eye contact, tone and volume of speech, because these revealed much about his or her emotions and what was not mentioned. These also became vital cues about whether or not the participant was comfortable with the questions. They showed me whether I needed to probe further, re-direct the line of questioning or steer away from the issue altogether. Long pauses, serious tones, repetitive statements mostly indicated issues which were important to the participants. Warning phrases such as "*na o taua a*" [just between us], "*na o oe lava lea la ou tau atu ai le mea lea*" [you are the only one I'm telling this to] and "*vaai oe nei e tautala i mea ia*" [make sure you do not talk about these things] were commonly expressed when participants did not want parts of their responses revealed.

One's seating position and clothing are an important part of Samoan cultural protocol. Sitting on the floor and beside the participant was always the first option unless the participant insisted we both sit on chairs. Sitting directly opposite the participant or on the chair while they are sitting on the floor was avoided because it was culturally inappropriate. A semi-casual wear of a long *lavalava* [sarong or a long skirt] and a sleeved top was worn to most interviews. In the case of focus groups held on a Sunday with youth groups, a white top and long black skirt was worn.

Saying thank you and farewell was another important part of the interview process. Samoan values of respect and reciprocity are significant aspects of communication and participation. Therefore, at the end of every interview and focus group, a thank-you speech was delivered in the formal Samoan language, followed by a gift to show my appreciation.

4.8 Types and sources of information

4.8.1 Primary sources

Primary data came from interviews and focus groups (with around 150 participants), as well as from photographs and sketch maps produced during field observations. Key informant interviews were held with 15 representatives from government and other relevant organizations. Most of the interviews and focus groups were held with 165 people from 8 villages across the country. 23-26 people were surveyed in villages which had a population of more than 2,000 people, 16- 18 people were surveyed in villages which had more than 1,000 people and about 10-15 people were surveyed in most of the villages that had below 1,000 people (see Table 4.3).

Table 4.3: Sources of research data.

Types of data	Sources
Primary	Non community sources
Key informant interviews	- 15 interviews with officers from Government, regional organizations and NGOs
Focus groups	Community sources
Field walks and observations	Saleimoa- population of 3,348
	- 3 focus groups [1 x 6 people] [2 x 5 people]
	- 10 key informant interviews
	- 4 transect walks and drives
	Auala- population of 573 people
	- 2 focus groups [1x 7, 1x 8 people]
	- 8 key informant interviews
	- 4 transect walks and drives
	Lano- population of 764 people
	- 7 key informant interviews
	- 2 focus groups [2 x 4 people]
	- 2 transect walks and drives
	Malaela- population of 193 people
	- 3 key informant interviews
	- 1 focus group [1 x 5]
	- 2 transect walks and drives
	Saanapu- population of 1,305 people
	- 2 focus groups [2 x 5 people]
	- 8 key informant interviews
	- 3 transect walks and drives- boat trip
	Maagiagi- population of 2,128 people
	- 3 focus groups [1 x 4 people] [2 x 5 people]
	- 9 key informant interviews
	- 4 transect walks and drives

	Sili- population of 1099 people - 2 focus groups [2 x 4 people] - 8 key informant interviews - 2 transect walks and drives Aopo- population of 369 people - 2 focus groups [1 x 4 people] [1 x 4 people] - 6 key informant interviews - 2 transect drives and walks
Secondary Government policy documents drafts- CRIP, NEMS, Samoa Programme for Climate Resilience and Renewable Energy Development and Power Sector Rehabilitation Project Document were sourced online Regional and international climate related strategies and policy documents- SOPAC reports District CIM plans, Review of CIM Plans (Draft), Government reports on Cyclone Val (1991); Evan (2012); 2009 tsunami- MNRE Village Sustainable Plans- Division of Internal Affairs, MWSCD Village disaster management plans, DMO monthly newsletters- Disaster Management Office, MNRE	

4.8.2 Secondary sources

To complement primary data collection, secondary data were gathered through textual analysis of academic sources and government reports, published, as well as unpublished. The aim was to construct a broad overview of the climate issue and related responses and to ground conclusions drawn from the interviews and focus groups. Information was also drawn from district CIM plans, Sustainable Village plans, village disaster risk plans and official maps. Further secondary information came from climate related documents produced by regional and international agencies and non-governmental organizations (see Table 4.3).

4.9 Analysing and interpreting the gathered information

4.9.1 A constructivist and interpretive approach

This research aims to interpret and understand human experiences, so principles of constructivist ontology and interpretivist epistemology were used to frame the study. Both subscribe to a subjective view of the world and to the existence of multiple truths. The interpretive paradigm acknowledges the process of discovery and emphasizes understanding (Sarantakos, 2005). In this case, the combination of comments and stories told by research

participants during interviews and focus group discussions, field observations and documentary analysis was expected to enable the understanding of community reality based on culturally defined and historically situated interpretations and personal experiences.

4.9.2 Structure of analysis

The analysis of the research findings utilised various analytical processes discussed next. While there is structure to their discussion, the analysis process was not, in any sense, linear nor straightforward.

A. Producing data

1. Writing and translating transcriptions from Samoan to English

Notes that were taken during the interviews and focus groups and audio versions assisted in the production of data transcriptions. The process mostly involved re-writing the field notes first to provide an outline of the interview or the focus group. This was then followed by listening to the audio versions to provide any missing details. This process was done in the Samoan language and then personally translated into English (see Box 4.1). The content of the transcriptions was organized under the sections titled: i) Knowledge and understanding of global warming, its impacts and likely consequences ii) Knowledge of coping mechanisms and adaptive strategies to survive current and future global warming.

Translation was a significant part of this research. Revisiting the recordings, transcripts and notes taken during the interviews, focus groups and field observations was done to validate translations. The transcriptions in both languages were then given a code number and filed according to the village in which they were gathered.

2. Drawing maps and other illustrations

Drawing sketch maps and sifting through photographs taken during the fieldwork was another part of data production. Like the transcriptions, all of these were organized and filed under the relevant study site.

B. Identification of general themes

1. Primary coding

The first level of coding was an initial attempt to understand participants' responses and organize these under the three main research questions. Descriptive and analytic coding suggested by Cope (2003) was used to open up meaning in the data. This involved skimming each transcript for terms that the participant had frequently mentioned and highlighting

phrases which the participant had used. In addition, labelling sections of data with concepts and inserting basic descriptions in the transcriptions (see Box 4.2).

Box 4.1: Samoan notes and English translation.

Part of an interview conducted at Site 7

Notes in Samoan

Tele le suiga lea ua iai i aso nei. O lea ua vaai atu, o le mea lea ua iai, aua e manaia tele le timu, a, o le timu lea ua iai nei a, ua malosi tele le timu. O iinei, a tele a aso o le vaiaso e la ai, pe tasi, lua, e iloa ai le mata o le la, ae a oo a ina palasi mai le timu, ia, o le mea a lea (amata ona timu), timu, tele a. O suiga na lea ua iai nei le tau. Mugala ia sa lavea ai isi nuu talu ai nei a, e le lavea ai iinei. E timu a iinei i lenei nuu. Timu a lenei nuu. E le lelei ni mea faalala a lenei nuu. E tigaina lava nai loomatutua e faalala ae taetaepalaloa a latou laufala i le ova o le timu (ata leo tele). Ta te alu atu i isi nuu, se o la e mugala a o lea e timu a iinei. Leiloa poo le mea lea o loo lelei ai le ola o mea toto, faatoaga. E malu a i taimi uma le mea ia, e le... Ia sa ta faapea e ai se la o lenei aso, ia ae ua vaai iai...

English Translation

There is a great change in these days. I am seeing, the thing is, because the rain is nice, ah, the rain that is now occurring aye, the rain is getting heavier...Here in our village, you see the sun in say, at most, one or two days of the week. But when the rain falls, well, this is what it is like, rain, heavily (started to rain heavily during the interview). Normally it would be hot and dry in other parts of the country but it would be raining here...you know the dry spells that recently affected other parts of the country? Our village did not experience that. It rains frequently here in this village. It mostly rains. It is difficult to dry things because of the rain. The women are often frustrated because they spread their pandanus leaves outside to dry but they end up being mouldy from the constant rain (laughs out loud). When I visited the other villages, it would be hot and sunny there but it was raining when I left here."

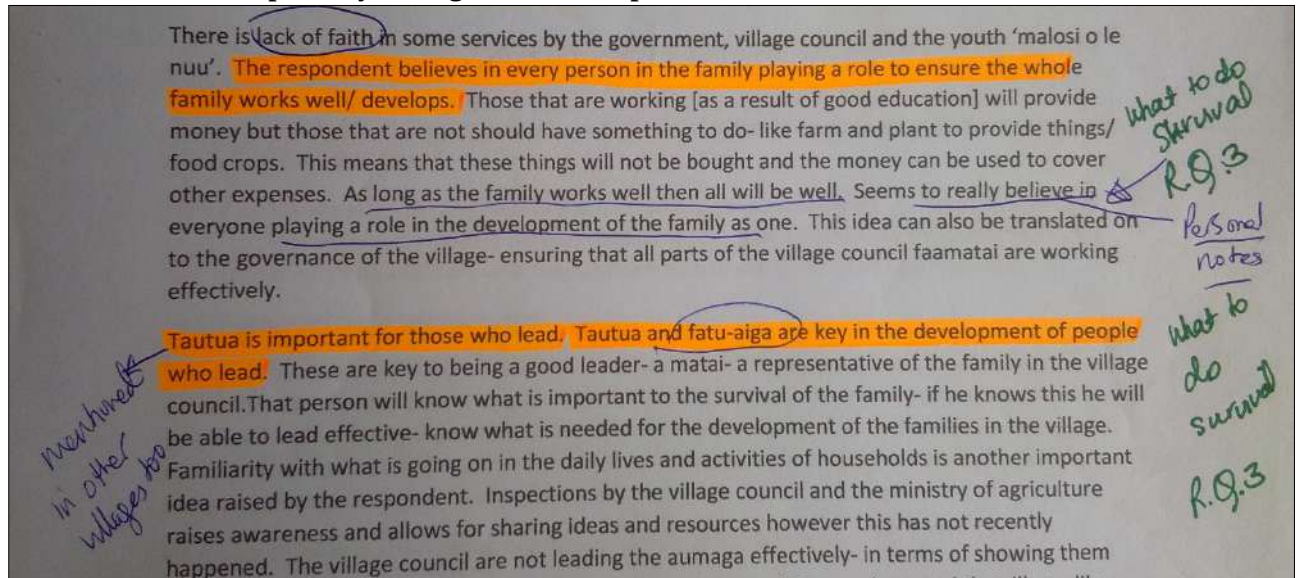
The main issues/themes that were identified in the transcriptions were then transferred on to a village summary chart in which they were sorted and organized according to their relevance, under the main research questions (refer to Box 4.3). Tracy (2013) refers to this process as ‘fracturing’ the transcriptions and ‘lumping’ similar data together. This was straightforward because the content of most of the transcripts had already been written according to the way the interview schedule was structured. The village summary charts created another level of data which enabled me to see all the issues that emerged from the interviews and focus groups in a village context.

C. Determining the ‘significance’ of themes

1. Secondary coding

A second round of coding was carried out to determine ‘significant’ themes which are presented in the results chapters. This was a time- consuming and very difficult exercise which involved checking all of the issues listed on each village summary chart against all of the transcriptions produced for each village. Specific actions were undertaken.

Box 4.2: Evidence of primary coding on a transcription.



i) Content analysis: First, I compared each village summary chart (section shown in Box 4.3) with all of the transcriptions and recorded the number of times each issue identified on the initial village chart was mentioned. Ryan and Bernard (2003) refer to this as part of content analysis- counting the frequency of a word or phrase in a given data set is often a good starting point for identifying repeated ideas within a large body of text, and according to Namey (*et al.*, 2008) gives an idea of the prevalence of thematic responses across participants.

As shown by Figure 4.2, relevant terms and phrases were highlighted and then the issue was recorded on the tally table (see Table 4.4). The numbers signify how many people mentioned that particular issue. The numbers were then totalled and charts, which rank the issues according to the number of times they were mentioned, were produced (see Figure 4.3). Transferring the themes identified through content analysis to the tables that finally appeared in the case studies was not a straightforward process. The latter process involved going back to the transcriptions and critically examining all of the information that appeared in the second lot of summary charts. The following analytical methods were a crucial part of this process.

Box 4.3: Themes being transferred from one section of a participant's transcript to a village summary chart.

English Translation		
There is a great change in these days. I am seeing, the thing is, because the rain is nice, ah, the rain that is now occurring aye, the rain is getting heavier...Here in our village, you see the sun in say, at most, one or two days of the week. But when the rain falls, well, this is what it is like, rain, heavily (started to rain heavily during the interview). Normally it would be hot and dry in other parts of the country but it would be raining here...you know the dry spells that recently affected other parts of the country? Our village did not experience that. It rains frequently here in this village. It mostly rains. It is difficult to dry things because of the rain. The women are often frustrated because they spread their pandanus leaves outside to dry but they end up being mouldy from the constant rain (laughs out loud). When I visited the other villages, it would be hot and sunny there but it was raining when I left here."		
What and how much do Samoans know about global warming?	How are they coping and what strategies are they employing?	What do they want and need to cope with what lies ahead?
Frequent heavier rainfall Hotter days and longer dry spells (heard this is what other villages are experiencing) Sea level rise	Awareness programs on reducing the burning of plastics Banning chemicals (weed killer) in the process of planting Farming and planting on land elsewhere (using family connections) Village council meetings...When the government came these people were trained so now they are taking care of maintenance. Inspections are done by the plumbers- a sinasina le vai e sala le aiga. 15% village, IWS 25%, government subsidises the rest- plastic pipes Women activities- food gardens, weaving sessions (done at the family level) ma fai ai latou faalelegapepe/ fuataga, meetings, inspections SBEC- known as the peimegi (payments) people- fai foi latou faalelegapepe. Ua ta tei i le ta mai o le aga i le taao ia ona o ta alu atu lea ave atu ai le taao.	Tar seal access roads to the plantations Improve river crossings Develop education for the young people of Sili- capacity building in technical skills Shift away from the flood prone areas of the village (next to the riverbanks) Plantations and food gardens Fence farm animals (pigs, chickens and cattle) Grow and conserve yam, cassava and taamu (for times of hardship) Maintain familial and other connections (through traditional and church obligations/ activities) Village council meetings- maopoopo faiga nuu/ cooperation between the various village and church groupings Weaving clubs and inspections

ii) Deconstruction and analysing non- verbal behaviour: This stage of the analysis process involved interpreting the information at a deeper level by deconstructing what the participants said in the context of what they do. An important part of this process was contextualising and interrogating the 'spoken words' within the time and space they were gathered. For example, not only thinking about the meanings of the words that were spoken, but the behaviour of the participant/s at the time of the interview. Questions that came to mind during this process included asking: i) What do people mean? ii) What are they implying? iii) What are they inferring? iv) Are there deeper layers of meaning that I can expose?

iii) Intensive written descriptions of responses: The selection and development of specific concepts and quotations to exemplify parts of each case study was another crucial part of the process of authenticating and validating ideas. Writing and rewriting chapter drafts caused me to think deeply about which quotes would be relevant to the thesis argument.

iv) Multi-level comparative analysis- between individuals in a site and then across communities: Another part of the analysis process involved comparing the information gathered across the eight sites (see Table 4.5) and then returning to the written transcriptions and audio recordings to confirm and refine the meaning of commonly noted and emphasized words and phrases. This process of confirming the meaning of the words and phrases in the context they were ‘spoken’, and comparing this to similar statements made in other sites was repeated several times before the summary tables were finalised.

Impacts of cyclones

Felelei o apa, gau laau, leai se vai no water, leai se eletise

Vai a Salepoaue ma Nonoa, vaitimu,

Meaai- lalo uma fai ma ulu, ai fai-matua ma faasolo atu ai i faimoto...seiloga ina sau loli ia na o mai tutu i le malae ae lau mai ai taga alaisa, taga falaoamata, suka. Sa oge ina ua uma oia ma Val- na ta uma mai a aufai e lei matutua ae ua pauu i lalo, o ulu, o pope ma faaputu uma i tua o le matou fale meamata. Tama na sa auauai mai. O pua totutu sa maua ai vai-inu i niu.

During the cyclone, the only food was koko alaisa, kopai, the whole day...shops were closed.

Miri- remembered her younger brother was sick during this cyclone- my parents were running to Lotosoa to look for a traditional healer. Cooking was done in the house- at the back. Kaleve elegi, kuka pipi for the sick boy. Families with shops tended to have a lot of food, including ice cream...

Neomai- warnings of cyclone tend to prepare but didn't happen. Seem to confuse gusts with cyclones...

Toshi and Totua- seem to know more about the weather than the girls....

Knowledge of the Tualoa- tatau ona oti ai tagata pe a agi....

Sea level rise Siitia o le suatai- Totua notices it- when the tide comes in, tends to go over the seawall, it reaches the coconuts in front of our house, pe ai le vao grass drying ma pisi-samia ai laau ma mamago ai.

Lologa- inundation flooding from the sea and when the rain is heavy- timuga tetele- appear mai ai vaivai [puddles], ola ai puna [falesā Metotisi e oo i le fale o Sei], tele le vaivai...at the beginning and the end of the year...ma vaitaimi afa- November to April- some families [including Neomai] have reclaimed this part of the village and built cement European houses to counter flooding...

Research Question 1- Process of determining the magnitude of knowledge and experience of global warming and its impacts across the 8 sites surveyed

Draft 1 of the tally table for Site 1-8

Concepts	Saleimoa	Magiagi	Auala	Aopo	Saanapu	Sili	Lano	Malaela
Total # of people surveyed	26	23	38	13	18	16	16	8
Cyclones								
-Storm surges								
Sea level rise								
-inundation								
More acidic seawater								
Frequent drought								
-soil drying								
-grass drying								
Longer dry season								
More intense heat								
Frequent bush and forest fires								
Greater coastal erosion								
Frequent gale- force winds								
Increased salinization of fresh-water sources								
Frequent flooding								
Frequent short heavy rainfall								
Extra issues mentioned								
Disappearance of freshwater sources								

Figure 4.2: Counting the frequency of relevant terms and phrases to determine significant themes. The tally table shown determined dimensions of climate change experienced by surveyed residents.

Table 4.4: An initial draft of one of the tally tables.

TALLY TABLE FOR SITES 1-8								
The numbers signify how many people mentioned that term when asked to talk about the impacts of global warming- the term was counted/recorded once per person even though some of the terms were mentioned more than once in the same interview.								
Concepts	<u>Saleimoa</u>	<u>Magiagi</u>	<u>Auala</u>	<u>Aopo</u>	<u>Saanapu</u>	<u>Sili</u>	<u>Lano</u>	<u>Malaela</u>
Total # of people surveyed	26	23	38	13	18	16	16	8
Cyclones -Storm surges	 I 26 26	 20 Gusts, flooding	 38 Storm surges	8 Strong winds/ gusts	 18 Strong winds/ gusts Storm surges	I 16 Strong winds Flooding of the river	I 16 Storm surges flooding	8 Storm surges Flooding Strong winds
Sea level rise -inundation	 15 8	0	 25	0	 16	0	I 11	5
More acidic seawater		0		0	0	0	0	0
Frequent drought -soil drying -grass drying Longer dry season More intense heat Prolonged and pronounced heat rather than frequent????	 26	 20 Grass drying Soil turning Grass turning brown	 38 Strong heat Crops drying out Soil drying up	 Soil and grass drying up	I 11	0	13 soil and grass drying, sand hot	I 6
Frequent bush and forest fires	I 1	0	0	12 Not frequent but greater intensity	0	0	0	0
Greater coastal erosion	 14	0	14	0	 18	0	15	5

Concepts	Saleimoa	Magiari	Auala	Aopo	Saanapu	Sili	Lano	Malaela
Total # of people surveyed	26	23	38	13	18	16	16	8
Cyclones								
-Storm surges								
Sea level rise								
-inundation	15							
	III 8							
More acidic seawater								
Frequent drought								
-soil drying								
-grass drying								
Longer dry season								
More intense heat	26							
Frequent bush and forest fires	I 1							
Greater coastal erosion								
	14							
Frequent gale-force winds								
	6							
Increased salinization of freshwater sources	III 3							
Frequent flooding								
	15							
Frequent short heavy rainfall								
	10							
Extra issues mentioned								
Disappearance of freshwater sources								
	9							
dust	I 1							
Dizziness/ headaches	III 3							
sunburn	4							

Fatigue	3							
Flash flooding	II 2							
Rising heat								
	27							
Hotter land	3							
Tsunami	II 2							
Parts of the coral reef dying	I 1							
More algae; crown of thorns starfish	II 2							
Invasive plants	II							
Birds	I 5							
African snail	II							
Cooler nights	I 1							
Famine/ shortage of food	II 2							
Decrease in variety and number of shellfish	II 2							
Decrease in size of mangrove areas	3							
Changes in food crops	I 1							
-bananas								
-taro								
Taro blight	I 1							

Site 1

Order of issues according to their importance to the research participants

- Increasing heat
- Cyclones
- Frequent drought and dry spells
- sea level rise
- frequent flooding
- frequent short heavy rainfall
- greater coastal erosion
- inundation
- disappearance of freshwater sources
- frequent gale force winds
- invasive plants and animals
- sunburn
- increased salinization of freshwater sources

Figure 4.3: Producing charts which list issues according to the number of times they were mentioned in each village.

Table 4.5: Draft section of issues raised by participants, in response to research question one, across the eight study sites.

COASTAL & INLAND VILLAGES						INLAND	
1 <u>Saleimoa</u> Coastal & inland	2 <u>Auala</u> Coastal & inland	4 <u>Lano</u> Coastal & inland	5 <u>Malaela</u> Coastal & inland	3 <u>Saanapu</u> Coastal and inland	6 <u>Magiagi</u> Inland	7 <u>Sili</u> Inland	8 <u>Aopo</u> Inland
1. Prolonged dry spells and more intense heat -dry grass and soil						Frequent short heavy rainfall	Prolonged dry spells and more intense heat
2. Strong damaging winds - cyclones, gusts, gale force winds					Decreasing freshwater sources -river drying up -irregular piped water supply -dirty water -hot tap water	Strong damaging winds	Decreasing freshwater sources -streams drying up -saline tapped water
3. Sea-level rise	Decreasing freshwater sources -salinization	Greater coastal erosion	Tsunami	Greater coastal erosion	reduction of forest areas	Cooler nights	reduction of forest areas
4. Frequent flooding- sea and rainwater	Reduction of forest areas	Decreasing freshwater sources -salinization	Degradation of mangroves	Sea level rise and inundation	Greater/intense flooding- flash-floods	Invasive plants: <u>patiki</u> grass & vine	Bush and forest fires
5. Frequent short heavy rainfall	Bush and forest fires -more intense rather than more frequent	Frequent short heavy rainfall	Decrease in number and variety of fish and shellfish [crabs in mangroves]	Degradation of mangrove area	Strong damaging winds	More intense heat	Strong damaging winds
6. Greater coastal erosion	Frequent short heavy rainfall	Flooding	Frequent short heavy rainfall	Frequent short heavy rainfall	Frequent short heavy rainfall	Wandering farm animals- pigs and cattle	Taro blight

Table 7.3: Current and future climate related changes frequently mentioned and emphasized by participants	
Changes that were experienced 1. Shorter and heavier rainfall 2. Stronger damaging winds	Future climatic changes that were perceived to occur 1. Shorter and heavier rainfall 2. Stronger damaging winds

Table 7.5 Impacts of climate change frequently mentioned and emphasized by participants	
Current impacts Risks 1. Damage to properties 2. New pests Opportunities 1. Access to food and other resources 2. Stronger and diversified networks	Perceived impacts Risks 1. Damage to properties Opportunities 1. Access to food and other resources 2. Stronger and diversified networks

Figure 4.4: The final versions of some of the results, which now appear in the following chapters, after several rounds of analysis and re-organization.

D. Producing templates to evaluate the ‘perceived significance’ of risks associated with climate change

The significance of actual and possible future risks associated with various dimensions of climate change was determined through several rounds of coding, categorizing and comparative analysis. The tools that were used to assess and determine the significance of climate-related events and associated risks were constructed from the participants’ responses. After the initial processes of translation and transcribing, participants’ descriptions of climate related events that they experienced and those they perceived likely to occur in the future were transferred onto summary tables. Each site had a summary table that listed the climate related events mentioned by the participants and the related descriptions (see Table 4.6). The second part of this process involved comparing and organizing the participants’ descriptions into common categories that were subsequently labelled Low, Medium and High to denote the significance of a particular climate related event and associated risks. This was done by closely examining the participants’ responses and highlighting words and phrases that were frequently mentioned, repeated and emphasized by the participants. For example, as Table 4.6 shows, phrases such as ‘little to no dust’, ‘very little dryness of the soil’, ‘little to no disruption in plant growth’ were allocated to the category labelled Low which then meant that for that participant, the significance of drought and associated risks was Low. Table 4.6 shows an initial draft of these summary tables.

As the process continued, the content of the tables were refined to show specific current and possibly future climate related risks and their levels of significance as constructed from the participants' responses (see Table 4.7 and Table 4.8).

Table 4.7 and 4.8 were then used to interrogate the relevant sections of the data from all of the surveyed sites. For instance, a description of had 'experienced' sea level rise in a particular transcript would be examined and labelled either Low, Medium or High after comparing what was 'said' to the key words and phrases given in the categories outlined in Table 4.7. In a similar way, a description of 'possible future' sea level rise would be examined and appropriately labelled according to the categories outlined in Table 4.8. These were then tallied to determine the final category that appears, for each climate related event, in the results chapters. The process was highly complex and tedious but rewarding in the sense that the process revealed how participants' perceptions of climate-related events and associated risks not only differed across places but according to time (see Table 4.10).

Table 4.6: A section of the first draft of the table denoting levels of perceived significance of climate related risks.

Risks associated with global warming	EXPLANATION OF RISKS		
	Low	Medium	High
1. ACTUAL EXPERIENCE OF DROUGHT [low rainfall]	- the participant/s mentioned that in the past 5 years there had been very little change to the amount of rainfall received particularly during the dry season -there had been very little dryness of the soil -there had been little to no dust during the dry months -there had been very little disruption to the growth of plants -grass turns slightly brown only during the dry months -land had not been affected by fire/s	- the participant/s mentioned that in the past 5 years the dry season had been getting longer - rain arriving later than usual- late September/early October rather than early September -the soil had been dry for about 3- 4 months -some root crops had dried out - grass had turned brown for about 3-4 months - there had been much dust - parts of rivers and streams had dried up -some areas of land affected by fire	- the participant/s mentioned that in the past 5 years the dry season had been getting longer and have caused:- - rain not arriving until October -soil had been dry for more than 4 months - many plants/ crops have dried out -grass had been brown for more than 4 months -very dusty during most of the year : most rivers and streams had dried up -a major bush/forest fire had occurred
PERCEIVED FUTURE DROUGHT	- the participant/s mentioned that in the next 20 years there would be very little change to the amount of rainfall received particularly during the dry season -there would be very little dryness of the soil -there would be very little to no dust during the dry months -there would be very little disruption to the growth of plants	- the participant/s mentioned that in the next 20 years the dry season the dry season would be longer - rain arriving later than usual- late September/early October rather than early September -the soil would be dry for about 3- 4 months -some root crops would dry out - grass would turn brown for about 3-4 months	- the participant/s mentioned that in the next 20 years would be much longer - rain would not arrive until late October -soil would be dry for more than 4 months - many plants/ crops would be dry and not grow -grass would brown for more than 4 months -very dusty during most of the year

Table 4.7: Final draft of table explaining the perceived levels (low, medium and high) of significance of risks associated with current climate related changes.

Climate related risks	'Perceived' significance of risks associated with current climate related changes		
	Low	Medium	High
1. Hotter days and dry spells	The participant/s mentioned there had been very little: - increase in daily temperature and some hot days - change to the amount of rainfall received particularly during the dry season - dryness of the soil - to no dust during the dry months - disruption to the growth of plants - change in the colour of grass and other plants during the dry months - to no fires	The participant/s mentioned there had been: - much increase in daily temperature and many hot days - a longer dry season with rain arriving later than usual such as in late September/early October rather than early September - low and erratic rainfall especially during the dry season - parts of rivers and streams that had dried up especially during the dry season - dryness of the soil making it difficult to plant crops. Grass had turned brown for about 3 to 4 months and some crops had withered due to the heat. - dust causing diseases such as conjunctivitis - areas of land affected by fire	The participant/s mentioned there had been: - a great increase in daily temperature and many very hot days - a longer dry season with rain not arriving until late October - low and erratic rainfall throughout most of the year - extreme dryness of the soil causing the grass and crops to wither and die - much dust causing many to be affected by conjunctivitis - rivers and streams drying up - several forest/ bush fires
2. Stronger damaging winds	The participant/s mentioned that damaging winds had occurred but caused little to no wind-related damage to properties. The sea and/or nearby rivers mostly remained calm and there were mostly favourable conditions for fishing and other activities. There had been little to no disruption to transport, water and electricity supplies because little to no damaging winds had occurred.	The participant/s mentioned that stronger damaging winds had occurred and: - damaged some houses and other properties - flattened or uprooted some plants and food crops - caused the sea and or nearby rivers to inundate and flood some homes and disrupt fishing and other activities - disrupted transport, water and electricity supplies for a brief period of time - caused difficulty in the preparation of fires to prepare food - caused injury to some people	The participant/s mentioned that stronger damaging winds had frequently occurred and: - destroyed many houses, plantations, food gardens and other properties - caused the sea and or nearby rivers to flood large parts of the village and wiped away homes and properties - destroyed transport, water and electricity supplies - caused many injuries and some deaths
3. Shorter and heavier rainfall	The participant/s mentioned there had been little to no change in the pattern of rainfall causing very little to no damage to houses and other properties.	The participant/s mentioned there had been instances of short heavier rainfall which had: - caused flooding and subsequent damage to houses and other properties - caused erosion and displacement of dirt and other debris onto peoples' lands and the marine area [beaches, lagoons, reefs]	The participant/s mentioned there had been frequent periods of short heavier rainfall which had: - often caused flooding that damaged many house/s and other properties - destroyed drainage, sewerage systems, reservoirs and roads - caused much erosion and displacement of dirt and debris onto peoples' lands/or marine area
4. Sea level rise	The participant/s mentioned sea level had risen but had caused: - little to no erosion of land - salinity of a few water sources located on the coast - little to no damage to houses and food crops located on the coast - little to no loss of marine organisms	The participant/s mentioned sea level had risen and have caused: - coastal erosion - some parts of the lagoon and reefs to be submerged and some marine organisms to disappear - salinity of some water sources located on the coast - flooding of some houses and other properties located on the coast	The participant/s mentioned sea level had greatly risen and have caused: - much erosion of the coast - most parts of the lagoon and reefs to be submerged and loss of many marine organisms : most water sources to be highly saline and become undrinkable : inundation of many houses and other properties

Table 4.8: Final draft of table explaining the perceived levels (low, medium and high) of significance of risks associated with future climate related changes.

Climate related risks	'Perceived' significance of possible future climate-related risks from surveyed participants		
	Low	Medium	High
1. Hotter days and dry spells	The participant/s mentioned there would be very little change to the amount of rainfall received during the dry season and possibly little: - dryness of the soil. - dust during the dry months - disruption to the growth of plants The grass would turn slightly brown only during the dry months. There is a low likelihood of fires occurring.	The participant/s mentioned it is possible that the dry season would be longer with rain arriving later than usually expected such as in late September/early October. It is possible that the soil would be dry for longer (about 3- 4 months) causing the grass and root crops to dry for a longer period of time. Parts of rivers and streams would possibly dry up for much of the dry season. Parts of the land are likely to be affected by fire.	The participant/s mentioned that it is very likely the dry season would be much longer and intensely hotter with rain not arriving until October. It is highly possible that the soil would be dry for about half of the year making it difficult to grow crops. The grass would be dry and hotter for longer causing dust and related diseases. Many parts of rivers and streams would possibly dry out. Forest or bush fires are highly likely to occur.
2. Stronger damaging winds	The participant mentioned few stronger and more damaging winds would occur. There would be little to no wind-related damage to homes, food crops and other properties. The sea and nearby rivers would be calm throughout most of the year and there would be mostly favourable conditions for fishing and other activities.	The participant mentioned stronger and more damaging winds are likely to occur and would possibly cause: - damage to some houses and properties - the sea and nearby rivers to flood some homes, destroy properties and disrupt fishing and other activities. - disruption to transport, water and electricity supplies for a short time. - injury to some people.	The participant mentioned stronger and more damaging winds are very likely to occur and would possibly cause: - widespread destruction to many houses, food crops and other properties. - the sea and nearby rivers to flood large parts of the village and wipe away many homes and properties as well as disrupt fishing and other activities. - much disruption to transport, water and electricity supplies. - injuries and some deaths
3. Shorter and heavier rainfall	The participant mentioned rainfall patterns are likely to remain the same and would cause: - little to no damage to houses and other properties and food crops - little erosion and displacement [on land and offshore] of dirt and other debris	The participant mentioned shorter periods of heavier rainfall are likely to occur and would possibly: - cause flooding and subsequent damage to some house and properties - erode and displace dirt and other debris onto peoples' lands and the marine area [beaches, lagoons, reefs]	The participant mentioned periods of shorter heavier rainfall would be more frequent and would possibly: -cause much flooding, even flash floods, that would damage many houses and other properties - destroy drainage, sewerage systems, reservoirs and roads - cause much erosion and displace huge amounts of dirt and other debris onto peoples' lands and the marine area [beaches, lagoons, reefs]
4. Sea level rise	The participant mentioned sea level would continue to rise and would possibly cause: - little erosion of land - few water sources located on the coast to be saline - little to no damage to houses and food crops located on the coast - little to no loss of marine food source areas	The participant mentioned sea level rise would possibly cause: - erosion of many parts of the coast - many parts of the lagoon and reefs to be submerged and some marine organisms to disappear - salinity of some water sources - flooding and inundation of some houses and other properties	The participant mentioned sea level rise would possibly cause: - severe erosion of much of the coast - most parts of the lagoon and reefs to be submerged and loss of many marine organisms - most water sources to be highly or completely saline - flooding and inundation of many houses and properties near the coast

Table 4.9: Draft 1 of summary table showing the perceived significance of risks associated with climate change across the eight study sites.

Climate related risks	1 Saleimoa Coastal & inland	2 Auala Coastal & inland	3 Lano Coastal & inland	4 Malaela Coastal & inland	5 Saanapu Coastal & inland	6 Magiagi Inland	7 Sili Inland	8 Aopo Inland	Greater change ≥ , >	No change =	Less change ≤ , <	Total across sites
Actual/ Perceived risk of DROUGHT	M M-H	M M-H	L-M M	L-M M-H	L-M M	L-M M	L L-M	M M-H	8 AR- L1, L-M4 , M3 PR- L-M1, M3, M-H4	0	0	≥ 8
Perceived level of risk	≥	≥	≥	≥	≥	≥	≥	≥				
Actual/ Perceived risk of DAMAGING WINDS	L-M M-H	L M-H	L M-H	L-M M-H	M M-H	L-M M-H	M M-H	L M-H	8 AR- L3, L-M3 , M2 PR- M-H8	0	0	≥ 5 > 3
P/Level of risk	≥	>	>	≥	≥	≥	≥	>				
Actual/ Perceived risk of FLOODING	L-M M-H	L L-M	L-M M-H	L-M M-H	L-M L	L-M M	L-M M-H	L L	6 AR- L2, L-M6 PR- L2, L-M1, M1, M-H4	1	1	≥ 6 = 1 ≤ 1
P/Level of risk	≥	≥	≥	≥	≤	≥	≥	=				
Actual/ Perceived risk of INADEQUATE WATER	L M	M M-H	L M	M M-H	L M	M M-H	L L	M M-H	7 AR- L4 , M4 PR- L1, M3, M-H4	1	0	≥ 3 > 4 = 1
P/Level of risk	>	≥	>	>	>	≥	=	≥				

Actual/ Perceived risk of SEA- LEVEL RISE	L	L-M	L-M	L-M	L-M	L	L	L	4 AR- L4, L-M4 PR- L4, M3 , M-H1	3	1	≥ 2 > 2 = 3 < 1
	M	M-H	M	M	L	L	L	L				
P/Level of risk	>	≥	≥	>	<	=	=	=				
Actual/ Perceived risk of TSUNAMIS	L	L	L	H	L-M	L	L	L	3 AR- L6 , L-M1, H1 PR- L4 , M1, M-H2	3	2 PR-H- M1	> 3 ≤ 1 < 1 = 3
	M	M-H	M-H	H-M	L	L	L	L				
P/Level of risk	>	>	>	≤	<	=	=	=				
Actual/ Perceived risk of DISEASES	L-M	L	L	L	L	L	L-M	L	8 AR- L6 , L-M2 PR- M8	0	0	≥ 2 > 6
	M	M	M	M	M	M	M	M				
P/Level of risk	≥	>	>	>	>	>	≥	>				
	≥ 4	≥ 4	≥ 3	≥ 3	≥ 2	≥ 4	≥ 4	≥ 2				
	> 3	> 3	> 4	> 3	> 2	> 1	> 0	> 2				
	= 0	= 0	= 0	= 0	= 0	= 2	= 3	= 3				
	< 0	< 0	< 0	< 0	< 2	< 0	< 0	< 0				
				≤ 1	≤ 1	≤ 0	≤ 0	≤ 0				

KEY

Actual Risk [AR]- 2013 [time of data collection] and 5 years previously [2012, 2011, 2010, 2009, 2008] experience of the 1960s, 1980s and 1990s were also related during the interviews and were considered in the study

Perceived Risk [PR]- next 20-30 years

L-Low, M-Medium, H-High

L-M, M-H When there was about the same number of participants whose responses fitted under both of the stated categories...

> greater than, ≥ greater than or equal to, = equal to, ≤ less than or equal to, < less than

Table 4.10: Final draft of Table 4.9 which shows the perceived significance of risks related to climate change across the surveyed sites. This is presented and discussed in Chapter 7.

STUDY SITES 1-8 LISTED FROM COASTAL TO INLAND	Perceived significance of risks associated with current climate- related events		Perceived significance of possible risks associated with future climate-related events	Change: > greater < less = equal to
Site 1 Saleimoa	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Shorter and heavier rainfall	Medium	Medium- High	>
	3. Stronger damaging winds	Medium	Medium - High	>
	4. Sea level rise	Low- Medium	Medium	>
Site 2 Auala	1. Hotter days and longer dry spells	Medium	Medium-High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Medium	>
Site 3 Lano	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Shorter heavier rainfall	Medium	Medium- High	>
	4. Sea level rise	Low- Medium	Medium	>
Site 4 Malaela	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Medium	Medium	=
Site 5 Saanapu	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Low	<
	4. Shorter and heavier rainfall	Low- medium	Low- Medium	=
Site 6 Maagiagi	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 7 Sili	1. Shorter and heavier rainfall	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 8 Aopo	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium	=

4.9.3 Ensuring soundness and validity of the primary data

Data and method triangulation were used to check soundness and validity of the data. The research participants that were selected varied in terms of age, gender, economic status and roles and responsibilities which they hold in the family and community. Comparing the views of these different people is a useful test of validity, because, as they were interviewed at different times and places, I was able to identify recurring issues that frequently emerged and also those which were emphasized. Additionally, the various methods and processes that were used to sift, organize and present the study's findings also contributed to the validity of the collected information.

4.10 Presentation of findings

An important aspect of the study would be the presentation of findings. The qualitative nature of this research required presentation of participants' words to ensure that their views are communicated directly to the reader. Their opinions and stories would be translated, but considerable effort would go into relating their views to the research questions. Long quotations and summary tables are significant parts of the thesis results chapters. Illustrations such as photographs, sketch maps and diagrams have also been used.

4.11 Research limitations

This study focuses only on Samoan communities in Samoa and does not include migrant communities overseas. The two smaller islands, Manono (816 people in 2011) and Apolima (94 people in 2011), were not visited due to time and budget constraints. The majority of these villagers have shifted to their lands on Upolu Island where they have established the villages of Manono Uta (1503) and Apolima Fou (432) (Samoa Bureau of Statistics, 2016). Unfortunately, there was no opportunity for community members to view their responses before the research was completed due to limitations on time and resources. However I intend to present the study findings in future national conferences and local group meetings such as Sunday youth meetings.

4.12 Conclusion

The methodology and methods utilized in this study considered ethical requirements of Otago University, as well as Samoan society. The study's qualitative approach and interpretive research design complemented its aim and the types of questions it sought to investigate. Additionally, they were relevant to the predominantly oral nature of Samoan society, where the fieldwork for the study was undertaken. As indicated in the chapter, Samoan cultural

protocols were a significant part of the data collection process. Analytical methods grounded on the notion of phenomenology and narrative descriptive approaches were used to identify significant themes and develop ways to present key findings. The next chapters present the study's findings.

Chapter Five. Coastal communities: Enduring challenges and anticipating climate change in Samoa

5.1 Introduction

As stated in the beginning of this thesis, the exposure of islanders to extreme events in the past, and climate related changes since the 1990s, could enhance their capacity to endure current and possible future climate changes. This chapter presents the study findings from the four coastal villages that were surveyed. The results have been organized and presented as village case studies because ‘firmly grounding the findings in place’ (or contextualization) provides for a greater understanding of participants’ responses to the research questions and appreciation of the ‘subtle’ ‘ambiguous’ differences of these places. Each case study provides a description of the village, details of the research conducted there, and general environmental issues faced by its residents. Additionally the case studies explain residents’ perceptions of climate change and key responses. The words of the participants are woven into each case study bringing to light experiences that vary according to each village and each situation. As Tuan (1991: 686) stated, “Words have the general power to bring to light experiences that lie in the shadow or have receded into it, and the specific power to call places into being.”

The findings revealed that most residents in the surveyed coastal villages have been resilient, as demonstrated by their endurance of past extreme events such as logging and forest fires at Auala in the 1960s and 1980s, taro blight in 1993, and the 2009 tsunami which affected Malaela. Peoples’ comments revealed that their exposure to past extreme events has caused most to be sensitive to slight changes in the climate as experienced in recent decades. To most, Cyclones Ofa and Val were the most destructive cyclones they had experienced, and since then have become aware that there have been stronger damaging winds, hotter days and longer dry spells, shorter heavier rainfall and sea level rise. While all of the villages generally experienced all four dimensions of climate change, there were slight variations in the way residents perceived the level of significance of risks associated with these changes. Location and the historical events which the village had been exposed to largely influenced their perceptions. For instance, the experience of risks associated with hotter days and longer dry spells at Auala has been slightly more intense compared with the other three villages, because Auala is located in the drier part of the country and has been exposed to intensive

deforestation. Risks associated with sea level rise were perceived slightly more intense by residents of Malaela who have recently been exposed to the destructive impact of tsunamis.

A multi-level crises management system based on *faamatai* [chiefly system], within which climate change responses are inherent, exists in all of the surveyed villages. This is a major similarity across the surveyed sites as *faamatai* continues to be the key socio-political structure in all Samoan villages. *Faamatai* has evolved and additional structures which have been established and adapted to the system, such as churches and government, have been helpful in the development of coping strategies to endure the impacts of extreme events in the past as well as climate change events in recent decades. These connections have enabled most villages to develop survival strategies such as diversification of livelihoods, mobility, mental and spiritual strength and managing the environment. There was evidence of assistance from government and external agencies, especially in the construction of infrastructure, establishment of conservation areas and provision of water tanks. Such assistance had been more evident in areas such as Malaela and Auala which have experienced more extreme challenges compared to other villages.

Many efforts which have been developed at the family and village levels are part of planning for future climate related changes and according to most, strengthening *faamatai* is the key to resilience. Most research participants emphasized the importance of strengthening connections and re-evaluating roles and responsibilities in families and villages to become more proactive. Many village residents insisted on village councils being more proactive in their role of carrying out inspections of food gardens, plantations and hygiene as these have been important for the development of families. Moreover the observance of evening curfews has encouraged families to maintain close connections and develop mental and spiritual strength. Churches, village councils and government should consider the knowledge of elders, farmers, fisherfolk and other local experts in the development and implementation of their plans and strategies.

5.2. Saleimoa

5.2.1 The village

Saleimoa is on a low-lying coastal strip in northwest Upolu (see Figure 5.1). The village has a wide lagoon, as the reef is located between 900 and 3,500 meters offshore (Government of Samoa and CIM Plan Committee for Sagaga le Falefa District, 2007). Three wetlands in the village have poor drainage and at times this affects the stability of roads and nearby houses.

Saleimoa comprises six *pitonuu* [sub-villages] named Fatitu, Nonoa, Salepouae, Lotosoa, Alamutu and Levi. These sub-villages are governed by councils of chiefs from each of the families in the village; namely Salepouae (which includes Fatitu families), Nonoa, Lotosoa and Levi (which includes Alamutu families). Each council is supported by the women's committee and the untitled men's group both made up of residents who do not have chiefly titles. There are six different churches in the village, with most residents attending the Congregational Christian Church of Samoa (CCCS).

In 2011, the village population was 3,348 (Samoa Bureau of Statistics, 2011), having reduced slightly from 3,724 in 1961 (Samoa Bureau of Statistics, 2016). Family residences, food gardens and most plantations are located on customary owned land, while land in the western and inland parts of the village, is now occupied by the Malua Theological College and church plantations and farms. These parts of the village were alienated in the 1800s and are now owned by the Congregational Christian Church of Samoa (CCCS). Other inland parts of the village are owned by the National Provident Fund (NPF) and a few private individuals. Most residents receive piped water supply and electricity.

5.2.2 Summary of research carried out at this village.

All of those surveyed live in extended family networks and the majority are members of village and church groupings. Ten key informant interviews and three focus groups were undertaken at this village. I also carried out field observations by walking and driving with a local resident to the inland parts of the village. The details of those surveyed are in Box 5.1.

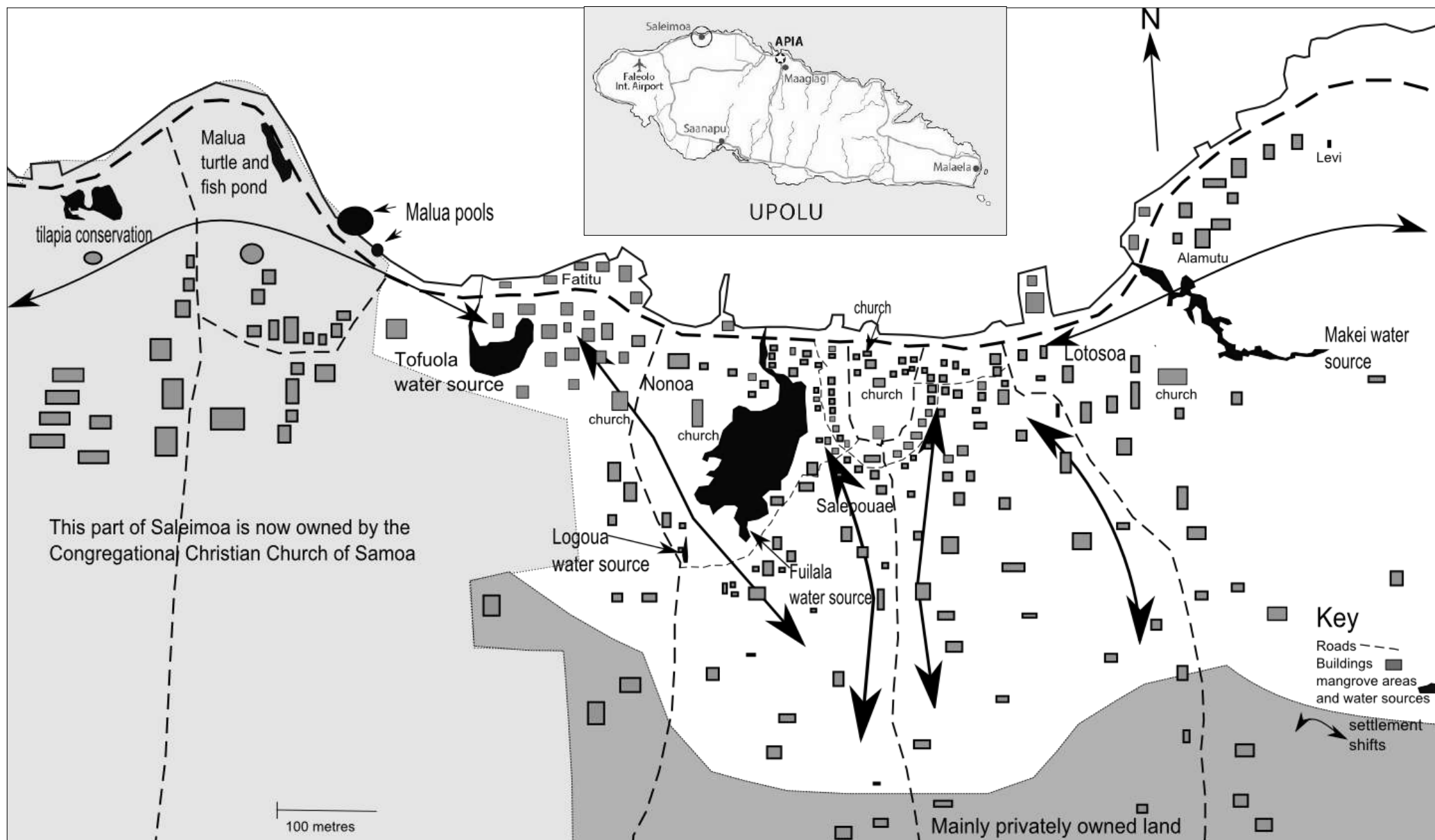


Figure 5.1: Village settlement and physical features of Saleimoa village (Source: after Google Earth, 2016).

Box 5.1: Details of study participants from Saleimoa.

<u>Interviewees</u> 85 year old male (SM001) Family- chief, father and grandfather Village- member of the village council Church- deacon Skills- farmer (plantation, pigs, chicken) 74 year old male (SM002) Family- father, grandfather, widower Village- untitled man Church- assistant pastor Skills- retired teacher, musician and composer, writer 66 year old male (SM003) Family- chief, father, grandfather Village- government representative Church- deacon Skills- farmer (vegetables, chicken, pandanus) 60 year old female (SM004) Family- mother, grandmother Village- member of the women's committee Church- church member, member of the women's committee Skills- shop owner 56 year old female (SM005) Family- chief, mother, grandmother, widow Village- member of the village council, member of the women's committee Church- deacon, member of the women's committee Skills- teacher, assistant school principal 51 year old male (SM006) Family- chief, father Village- member of the village council Church- member of the church and church choir Skills- fisherman (sells crabs from time to time) 45 year old male (SM007) Family- father	Village- member of the untitled men's group Church- member of the congregation Skills- farmer (plantation, pigs and chicken) and fisherman 40 year old female (SM008) Family- mother Village- member of the women's committee Church- Sunday school teacher, member of the youth Skills- government employee 37 year old female (SM009) Family- mother Village- member of the women's committee Church- member of the women's committee Skills- farmer (chicken and vegetables) 26 year old male (SM010) Family- chief, father Village- member of the village council Church- Sunday school teacher Skills- teacher <u>Focus group participants</u> Focus group 1 (SMFG01) • 3 females and 2 males • Age- 20s to mid 30s • All are members of the CCCS church youth Focus group 2 (SMFG02) • 2 males and 2 females • Age- late teens to late 20s • 3 members of the CCCS youth and 1 Sunday school teacher Focus group 3 (SMFG03) • 3 males and 2 females • Age- mid to late teens • 4 are related • All attend high school in the Apia Urban Area
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5.2.3 General environmental issues.

The main environmental challenges faced by most residents have been damage to properties, diminishing marine resources, reduced productivity of the land and new diseases caused by the combined effect of past extreme events, human activities and recent climate related changes. Specific extreme events that the participants have experienced included the cyclone

in 1966, and more recent cyclones such as Ofa, Val, Heta and Evan and taro blight in 1993. They also mentioned tsunamis, which occurred during the 1960s, and more recently in 2009 but these did not cause much damage to the village's environment and peoples' properties. Changes effected by both the government and local residents to the village environment in the 1990s and 2000s include the building of roads and the village seawall, reclamation and clearance of parts of wetlands and forested areas for settlement and cultivation of crops. Most interviewed residents suggested that climate change is already occurring, and were able to identify and describe various dimensions of climate change amidst other historical challenges they had previously experienced.

5.2.4 Perceptions of climate change

A. Dimensions of climate change experienced by surveyed residents.

Hotter days and longer dry spells were the main climate-related changes mentioned and emphasized by most study participants (see Table 5.1)²⁸. In their comments, many participants commented on how they are 'feeling' the hotter days and longer dry spells. In addition, most suggested 'seeing' the heat through the behaviour of people and plants. Information about the heat is also heard from other people in their village and media sources. An elderly male (SM002) said he felt that 'the heat is getting stranger' and had heard people talking about it at the school where he once taught. A middle aged woman (SM005) described how she had noticed the heat by observing the changing behaviour of many people, such as their recent adoption of 'sweat towels' as a way to cope with the heat. This, combined with information she had heard on the media and during her trip to Korea, strengthened her belief that there has been a rise in daily temperatures. She said,

"The heat is greater. We have bought electric fans to help cool the house for the young children. Another new thing that I now observe is that many people walk around with sweat towels, in town and other places they walk around with sweat towels. They hang these on their shoulders. This was rarely seen when I was younger. In those days, despite people doing heavy work on a sunny day, you rarely saw people walking around with sweat towels. When they participate in village work programmes like weeding the grass but now when they walk they would need sweat towels. It is very hot now. When I watch the weather reports on TV, I can see that the temperature is at 31°C but in those days I remember the weather reports on the radio use to state that the temperature is around 25°C, 26°C. Now it is 31, 31, 31" (September 16, 2014).

²⁸ The main dimensions of climate change described in this section and listed on Table 5.1 were determined through several rounds of secondary coding. The actual process and methods used to determine these issues and construct Table 5.1 and subsequent tables in this chapter are described in detail Chapter 4, section 4.9.2: pp100-110.

Younger residents also described ‘feeling’ the heat and ‘seeing’ it in the changing behaviour of people in their village (see Box 5.2).

Box 5.2: Excerpt of a focus group discussion with youth at Saleimoa (SMFG01, September 22, 2014).

- TF²⁹ “I believe the heat has changed compared to when I was younger. When I listened to the weather reports and forecasts on the radio and TV the temperature for Samoa keeps increasing. When I was young, I could play rugby and walk around in the sun. Now that I am older I cannot really play in the sun. These days, after playing in the sun, people sometimes get sick.. you see them massaging their heads with *ti* [*Cordyline fruticosa*] leaves”.
- TL “When I was younger the heat of the sun and weather were not like this....especially for us who work the land, we are now mindful of the heat and the weather, before the heat was not like this, so we are very careful of the sun and the weather because there has been a big change. As TF has said, the weather reports that we listen to indicate that the heat has been increasing...Because those days when I was young like what the young ones are going through right now (pause) there is much, even though it is hot, but they still go aye? Now that I have reached the time of life where I am a caregiver and older, now I am more cautious aye? Now this time when I say to the children not to go to the sun, but they still go just like I used to do. My parents used to tell me not to go outside, but it’s like going outside was my favourite thing, but now I feel that what they said is true and now I think even the children notice that there has been a change in the temperature and [did not finish this statement] even me at this time I feel that it is hot. That’s how I figure the issue in my mind”.
- MT “I have an opinion about the work we do for the church such as cleaning the church compound. At times when I was young the work would begin in the morning and would continue until it was finished (mmm and nod from NM). But these times, it would mostly be done in the early morning, resume when it’s evening. People would stop when the sun is high in the sky. And then I think, those days, it’s true that it was hot, but people did not easily become ill due to the sun, it was like they continued on working. When I was young I carried grass all day. The work would finish in a day. Even though the sun is highest in the sky the work would continue until it is finished. Whatever it is. Then people would leave. But at this time, most of the women’s work is done in the morning. When the sun’s eye is seen the work would be stopped and would be resumed in the evening say 5pm or later they would resume the work of the church that they normally do on Saturday...The other thing that I have noticed is water flooding houses in this part of the village (referring to where TF and NM reside). Especially when it rains heavily eh? Well you would see many puddles around our house but these poor families, aye TF? These poor families would suffer from the water flooding their houses. The water would flow right into their houses”.
- TF “Mmmm yeah”.
- NM “Mmmm yes”.
- MT “The rain causes this. It causes the water to rise and flow into their houses”.
- TF “Yes there are many springs in this part of the village. These springs burst when it rains heavily eh? You would see this happening infront of the Methodist church”.

²⁹ The initials used in this textbox and subsequent ones are not the actual initials of the participants. This was done to protect the identity of the participants.

MT	“Yes, in front of the Methodist church. Yes there are so many springs there (emphasized)”.
TL	“I know that if Tili’s family hadn’t added rocks and soil to lift their frontyard their house they would still be faced with flooding”.
TF	“Yes, that’s another family. And also in front of Tala Popo’s family. That area and all the way to Kalasa’s house”.
MT	“mmm...”

Shorter but heavier rainfall was the second most frequently mentioned issue at this site. As evident in the last part of the above focus group discussion many young people had experienced rainfall and flooding. As soon as MT mentioned rainfall and flooding, the rest of the group nodded in agreement (see Box 5.2). An older resident (SM004) talked about how short heavy rainfall had recently occurred more often. This change in the climate combined with increased clearance of forested areas inland had caused frequent flooding. She said,

“Oka! There were instances of heavy rainfall this year in June and July which caused flooding in our part of the village. These rarely (emphasized) happened, not until during the cyclone season, but now they have become more frequent throughout the year....Newly tar sealed access roads have caused increased runoff from inland areas to these parts. When it rains heavily, oh the water would strongly flow onto the road and towards here. Before it was tar sealed, oh the water brings so much dirt and dumps it besides the houses in this area. Sometimes it would flow into the houses. There is a great impact of rain. There are drains on the western side of our houses but parts of this drain were blocked when the seawall was built. So the water flows onto the road... more people have shifted inland and they have cleared much of the land. They have cut down the trees for their houses and plantations making it easier for the water to erode the land” (September 18, 2014).

Stronger damaging winds were the third dimension discussed by most residents. Interviewed residents who had experienced Cyclones Ofa and Val in the early 1990s suggested these events made them aware that cyclones have become slightly more intense and unpredictable due to climate change. Many of those who experienced these cyclones remembered the events vividly and referred to Cyclone Val as the most destructive cyclone they had experienced. Some residents also explained how gusty winds have also become stronger in recent years. Sea level rise was the least mentioned issue by most of those interviewed, with many suggesting this had been less noticeable compared with other climate-related events. An elderly male said:

“I know that the sea is rising but its effects have only been minor. The area near Malua has eroded inland but there hasn’t been much erosion in most parts of the village. This is mainly because of the seawall that protects the coastal area and reclamations which people have done to protect their houses. For example, those

houses that we see (pointing to the seaward side of the road) were there 30-40 years ago and they are still there” (SM003, September 23, 2014).

Other participants suggested that sea level rise had only been noticeable during periods of extreme high tide and storm events, as indicated in the following textbox (see Box 5.3).

Box 5.3: Excerpt of a focus group discussion with youth at Saleimoa (SMFG02, September 26, 2014).

- MP “There were times when the sea rises, higher, and flows onto the road. Sometimes it washes fish and other marine organisms onto the road and we would collect these...I’m not quite sure if NM and TF have noticed this (laughs)”.
- VK “No you’re right. I have seen this happening. There are times when the sea would rise higher than normal when it’s high tide. I see the sea reaching the area where the coconuts are growing, on the other side of the road. Other times, the sea would flow onto the road and on to our frontyard”.
- FV “No, there are times when that happens (said this at the same time with VK) the sea comes over the old seawall eh? When the tide is very high”.
- MP “Yes, this tends to affect the plants growing close to the sea. The plants are sprayed with seawater”.
- VK “Yeah and the grass would also turn brown because it gets covered by seawater, but there is no great effect of this unless the wind blows strongly, as during cyclones, then the sea would be sprayed over most of the trees, growing close to the sea and dries them out”.

A young farmer who participated in one of the focus groups talked about how in recent years, his crops had been inundated with seawater causing him to believe that the sea level is rising. He said,

“Our house and food garden are located on the mouth of a wetland- the food garden used to grow before, but now the area is no longer cultivated as the bananas tend to die because when the tide is high the seawater floods this part of our land...the construction of the road and seawall has altered the area. The seawater flows through the drain that has been constructed and floods this area (SM007, September 26, 2014)”.

1. Impacts of climate change experienced by surveyed residents.

Participants’ descriptions of current climate change impacts suggested both risks and opportunities which are listed in Table 5.2 and described in the following section.

i) Risks

The most frequently mentioned and emphasized risk by most participants was damage to crops, houses and other properties, caused by heavy rainfall, storm surges and strong winds, which mainly occurred during the cyclone season (see Table 5.2). Cyclones Ofa and Val had

caused the most serious damage to crops, houses and properties. SM004 described the destructive impact of storm surges she had witnessed during Cyclone Val. She said,

“I was at school when Cyclone Val came...My friend and I caught the last bus home, very late in the evening, but it was blocked at Leauvaa (two villages away from Saleimoa) so we had to walk the rest of the way (laughed). The wind was so strong at that time (emphasized) and all throughout the night. The damage was great. Our house was completely destroyed. Even the house in front of us was completely destroyed. The sea flowed right into the house. The sea, sea, sea, sea. The sea flowed through SE’s house in front of us and moved towards our house. Oh even though our house was on higher ground compared to SE’s house it did not save it from the sea. The sea flowed into our house. Well, everyone had to be evacuated by car and they were brought to the pastor’s house. It destroyed (emphasized)...that cyclone greatly impacted (tone of voice weak) and destroyed many houses. I did not notice any water from inland it was just the sea that did the greatest damage” (September 18, 2014).

Interviewed residents who were 9 and 10 years old at the time remembered roofs of houses being blown off and crops flattened. Most participants indicated they had ‘felt’ and ‘seen’ the dry spells during the dry season getting longer as shown by the grass turning brown for a much longer period of time in recent years. Farmers interviewed stated that the soil was drier now than in previous years causing some of their root crops to wither in the hot sun. Shorter heavier rainfall and the sea had also damaged properties as described by young residents (see Box 5.4).

Additional risks that were also mentioned by surveyed residents at this site included diminishing marine resources, reduced productivity of the land, and new diseases such as ‘chikungunya’³⁰ (see Table 5.2). An elderly farmer said the 1990s cyclones also played a role in damaging the coral reef and diminishing marine resources. After the cyclones, he decided not to fish any more, but concentrate on cultivating his plantation. Some participants said the impact of shorter heavier rainfall and the building of the new seawall had also contributed to the loss of shellfish. SM005 said,

“The coast and sea have changed. I used to fish, both night and day, when I was younger for cockles and other shellfish like *fole*, *gau*...but it has been about twenty years since I visited the sea. I hear that shellfish have diminished...I believe this is one of the effects of greater ‘runoff’ (spoken in English) that has occurred. Greater runoff from inland. And also because of the building of the new seawall. The new seawall extends about ten metres into the sea, so we cannot see the sand and seashore

³⁰ This disease is carried by mosquitoes and causes people to develop skin rashes and aching joints. Came to Samoa in 2013.

that used to be there which people have used to fish for pipis and cockles (September 16, 2014)”.

Box 5.4: Excerpt of a focus group discussion with youth at Saleimoa (SMFG01, September 22, 2014).

- MT “Ofa and Val”.
- TF “Ofa, Val”.
- TL “It happened in 1990 eh? Was it 1990?”
- MT “Yes, Ofa came in 1990”.
- TF “And Val came in 1991. I was only 3 years old then so I don’t remember anything (laughs)”.
- TL “I was 9 years old when Ofa came (laughs)”.
- MT “I was 11”.
- TL “Well I remembered roofing iron flying off some houses eh? The trees were overturned or snapped in half. There was no water and electricity. I remembered we had to go to the Nonoa pool to get water and bathe there”.
- MT “Yes, we did the same. Sometimes we shower in the rain or rainwater collected in drums. I remembered the banana trees were down, the breadfruits were down. What my family did was we collected the breadfruits and bananas and piled them at the back of our house (voice weakened). Even the non-matured breadfruit and bananas. Well (raised voice) we ate the matured ones and then move on to using the non-matured ones for our meals (laughs) that is what our family did. Because the plantations were flattened”.
- TL “Sometimes we bought rice from the shops”.
- MT “Yes, help from overseas came later. I remembered all these trucks came and parked in the middle of the *malae* [village open space]. They brought bags of rice and flour. Oh and the helicopter (laughs) that was the first time I had ever seen a helicopter (laughs)”.
- TL “Yes, me too (laughs) lots of flour and sugar”.
- MT “Yes, because there was hardly any food because the cyclone had blown off all the fruits of the trees that provided food and destroyed taro plantations. My statement about eating non matured bananas is absolutely true”.
- TL “Yes, and non- matured breadfruit and coconuts”.

a. Perceived significance of risks associated with current climate change

Participants’ descriptions of climate related events also suggested at the ‘significance’ of climate related risks to their lives (see Table 5.3). Section 4.9.2D of Chapter 4 discusses the process of determining the significance of risks. In short, the analysis considered the frequent mention of a certain climate related event in the participants’ responses. It also examined words and phrases which the participants used to describe the magnitude of such an event and its impacts. These words and phrases were then categorized to produce a template (see Table 4.7) which outlines and defines difference levels of ‘significance’, namely Low, Medium and High.

As Table 5.3 shows, most participants' interviewed at Saleimoa perceived the significance of risks associated with the current rise in temperature, shorter heavier rainfall and stronger damaging winds as being at a 'medium level'³¹. The significance of risks associated with sea level rise were between 'low and medium' suggesting that the former events have had more impact on most participants compared to sea level rise.

ii. Opportunities

Survey participants also repeatedly mentioned and pointed out opportunities associated with climate-related events which are seen on Table 5.2. These comments suggest that climate related events do not just cause risks but their occurrence had also been beneficial to the lives of these participants in some instances. For example, younger residents mentioned the sea washing 'fish onto the road' and they would collect these. Breadfruits, bananas and coconuts were plentiful during the cyclones and afterwards, food and other types of assistance would be available (see Box 5.4). Most also stated that cyclones have caused people to share resources leading to a strengthening of social networks. The village seawall and access roads were also developed by the government as a response to the occurrence of such events.

B. Dimensions of climate change likely to be experienced in the future

Table 5.1 shows residents' perceptions of possible future climate changes mainly mirrored those they had previously experienced. As the second column of Table 5.1 shows, hotter days and longer dry spells, shorter but heavier rainfall, stronger damaging winds and sea level rise are perceived by most to possibly occur in the future due to climate change.

Table 5.1: Current and future climate related changes frequently mentioned and emphasized by interviewed residents of Saleimoa.	
Changes that were experienced 1. Hotter days and longer dry spells 2. Shorter and heavier rainfall 3. Stronger damaging winds 4. Sea level rise	Future climatic changes that were perceived likely to occur 1. Hotter days and longer dry spells 2. Shorter and heavier rainfall 3. Stronger damaging winds 4. Sea level rise

1. Likely impacts of climate change and their significance

Table 5.2 shows some changes in how participants perceived the likely impacts of climate change compared to their perceptions of current impacts. While most residents believed that the many risks and opportunities they have experienced would continue to occur, certain risks such as reduced productivity of the land are perceived likely to be more significant in the

³¹Table 4.7, page 112 provides a detailed explanation of these categories.

future. A new likely risk that was identified by some residents was inadequate water. A few residents commented that the current rise in temperature and sea level might cause water sources located along the coast to ‘dry up’ or ‘submerge’ under seawater. Access to food and other resources, stronger and diversified connections and improvement in infrastructure were also perceived by many as likely opportunities.

Table 5.2: Impacts of climate change frequently mentioned and emphasized by interviewed residents of Saleimoa.	
Current impacts Risks 1. Damage to properties 2. Diminishing marine resources 3. Reduced productivity of the land 4. Diseases Opportunities 1. Access to foods and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure	Perceived possible future impacts Risks 1. Damage to properties 2. Reduced productivity of the land 3. Diminishing marine resources 4. Diseases 5. Inadequate water Opportunities 1. Access to food and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure

Table 5.3 shows important shifts in participants’ perceptions of the significance of likely climate-related risks compared to the ones they have experienced. Most perceived that the significance of risks associated with hotter days and longer dry spells, shorter and heavier rainfall and stronger damaging winds will increase to about ‘medium-high’³² in the future, while risks relating to sea level rise would increase to ‘medium’ levels.

Table 5.3: Perceived significance of risks associated with current and possible future climate related events, by surveyed residents of Saleimoa.		
Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days and longer dry spells	Medium	Medium- High
2. Shorter and heavier rainfall	Medium	Medium- High
3. Stronger damaging winds	Medium	Medium- High
4. Sea level rise	Low- Medium	Medium

5.2.5 Crises management system based on *faamatai* and its key coping strategies

The majority of those interviewed suggested the extended family network and supportive roles of the village, church groupings and, at times, the government and external situations had enabled them to endure previous extreme events and climate related changes they had experienced. These networks have ensured sustainable access to food, water and shelter

³² Table 4.8, page 113 provides an explanation of the different levels of significance of risks associated with possible future climate change.

through their development of key survival strategies of diversification, mobility and mental and spiritual strength. These are discussed further in the next section.

A. Extended families: diversification, mobility and spiritual and mental strength

1. Diversification

Diversification, which mainly refers to multiple ways in which people access resources to sustain their livelihoods, has been a significant characteristic in extended family households that have enabled households to cope with previous risks to food and water supply, as well as shelter. All of the surveyed residents stated that their households comprise those who are employed in private businesses and government ministries and schools, and those who engage in small-scale fishing and plantation activities. Most stated that their families have plantations, which are mainly located inland away from where they live, as well as small food gardens, chicken and pig farms at the back of their houses. The majority of families have also received remittances and other assistance from relatives working and living overseas.

The importance of these multiple sources of food and income, are captured in the comment of an elderly resident (SM001), who stated that all members of his family play different, but equally important, roles which have ensured the survival of his household. His eldest daughter who is unmarried stays home to watch the younger grandchildren and help prepare food for the family. The other daughter and her four children are employed in private companies or government agencies, and they provide money to pay household expenses mainly water and electricity costs and meet financial obligations from church and traditional activities. The latter daughter's husband helps him in the plantation and the raising of his pigs and chickens. Sometimes relatives and other villagers come and buy from him pigs, chickens or some of his food crops. Additionally, he often receives money and care packages from his other three daughters and their families living in the United States. When their house was destroyed in the 1990s cyclones, the daughters living overseas had contributed money to help repair their house on the coast and also build a new one inland.

There are multiple sources of water in the village (see Figure 5.1) with most residents having access to a piped water supply, and village pools and springs when piped water supply has been disrupted. Some families have also installed water tanks as an alternative supply of water while others use drums and empty containers. Many also revealed that the diverse range of plants, such as root crops, fruits, medicinal plants and trees, they had grown in their

food gardens and plantations ensured there was food supply and medicine available during and after events such as cyclones. Trees are used to make handicrafts and other cultural products as well as build houses.

A significant part of diversification has been the incremental adoption of new products and techniques of sourcing food, water and places to live. At the same time, slightly modifying older products and adjusting techniques only when necessary. Young and elderly farmers who were interviewed suggested that while they have adopted and adapted some new varieties of root crops and tools to improve the cultivation of crops, the timing, techniques and processes of planting are very much the same as in the early 1900s. Most have bought and are using wheelbarrows to transport crops. Other families have bought cars to travel to their plantations, which are usually far from where they live. Some are using weed killer chemicals to help clear the land for farming. Since the taro blight in 1993, many people have grown different and newer varieties of taro developed by the government. But the *oso* is still the main tool used for planting taro and the same technique of digging holes and planting tubers is used. Work schedules and planting calendars have only slightly changed since the early 1900s. An elderly farmer (SM001) described stated that older methods of cultivating crops have been important as the rain had occurred slightly later in the year. For example *tuiefu* [planting crops in the dry season], mixed cropping, *vaitoaga* [crops grown in between harvests] and planting supplementary crops: for example, vegetables during the rainy months of December and January. In addition, planting root crops little affected by the heat and strong winds such as the giant taro, yams and cassava has been taking place (see Table 5.4). Both older and younger farmers said that they usually begin work between 5 and 6am and work till about mid-morning, between 10-11am. They then rest and do light work in shady areas and resume work between 4pm-6pm.

Table 5.4: Planting calendar (constructed from research findings)			Buck (1930) and Watters (1958)
October	Vaipalolo (wet season)	Middle to the end of the breadfruit season	
November		<i>fafai le toaga</i> [harvest] <i>talo mua</i> [first harvest]	Yam planting
December		<i>Polili</i> [removing the tuber and replanting the top part of the taro or taamu]. These taro would be too small when the cyclone season starts and would not be harmed if a cyclone	Harvesting of crops planted in May/June -planting by farmers happens in December rather than November-later planting means taro would be

		occurs. Plant <i>vaitoaga</i> [crops grown in between harvests]	too small to be harmed by cyclones that were most common in January Yam planting
January		Seasonal crops- vegetables	Yam planting
February		Prepare for cyclones	
March		Prune trees/ banana crops	
April	Vaitoelau (dry season)	- End of the cyclone season - <i>Talo muli</i> [second/ final harvest] - <i>polili</i> - Clearing land and weeds	
May		Beginning of the dry season	Early planting
June		- Slash and burning - Prepare land for next planting	-Northwest Upolu & Savaii (Watters, 1958) June- yam planting (Buck)
July		- <i>Tuiefu</i> dry season planting begins - Planting root crops in dry soil	-yam planting
August		- Crops would gain roots and shoots <i>Tau tuputupu</i> [springtime/ growing season] by this time but in recent years this month had increasingly gotten drier.	-yam planting
September		- In previous times, crops would be growing well by this time but this had not been the case so <i>tuiefu</i> had been occurring in August and September.	

The combination of older and newer knowledge and techniques has also enabled fishermen to continue fishing activities and provide food and money for their families in the past. Equipment such as torches have replaced the lanterns they once used, but the places where fishermen go fishing are still largely the same. A younger fisherman related that frequent fishing trips with an elderly fisherman enabled him to learn the names and locations of particular places in the sea where fish could be found. They would mostly fish in these parts of the sea throughout the year and then shift to the south coast of Upolu when the wet season begins.

2. Mobility

Extended family connections and the communal nature of land ownership have allowed most residents to also diversify places of residence. The majority of those interviewed talked

about the concept of *faa-aigalua* [having two residences] in relation to their homes. Most families would have their main houses on the coast, along with other smaller houses (such as open *fale* [house], outdoor kitchens, outdoor lavatories) in the same place. Some residents, whose main houses were destroyed by Cyclone Val, lived in their small open *fale* while their main houses were being repaired. Others used materials from their damaged houses to add living spaces to their outdoor kitchens and they lived there while they slowly repaired their main houses.

Since the 1990s, some families have also built other houses inland, in areas where they cultivate their plantations. Many other families did this after the 2009 tsunami. According to the respondents, it is mostly the middle aged members of their families who have moved inland, but they do not permanently stay there and often visit homes in the coastal part of the village (see Figure 5.2). This flexibility of movement is demonstrated by the ‘two-headed arrows’ in Figure 5.1. This has been observed in all the other surveyed villages.



Figure 5.2: Development at a plantation site at Saleimoa. This family who also reside on the coast first built an open house on their plantation back in the 1970s. They replaced it with another one in the mid-1990s (pictured left). They started building the closed European house in 2011 where one of the daughters and her family has moved.

Extended family connections have also allowed many people (facing coastal erosion and inundation) to build houses and cultivate plantations on land outside the village they currently reside on. A 21 year old male living at Saleimoa said that they cultivate their plantation on family land at Lefaga (a village on the south-coast of Upolu island), the village of his grandmother. This is because there is no space at Saleimoa to cultivate a plantation except a few banana trees. The sea tends to inundate land where their food garden is grown. A 38 year old female living at Saleimoa has built a house on land at Moataa, her mother’s village.

A few families have bought freehold land in other parts of Upolu where they have built houses and cultivated plantations.

3. Mental and spiritual strength

Elderly residents, in particular, mentioned that daily morning and evening family gatherings were important in developing mental and spiritual strength to endure difficult times. Most participants also mentioned their families holding evening services most days of the week. A mature female (SM004) described that during their evening prayers they often share stories with their children, which she thinks has been important in providing motivation for them to do well at school, secure jobs and start their own families. She said,

“We talk to our children, usually after evening prayers, about the *va-fealoai* [mutual respect] between people in the family. We ‘share the stories’ (spoken in English) of our families. Who their father’s family is and who my family is. We share the story of our lives, how we grew up and the ‘struggle’ (spoken in English) we went through to try and build our family. Our parents went through the same thing. My husband often shares the stories of when he was growing up at Apolima and how things were difficult in those days- how his family depended on the sea and the forest for food. Compared to now, things have gotten easier but it’s important to work hard and not be lazy. We talk to them about the importance of carrying out chores...working hard at school to secure a job. We talk to them about the ways of Samoa, the ‘respect’ (spoken in English) one should have of the extended family network and the village and how it is important to turn up to your family’s *faalavelave* [traditional activities like funerals and weddings]. And also we talk to them about the church. The role of the church is important and participation in the youth group, Sunday school and choir is important to build their spiritual life so they can cope with difficulties they face” (September 18, 2014).

Mental and spiritual strength was evident in the way most participants described their responses to previous challenges. Most participants, especially elders, were calm and had a balanced view of environmental challenges. Younger and older participants saw risks and opportunities associated with climate-related events, suggesting that the latter are crucial to their survival and development. Participants were not generally fatalistic, but optimistic about their situation and have accepted these changes as part of their life. Interestingly, elderly participants mostly referred to the current time as ‘easier’ and the older days as ‘harder’, ‘a struggle’, or ‘difficult’ suggesting that they are better able to deal with changes now compared to the past. An elderly male (SM002) said,

“The cause for developing a hard working attitude is if a boy or a girl has seen the struggle and hardship of his or her family. This would cause an attitude of hard-work and persistence in the mind of a person to change their situation. They will focus on changing their circumstances through hard work. But it is very hard for a person that is born into a home that already has a lot of things. They tend not to progress and

develop because they consider themselves fine. Others will tend to live recklessly because they have things, especially things that they did not produce from their own sweat. They would be ignorant because they haven't lived a life of struggle and hardship" (September 17, 2014).

B. Village groupings and churches: managing resources, inspections, negotiating access to lands and developing mental and spiritual strength

1. Managing village resources

The council manages village resources such as pools, springs, seawall and work roads. According to interviewed residents, the council and the untitled men's groups have conducted, from time to time, important maintenance activities such as clearing debris from water sources, planting trees along the coastal area and clearing work roads to inland parts of the village. Many stated that these activities have been important to ensuring villagers have access to water and food as witnessed after previous cyclones.

2. Encouraging diversification through village inspections

Monthly inspections of food gardens, plantations and household items by village council, untitled men's group and women's church committee, have encouraged some residents to develop these essential resources which had sustained them during previous setbacks. In recent years, nine stalls of various sizes have been set up (some by individual families and others by the village) beside the road and village residents have been using these to sell food products and other items for money. Other villagers have been selling their food crops in front of Farmer Joe's shop which is the biggest in the village.

3. Protection of village residences and facilitating access to land and other resources

The village council in the past requested the CCCS Church, which 'now owns' the inland part of the village, to allow Saleimoa residents to cultivate and reside on some parts of its lands. The request was accepted and some participants' families are currently cultivating their plantations on these lands. This has been significant because it has allowed some residents to develop food supplies and earn money for church and other cultural obligations.

Village groups have also worked with the government in efforts to ensure the sustainability of village resources. In the early 2000s the council, the untitled men's group and women's committee assisted the government in the preparation of the village CIM Plan (Coastal Infrastructural Management Plan) which identified parts of the village susceptible to coastal

hazards, mainly flooding (see Figure 5.3). This led to the building of the seawall and tar-sealing of access roads to inland parts of the village. The village council and untitled men's group have since helped with their maintenance by planting trees along the seawall and clearing areas alongside access roads. According to farmers interviewed, the Ministry of Agriculture have committed to provide farming equipment, seedlings for farmers and they are awaiting these.



Figure 5.3: Parts of Saleimoa susceptible to flooding (Source: Government of Samoa and CIM Plan Committee for Sagala le Falefa District, 2007).

4. Developing mental and spiritual strength

The roles of various churches in the village have been equally significant. All of those surveyed belong to one of the churches in the village. Being part of church groups and regularly attending church services on Sunday is part of most people's weekly routine which also helps to build mental and spiritual strength to endure challenging times. The majority are members of either one or more of the groups that exist within the church as youth groups, women's committees, Sunday school teachers' group and choir. These groups meet a few times a week and provide opportunities for village members to discuss and develop programmes to help build awareness and preparedness for various situations including

climate-related disasters. It has been a common practice for these church groups to visit and offer spiritual support and gifts for village members who had been ill. The same had also been done for families who were having a funeral of a family member. During previous cyclones, churches, pastor's houses and church halls had been used as shelter for families whose houses were destroyed. Some churches, such as the Latter Day Saints, provide disaster relief assistance in the form of food, farming equipment and housing materials when cyclones have occurred.

C. Assistance from the government and external agencies

Infrastructural development such as the provision of piped water supply, electricity and the building of the seawall and access roads had been implemented by the government. The government has also helped develop the village's CIM-plan and establish a tilapia farm which is no longer in operation.

5.2.6 Preparing for possible future climate changes

When the interviewees were asked to talk about possible strategies to endure future climate change, younger participants mentioned strategies like mobility, replanting, installing water tanks and air conditioning. In contrast, elderly participants emphasized the importance of strengthening networks particularly at the family level. Many suggested that the individual is at the heart of *faamatai* and therefore should be the starting point for all of the changes. This is captured in the following quote by one elderly male (SM001). He said,

“The family is the foundation of all things. That is the foundation of a young Samoan's life. There are certain behaviours/ routines that must be revived in order for people especially young people to live well in the future. One has to avoid being selfish and lazy...If the beginning of a person's life is well founded then that person would be persistent and strong. They would not falter during challenges because they have a strong foundation. Parents should be firm about this at the beginning of a child's life. Chiefs should play their role in pushing young people in their families... to work and develop their skills” (September 15, 2014).

A key point is instilling in family members, especially young people, an ethic of hard work in order to survive in the future, and the family and village groups should always consider their roles in ensuring that this happens. Elderly members of each family, parents and holders of chiefly titles need to encourage and empower younger members to be more proactive, hardworking and avoid being selfish and individualistic. Many believed family gatherings

such as evening services, which had been important in ensuring there is sharing of knowledge and values, must be encouraged/ continued.

Both young and older participants feel the village council could do more in terms of encouraging a hard work ethic by conducting regular inspections of food gardens, plantations and household amenities. These are reflected in the following quote by SM002 who said,

“The village is the totality of all families and the village comprises specific groupings that should work together for the development of the village. These groupings like the council, women’s committee, untitled men should work together and carry out their roles and responsibilities...conduct inspections of plantations and food gardens, upgrade water sources and so forth. This would encourage village members to work the land and continuously develop their crops, livestock, homes to endure future challenges” (September 17, 2014).

Older participants feel the supportive role of the village council and churches could encourage families to hold evening services through their implementation of evening curfews. The latter could provide the time and space for families to conduct their evening services, re-connect with each other, re-align goals for the next day and re-connect knowledge and values. Many also suggested the council should continue negotiations with the church regarding obtaining land inland for village residents to grow food crops and build houses. Moreover, the council and other village and church groups should continue regular maintenance of village resources such as the village wetlands, marine area and water sources.

Many also commented that communication between the village and government and external agencies must be improved so government assistance is more locally relevant. There is a need for assistance in terms of farming and fishing equipment and crop seedlings. The government must ensure that in regards to discussing proposed projects and development schemes, there should be longer and more productive consultations which include everyone in the village and address locally derived concerns. The adverse effects of government projects on the livelihoods of local residents, such as loss of seashells and sandy areas, increased erosion and flooding, must be taken into account in the development of future projects.

5.2.7 Summary of findings from Saleimoa

In response to the first two research questions on respondents’ knowledge of climate change, the findings from Saleimoa revealed that exposure to previous extreme events, such as the

1990s cyclones has created a greater awareness of climate change among surveyed residents. Most residents have been sensitive to slight changes in the climate mainly hotter days, longer dry spells and unpredictable rainfall and wind patterns. Some were also aware of slow, incremental sea level rise. Most interviewed residents had also demonstrated familiarity with impacts of climate change, with many mentioning both risks such as damage to properties and diminishing marine resources and opportunities like access to resources, networks and infrastructure. Interviewed residents were also able to project their knowledge into the future and imagine likely climate-related scenarios that could occur. Likely climate related changes and associated risks that many of the residents identified were similar to the ones they had already been experiencing. A new likely risk that was identified was inadequate water. Likely opportunities similar to those they had been experiencing were also identified.

In terms of coping strategies, a crises management system based on *faamatai* and its related structures of family, village and church groups had already been put in place and this system has been crucial to residents enduring previous challenges including climate changes in recent decades. Existing networks at the family, village and church levels have enabled most to develop and diversify food and water supplies, alternative places to live and build mental and spiritual strength. There has also been some assistance from the government in providing alternative resources.

The existence of this crises management system means there is readiness to cope with future climate change. Most participants stated that a major challenge for Saleimoa in the future could be mobility inland because most inland parts of the village are now owned and controlled by the CCCS and some private landowners. However, diverse actions are being undertaken at the family and village levels to deal with this challenge. For example, the village council is planning further negotiations with the church regarding land for some families to cultivate, and possibly lease with a view to own it, in the future. Many families are also accessing land through their extended family networks in other villages and/ or purchasing private land near the Apia Urban Area. Complementing these strategies are activities directed towards economic diversification and development of mental and spiritual strength. Key recommendations for improving the system includes the strengthening of *faamatai* at all levels-i.e. Family, village and government. This could be facilitated through the encouragement of family gatherings and evening services, village inspections and longer and more meaningful consultations with government and external agencies. The failure of

the tilapia farm showed how top-down initiated projects fail if they do not have the support of the local residents.

5.3: Auala

5.3.1 The village

Auala lies on a coastal plain in the northwest of Savaii (see Figure 5.4). The barrier reef on the east becomes a fringing reef in the western parts of the village. The population of Auala has increased from 363 in 1961 (Samoa Bureau of Statistics, 2016) to 573 in 2011 (Samoa Bureau of Statistics, 2011). Most of the village people used to live on the coast, but the coastal part of the Auala settlement was destroyed by cyclones Ofa and Val in the 1990s. After the cyclones, most households shifted inland, except for a few houses and the Congregational Christian Church of Samoa (CCCS) compound- the main church in the village- which has remained on the coast. The main road closely follows the coastline and cuts inland in a few parts. Sections of the old road, which existed before the cyclones, are partially submerged along the shoreline, west of the village.

The timber industry provided employment for most people between 1960 and 1990, but the majority of inhabitants are now supported by remittances from family members who live and work in Apia and in overseas countries, and through traditional activities such as fishing and farming. A couple of small tourist operations, notably, the Vaisala and Vaimoana hotels, provide employment for a few young people. Auala is located next to Asau, which was a thriving commercial centre in the 1960s, 1970s and 1980s when it was the centre of the timber industry in Samoa (see Appendix 1). At this time, logging of native forests was common in the northwest of Savaii, and a significant part of the reef on the eastern side of the village was removed by the United States company, Potlatch Forests, to allow ships to enter Asau harbour. Potlatch Forests also built an airfield and a road in front of the barrier reef to connect the airfield to Asau. The remains of the airfield, which resembles an offshore island, and the road, can still be seen (see Figure 5.5).

Electricity has been made available, but the water supply remains a challenge. The area normally experiences drought in the middle of the year, and the lack of rivers and streams means the village is largely dependent on rainwater collected in tanks, or on brackish water from taps and coastal springs. In September 2008, bushfires destroyed more than 2000 acres of forest located inland from Auala and its neighbouring villages (Ministry of Natural Resources and Environment (MNRE): Government of Samoa, 2013).

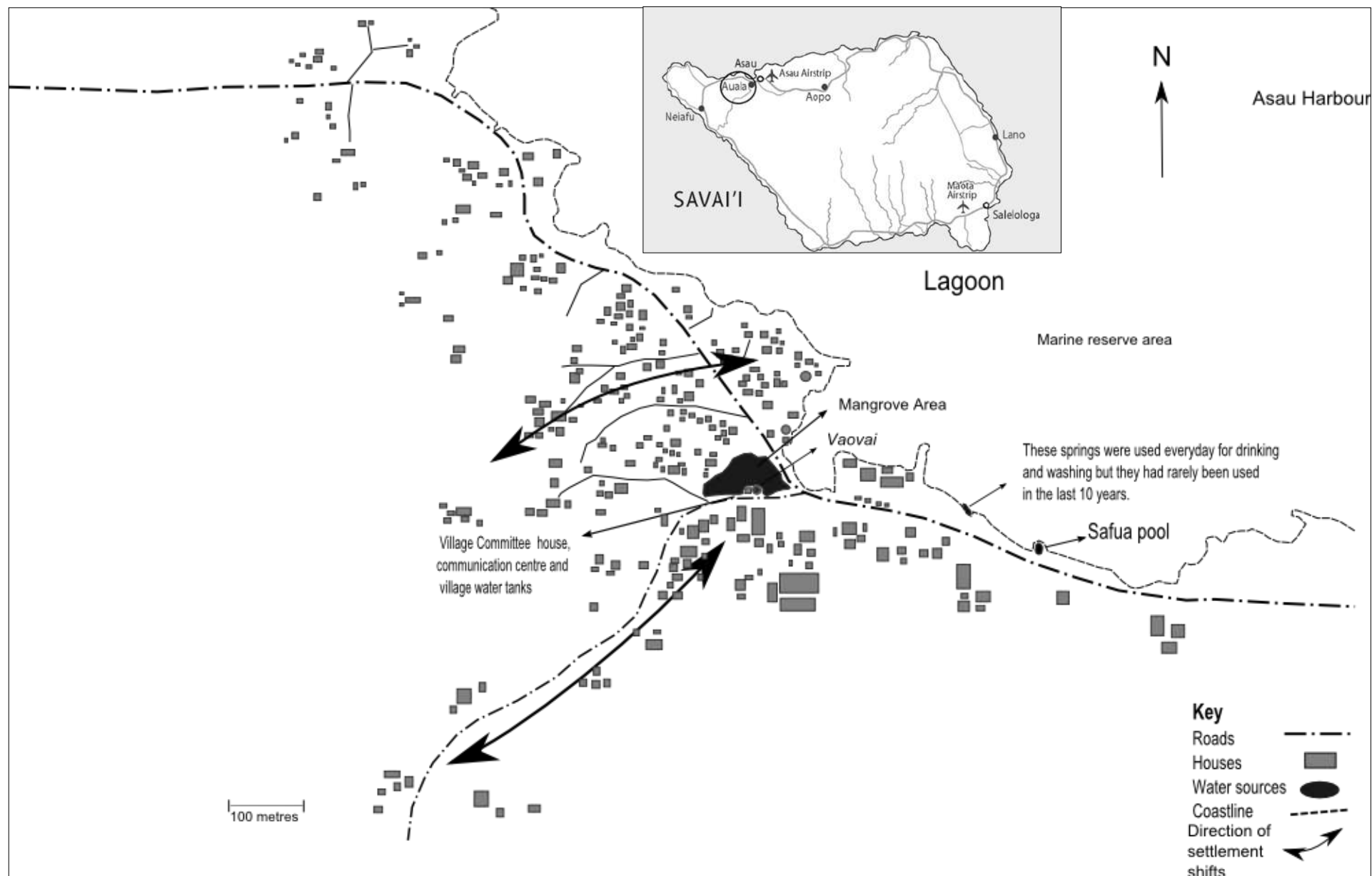


Figure 5.4: Auala settlement and village resources (Source: after Google Earth, 2016).

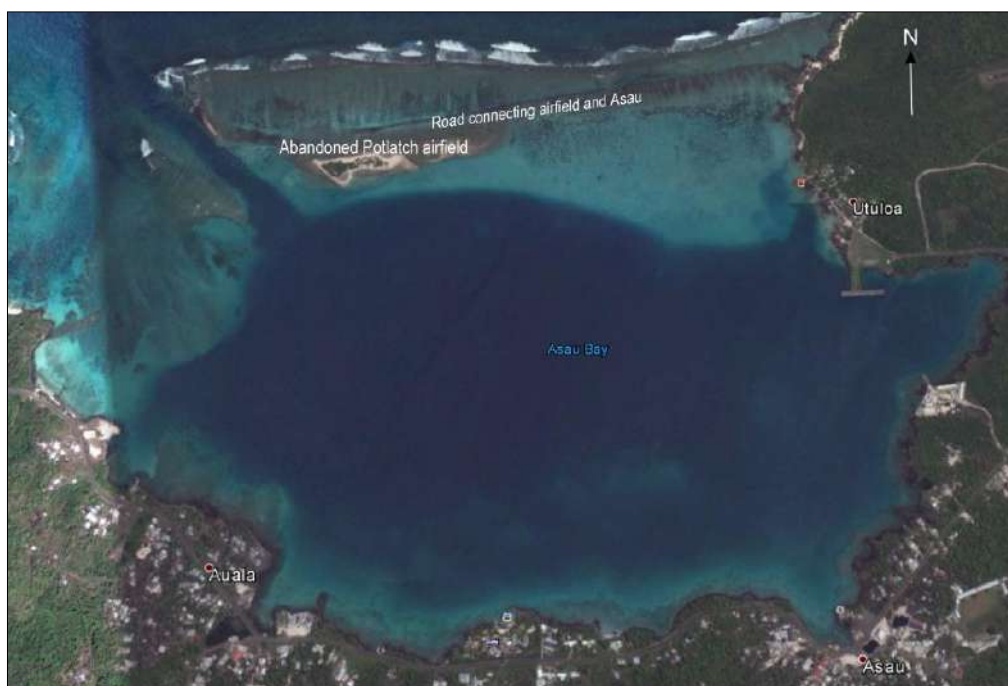


Figure 5.5: The airfield and road that were built by Potlatch Forests can still be seen in Asau Bay (Source: after Google Earth, 2016).

5.3.2 Summary of research carried out at this village.

Eight key informant interviews and two focus groups were conducted at this site. Field observations were all carried out by walking and driving mainly to the inland areas of the village. The details of residents who were consulted are in Box 5.5.

Box 5.5: Details of study participants from Auala.

<u>Interviewees</u>	
76 year old female (AU001) Family- mother, grandmother, widow Village- former government representative, member of the women's committee Church- member of the women's committee Skills- retired nurse (midwife), traditional healer, weaver, farmer (pandanus, vegetables, chickens)	48 year old female (AU006) Family- mother Village- member of the women's committee Church- Sunday school teacher, member of the choir, member of the women's committee Skills- weaver (mats and handicrafts), farmer (vegetables)
62 year old male (AU002) Family- chief, father Village- former government representative, member of the village council Church- deacon, member of the church committee, member of the youth committee Skills- retired mechanic (Potlatch timber mill), fisherman and farmer (plantation, pigs, cattle, goats, chickens)	47 year old male (AU007) Family- single male Village- member of the untitled men's group Church- member of the youth committee, Sunday school teacher Skills- teacher
60 year old male (AU003) Family- chief, father Village- government representative, member of the	45 year old male (AU008) Family- father Village- member of the untitled men's group Church- member of the congregation

village council Church- deacon, member of the church committee Skills- retired driver and timber loader (Potlatch timber mill), fisherman and farmer (plantation, pigs, chickens) 59 year old male (AU004) Family- chief, father, grandfather Village- former government representative, member of the village council Church- deacon, member of the church youth Skills- fisherman and farmer (plantation, pigs, chickens) 52 year old female (AU005) Family- single woman Village- leader of the women's committee Church- Sunday school teacher, member of the youth, member of the women's committee Skills- teacher, weaver	Skills- farmer <u>Focus group participants</u> Focus group 1 (AFG01) • 3 females and 4 males • Age- late teens to early 20s • Most attend high school while a few have just started working • All are members of the CCCS youth group Focus group 2 (AFG02) • 3 females and 5 males • Age- mid 20s to late 30s • Some work while others cultivate plantations
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5.3.3 General environmental issues.

Inadequate water and damage to properties have been the main challenges faced by many Auala residents and these have been due to human activities, extreme events and recent climate change. Factors that have contributed to these challenges include extensive deforestation between the 1960s and 1990s, as well as clearance and reckless burning for agricultural purposes by the residents themselves. Additionally, the occurrence of extreme events, particularly the 1983 forest fire commonly referred to as the 'Big Fire' (see Appendix 1) and the 1990s cyclones, which many believe were associated with climate change. Many other forest fires have occurred especially during the dry seasons in the past two decades, and the 2009 tsunami was also mentioned by many of those interviewed, but according to these residents their impacts had been minor compared to the 'Big Fire' and the 1990s cyclones.

5.3.4 Perceptions of climate change.

A. Dimensions of climate change experienced by surveyed participants.

The majority of surveyed Auala residents suggested they have been experiencing hotter days and longer dry spells, damaging winds and sea level rise especially in recent decades (see Table 5.5). Most commented that an increase in hotter days as well as in the intensity and duration of dry spells have been the most significant climate-related change. In contrast to residents of other coastal villages in Upolu (such as Saleimoa, Saanapu and Malaela) who mostly talked about 'hotter days', the residents of Auala spent a lot of time talking about patterns of rainfall during the dry season (similar to Maagiagi and Aopo residents). Slightly hotter and longer dry seasons in recent years have meant lengthier periods of very low or no

rainfall. Elderly informants also suggested that it has become more difficult to predict the onset and duration of the rainy season and the pattern of rainfall. Informants between 60 and 70 years of age stated that in their youth the driest months had generally been between May and August, with September marking the beginning of the rainy season. In the past ten years, by contrast, the rains have been unreliable, coming as late as September and even October. A 62 year old farmer said,

“Well because it is true that this place is sunny (hot and dry), but the seasons were marked/distinct, like when we reach May, the rains would decrease. June, July, August, September it begins to rain. It starts to rain. By this time October, the rains would be good/ reliable. October, November, December, January, February, March yes it would be like that (paused). Now, it’s all over the place, it’s like it’s mostly the dry season and, there is no, there is confusion/uncertainty, it’s like there are no ‘boundaries’ (spoken in English), there is confusion/uncertainty, it shifts around, the time that one expects rain but there is no rain, the time that one expects it would be three months of continuous sun but then it would rain. ‘Well mind you’ (spoken in English) that one rain, ‘it’s like boiling water’ (spoken in English) on top of the land. ‘In one day’ (spoken in English). That rain in one day is not sufficient to replenish these things and provide adequate water for the land and trees that need water” (AU002, October 20, 2014).

The above quote and the comments of many other residents show that short duration spells of heavy rainfall had also occurred during the dry season when it was least expected. Water from short bursts of heavy rain was insufficient to replenish water in the soil, and in some cases it did more harm than good to crop growth. Hence the quoted words “like boiling water on top of the land”. Many participants also mentioned forest fires which have occurred more frequently in recent years, especially during the dry season. Government reports also confirm the scarcity of water in this part of Savaii, supporting the comments of those interviewed. As evident from the following map, the main rivers in Savaii are located away from the northwest coast of the island where Auala is located (see Figure 5.6).

The majority of participants also suggested the increasing intensity of winds and the reality of sea level rise. Older participants talked about the increasing intensity of cyclones, with the most significant being Cyclone Val in 1991 as evidence that climate change is taking place. Sea level rise was mentioned by the participants, but was mostly discussed in the context of the 1990s cyclones.

1. Impacts of climate change experienced by surveyed residents.

The participants’ descriptions of their experiences of climate change included both risks and opportunities. The most frequently mentioned risks and opportunities are listed in the first column of Table 5.6.

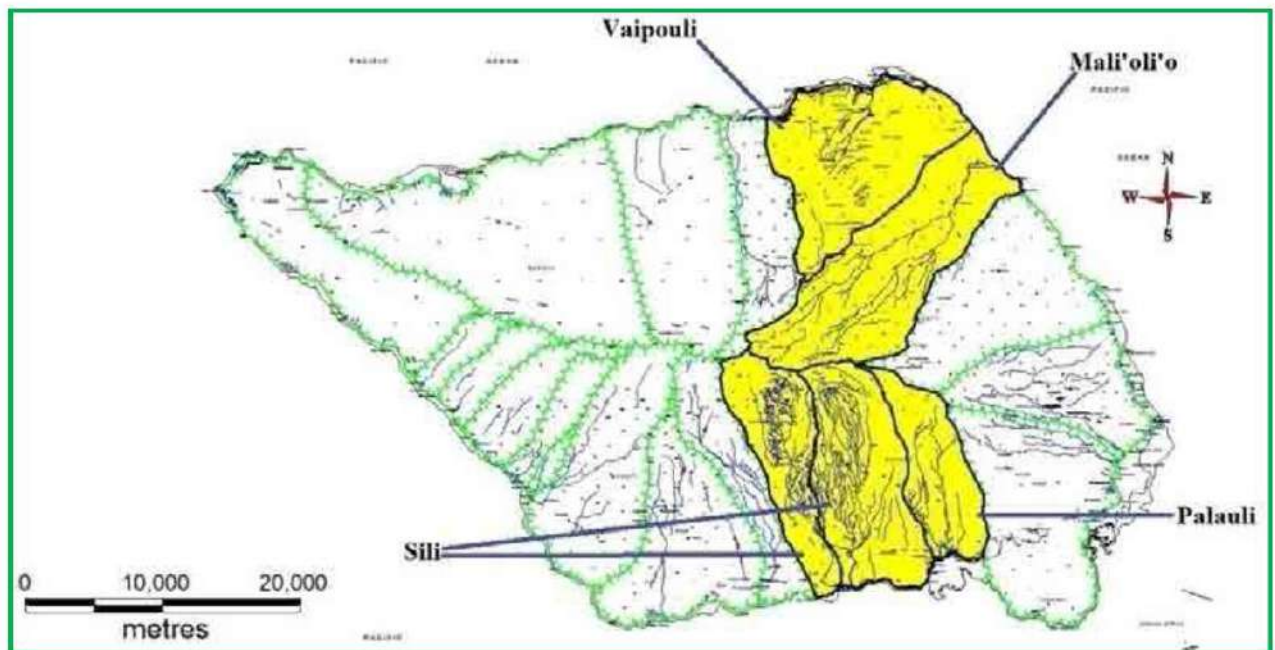


Figure 5.6: Main river systems in Savaii and the surrounding water catchment regions (highlighted yellow) (Source: MNRE: Government of Samoa, 2013).

i). Risks

An inadequate water supply had long been a challenge for Auala residents, but global warming has exacerbated issues of water quality and supply, especially over the past two decades. The supply of water has been low, especially in the dry season due to low and erratic rainfall. Elderly residents also commented that deforestation and tropical cyclones like Ofa (1990) and, especially Val (1991) contributed to the loss in forested areas which meant less water was captured and conserved. Furthermore, slow, incremental sea level rise has led to further increase in the salinity of the village's water sources, which are all located on the coast (see Figure 5.4). These factors, combined with the availability of water tanks filled by rainfall, have caused people to avoid drinking water from most pools and springs near the seashore. While many of these sources provided potable water for the village more than fifty years ago, since the late 1990s, these water sources have been used only for bathing and washing clothes. This was indicated by an elderly chief who said,

“Our village has two main springs Vaovai and Safua. The pool at the mouth of the mangrove area which people have been using to bathe is Vaovai. Water from these sources used to be drinkable. Water from Safua is still used by some for drinking and cooking, but Vaovai had recently been used only for bathing and washing clothes” (AU003, October 21, 2014).

Younger people who were interviewed related that they would often meet at these places to chat, play or bathe after playing sport or working in the sun.

Another major impact that was mentioned was damage to crops and other properties due to tropical cyclones and forest fires associated with dry spells and reckless burning by people. Many of those interviewed stated that strong winds and storm surges during Cyclones Ofa and Val in the early 1990s completely destroyed their homes and water tanks. A woman in her fifties said,

“I will never forget it. The waves kept pounding and the sea flowed right up to our back door. The water swept away our kitchen and pig sty which were located right on the beach. The wind just stripped away the iron roofing of our house, it was doing the same to other houses nearby. It looked like the wind was removing foil from top of the houses (laughs). They just flew off like plastics... We took whatever we could and went to my uncle’s house about 500 metres inland. Rain and sand pounded our skin like we were being hit with coconut brooms... The next day our house and properties were all gone. Only the cemented foundation and parts of the sides were left. Some families had taken shelter in their water tanks (laughs). The main road had disappeared and the sea had taken its place...” (AU005, October 13, 2014).

In addition, AU003 talked about the destruction of his crops by Cyclone Val. He said,

“The cyclone hit while I was a driver in the timber mill. Our land was good in those days, producing cocoa, oranges, those things were... (did not finish) You should see the cocoa plants in those days. When they bear fruits they are like bouquets of flowers, they are like bouquets. What I mean is that, when the cyclone hit our village, that was when our surroundings of cocoa and oranges was completely destroyed. What I mean is that, when I saw my oranges in those days, I said to myself, I am going to leave my job eh? And I would come and pick and (did not finish) because my orange plants were heavy with fruit. Their branches were drooping (pointing to the ground), heavy with fruit. Yes I came and said to my family that I will take leave from my job and will come and take my oranges to the market but then (begins to laugh and say) the cyclone hit. Well that wiped out everything. No tree was left standing. The orange trees were all uprooted by the wind. The cocoa trees were destroyed, snapped in half by the wind. It was like a bomb had hit our village when Ofa and Val finished with us” (October 21, 2014).

Forest fires have also occurred during the dry season and have destroyed peoples’ crops. Reckless burning and clearance of forested areas were other contributing causes of forest fires. The outcome is the destruction of sections of the forest and agricultural lands and crops.

a. Perceived significance of climate related risks

Table 5.7 shows most of those interviewed at Auala perceived the significance of risks associated with hotter days and longer dry spells as ‘medium-high³³’, this being slightly more extreme compared to the perception of the latter held by those interviewed in other villages. Such perceptions reflect the residents’ experiences of living in a hotter and drier part of the country as previously stated in earlier sections. Risks associated with stronger damaging

³³ Table 4.7, page 112 provides a detailed explanation of these categories.

winds were ‘medium’ while those relating to sea level rise were mostly perceived between ‘low and medium’.

ii). Opportunities

Similar to other sites, the majority of Auala residents that were interviewed also mentioned that opportunities for accessing food supplies, housing materials and other resources occurred when extreme events and severe climate related changes happened. For example, after cyclones Ofa and Val many received assistance, such as food, water tanks, housing materials and farming equipment from the government and their relatives overseas. Others received housing materials and were able to negotiate lands inland or in other parts of the country, through their family connections, enabling them to shift away from the coast and rebuild their homes.

B. Dimensions of climate change likely to be experienced

There was no difference evident in these participants’ perceptions of future climatic changes compared to the current climate changes they were experiencing. As Table 5.5 shows, all of the participants perceived that the same climatic changes they were experiencing, namely hotter days and longer dry spells, stronger damaging winds and sea level rise would continue in the future.

Table 5.5: Current and future climate related changes frequently mentioned and emphasized by surveyed residents of Auala.

Changes that were experienced	Future climatic changes that were perceived to occur
1. Hotter days and longer dry spells	1. Hotter days and longer dry spells
2. Stronger damaging winds	2. Stronger damaging winds
3. Sea level rise	3. Sea level rise

1. Likely impacts and their significance

A few changes were evident in participants’ perceptions of the likely impacts of climate change compared to their current experiences. As evident in Table 5.6, reduced productivity of the land was identified by most of the participants as a new likely risk. As explained in the previous section, farmers in particular, have seen the impact of the heat on the land and their crops during the dry season. Knowledge and experience of the rising heat and the belief that this trend is highly likely to continue seems to have led to the identification of this new risk. Improvement in infrastructure was not perceived as a likely impact of future climate change.

Table 5.6: Impacts of climate change frequently mentioned and emphasized by surveyed residents of Auala.	
Current impacts Risks 1. Inadequate water 2. Damage to properties Opportunities 1. Access to food and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure	Perceived impacts Risks 1. Inadequate water 2. Reduced productivity of the land 3. Damage to properties Opportunities 1. Access to food and other resources 2. Stronger and diversified networks

There were obvious changes evident in participants' descriptions of the significance of likely risks associated with future climate change compared to how they perceive the significance of current risks. Table 5.7 shows the majority of those interviewed perceived risks associated with hotter days and longer dry spells to possibly increase to 'High'³⁴, while those associated with stronger damaging winds to possibly increase to 'medium-high'. Risks associated with sea level rise would possibly be 'medium'.

Table 5.7: Perceived significance of risks associated with current and possible future climatic related events, by interviewed residents of Auala.		
Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days and longer dry spells	Medium- High	High
2. Stronger damaging winds	Medium	Medium- High
4. Sea level rise	Low- Medium	Medium

5.3.5 Crises management system based on *faamatai* and its key coping strategies.

Diversification, social networks, mobility, mental and spiritual strength and managing the environment were key themes that emerged from discussions with interviewed participants about responses to current climate-related risks which are: inadequate water, damage to properties and reduced productivity of the land. Family networks and partnerships between village, church and government have been significant in effecting multiple responses to minimizing risks associated with climate related changes, mainly inadequate water and damage to food crops.

³⁴ Table 4.8, page 113 provides an explanation of the different levels of significance of risks associated with possible future climate change.

A. Extended families: diversification, mobility, managing the environment and developing mental and spiritual strength

1. Diversification

Diversification has been a significant strategy to deal with climate-related risks experienced by Auala residents. The semi-subsistent³⁵ nature of the Samoan extended family network which is evident in other surveyed villages has also helped Auala families endure current climate-related risks. An elderly widower described how her salary enabled her to install a water tank for her family after the 1990s cyclones. Now that she is retired, one of her children, who teach in a school in American Samoa, provides for them financially, while the others cultivate their family plantation, food garden and raise pigs and chickens. This way of living has helped her family survive. She said,

“The most important things I tell my children is not to live individually. They must love and respect each other and learn to share what they have. Live, distribute and share what you have. The stronger person should consider the weaker person. The educated should consider the non-educated person and vice versa. These are the basic foundations of a good Samoan family” (AU001, October 20, 2014).

Diversification has also been a significant response to the risk of inadequate water. Water sources and related ways of collecting and storing water have evolved and diversified over the past fifty or more years. Village springs and pools such as Vaovai and Safua, have been vital water sources, but in recent years water from these sources has only been used for bathing and washing clothes. Parts of these water sources are still reserved for drinking, but were rarely used because they had become increasingly brackish (see Figure 5.4 and Figure 5.7). However, many respondents said they resorted to these sources for drinking water when water had been scarce, especially during extreme events such as the occurrence of droughts, fires and cyclones.

During these times, most had used brackish water for tea and when preparing meals. Tea and kava made with brackish water were commonly drunk by farmers and builders who spent most of their time working in the sun. Fruits such as coconuts, oranges, pineapples, vi (Otaheite apple *Spondias dulcis*) and papaya were also an important part of the diet and are a source of water. A man in his late fifties said,

“As young children we used fruits, coconuts, papaya, bananas, pineapples, oranges...when I come home there would be *miti* [fermented coconut milk] and *kokoesi* [papaya with cocoa]” (AU004, October 12, 2014).

³⁵ The family survives by carrying out both commercial (monetary-based) and non-commercial activities.

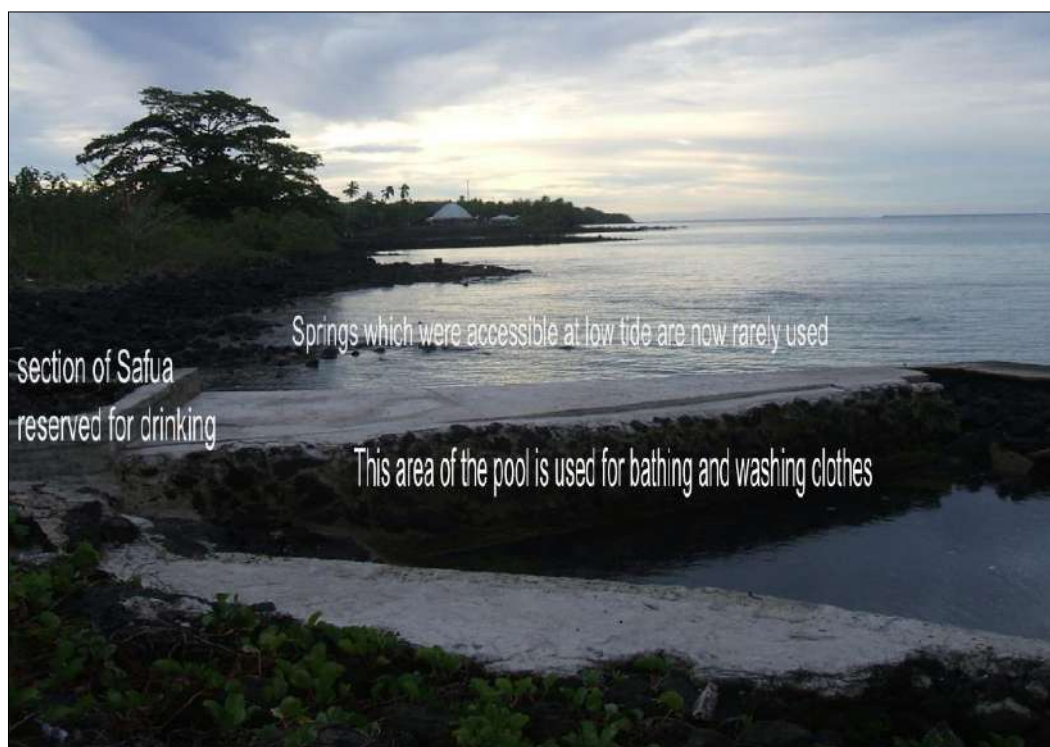


Figure 5.7: Safua pool. Springs which were commonly tapped for potable water can be seen in the background. Cement walls are evidence of efforts by Auala residents to protect their water sources.

Collecting, using and recycling water are significant to many Auala residents. The quote below also indicates how water collection was a major part of a young person's life about 50 years ago. "My mother would tell me my chores for the day before I go to school. She would say, 'When you come back from school, take our dishes and my washing to the pool.' And that was how the day was. After school there were chores to do and most of them would involve getting water (laughs) yes those days were hard" (AU003, October 21, 2014). Reusing and recycling empty containers to store water has long been important to residents for the collection and storage of water. Plastic drums, empty bottles and containers of all sorts are washed and set aside to be filled when rain falls. Elderly residents said that empty oil drums (gallons), paint cans and buckets that used to contain salted beef were used to store water in the 1960s and 1970s. AU002 said:

"In those days we had to collect water in gallons or drums (laughs). People bought gallons that were used to store oil from the Potlatch company in those days, they wash it, paint it, then wash it again and they use these to store water (laughs). And buckets, paint cans, anything that can store water. Only our school had a water tank in those days. Yeah, some people from the Health Department say that that is not safe, but I never heard of anyone getting sick from drinking water stored in gallons during those days (laughs). Now I say to my children, 'You are lucky that things are easy in these days. When I was a young boy, every day after school I would come home, change my clothes and then go to the coastal springs to fetch water to fill the gallon. That was a chore for most young boys in those days (laughs)- yeah it was a struggle back then" (October 20, 2014).



Figure 5.8: Cement water tanks built after the 1990s cyclones.

In addition to these older methods, households have adapted newer ways of collecting and storing water. Most households own water tanks in which rainwater is collected and stored for drinking and cooking. A variety of tanks were observed in the village. The most common are large cement water tanks (see Figure 5.8) which, according to most residents, were installed after the 1990s cyclones. In some households, family members who were working borrowed money from the National Provident Fund (NPF) to pay for water tanks. Others were able to install water tanks with money received from relatives working overseas, most of them in New Zealand, Australia and the United States of America (USA). A few families also received assistance from relatives who worked as sailors on boats in Europe. Many water tanks installed in recent years are plastic.

Most households also have a water supply on tap, which is mainly used for washing dishes, for bathing and for the toilets because it is brackish. Tap water was installed and upgraded by the government between the late 1990s and early 2000s, and comes from a borehole located half a kilometre inland of Auala. Most households also have composting toilets, which do not require water and are mostly used during droughts and cyclones when water supplies are low. Some interviewed residents said that their families have always had composting toilets, while others had received theirs from a government assistance scheme which provided more than 20 composting toilets for Auala in 2013. Water is still commonly recycled when washing dishes and clothes. Instead of letting the tap run continuously, most people wash dishes or clothes in a tub or bucket of water before rinsing them in another bucket of water. The ‘grey’ water is either saved to wash dishes at a later time, or used for the toilet.

Diversification is also evident in the development of food crops and farms. All of the residents explained their families having food gardens and plantations that grow a variety of food crops for daily sustenance and to provide for traditional activities that often occur. Additionally most would raise pigs and chickens at the back of their houses, as is the common practice in other surveyed sites. AU007 said,

“We grow bananas, breadfruit and some fruit trees next to the house, like papaya, mango, pineapples and also some vegetables, cabbages, tomatoes, lemon, oranges, eggplants... we feed chickens for the young children and the elderly and also for any guests that we have. We feed the pigs for the village and church activities and also for special occasions. Our family plantation would have taro, yams, giant taro, cocoa, oranges, mangoes....any plant we grow because they are all useful...” (October 18, 2014).

2. Mobility

Many village residents who lived along the coast before the 1990s shifted inland after Cyclone Val. Many more built additional houses on lands that were once reserved for their plantations. Many residents commented on how they had temporarily shifted to these houses when they heard the warning for the 2009 tsunami.

3. Managing the environment: sustainable planting techniques

Certain planting techniques suitable to this area have been adapted over the years. According to the farmers interviewed, keeping plantations small is ideal because of the hot and rocky nature of the land at Auala. This was emphasized many times, as captured in the following quote by AU002. He said,

“Here in the Asau district where the sun is hot and the land rocky, the most vital thing is that ‘there is something for the kitchen’ (spoken in English), something should be spared for the kitchen. One would have bananas and breadfruit growing just outside the house for the preparation of daily food. You cannot grow a big plantation in this area. Big plantations and farms are not ideal for this type of environment. Every now and then you will have something but that won’t be the case every day” (October 20, 2014).

Most farmers that were interviewed admitted they had learned a lot by working at the timber mill and experiencing the time when their village’s forested area was cleared by the Potlatch logging company. All stressed the importance of preserving big trees that are growing on their lands and reforestation activities. AU004 said,

“When I was younger I used to clear my whole land for my plantation. But now when I come across a *maali* (gum *canarium vitiense*), or a *tavai* (sumac *rhus taitensis guill*), then I know that I have to save it so there is shade over the land...” (October 12, 2014).

All of the farmers suggested the timing as well as the process of clearing land to grow a plantation has become important more than ever. Burning is done at the beginning or the end of the rainy season, but not during the dry season. Not all trees are burnt or cut down. Some farmers grow their crops using a specific order. For instance AU004 said he would normally grow giant taro and taro after the land has been cleared. After a short while, he would plant cocoa and when the taro had been harvested he would grow bananas in that area. He described,

“I would burn or cut down trees that are in the way eh? I leave the big trees growing on the outer boundaries of the plantation so they can provide shade...Food crops are giant taro, cocoa, taro, bananas. I would cultivate giant taro and taro first. Later I would grow cocoa eh? I would weed the area continuously so both the crops would grow well. Taro and giant taro would be ready for harvest first and as they are removed to be used, the cocoa is left behind. Cocoa plants are growing well because I have been weeding it. By the time I harvest the taro the cocoa plants have grown higher (laughs). Then I would grow bananas in the area where taro used to be. Common knowledge is if there are weeds growing with the cocoa, they would grow slow but if weeds are cleared then cocoa would grow faster...” (October 12, 2014).

He also suggested the importance of using methods that do not greatly disturb the land and surrounding environment. For instance, weeding and growing crops around rocks instead of removing them had also been common practice. AU004 explained,

“The land is rocky. It’s just the way it is. Where would you take the rocks? (laughs). I use my hands to remove some of the rocks and then I dig holes with the *oso* eh? Well here’s the situation eh? Two things, soil and rock eh? During periods when the sun has been hottest I have noticed leaves of crops growing on cleared land would turn yellow and wither. But when I look at areas that are rocky and have not been completely cleared, the crops are green and growing well. The reason was the soil under the rocks and bush was well protected compared to the cleared area that had lost its moisture and become dry eh? That is the difference. Don’t take away the rocks. The only thing is ensuring that you have somewhere to dig a hole and plant a crop. Leave the rocks. There is no reason why you need to bother the rocks (laughs). Yes, and the proof of that is when you turn a rock over, you will notice that the soil underneath is wet” (October 12, 2014).

4. Developing mental and spiritual strength

The majority of those interviewed belong to the Congregational Christian Church of Samoa (which most of the village residents attend) and its various groups. Participation in the activities of the church is a significant part of village life. Many are members of various church groups such as the Sunday school, youth, choir and women’s committees. According to most, attending church on Sunday, participating in church activities and holding family evening prayers in most days develop mental and spiritual strength that has helped them cope with past difficulties.

B. Village groups and churches: managing the environment and diversification

1. Managing the environment

All of those surveyed were members of extended families and various groupings such as the village council, untitled men's group and women's committees. These groups had played an important role in the development of strategies to protect village resources mainly water and forested areas. There is no mention of water related challenges in the Auala Coastal Infrastructural Management Plan (Government of Samoa and CIM Plan Committee for Vaisigano Number 1 District, 2001), but there is evidence that there have been efforts by the village council to both protect its water sources and find alternative supplies. Most of the water sources, such as Vaovai and Safua, have been cemented by the village residents for protection (see Figure 5.7). Other separate initiatives include water tanks owned by the Auala Congregational Christian Church of Samoa (CCCS) which many residents have also used as alternative sources when water was scarce.

Village rules and related penalties regarding the use of common resources are applied to water sources. These rules were known and understood by the majority of interviewed residents, even though they had not been written down. Elderly residents spoke of older methods of collecting drinking water from the village's coastal springs and pools. AU001 said:

“Yeah, well because sometimes, you would see people paddling their canoes to there (pointing east). People living in that part of the village (pointing west) find it difficult to carry their water and walk from there to here. That part of the village out there (pointing to west coast) they come in canoes and they put in them (laughs), they put in them (laughs), buckets and (did not finish statement). The village springs and pools which people use for drinking and bathing are on that side (pointing east). The pool that is cemented is for bathing and washing clothes, but the springs are on the seashore. One would walk to the edge of the water when the tide is low and taste the pools of water there. Usually when I arrive people have already gathered waiting, sitting around waiting for the tide to recede. The person who tasted the water would say that the water is now *magalo* [less brackish and becoming suitable for drinking], that it is starting to be *magalo*, then people would take turns presenting their buckets forward to be filled. Only one person sits there and (laughs) uses something like an empty container or jug to scoop the water into the buckets, one by one. No one else can come and scoop the water, people wait their turn in a ‘queue’ (spoken in English). Yes that was what it was like in those days” (October 20, 2014).

The above comment suggests there are well understood rules for the collection of drinking water from springs and these are strictly followed. It was further suggested that it is important not to contaminate the water source, which is demonstrated by only one person tasting and obtaining water from the spring, while everyone else stands back and they only

present their containers when it is their turn. There are also bans on reckless behaviour and activities that could adversely affect the quality of water, such as bathing and washing clothes in sections of pools that are reserved for drinking.

Village rules and related penalties had also encouraged the protection and re-development of the village's forests. Burning of land has been prohibited, since the 'Big Fire' in 1983, especially during the dry season, and farmers are encouraged by the village council to protect native trees which are growing on their land. Some farmers mentioned taking part in the government's reforestation programme. Similarly, the use of weed killers is not allowed. According to AU002,

"If you use weedkiller this year, the crops would grow fine that year and maybe the next year. But surely after two years, you will notice that the height of the taro would be lower compared to the previous years. The growth of the taro is no longer strong because the soil has been 'greatly affected' (emphasized). The thing is, the weedkiller kills all those little organisms, 'insects' (spoken in English) that work to make the soil fertile. The weedkiller kills all these. 'So' (spoken in English) the weedkiller does not only kill the weeds, but these 'servants or soldiers' (spoken in English) which work to make the soil good" (October 20, 2014).

2. Diversification

Regular inspections of food gardens, plantations, fine mats by village and church groups such as the council and women's committees have motivated many residents to develop these resources which had helped them survive past difficulties.

C. Assistance from the government and external agencies: diversification, managing the environment and infrastructural development

The findings indicated the assistance provided by governmental and external agencies to develop water and food supplies as well as protect village resources. The government has supplied tap water to the residents, which most use for washing and bathing as this water supply is saline. The government has also supported the village in sourcing externally funded water tanks and compost toilets. A seawall had also been built to protect the village's coastline in the early 2000s.

Other government initiatives evident which had been helpful to the village residents include The *Aiga Fia Atiae Project* which provided seedlings for the development of vegetable gardens. According to the government representative, in 2014, 35 families were provided with seedlings of tomatoes, eggplant, cucumbers, beans and cabbages. One of his

responsibilities is to inspect and provide the Ministry with updates of the progress of these gardens and so far, most families had been utilising the assistance well. Some gardens had already been harvested with some families selling parts of their produce to earn money.

The government had also encouraged and assisted the village to establish a mangrove conservation area, tilapia farm and a Marine Protected Area (MPA) but some residents interviewed commented these initiatives had not been sustainable. The village's mangrove area, which contains Vaovai, was turned into a turtle conservation reserve. Part of the reserve was later turned into a tilapia *oreochromis niloticus* farm. A Marine Protected Area (MPA) was also established to reserve parts of the village's lagoon (see Figure 5.9).



Figure 5.9: Parts of the lagoon at Auala has been declared a Marine Protected Area (MPA).

In 2014, USAID (United States Agency for International Development) and the Red Cross donated more than 50 water tanks to the village, and three of these were installed in the village committee houses (see Figure 5.10). These water tanks provided water for communal use especially during village meetings and other activities, and are an alternative supply for households in times of water scarcity.



Figure 5.10: The village committee houses and water tanks provided by USAID in 2014.

5.3.6 Preparing for possible future climate related changes.

Most household and village council activities currently being implemented are relevant strategies to cope with possible climate related risks. When asked to comment about strategies to cope with future climate change, most emphasized the importance of maintaining family, village and church networks because these networks are important to diversifying water and food sources, mobility and sustainably managing the environment. Many residents, especially the elderly and those who were farmers, fisherfolk and traditional healers were concerned with people-environment relationships and the need to be cautious in the use of resources such as water, forests and their lands. These attitudes are crucial to their future survival in this dry part of the country. Many suggest the need for continuous sharing of this knowledge between elderly residents and young people during family gatherings and in village and church meetings and activities.

The role of the village council in enforcing rules to prevent unsustainable land use methods and protecting village resources such as parts of the coastal and marine area and water sources are also important strategies for the future. Many suggested that these are necessary for the sustainability of village resources. However, most interviewed residents were concerned with the relevance and sustainability of some village- government initiatives such as the turtle conservation and tilapia farm. Many believe that such initiatives are meant to be for the village but are uncertain of their benefits. Better consultation is needed between the government and village residents to discuss the purpose of such schemes and their relevance to the lives of Auala residents. Moreover, there is a need for government ministries to consider the expertise of local residents such as farmers and traditional healers in their

reforestation programmes. According to the residents, the majority of trees handed out by the Forestry Division had been mostly foreign species which do not have much foliage nor provide shade to the land compared to native trees. This is illustrated in the following comment by AU002. He said,

“Because the thing that is, the reforestation (spoken in English) that was carried out by the ‘Agriculture’ (spoken in English) Department (referring to the Ministry of Agriculture, Forestry and Fisheries (MAFF), the problem was that they used trees that were not native and very different from native trees... I’m not sure what their theory was. But as you may know introduced/ foreign trees were planted in lanes, only foreign trees but you won’t find the types of trees that used to be there, that made the forest ‘dense’ (spoken in English), like a ‘jungle’ (spoken in English). You ‘see through’ (spoken in English) the ‘lane’ (spoken in English) of foreign trees, ‘it’s like a park’ (spoken in English), not like what was there before, it was like a ‘web’ (spoken in English), they ‘cover’ (spoken in English) the whole area and protect the land from the heat of the sun, and things like that...” (October 20, 2014).

5.3.7 Summary of findings from Auala.

In response to the research questions that were posed, the findings from Auala showed that the majority of those interviewed demonstrated resilience because they recognized not only current climate changes and associated risks but were able to imagine likely climate related scenarios and associated risks that could occur. Hotter days and longer dry spells and associated risks had been slightly more extreme here with residents experiencing frequent fires in recent decades. Interviews and observations conducted in Auala showed residents had been exposed to slightly more extreme and enduring challenges because the village is located in the driest part of the country and had faced intense deforestation between the 1960s and 1990s. Cyclones Ofa and Val which most believed was part of climate change had a slightly greater impact on these residents compared to other coastal villages, as most described their homes and food crops were largely destroyed. Inadequate water and damage to properties had been key concerns and most perceived these risks would be greater in the future due to possible changes in the climate. Reduced productivity of the land was perceived likely to occur in the future. Much of the latter descriptions reflected scenarios described in national government reports. Like those surveyed at Saleimoa, Auala residents also identified opportunities associated with current and future climate change, suggesting a more balanced view of climate processes.

Auala’s crises management system based on *faamatai* is generally similar to those of other surveyed villages although findings reveal more being done in this village compared to others. This is especially in terms of dealing with risks of inadequate water and damage to properties such as houses and food crops. The majority of households own water tanks as

well as have access to piped water supply and village pools. Compared to Saleimoa, much of the land here is customary owned and therefore most have lands in which they are cultivating plantations and building additional houses. There is also more evidence of government assistance towards this village compared to Saleimoa and Lano (discussed in the next section).

An important finding is the shift in many peoples' behaviour towards developing sustainable ways of using and managing their lands, marine and coastal area and water sources, and this has mainly been the result of experiencing unsustainable logging in the 1960s and 1970s and the destructive impacts of Cyclones Ofa and Val. This has been especially evident in conversations with elderly residents, farmers, fisherfolk and traditional healers and demonstrated in village council rules relating to the use of these resources. Many suggest that continuous sharing of local knowledge such as cultivating and water collection methods and reflecting upon previous shortcomings at the family and village levels is crucial to dealing with possible climate-related risks. Similar conversations with relevant government ministries also need to happen to evaluate the success and relevance of existing government initiatives, as well as to inform any future ones that may occur.

5.4: Lano

5.4.1 The village

Lano, which is located on the northern coast of Savaii, has similar natural features to other coastal villages in the country. The village lies on a wide band of low-lying land, with a lagoon and a barrier reef offshore (see Figure 5.11). A mangrove forest area and a pool are on the northwestern end of the village. Another swamp lies on the western end. These pockets of wetlands along the coast affect drainage and the stability of roads during times of heavy rainfall. The main road is on the coastal strip, although not immediately adjacent to the coast in some places. Much of the coast is occupied by houses, churches, schools, recent seawalls and reclamation areas. Small tourist operations are found on the western end of the village. Settlement extends inland and here families cultivate plantations and farm. Most of the families that live inland are farmers or families that have moved there after the 1990s cyclones. Like other coastal villages, land clearance for inland settlements and agriculture has increased storm water runoff and siltation (Government of Samoa and CIM Plan Committee for Faasaleleaga IV District, 2007).

Lano's population has increased from 472 in 1961 (Samoa Bureau of Statistics, 2016) to 764 in 2011 (Samoa Bureau of Statistics, 2011). Economic activity is dominated by semi-subsistence fishing and farming. Non-traditional work is associated with local tourist businesses or shops and government offices in Salelologa or Apia. The majority of the village has access to piped water supply and electricity. The water reservoir and pump station which serves Lano and its two neighbouring villages is located in the inland part of the village.

5.4.2. Summary of research carried out at this village.

Seven key informant interviews and two focus groups were conducted at this site (see Box 5.6). In addition, field observations were carried out by walking and taking drives, accompanied by a village resident, to the inland parts of the village.

Box 5.6: Details of study participants from Lano.

<u>Interviewees</u> 71 year old female (LN001) Family- mother and grandmother Village- member of the women's committee Church- member of the women's committee Skills- retired teacher 66 year old male (LN002) Family- chief, father, grandfather Village- member of the village council Church deacon Skills- fisherman, farmer (plantation, pigs, chickens) 66 year old female (LN003) Family- mother and grandmother Village- member of the women's committee Church- member of the women's committee Skills- traditional weaver, healer, farmer (vegetables, chicken, pandanus) 50 year old male (LN004) Family- father, chief Village- member of the village council Church- church member Skills- fisherman, farmer (plantation, pigs, chicken) 48 year old female (LN005) Family- mother Village- member of the women's committee	Church- member of the youth, member of the choir Skills- nurse 46 year old female (LN006) Family- mother, chief Village- member of the village council Church- member of the youth committee, member of the women's committee, member of the choir Skills- government officer 37 year old male (LN007) Family- father Village- member of the untitled men's group Church- member of the youth, member of the choir Skills- bus driver, farmer (pigs, chicken, plantation) <u>Focus group participants</u> Focus group 1 (LFG01) 2 males and 2 females All are attending higher education Some are members of the church youth (2) Late teens to early 20s Focus group 2 (LFG02) 2 males and 2 females Mid to late 20s All are members of the church youth
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5.4.3 General environmental issues

The main challenges faced by Lano residents are damage to properties and pests. Similar to other coastal sites, these have mainly been the result of extreme events, human activities and recent climate change. Specific climate- related events that most of the participants mentioned included Cyclones Ofa and Val in the 1990s. These were perceived as being part of climate change which most suggested had already been occurring. Non-climate related events such as the taro blight destroyed village crops in the 1990s, and the appearance of the African snail and invasive species of weeds in subsequent years, have challenged the cultivation of plantations and food gardens. Some residents suggested human activities such as sandmining, clearance of forested areas and wetlands for settlements, infrastructural developments such as roads, bridge, seawalls, cattle farms, digging of inland areas for seawalls and road construction had also reduced the capacity of some areas to withstand the impacts of extreme natural events. While many mentioned the 2009 tsunami, they indicated that this event did not cause any damage to their village.

5.4.4 Perceptions of climate change.

A. Dimensions of climate change experienced by surveyed participants.

Hotter days, shorter spells of heavier rainfall and stronger damaging winds were most frequently mentioned and emphasized by Lano participants (see Table 5.8). Like those interviewed in other coastal villages, most people suggested they not only ‘feel’ the heat getting more intense but ‘hear’ it from others and from various media sources. They also ‘see’ it by observing the behaviour of people in the village such as the increasing use of protective clothing by those who work in the sun. Shorter heavier rainfall and stronger damaging winds were other changes that were frequently pointed out by many participants. Like those interviewed in Saleimoa, many Lano residents noted how short bursts of rainfall had occurred during very hot days and this had become more frequent in recent years. Most were also aware that sea level rise is occurring, but at a very slow rate.

1. The impacts of climate change experienced by surveyed residents.

As Table 5.9 shows, surveyed residents at Lano suggested both risks and opportunities when they were asked to talk about the impacts of climate change.

i). Risks

The most commonly quoted risks stated by participants were damage to properties which mainly occurred during the cyclone season (see Table 5.9). Cyclones Ofa and Val caused widespread destruction in the 1990s, while subsequent cyclones have caused damage to specific parts of the village. An elderly resident who once lived on the coast before the 1990s recounted the destruction of their home by Cyclone Val. She said,

“We used to live on the sea together with other members of our family. The houses nearby are our relatives. My father’s brother lives in the cement house on the inland side of the road. Our houses were destroyed by the sea during the cyclones. We lived with my parents in small open houses like this one. The houses did not fall but the posts slanted because the sea flowed into our houses and covered the whole area inland. The whole coast was covered by the sea. When we walked the sea came up to our knees. My uncle came to help us out. I gathered my parents and brought them to my uncle’s house on the first day. Because my father is blind. We lived at my uncle’s house until our house was rebuilt...” (LN001, November 24, 2014).

In recent years, there has been flooding during the rainy season which has also damaged village infrastructure and houses of those living close to the mangrove areas.

a. Perceived significance of climate related risks

Many of the participants interviewed suggested the significance of risks related to hotter days, stronger damaging winds and shorter heavier rainfall as ‘medium’³⁶ while risks associated with sea level rise are perceived as ‘low to medium’ (see Table 5.10).

ii). Opportunities

As listed in Table 5.9, opportunities that were mentioned included access to food and other resources from neighbouring and overseas relatives as experienced during and after previous cyclones. These periods also provided a chance to strengthen and diversify social connections with relatives and external agencies such as the government and aid providers which according to some, have helped built the new village seawall. Younger residents and an owner of a local tourist business talked about how sand became available after some storm events which provided a place for young people to play and tourists to enjoy (see Figure 5.12).



Figure 5.12: Young boys playing on sand on the mouth of Lano’s mangrove area.

³⁶ Table 4.7, page 112 provides a detailed explanation of these categories.

B. Dimensions of climate change likely to be experienced.

A comparison of participants' descriptions of current and future climatic changes did not show any changes. As seen in Table 5.8, most surveyed residents at this site commented that the climate related changes they have experienced will all continue to occur in the future.

Table 5.8: Current and future climate related changes frequently mentioned and emphasized by surveyed residents of Lano.

Changes that were experienced 1. Hotter days 2. Shorter heavier rainfall 3. Stronger damaging winds 4. Sea level rise	Future climatic changes that were perceived to occur 1. Hotter days 2. Shorter heavier rainfall 3. Stronger damaging winds 4. Sea level rise
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1. Likely impacts and their significance

Changes were evident in participants' descriptions of the likely impacts of climate change as well as the significance of likely climate-related risks. The second column of Table 5.9 shows inadequate water was identified as a new likely risk associated with future climate change. This was mainly due to the belief that increasing temperatures and sea level rise might cause the village's alternative water sources, most of which are located on the coast, to dry up or become saline. Current risks such as damage to properties and pests were also perceived likely to occur in the future. Improvement in infrastructure, which was mentioned as an impact of climate change was not mentioned as a possible impact of future climate change.

Table 5.9: Impacts of climate change frequently mentioned and emphasized by those interviewed at Lano.

Current impacts Risks 1. Damage to properties 2. Pests Opportunities 1. Access to food and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure	Perceived impacts Risks 1. Damage to properties 2. Pests 3. Inadequate water Opportunities 1. Access to food and other resources 2. Stronger and diversified networks
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Table 5.10 shows that interviewed residents suggested the significance of risks associated with possible future climate events would increase. Risks associated with hotter days,

damaging winds and shorter heavier rainfall would increase to ‘medium high’ while sea level rise would be ‘medium’³⁷.

Table 5.10: Perceived significance of risks associated with current and future climatic related events from surveyed residents at Lano.

Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days	Medium	Medium- High
2. Stronger damaging winds	Medium	Medium- High
3. Shorter heavier rainfall	Medium	Medium- High
4. Sea level rise	Low- Medium	Medium

5.4.5 Crises management system based on *faamatai* and its key coping strategies.

Social networks such as extended family connections, village and church groupings which most people are part of, have been very helpful in the development of coping strategies for residents.

A. Extended families: diversification, mobility and mental and spiritual strength

1. Diversification

Like most families living in other villages, diversification has been a key survival strategy for most Lano households that were surveyed. All of those interviewed here live in extended families with some members working to earn an income and others tending to the family’s food gardens, plantations and raising pigs and chickens. An elderly male said two of his children who are now married currently live in Upolu but they provide finances when needed. Here he lives with his other three children. One goes to school while his other two boys help him in the plantation. Some families have also developed cattle farms and established tourist businesses. Financial assistance from children and other relatives working in Apia or overseas countries have been crucial in the rebuilding of homes after Cyclones Ofa and Val. This has also helped some families build alternative residences inland especially after the 2009 tsunami.

Diversification is also evident in the way most people develop their plantations and food gardens, with most planting many different edible crops, as well as adding new varieties of taro or bananas that have become available in recent years. Most explained that the rocky nature of the soil at Lano causes them to plant anything that grows to increase the likelihood

³⁷ Table 4.8, page 113 provides an explanation of the different levels of significance of risks associated with possible future climate change.

of having food crops. This is reflected in the following quote by one female resident. She said,

“The way we cultivate our lands has not changed much. The land here is mostly rocky with only a few parts that are soft and easy to cultivate...Therefore the most important thing is putting the plants down. Any plant is important. Before we used to plant giant taro and bananas. If there were soft parts of the land then we would plant taro there. And yams and then some papaya. We do not plant only one thing. We do not depend on one thing but make sure different crops are planted. Anything that grows, we plant those. Bananas, coconuts, cocoa...some varieties of taro that are now available are able to grow easily on our lands so we have planted those. But we also have yams, giant taro, various species of bananas. In the front here I have planted papaya, eggplants, melons, tomatoes, beans, cabbages, cucumbers” (LN003, November 21, 2014).

The cultivation of root crops is largely similar to the processes described by Saleimoa and Auala residents. Many have adopted the use of salt to kill African snails that have appeared in their plantations.

2. Mobility

Most families shifted residence inland after their homes were destroyed by Cyclones Ofa and Val in the 1990s, while others had shifted after the 2009 tsunami. Some families have now built houses within their plantations. The development of access roads has facilitated this over the years.

3. Mental and spiritual strength

The majority of surveyed residents agreed that evening prayers, attending church on Sunday and participating in other church activities have been very important in developing strength which has enabled them to endure past challenges.

B. Village groups and churches: diversification, developing mental and spiritual strength and managing the environment

1. Diversification

The village council holds monthly meetings and at times conducts inspections of plantations and food gardens which has encouraged the development of food sources for many families. The women’s committee has also been active in the conducting of inspections of household goods and holding weaving sessions. The latter were important in the development of alternative income sources for a number of women that were interviewed. In 2014, the

women's committee completed building its committee house with funding they had sought from the CSSP (Civil Society Support Programme). The committee house had been an important centre to conduct health clinics, weaving programmes and government project consultations.

Churches have also assisted in the development of food gardens and in the provision of disaster relief assistance. Some of the participants attending the LDS church said seminars had been conducted at their church regarding the planting of food gardens. They also learnt through the church of the importance of preparedness in terms of preparing emergency food and water. Most of the village sought shelter at the LDS church when the 2009 tsunami affected other parts of the country. Disaster relief assistance was very important. Those attending the LDS church received food, water, household goods and building equipment and materials after cyclones.

2. Developing mental and spiritual strength

Churches have also been crucial in the development of mental and spiritual health amongst residents. Many explained that their faith had been an important source of strength, especially when they had been faced with challenges such as the destruction of their homes during the 1990s cyclones. Church groups and related activities had not only provided support during these times, but had mentally and spiritually prepared them to cope with loss and destruction.

3. Managing the environment

There is evidence of joint initiatives between Lano village groups and various government agencies. Since the 2000s, the village council had worked in partnership with the government to establish Lano's mangrove conservation area, a fish reserve (see Figure 5.13) and build their new seawall.

C. Assistance from the government and external agencies: infrastructural development and managing the environment

As in other villages, piped water supply, electricity and seawalls had been implemented by the government. In addition, the government has also helped establish the village's mangrove conservation area and its fish reserve.

5.4.6 Preparing for possible future climate related changes.

Most of those interviewed suggested what they are already doing to cope with possible future climate change- namely diversification, developing alternative places to live inland and building mental and spiritual strength- are important strategies to prepare for future climate related risks. Key networks in the village such as families, village and church groups will continue to play vital roles in the development of these strategies. Most suggested families should continue to work hard to diversify food supplies by developing food gardens, plantations and backyard farms to ensure they are self-sustaining.



Figure 5.13: Lano, in partnership with the Ministry of Agriculture and Fisheries, has established a fish reserve.

An elderly male (LN002) stated,

“It is important for people to work the land. Cultivate the areas in front and behind their houses and work hard to develop plantations. You know, build a small pen at the back of the house to raise a few pigs and some chickens. Plant some taro, bananas, giant taro there for the family to depend on for food so they won’t buy these things with money. Well... because things might change. Days come and go and

there will be times when things would be hard and these are the things that you would depend on” (November 27, 2014).

As suggested in other villages, attending churches, being part of church groups and holding morning and evening services have helped many endure previous challenges and would also be important in coping with future difficulties.

The role of the village council and government in the establishment and management of village reserves is commended because these would be important in the sustainability of food supplies. However most residents indicated there is an urgent need for the village council members to design village rules to prevent activities that undermine the village’s resources such as sand-mining, clearance of mangroves and illegal poaching. Also, the council should look into ways to protect village water sources which have been neglected in recent years, and carry out regular inspections of village plantations and food gardens. Village inspections had been important in encouraging diversification among households, but there are times when these have not been carried out at all. LN001 said,

“The village is the totality of all families and the village comprises specific groupings that should work together for the development of the village. These groupings like the council, women’s committee, untitled men should work together...conduct inspections of plantations and food gardens, upgrade water sources and so forth” (November 24, 2014).

Most suggested that the government and village and/ or church groups could upgrade access roads so that more people would be able to access inland parts of the village to build houses and develop plantations. A male resident (LN007) stated,

“It would be easier for people to shift inland if the roads are improved. Saasaai’s (the neighbouring village) access roads have been cleared and tar sealed. All the way to their plantations. My mother is from there so we have another plantation there as well and we find that many people from that village have built other houses further inland compared to here. Oh the land here is *gaoa*, *gaoa ia o matou* [rocky, very rocky here]” (November 28, 2014).

5.4.7 Summary of findings from Lano

Interviews and observations held at Lano also indicated an awareness of climate related changes such as hotter days, shorter heavier rainfall, stronger damaging winds and sea level rise. Like those interviewed at Saleimoa and Auala, many Lano residents referred to Cyclones Ofa and Val as the most destructive events they had experienced. These interviewees also suggested that these events marked their earliest experience of climate

change. Damage to properties and pests were the most commonly mentioned risks suggesting their significance. Many also mentioned that climate change produced opportunities, such as access to food, networks, infrastructural development and other resources. Similar to the other sites, all of the changes they were experiencing, as well as their impacts, were perceived by most residents, to continue into the future. Like Saleimoa residents, those interviewed at Lano also identified inadequate water as a likely risk to occur in the future.

Faamatai and related structures of family, village and church have also been vital in the development of diversification, mobility and mental and spiritual strength at Lano and would continue to be central to enhancing future preparedness. As is evident at Auala, the government has also been working with Lano's village council to establish its village mangrove and Marine Protected Area and build the village seawall. Many suggested preparations for future climate change require a reconsideration of the role of individuals in developing ways to sustain their families. Continued participation in church groups and related activities would also be vital for developing mental and spiritual strength to endure likely difficulties that may occur. Members of the village council should consider ways to effectively manage the use of village resources and empower residents to develop food gardens and plantations. Government and external assistance is required in the upgrade of access roads leading inland to enable more families to build alternative residences further away from the coast.

5.5: Malaela

5.5.1 The village

Malaela is a small village located on the southeast coast of Upolu (see Figure 5.14). A large wetland occupies much of the coastal part of the village. The edges of the wetland have been largely reclaimed by the villagers and government to build houses, roads and seawalls. This has reduced the natural flow of the river that runs through the village. Offshore lies the island of Namua, which acts as significant erosion buffer for the village. A road leads inland to a small family cemetery and the homes of families who shifted there after the 2009 tsunami killed seven villagers and destroyed the majority of village houses on the coast. This road connects to a newly-built road that runs from Tiavea to Vailoa and continues inland to where village plantations and cattle farms are located.

The population of Malaela has decreased from 205 in 1961 (Samoa Bureau of Statistics, 2016) to 193 people in 2011 (Samoa Bureau of Statistics, 2011). Most residents have access to piped water and electricity. Additional water sources, that residents have used when tapped water supply has been disrupted, are located within the wetland. Most village households are semi-subsistent. Some members of village households are employed in government ministries and private companies in town. Additionally, others are employed in tourist businesses in nearby villages. Daily subsistence is mainly subsidized by agriculture, farming, fishing and remittances from overseas relatives.

5.5.2 Summary of research carried out at this village.

Three key informant interviews and one focus group were conducted at this site (see Box 5.7). Field observations were conducted by driving and walking, with a local resident, to inland parts of the village.

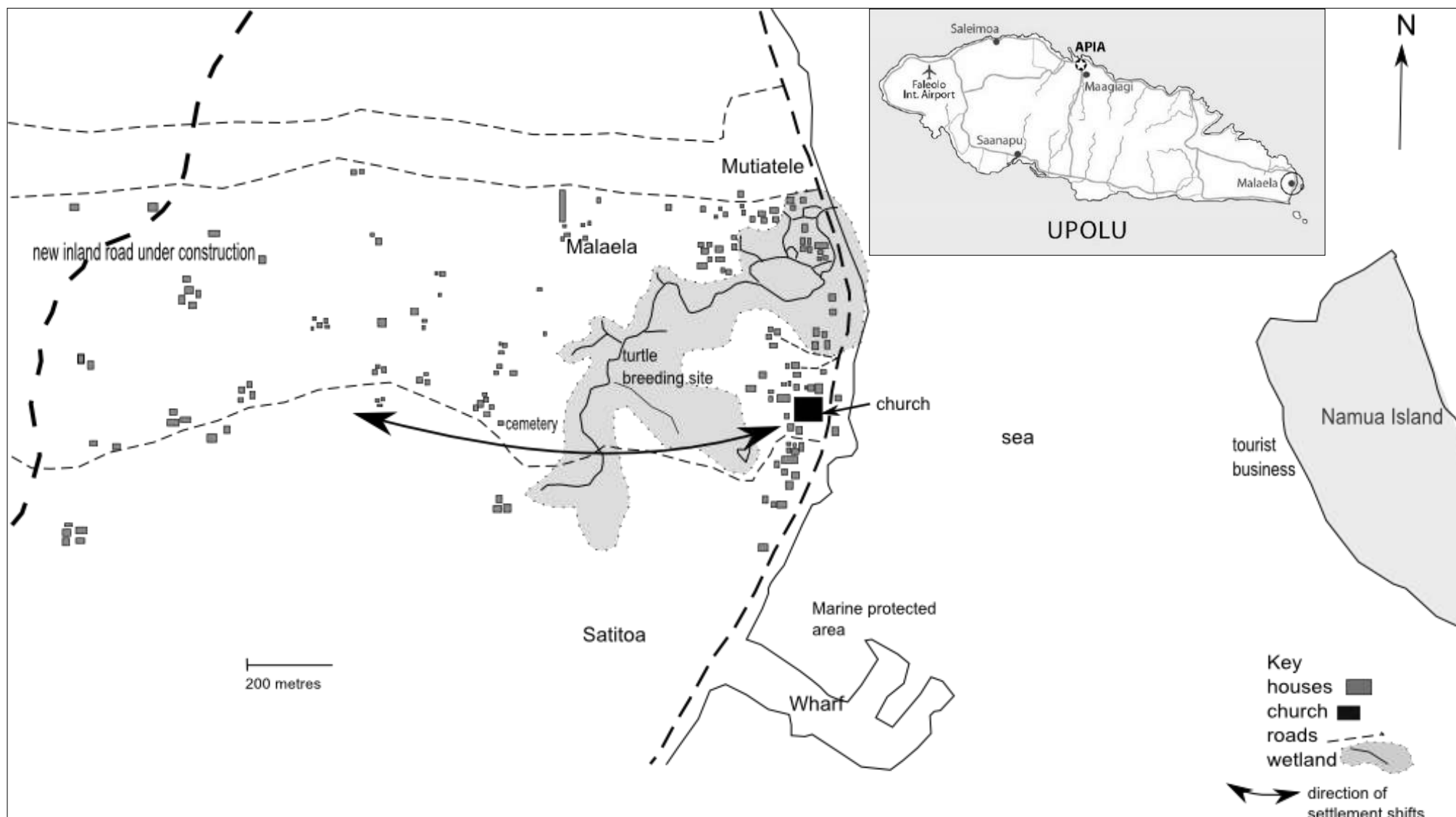


Figure 5.14: Malaela village settlement and resources (Source: after Google Earth, 2016).

Box 5.7: Details of study participants from Malaela.

<u>Interviewees</u> 77 year old male (ML001) Family- chief, father, grandfather Village- member of the village committee Church- member of the congregation Skills- farmer (plantation, pigs, chickens) 65 year old female (ML002) Family- mother, grandmother Village- member of the women's committee Church- member of the LDS women's group Skills- weaver, farmer (vegetables, chickens)	50 year old male (ML003) Family- father Village- untitled man Church- assistant pastor Skills- farmer (plantation, pigs, chicken), government officer <u>Focus group participants</u> Focus group 1 (MLFG01) • 3 males and 2 females • Age- late teens to early 20s • All are attending higher education • All are members of the LDS church
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5.5.3 General environmental issues.

Damage to properties, diminishing marine resources and inadequate water supplies have been the main challenges faced by most Malaela residents. Extreme events that were mentioned by those interviewed included the 1966 cyclone, Cyclones Ofa, Val, Heta and Evan. Non climate related events that were mentioned were the taro blight that destroyed village crops in the 1990s and the 2009 tsunami which wiped out the village's main settlement (see Figure 5.15).



Figure 5.15: Scenes of destruction at Malaela shortly after the 2009 tsunami.

Human activities such as the clearance of forested areas and wetlands for settlements and cattle farms have also contributed to these challenges. These have increased the rate of erosion and supply of sediment to the coast, resulting in siltation of the wetlands and lagoons (Government of Samoa and CIM Plan Committee for Aleipata Itupa i Lalo District, 2006).

At the time of the fieldwork, further clearance of inland parts of the village was ongoing to make way for a new inland road.

5.5.4 Perceptions of climate change.

A. Dimensions of climate change experienced by surveyed participants.

Hotter days, stronger damaging winds and sea level rise were the most frequently mentioned changes by most of those interviewed at Malaela (see Table 5.11). Most of these changes have been noticed since the occurrence of Cyclones Ofa and Val in the early 1990s. The destruction of the village by a non-climate related event, the 2009 tsunami, had also made residents more aware of the rising heat and the powerful nature of the sea. Like residents interviewed in other sites, many used different terms to describe how days and the dry season had been getting hotter in recent decades.

1. The impacts of climate change experienced by surveyed residents.

Risks and opportunities were suggested by most surveyed residents when they were asked to describe the impacts of current climate change. These are listed in Table 5.12.

i). Risks

Damage to properties, diminishing marine resources and inadequate water were the main climate related risks that were frequently mentioned (see Table 5.11). Much of the village settlement and coastal features, such as its wetland and marine area, were destroyed by Cyclones Ofa and Val in the 1990s. According to most respondents, their houses were either completely or partly destroyed by storm surges and strong winds that occurred during Ofa and Val. Parts of village water sources were also inundated with seawater. These risks were also experienced during subsequent cyclones, but to a lesser degree than the damage caused compared with the 1990s cyclones. The same risks had been extreme during the 2009 tsunami. Elderly residents who were interviewed remembered the destructive impact of cyclones on the lagoon and reef area of the village which had caused some to temporarily cease fishing activities (see Figure 5.15).

a. Perceived significance of climate related risks

Table 5.13 shows how most interviewed residents perceived the significance of climate related events they have experienced and associated risks. The majority of those interviewed viewed the significance of risks associated with hotter days and stronger damaging winds as

‘medium’³⁸. The significance of risks related to sea level rise was mostly perceived as ‘medium’ which was slightly higher compared to what was observed in the other surveyed coastal villages. Those interviewed at Malaela suggested that sea level rise had been very slow and difficult to notice because of the village seawall however most believed the impact of sea level rise combined with other forces such as strong winds and tsunamis (which are not related to climate change) had caused much destruction.

ii). Opportunities

Many of those interviewed also mentioned that there were opportunities associated with climate related events mainly through assistance received in terms of food, houses, water tanks, farming equipment and seedlings for the development of plantations. In addition, stronger and diversified networks within the family, church and the village as well as with the government and external agencies had been a positive development (see Table 5.12).

B. Dimensions of climate change likely to be experienced.

All of those interviewed indicated that the climate-related events which they are currently experiencing will continue to occur in the future. This suggests no change in residents’ perceptions of future climate change when compared with their current experiences. As seen on Table 5.11, most mentioned that hotter days, stronger damaging winds and sea level rise will continue. This is similar to the perceptions of residents surveyed in other sites and the future scenarios depicted in government reports.

Table 5.11: Current and future climate related changes frequently mentioned and emphasized by interviewed residents of Malaela.	
Changes that were experienced	Future climatic changes that were perceived to occur
1. Hotter days	1. Hotter days
2. Stronger damaging winds	2. Stronger damaging winds
3. Sea level rise	3. Sea level rise

1. Likely impacts and their significance.

Slight changes are evident in the perceptions of possible future impacts and the significance of likely risks associated with future climatic changes. The second column of Table 5.12 shows that inadequate water would be more of a concern for residents in the future than diminishing marine resources. This could be due to residents’ experiences of rising temperatures and longer periods without rainfall. Other risks such as damage to properties,

³⁸ Table 4.7, page 112 provides a detailed explanation of these categories.

inadequate water and diminishing marine resources were also viewed likely to continue in the future. Improvement in infrastructure was not mentioned as a likely opportunity associated with future climate change.

Table 5.12: Impacts of climate change frequently mentioned and emphasized by interviewed Malaela residents.

Current impacts Risks 1. Damage to properties 2. Diminishing marine resources 3. Inadequate water Opportunities 1. Access to food and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure	Perceived impacts Risks 1. Damage to properties 2. Inadequate water 3. Diminishing marine resources Opportunities 1. Access to food and other resources 2. Stronger and diversified networks
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Changes are obvious in participants' perceptions of the significance of likely risks associated with future climate change when these are compared with their perceptions of current climate change risks. Table 5.13 shows that most viewed the significance of likely risks associated with future hotter days and stronger damaging winds to increase to about 'medium-high'³⁹. The significance of likely risks relating to future sea level rise would remain 'medium'. Many suggested that most families have built inland shelters due to the destructive nature of surges they experienced during the 2009 tsunami and cyclones. These actions could reduce the likelihood of properties being destroyed due to sea level rise. However, according to most, possible risks to food and water sources are still likely to occur as some of these are located within the coastal and marine area.

Table 5.13: Perceived significance of risks associated with current and future climatic related events from surveyed Malaela residents.

Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days	Medium	Medium- High
2. Stronger damaging winds	Medium	Medium- High
3. Sea level rise	Medium	Medium

³⁹ Table 4.8, page 113 provides an explanation of the different levels of significance of risks associated with possible future climate change.

5.5.5 Crises management system based on *faamatai* and its key coping strategies.

A. Extended families: diversification, mobility and mental and spiritual strength

1. Diversification

Diversification has enabled families of those interviewed at Malaela to endure not only extreme events, but climate related changes experienced since the 1990s. Plantations and alternative homes that have been built further inland have been important in the recovery from previous crises as these provided food and shelter when the coastal settlement was destroyed. Also, as is evident in other study sites, all of those surveyed at Malaela live in extended families where some of their family members work in town or nearby schools and tourist businesses, while others fish, raise livestock and cultivate for food. These multiple sources ensured there were alternative sources of food during previous challenges. Remittances from relatives working and living in other parts of Samoa and abroad have been especially vital for rebuilding homes and re-developing food gardens and backyard farms. An elderly farmer described how he had received tubers of new varieties of taro and banana suckers from his relatives living in other villages, so he could regrow his plantation after it had been destroyed by the 1990s cyclones. He did the same thing after the 2009 tsunami. Younger residents interviewed described how they had received food, water, and housing materials from their relatives living in other parts of the country after the tsunami. Most residents interviewed also mentioned that since the 2009 tsunami, all of their houses had been equipped with water tanks.

2. Mobility

Like the majority of those surveyed in other sites, the families of those interviewed in Malaela have customary owned land in the coastal and inland parts of the village. Most resided on the coast while the inland areas were reserved for cultivating and farming, however a few families had shifted inland after the 1990s cyclones, and many more after the 2009 tsunami. Members of households who were employed in Samoa and overseas financed the rebuilding of most residents' houses.

3. Mental and spiritual strength

All of the participants belonged to the Latter Day Saints Church and were members of various church groups such as the youth and women's committee. All mentioned the importance of having faith during troubling times, as it gave them strength to cope with the destruction of their homes and death, as was experienced by most during the tsunami. Young people described that holding village *lotu* [morning and evening prayers] during the days

after the tsunami eased their feelings of worry and grief. A teenager described how she was comforted when she ran inland and saw their pastor and his wife there, offering spiritual comfort to the confused children. She was also moved and strengthened by seeing the elders of her village praying.

B. Village groups and churches: sharing resources and mental support and diversification

1. Sharing resources and mental support

Village and church groups had been a crucial element of survival at Malaela, particularly during times when the village faced extreme risks (some of which are not climate related) such as the destruction caused by the tsunami. In the days following the tsunami the whole village lived inland and shared whatever resources they had. The untitled men's group worked together to prepare food for the villagers. During a focus group discussion (MLFG01) a young female said,

“In those days following the tsunami at about 8:30am the young men of our village would meet at Simi's house to prepare the food for the families. They would prepare the *umu* [oven made with hot stones] to cook the food for everyone, mainly taro and bananas from the plantations and fish from those whose boats were washed ashore by the tsunami...Young boys would go and fetch coconuts for the people to drink. Everyone shared whatever food they have and eat together, elderly people, chiefs, untitled men, women and children” (November 11, 2014).

Another young resident said village groups provided physical and mental support during the process of revisiting the sites of their houses and rebuilding their homes. He said,

“All of our village were living inland, mostly in tents. After we have our morning tea, we would go, in a group, to the coast together, to where our homes were and try to clean the mess up and salvage some of our properties. Around 4pm, we would start walking back (in a group) here to the bush...” (November 11, 2014).

2. Diversification

The LDS church provided emergency supplies such as food, water and housing materials for church members. After the 2009 tsunami, the church built 3 houses that were destroyed. The women's church committee, *Lotu galuega a le Aualofa* continues to hold inspections for household goods and conduct weaving sessions which encouraged church women to continue re-developing their families and find alternative sources of income.

C. Assistance from the government and external agencies: disaster relief assistance, diversification, managing the environment, infrastructural development and disaster awareness, village strategic documents

1. Disaster relief assistance

The role of the government and external agencies has been significant, especially after cyclones and, more recently, after the 2009 tsunami, providing food, tents and farming equipment. In addition, developing infrastructure such as seawalls, roads and ensuring electricity and water supply has been important. After the tsunami, assistance flooded into the village, for example, tents, blankets, tarpaulins, mosquito nets, clothes, hygiene kits and jerry cans. The Samoa Red Cross helped the Samoa Water Authority (SWA) to truck in water in the first 3 months after the tsunami (International Federation of Red Cross and Red Crescent Societies (IFRC and RCS), 2011).

The government helped with the clearance of debris and waste and built 16 new houses and repaired 6 houses by the end of 2010. The construction process was accelerated by the assistance of the NZ Habitat for Humanity who helped with the construction of the houses through work teams that were rostered to be in the country throughout the year. These houses were based on a standard Samoan styled home that was cyclone resistant and was provided with sanitation facilities and a water tank. The design also allowed for any extensions provided by the households themselves. All houses now have water tanks, piped water supply and electricity (Government of Samoa, 2009; 2011). The International Federation of Red Cross and Red Crescent Societies, Samoa Red Cross, OXFAM and Caritas provided 5,000 litre water tanks for all new houses. Community water tanks were provided for storage in the relocated settlements. The Red Cross also provided training on how to construct and install guttering and carry out a ‘first flush’ of the system to allow the first dusty run-off to be diverted before the water tanks are filled. Water trucks were also provided (IFRC and RCS, 2011).

2. Diversification

In addition, the Ministry of Agriculture and Fisheries (MAF), with the support of the Food and Agriculture Organization (FAO) provided planting materials for the traditional crops of taro, cocoa and coconuts as well as vegetable seedlings and fruit trees. Pigs and chickens were also distributed to all affected villages to help replenish livestock (Government of Samoa, 2011). Those who have shifted inland were no longer removed from their plantations

making work easier. The great assistance offered by external agencies has enabled many residents to quickly build new homes and establish an alternative village settlement inland (see Figure 5.16). A middle aged male said,

“Well at that time, no one would stupidly sit around when the village distributes the gifts (referring to the aid assistance) because if a person stupidly stands around then their family might be missed in the distribution. Well now you see peoples’ homes and things, they are *mautu* [solid], everything. The houses have been built. We have electricity supply and lights here in the bush. The bush has turned into a settlement and there are lights beside the road. We have a volleyball area here that is filled with young people during most evenings. The coastal part of the village has also improved as some have rebuilt their homes there. But while there have been improvements in the coastal settlement, there are hardly any people living there...” (ML003, November 14, 2014).

3. Managing the environment

The village, in partnership with the government and external agencies has also resumed activities which were disrupted by the tsunami. For example, establishing the wetland conservation area and resuming replanting activities on the coast and along the wetland, and implementing the Marine Protection Management Plan to protect marine areas. The wetland prior to the tsunami had been a turtle breeding area and the government, through the Ministry of Natural Resources and Environment (MNRE) is helping the village to re-establish the turtle breeding site.



Figure 5.16: New houses stand, once again, in the coastal part of Malaela settlement that was destroyed by the tsunami.

4. Infrastructural development and disaster management exercises

The government has also rebuilt the seawall, tar sealed inland roads and constructed a new road to the inland part of the village. In addition, tsunami warning posts and sirens have also been installed at the village by the government through external assistance. Malaela and Mutiatele was one of the four pilot sites for a project that piloted the development of tsunami evacuation maps and signage based on science-based tsunami hazard assessment and inundation modelling (see Figure 5.17). The map and signage identified the danger and safe zones in the village and showed evacuation routes which should normally be taken by residents in the event of a disaster. The project was implemented by the MNRE and NZ Institute for Geological and Nuclear Science (GNS Science).

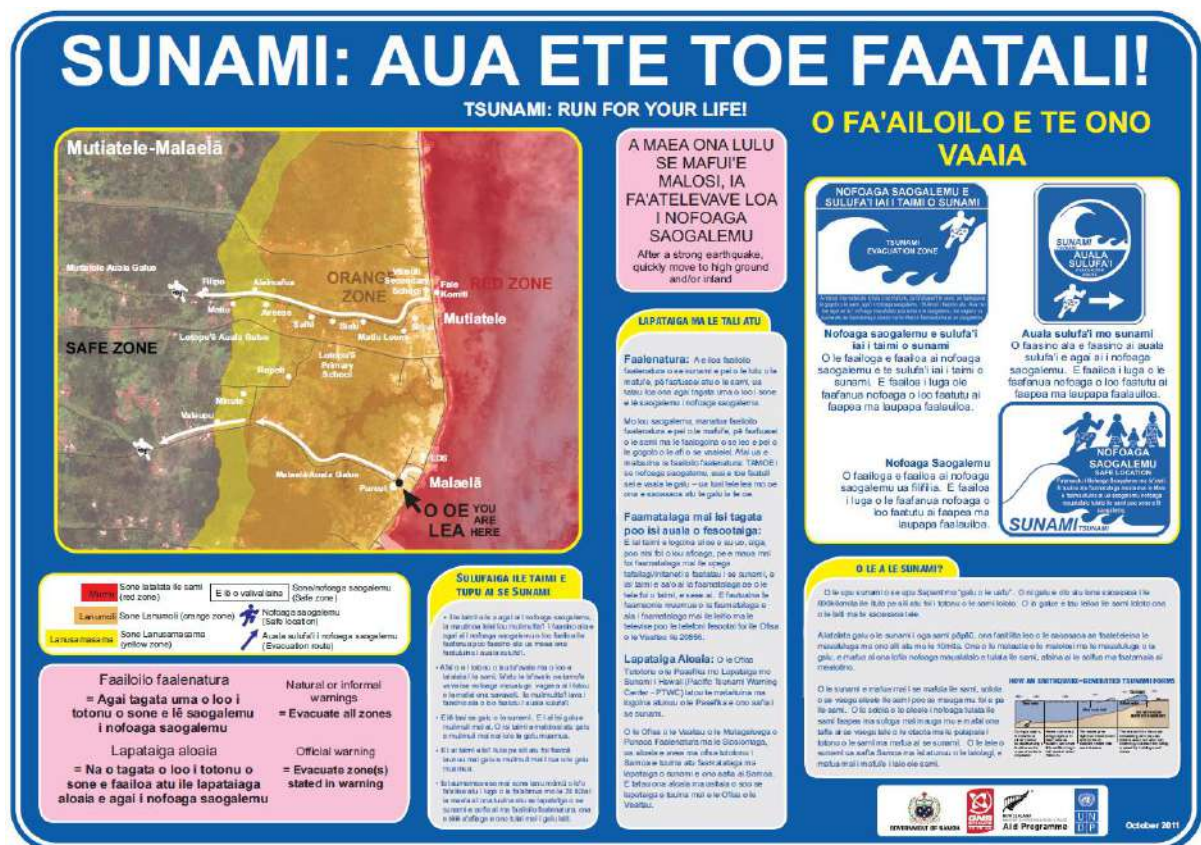


Figure 5.17: Map showing evacuation routes and instructions in the event of a tsunami (Source: Government of Samoa *et al.*, 2011).

Community consultations and the tsunami demonstration exercises, which tested the effectiveness of the evacuation maps, were completed on September 10th, 2011. Malaela is also included in the next phase of the project which is developing disaster management plans for more than 100 villages in the country. This phase of the project encouraged villages to establish their own disaster management teams comprising village residents. These people

would be trained on basic first aid skills so they would be able to effectively assist residents in the future (pers. comm., MN, 2014).

5. Village strategy documents

The village has prepared, in partnership with the government, a Coastal Infrastructural Management Plan (CIM-Plan) in 2006 and a Village Sustainable Development Plan in 2010 where future goals and strategies have been proposed. The CIM- Plan identified the need for people to shift inland and most residents now have houses both in the coastal and inland parts of the village. The East Coast inland route which was being built at the time of my fieldwork is now completed (as mentioned in Chapter 3) making it easier for residents to evacuate or shift to live inland. The Village Sustainable Development Plan 2010 identified the need for assistance in terms of fishing and agricultural equipment which, according to interviewed residents, have now been provided, either by the government and external agencies or their family members (Community Centred Sustainable Development Programme (CCSDP), 2010).

5.5.6 Preparing for possible future climate related changes.

The role of the extended family network in enabling diversification, mobility and mental and spiritual strength is an important part of preparing for likely climate related changes. All of those interviewed have alternative residences inland and most residents have installed water tanks in their homes which would reduce their susceptibility to future storm surges and inundation. Most of those interviewed suggested members of the village council need to be more proactive in developing ways to effectively manage and sustainably use village resources. Parts of the village have been reserved in order for resources to recover from the tsunami and previous disturbances, however, according to most, these would not be sustainable if village residents do not see their importance and related benefits. Therefore, it would be important for the council to uphold village rules that prohibit the clearance of forested and mangrove areas and poaching within reserved parts of the wetland and marine area.

Assistance provided by relatives, government and external agencies after the tsunami have greatly equipped Malaela residents with materials and skills that prepare them for possible future climate related risks such as damage to properties, inadequate water and diminishing marine resources. For example, warning sirens, tar sealed access roads, a new seawall,

disaster maps and training for disaster teams have been provided in recent years. However, the government needs to be more cautious in the development of infrastructure such as roads and seawalls, as to not compromise the village's wetland and marine area.

5.5.7 Summary of findings from Malaela

Most of those interviewed at Malaela were greatly aware of climate related changes and explained that they had been experiencing hotter days, stronger damaging winds and sea level rise since the 1990s. The occurrence of such events had caused problems such as destruction of properties, diminishing marine resources and inadequate water- as witnessed by most during Cyclones Ofa and Val in the 1990s, and again during the 2009 tsunami. At the same time, these events created opportunities such as access to food and networks with external agencies which have provided either food, housing materials or reconstructed village infrastructure. Most interviewees perceived that all of these changes are likely to continue in the future and the significance of associated risks would be greater. Opportunities that were created by previous climate related events (as mentioned earlier) are also very likely to occur.

I discovered at Malaela the significance of the multi-level nature of the crises management system based on *faamatai*. Both young and older research participants suggested the importance of family, village, church and government agencies to the development of coping strategies. In situations when affected families could not cope with all of the risks they were experiencing, such as in the case of the 2009 tsunami, village and church groups automatically played a supportive role and took care of residents until the arrival of external assistance. *Faamatai* structures of extended family, village and church groups are all connected by blood ties and these connections are constantly nurtured by residents being part of these groups and attending their regular meetings and activities. These connections, which existed prior to the occurrence of the tsunami, made it easier for individuals to cope with the difficult circumstances. Evidence showed a high level of external assistance during the 1990s cyclones and again after the 2009 tsunami when the village was destroyed. The findings showed there had been more external assistance given to Malaela than any other village surveyed in this study and this had been due to the level of destruction during the 2009 tsunami. Most respondents suggested knowledge and assistance gained as a result of the tsunami have contributed to them preparing for future climate related risks. The role of the village council in effecting village rules and regulations regarding the protection of their resources would be important for the future. Moreover, the responsibility by government to

ensure infrastructural developments that are currently being undertaken in the village does not compromise the sustainability of village resources such as the wetland and marine area, both of which have been declared reserves.

5.6: Conclusion

To determine whether residents' experiences of previous extreme events could enhance their capacity to cope with future climate change, this chapter has examined the perceptions of climate change and relevant coping strategies in four coastal villages within the context of other historical changes they had experienced. The findings indicate that all of the villages have experienced tropical cyclones Ofa and Val and the 1993 taro blight suggesting these events had extensive impacts on the country. The majority of interviewees indicated that Cyclones Ofa and Val were extreme events that were part of climate change and since then they had noticed other climate related changes. This not only suggests that most residents had already experienced climate change, but their experience of previous extreme events made them more sensitive to various dimensions of climate change and related risks and opportunities.

5.6.1 Coastal residents' perceptions of climate change

Many recognized that air temperatures have been increasing and would continue to rise, corroborating the trend towards higher temperatures mentioned in scientific reports by the IPCC. Most people are also aware of various dimensions of climate change, mainly hotter days, prolonged dry spells, changing rainfall patterns, stronger winds and sea level rise (see Table 5.14). Although sea level rise was mentioned by many participants, only a few people talked about it in detail. This finding suggests that dry spells, shorter but heavier rainfall events and damaging winds were more significant to the majority of those interviewed compared with sea level rise. Moreover, this contrasts with national and regional reports on climate change that portray sea level rise as the most significant dimension of climate change.

Table 5.14: Dimensions of climate change experienced by those surveyed in four coastal communities in Samoa. The listed items were frequently mentioned and emphasized by respondents.

1. Saleimoa	2. Auala	3. Lano	4. Malaela
Hotter days and longer dry spells		Hotter days	

Shorter and heavier rainfall	Stronger damaging winds	Shorter heavier rainfall	Stronger damaging winds
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise
Sea level rise		Sea level rise	

The majority of people interviewed reported risks and opportunities associated with climate change. Damage to properties was the most frequently mentioned risk in most coastal villages, while inadequate water supply was seen as the most significant risk for Auala. Other risks that were mentioned included diminishing marine resources, the appearance of pests, mainly the African snail and invasive weeds, reduced productivity of the land and new climate related diseases such as chikungunya.

Risks	Table 5.15: Impacts of climate change experienced by those surveyed in four coastal communities in Samoa. The listed items were frequently mentioned and emphasized across the surveyed communities.			
	1. Saleimoa	2. Auala	3. Lano	4. Malaela
	Damage to properties	Inadequate water	Damage to properties	
	Diminishing marine resources	Damage to properties	Pests	Diminishing marine resources
	Reduced productivity of the land			Inadequate water
	Diseases			
	Opportunities	Access to food and other resources		
Stronger and diversified networks				
Improvement in infrastructure				

Risks associated with hotter days and longer dry spells were perceived to be of ‘medium’ significance by most villagers except at Auala where it was seen as between ‘medium and high’. Stronger damaging winds and shorter heavier rainfall were perceived to be of ‘medium’ significance by the majority of participants in all four villages. Risks associated with sea level rise were perceived as ‘low to medium’ in most villages, except for Malaela where it was seen as ‘medium’ (see Table 5.18).

The positive impacts of climate change that were frequently mentioned included access to food and other resources. Almost all of the interviewees stated that receiving food, clothing, water tanks, farming equipment and crop seedlings, housing materials and more remittances from relatives, government and external agencies during and after cyclones. Some residents of Lano spoke of cyclones bringing sand to some parts of their village. Some of those who were affected by the tsunami at Malaela commented on their new houses and water tanks provided by the government, church and external agencies. Those who were employed stated that cyclones often made it easier to access finance at lending institutions like the National Provident Fund. In all of the coastal villages that were surveyed, seawalls had been built by the government in partnership with external funding agencies. Additionally, many respondents suggested that these events often brought families, churches, villages and the whole nation together and created opportunities for them to build and strengthen relationships.

The slight differences which were evident in interviewees' perceptions of current climate change and related impacts are largely shaped by the specific location of the village and the environmental processes experienced. Those interviewed in villages located in the north-western parts of Upolu and Savaii islands, such as Auala and Saleimoa, not only mentioned 'hotter days' but also 'longer, drier seasons', while Lano and Malaela residents provided descriptions of 'hotter days'. This finding suggests that the north-western parts of the country may be slightly drier than the north-eastern sides where Lano and Malaela are located. While the majority of residents recognized that the pattern of rainfall had changed, there were also differences in their descriptions. The residents of Lano and Saleimoa suggested that in recent decades, shorter but heavier rainfalls had become more frequent. Many people had observed an increased incidence of short heavy downpours of rain in the afternoon for half an hour, and then the sun would shine again. This would be followed by hot and dry conditions. In contrast, those interviewed at Auala suggested that rainfall receipts had been small and erratic, especially during the dry season. Only a few participants noted sea level rise at Saleimoa, Lano and Auala, which are all located on the northern part of the islands. The majority of participants said that the construction of seawalls in their villages had made it difficult for them to determine the extent of sea level rise and associated processes of inundation and erosion. Contrastingly, at Malaela, located on the south coast of the country, people were slightly more concerned with sea level rise due to the recent devastation of their village by the tsunami.

The notion that exposure to previous extreme events had heightened awareness of climate change is further strengthened by findings at Auala and Malaela where residents had faced other extreme events, in the past, compared to Saleimoa and Lano. Auala residents showed more sensitivity to ‘hotter days and longer dry spells’ compared to the other three villages. There, the perceived significance of risks associated with hotter days and longer dry spells is higher compared to the rest of the villages. This perception is closely linked to these residents’ descriptions of experiencing intensive logging of forested areas, forest fires, cyclone devastation and rising temperatures. Similarly, at Malaela, where residents had faced destruction from cyclones and the 2009 tsunami, the perceived significance of risks associated with sea level rise is higher compared with the other three villages (see Table 5.18).

Interviewees’ experiences also largely determine the way they perceive possible future climate changes and their associated impacts. Most responded that the climate related changes they had been experiencing are highly likely to continue into the future. Hotter days was the most frequently mentioned and emphasized change in seven villages, with Saleimoa and Auala, noting both hotter days and longer dry spells. Saleimoa and Lano residents perceived shorter and heavier rain storms to be another future concern, while stronger damaging winds were another significant concern for those residing at Auala and Malaela. Sea level rise featured, as the least significant concern in all of the surveyed coastal villages (see Table 5.16).

Table 5.16: Dimensions of climate change perceived to possibly occur in the future by those surveyed in four coastal communities in Samoa. The listed items are those frequently mentioned and emphasized across the surveyed coastal communities in Samoa.			
1. Saleimoa	2. Auala	3. Lano	4. Malaela
Hotter days and longer dry spells		Hotter days	Hotter days
Shorter and heavier rainfall	Stronger damaging winds	Shorter heavier rainfall	Stronger damaging winds
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise
Sea level rise		Sea level rise	

Examining the participants' descriptions of climate-related impacts it is evident that they were experiencing and perceived future climate related scenarios and they also suggested possible risks and opportunities that are likely to occur in these places. There is a suggestion that a few new risks will emerge in some places such as inadequate water in Saleimoa however the likely significance of this risk might be very low. Damage to crops and property was the most frequently mentioned risk in most of the surveyed villages, except for Auala where inadequate water was perceived as the most likely significant risk. Reduced productivity of the land was the second mostly frequently mentioned issue in Saleimoa and was identified as a new likely risk in Auala. In contrast to the likely risk of inadequate water at Saleimoa, the likely significance of reduced productivity of the land at Auala might be greater. A greater incidence of pests was the second most frequently mentioned future concern in Lano, while Malaela residents suggested inadequate water. The majority suggested future changes might also bring desirable opportunities, such as better access to resources and improvements of social networks while no one mentioned improvement in infrastructure (see Table 5.17).

Possible risks ↑ Issues have shifted upwards in ranking because they were more frequently mentioned and emphasized. ↓ Issues have shifted downwards in ranking because they were less frequently mentioned and emphasized. A new issue was mentioned.	Table 5.17: Impacts of climate change perceived likely to occur by those surveyed in four coastal communities in Samoa. The listed items were frequently mentioned and emphasized by respondents.			
	1. Saleimoa	2. Auala	3. Lano	4. Malaela
	Damage to properties	Inadequate water	Damage to properties	
	Reduced productivity of the land	Reduced productivity of the land	Pests	Inadequate water
	Diminishing marine resources	Damage to properties	Inadequate water	Diminishing marine resources
	Diseases			
	Inadequate water			
	Likely opportunities	Access to food and other resources		
	Stronger and diversified networks			

Additionally, the majority of participants perceived the risks associated with most dimensions of climate change would be greater in future. The majority of those interviewed in all coastal villages thought that risks associated with sea level rise would increase to ‘Medium’ in future, while all other risks would increase to ‘Medium-High’ (see Table 5.18). At Auala risks associated with hotter days and longer dry spells were perceived to increase from ‘Medium-High’ to ‘High’ in the future.

Table 5.18: Perceived significance of risks associated with current and future climatic related events from surveyed residents in coastal communities.

STUDY SITES 1-4	Perceived significance of risks associated with current climate- related events		Perceived significance of possible risks associated with future climate- related events	Change > greater, < less, = no change
1. Saleimoa	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Shorter and heavier rainfall	Medium	Medium- High	>
	3. Stronger damaging winds	Medium	Medium - High	>
	4. Sea level rise	Low- Medium	Medium	>
2. Auala	1. Hotter days and longer dry spells	Medium- High	High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Medium	>
3. Lano	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Shorter heavier rainfall	Medium	Medium- High	>
	4. Sea level rise	Low- Medium	Medium	>
4. Malaela	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Medium	Medium	=

5.6.2 Crises management systems of coastal communities and key coping strategies

Evidence from the four coastal villages indicated that *faamatai* and related social networks of the extended family, village and church groupings, and government and external agencies have enabled most households to manage, avoid and reduce the impacts of previous crises, including those associated with climate change. These connections enabled the majority of those interviewed to develop a greater diversification of livelihoods, mobility and mental and spiritual strength. Furthermore, these connections have assisted them in the development of

ways to manage their environment and related resources, notably water, forests and marine areas.

Most of the people surveyed were members of extended families where some people were farmers and fisherfolk, who at times engaged in informal economic activities, while others worked in the formal economy. These households had multiple ways to obtain food and income after a setback. Cooperation between family members, including sharing of skills and resources, is considered important to the survival of the household. The majority of participants owned either a food garden or a plantation, usually located inland. In addition, most families had a piggery and a chicken farm at the back of their house for daily food supply and traditional activities.

Key aspects of family food gardens and plantations are diversification with mixed cropping and planting of locally resilient crops such as yams, cassava and taro. According to most farmers interviewed all these varieties were destroyed in 1993 and are no longer planted. Instead, they now plant different and many more varieties of taro supplied by the government or sourced through their relatives and friends. The majority of farmers and fisherfolk agree that while there have been some changes, most of the techniques that they use are grounded in older methods of farming and fishing, learned mostly through observing older members of the family. Both older and younger farmers agreed that some traditional farming methods that have been practised for more than a century, are now more important to them, as parts of their lands are slightly drier, especially during the dry season. Examples of these include, dry season planting and mixed cropping and farming. Farmers interviewed at Asau said that due to longer dry spells and the increased risk of fires, they do not burn the land during the dry season, but they just clear the vines beneath the trees and cultivate. Big trees are protected to provide shade for the plantations which many say are mostly kept small to provide food for the family. In rocky areas crops are planted in between rocks. According to some elderly farmers, early planting now occurs either in June or July. The time of harvesting has also slightly changed: some farmers had begun harvesting their crops earlier in November. December planting had been harvested in April or at the end of March (see Table 5.4). Seasonal crops, mainly vegetables, are also more commonly grown.

The majority of households in all four villages have access to piped water supply, village pools and springs and church owned water tanks. In Auala, where the water supply has

always been inadequate, different ways of obtaining water had been developed. All of the interviewed residents stated their families have one or more water tanks and water filled drums and containers. Older techniques of collecting and recycling water are remembered and practised when necessary.

Family connections and the collective nature of land ownership enabled most interviewed residents to shift residence and/ or build other houses and cultivate plantations on lands that are separate from where they currently reside. This practice commonly referred to as *faa-aigalua* [to have two residences or families] is evident in all of the villages surveyed. The effect of the 1990s cyclones also prompted many families living in all of the surveyed coastal villages to build other houses on their plantation lands, mostly located inland. This was particularly evident in Auala and Lano. At Saleimoa, where most inland areas had been alienated, some families are now cultivating plantations and building houses on their customary lands in other villages. Some are cultivating plantations, for free, on church owned lands. Others have bought freehold lands in areas near Apia where they have built houses and cultivated plantations. The 2009 tsunami caused many more families to build residences inland at the village of Malaela. Another feature of mobility is evident in how Samoans build and shift between the multiple houses that make up their homes. Most respondents surveyed live in small compounds consisting of 3 to 4 different houses in which all members of the family have access. The arrows which indicate resettlement on the maps of all of the sites do not show a one way or permanent shift as most residents maintain their connections with one or more places of residence.

The majority of people that were surveyed participated in morning and evening prayers every day. In fact, for most, morning and evening prayers are part of the daily routine in their households. Elderly members and parents who were interviewed talked about the significance of these times in imparting knowledge and sharing ideas with young people. Those affected by the tsunami, especially at Malaela, mentioned feelings of worry and panic during climate related events such as cyclones and tsunamis, and the important role of spiritual strength in easing these feelings.

The supportive role of village and church groups is evident in all of the sites. Many mentioned the role of the council in the protection of water sources and in managing land and marine resources. Councils of Auala, Lano and Malaela, all of which were rural villages have established, in partnership with the government and international agencies, conservation

schemes which involve reserving parts of their mangrove forests and marine areas. At Saleimoa village groups had done some work towards protecting water sources and negotiating access to inland parts of the village which are now owned by the CCCS. At Auala, where most residents had long been faced with various environmental challenges such as inadequate water, the council had been more proactive (compared to other villages) in effecting rules regarding sustainable land and water use. Malaela, which had recently faced major destruction showed evidence of disaster management activities being undertaken at the village level. Activities and inspections conducted by untitled men's groups and women's committees have also helped with developing diversification in most of the villages. Local churches had been used as cyclone shelters and had provided disaster relief assistance for most residents during extreme events. Church groups and their activities have developed mental and spiritual strength which have helped many to cope with difficulties.

There was also evidence of assistance from government and external agencies in all of the villages, with more government involvement in rural villages and those which have experienced disasters in recent years. Seawalls and roads had been constructed by the government in all of the coastal sites for protection. Water tanks, housing materials, crop seedlings and farming equipment had been provided to most households in the tsunami affected village of Malaela, while at Auala there had been provision of water tanks, portable lavatories and crop seedlings to some families.

5.6.3 Coastal communities preparing for future climate change

Most respondents suggested that current efforts at diversification, mobility, developing mental and spiritual strength and managing village resources are all part of developing preparedness to cope with future climate change. However, more work is needed to improve some aspects of *faamatai* and related strategies. Many residents, especially the elderly, insisted on the importance of strengthening networks at the household and village levels. Family gatherings, especially daily evening services, are a crucial part of sharing experiences between elders and young members, remembering and reflecting on past challenges and empowering members to carry out their roles and responsibilities within the family, village and nation. The village council and its groupings should also play their part in carrying out inspections and effectively monitoring the use of resources such as water sources, village lands and marine areas. Moreover, village councils and churches need to ensure there is time for reflection and sharing of experiences at the family and village levels. Both council and

churches must also ensure there is space and time for sharing of knowledge at the village level with elders and local experts. Farmers, fisherfolk, traditional healers and weavers could contribute to village plans regarding sustainable ways of managing the environment. Saleimoa's council needs to ensure negotiations are continued and clear arrangements are made with the CCCS in terms of securing lands for its residents to shift to in the future.

Many commended the role of the government and external agencies in the development of infrastructure such as roads, seawalls, piped water and electricity supplies and water tanks, however some raised concerns with some of these projects exacerbating the impacts of climate related events such as recent flooding observed at Saleimoa. This is similar to instances observed in other coastal areas in the Pacific (Resture, 2006 cited in Veiyataki, 2010; Kenny, 2012; McNamara, 2013) where infrastructural developments being carried out as climate change adaptation have compromised the livelihoods of local residents. Seawalls had been constructed in all of the surveyed villages by the government although they have been a failure in many places and therefore constitute an unsustainable approach to climate change.

Others questioned the relevance and sustainability of some conservation projects such as tilapia farms, turtle and mangrove conservation areas. According to most, longer and more effective consultations are needed to ensure that residents understand the goals and impacts of such initiatives. Local knowledge and expertise must be considered and used to inform government decision making and plans for future community development. Most suggest the need for government assistance in terms of fishing equipment and crop seedlings. Upgrade of access roads is also needed at Auala and Lano to facilitate the movement of people inland.

Chapter Six. Inland communities: Enduring challenges and anticipating climate change in Samoa

6.1 Introduction

This chapter presents the findings from the four inland villages that were surveyed. Like Chapter 5, this chapter is also divided into four sections which discuss the physical and social characteristics of each village, details of the research carried out there, and the general challenges faced by the residents. The remaining sections explain perceptions of climate change and related responses. As noted in the previous chapter, the location of the village and peoples' experience of previous risks have greatly influenced their perceptions of climate change, as well as responses. All of the surveyed sites had been exposed to different extreme events in the past because they are located in different parts of the country. Aopo has endured more extreme challenges than the other three villages, facing volcanoes up until the early 1900s, deforestation between the 1960s and 1990s, the Big Fire in 1983 and climate-related events in recent decades. Saanapu has faced a slow but enduring issue of severe coastal erosion which since the 1990s has been exacerbated by climate change. Maagiagi, which had been facing frequent flooding from its Vaisigano river, has in recent years been experiencing inadequate water supply due to the loss of residents' rights to its water resources and lower rainfall receipts attributed to climate change. Sili has also faced frequent flooding from its river and government pressure to alienate their rights and access to their river, but more recently pests have been a more pressing concern. Similar events which all of the sites experienced were the taro blight and the 1990s cyclones, the latter suggested as part of climate change.

Variations in the experiences of each community account for the different strategies that have been developed and prioritised in each village at certain times. However, all of these strategies are part and parcel of a crises management system based on *faamatai* which is found in all of the surveyed villages. *Faamatai* of villages in Savaii namely Aopo and Sili, located further away from the country's urban area, was more intact than in Maagiagi, which was closer to Apia. Here, ownership and governance of village resources remained largely with the councils of Aopo and Sili, while the Maagiagi council had been facing issues relating to the loss of their rights and access to their water resources. Village councils in these villages had also been more proactive in the management of their key resources, notably forested areas and water sources. The same is also evident at Saanapu. There is evidence of government efforts to provide infrastructural support in all of the villages, such

as piped water supply, electricity and roads. A seawall has also been constructed in the coastal part of Saanapu whilst government and external agencies had helped in the establishment of forest reserves at Aopo, Saanapu and parts of Maagiagi.

6.2: SAANAPU

6.2.1 The village.

Saanapu lies on a gently sloping ridge on the south coast of Upolu island. The coastal part, commonly known as Saanapu- tai, is characterized by a few small houses, the Congregational Christian Church, that is currently being rebuilt, and an abandoned tourist business. All are closely located on a narrow strip of land separating the sea and the Sataoa-Saanapu Mangrove Forest Conservation Area (see Figure 6.1). A barrier reef is located offshore.

The population of Saanapu has increased from 739 in 1961 (Samoa Bureau of Statistics, 2016) to 1,305 in 2011 (Samoa Bureau of Statistics, 2011). The majority of Saanapu's inhabitants lived on the coast before the 1990s, but now only 18 families remain, as most have shifted inland to live in their plantation lands. This part of the village is now called Saanapu-uta. The shift started in the 1950s when the south coast road was completed. The trend accelerated after the 1990s cyclones which destroyed much of the village (Ward and Ashcroft, 1998). A few families shifted more recently after the 2009 tsunami. In 2011, 143 people lived in the coastal part of the village, while 1162 people lived inland (Samoa Bureau of Statistics, 2011). The village is governed by one council of chiefs. Those households who have shifted inland established another Congregational Christian Church in 1980 and built their church in 1981.

The majority of residents have piped water supply and electricity. Also, freshwater springs are located in the mangrove area (see Figure 6.1) which the village residents use for drinking, bathing and washing, particularly when the piped water supply is disrupted. Livelihood sources include fishing and farming activities, job opportunities in town and remittances from overseas relatives.

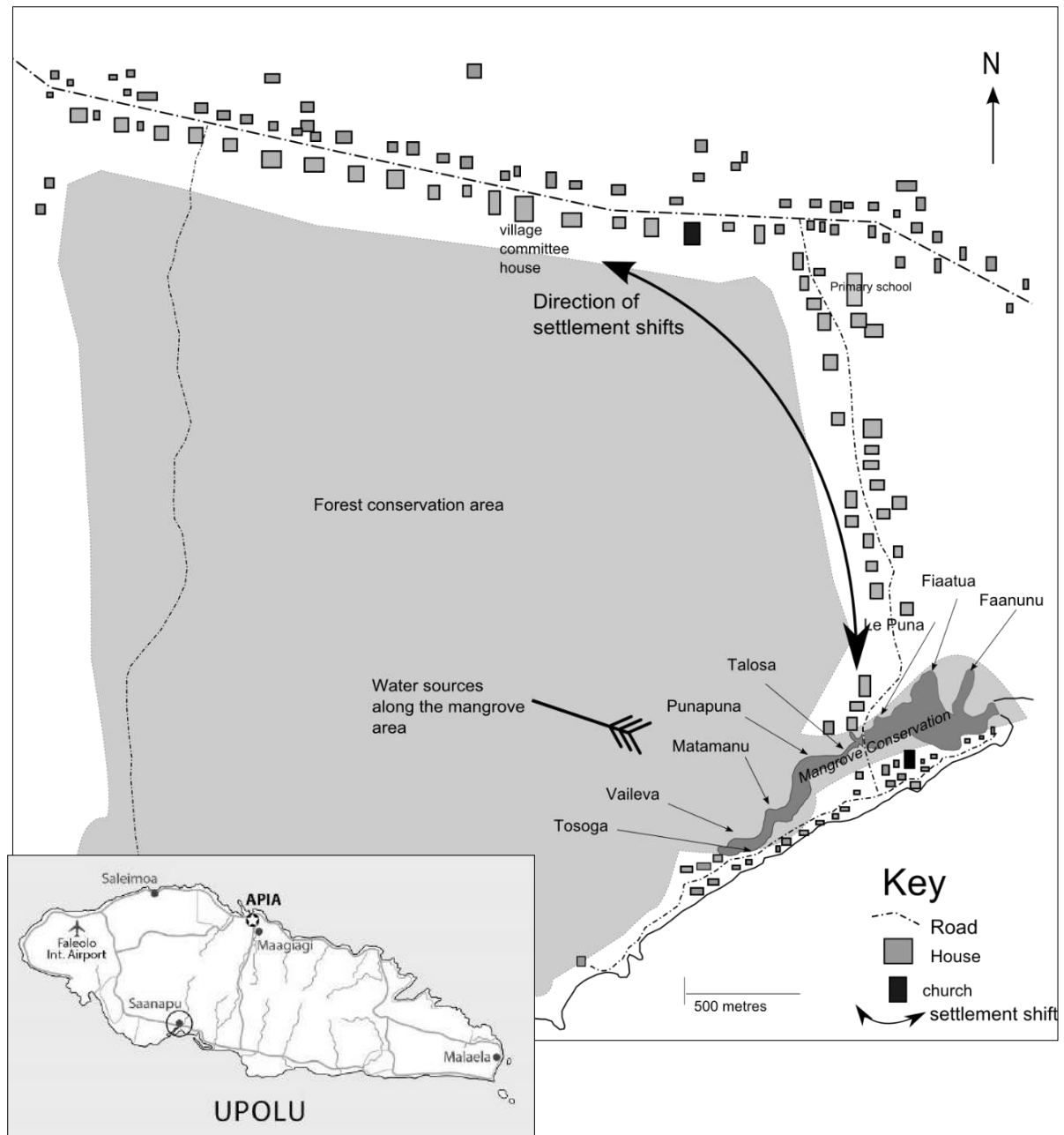


Figure 6.1: Sketch map to show the inland spread of houses in Saanapu to where the main road is located (Source: after Google Earth, 2016).

6.2.2 Summary of research carried out at this village.

Two focus groups and eight key informant interviews were undertaken in this village (see Box 6.1). Field observations of the village were carried out by walking and driving with local residents. I also went on a canoe trip, to explore the mangrove area and water sources located nearby. The village's CIM plan and strategy also provided useful information.

Box 6.1: Details of study participants from Saanapu.

Interviewees 72 year old male (SN001) Family- chief, father and grandfather Village- member of the village committee, former government representative Church- President of the church youth (CCCS), assistant pastor Skills- fisherman, carves canoes, farmer (plantation, pigs, chickens) 70 year old male (SN002) Family- chief, father Village- member of the village council Church deacon Skills- fisherman, farmer (plantation, pigs, chickens) 65 year old female (SN003) Family- mother and grandmother Village- female government representative, member of the women's committee Church- Member of the church youth, member of the women's committee Skills- traditional weaver, farmer (vegetables, chicken, pandanus) 61 year old female (SN004) Family- mother and grandmother Village- member of the women's committee Church- church member, member of the women's committee Skills- weaver, farmer (vegetables, chicken) 50 year old male (SN005) Family- father Church- Pastor	45 year old female (SN006) Family- mother and wife to a Saanapu male Village- member of the women's committee Church- member of the church, choir Skills- sells crabs and fish from time to time otherwise stays home 38 year old male (SN007) Family- single male Village- member of the untitled men's group Church- member of the church youth Skills- teacher 35 year old female (SN008) Family- single female Village- member of the women's committee Church- member of the church youth Skills- government officer Focus group participants Focus group 1 (SFG01) 2 males and 3 females • Age: Late teens to early 20s • All are attending higher education • Some are members of the church youth Focus Group 2 (SFG02) • 2 males and 2 females • Age: Mid to late 20s • All are staying home (some have just finished University but have not yet worked, others left high school and are already married with children, farming and doing odd jobs at home)
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6.2.3 General environmental issues.

Damage to crops, houses and water sources, loss of coastal land for crops and houses, and reduced productivity of the land and marine areas, have been main challenges experienced by Saanapu residents. These were caused by extreme natural events, mainly cyclones, incremental sea level rise, 2009 tsunami and human activities such as the clearance of trees for settlements and infrastructure and climate related changes. Non climate-related events that were mentioned were the 1993 taro blight and the 2009 tsunami.

6.2.4 Perceptions of climate change

A. Dimensions of climate change experienced by surveyed residents.

Hotter days, stronger damaging winds, sea level rise and shorter, heavier rainfall were the most frequent and emphasized changes suggested by the majority of surveyed residents (see Table 6.1)⁴⁰. All of the participants described how they 'feel' the days have been getting hotter in various ways. During a focus group discussion, a group of young people used

⁴⁰ The main dimensions of climate change described in this section and listed on Table 6.1 were determined through several rounds of secondary coding. The actual process and methods used to determine these issues and construct Table 6.1 and the rest of the tables in this chapter are described in detail Chapter 4, section 4.9.2.

various phrases to describe the rising temperatures (see Box 6.2). For example; *ua siisii le vevela* [the heat is increasing], *ua aasa le la* [the sun is fiercely hot]. The latter phrase is usually stated to describe the ‘red-ness’ of stones used in an *umu* [traditional Samoan oven made with hot stones]. Another person just stated *ua matua ova lava le vevela* [it’s just too hot]. The character VL (see Box 6.2) stated the phrase ‘cool down’ twice referring to how their bodies are feeling the heat.

Box 6.2: Excerpt of a focus group discussion with youth at Saanapu (SFG01, November 6, 2014).

Moderator	“Can you talk about the heat that Samoa is experiencing now? Do you think it has changed?”
	Everyone nods and said <i>mmm</i> <i>silence</i>
Moderator	“Do you think the heat has increased from when you were younger, say 10- 15 years ago? Decreased? Or is it the same as always?”
PE	“No the heat is increasing”.
AN	“mmm...”
TF	“Yeah”.
VL	“Yeah”.
Moderator	“How do you know that the heat is increasing?”
PE	“The sun is fiercely hot”.
VL	“During the middle of the day the sun is fiercely hot”.
PE	“Yes it starts getting hot around 10am”.
AN	“I notice that this heat is increasing because I tend to stay inside the house more now. It’s just too hot to go outside”.
VL	“Yeah us boys we go to the pool to swim to cool down our bodies because of the heat of the sun....that’s what I normally do to cool down”.

In a similar way elderly residents emphasized that the heat is increasing and has been exacerbated by activities such as clearance of trees for settlement. There is a tendency for elderly residents to compare the heat now to when they were younger, as the following quote illustrates. An elderly woman (SN003) said,

“The truth is the heat is increasing (emphasized). There has been a big change in recent years compared to when I was younger...there used to be many plants in this area, surrounding the open *fale* [house] and I was able to do chores outside right up until mid-morning, under the shade of the trees. Now the sun is too hot (emphasized) and there is not much tree cover anymore because we cleared the area for our new house. We have also put sand in the front yard which makes the sun even hotter” (November 3, 2014).

Many of those interviewed also mentioned stronger damaging winds, mainly cyclones which they have experienced in recent years. Elderly participants, aged over 60, recalled the 1966

cyclone, Ofa in 1990, Val in 1991 and Evan in 2012 as significant events. An elderly male (SN001) described one of his experiences during the most recent Cyclone Evan. He said,

“Well I was a victim of Evan. Yeah? I went, because it was (mumbled) we were sitting around here that morning and we saw tamaligi [rain trees] falling over, these big tamaligi falling over. I used one of them to carve a canoe. Anyway, one tamaligi fell over the road and blocked the flow of cars. So I went that morning and gathered some of the village youth to start clearing the trees so the cars can move. We started clearing this part first and then shifted down to other parts of the road where our pastor lives. As soon as everything was cleared from the road and the cars have all left, I decided to go and check on our pastor and his family. Well, when I came he greeted me happily and said they were all fine. He urged me to come in for a cup of tea so we went. We chatted for a while, but we noticed that the wind was getting stronger. The wind was swirling and spinning, blowing mainly from there (pointing north) so I said to the pastor, You know? I’m going to leave. I need to go and see how my family is. But (tone of voice changed to high-pitch), as I was walking from the pastor’s house towards the road, I found it very difficult to walk. The wind kept pushing me backwards (said this statement in a loud voice). This was the first time I have ever experienced such a thing, a ‘feeling’ (said this word in English) like this. Instead of walking straight to the road, I tried going towards the church (beside the pastor’s house). I wanted to go over to the other side of the church where I thought would be sheltered from the wind. Sole! [Samoan term sometimes used to indicate a feeling of astoundment], as soon as I stepped onto the façade of the church, on the cement, my feet could no longer hold my body. The wind pushed me and my body slammed on to the wall (chuckled). Then I fell down, rolled over and found myself being blown out of the façade and onto the sand outside the church. Well I stood up (chuckled) painfully defeated. The pastor had not seen me. I sat down and tried to gather my strength. But the wind was howling, blowing quite strongly (emphasized). And then a car came bringing people of our village who were seeking shelter in the church. I said to the driver to take me home. When we got there, the driver’s parents were at our house. They have come there because their house had been damaged by the wind. But our house was safe and sound. There was no damage. I tell you, I have experienced a number of cyclones. The cyclone in 1966, the cyclone in 1978, the cyclone in 1990, 1991, Heta in 2004 and the one in 2005, Olaf, that came close but did not quite affect us. And now Evan” (November 7, 2014).

Younger participants, mostly in their early 20s, only remembered Cyclone Heta in 2004 and Cyclone Evan in 2012. Sea level rise was mentioned and discussed in detail by a few participants who still reside on the coastal part of Saanapu. Incidences of shorter bouts of heavier rainfall were also mentioned (see Box 6.3).

Box 6.3: Excerpt of a focus group discussion with youth at Saanapu (SGF02, November 6, 2014).

- | | |
|----|--|
| ML | “There have been strong winds and cyclones like Cyclone Evan and Heta”. |
| SN | “Yes these are the cyclones we have experienced”. |
| OT | “Yes. The heat is usually followed by periods of short heavy rainfall, heavy rainfall for a short time and then it stops”. |

FP	“Like now”.
OT	“Yes like now”.
ML	“Yeah it was sunny just before and now it’s pouring rain”.
SN	“And there has been ‘sea level rise’ (said in English)”.
ML	“Yes rising ‘sea level’ (said in English)”.
SN	“Yes that is another thing I see down at the coast where I live is that the coast is eroding, ‘erosion’ (said in English) (coughs), affecting the trees, people that live there. The sea water damages peoples’ properties like cars, iron roofing of houses”.
OT	“The heat dries the grass”.
SN	“I hear some people gets diseases like cancer from the radiation”.
OT	“Yes there is also conjunctivitis from the dust and other diseases as well”.
SN	“Where we lived before our house was damaged by the tsunami. The wave came and caused the posts of our house to tilt. All our furniture were destroyed. We had a seawall but it was not really useful in blocking the sea. Now we have a siren to warn people in the future”.

1. The impacts of climate change experienced by surveyed residents.

i). Risks.

Those who were interviewed described both negative and positive impacts of these events on themselves and their families as listed in Table 6.2. The most frequently mentioned negative impacts seen in the first column of the table were damage to crops, houses and water sources and these had mainly occurred during cyclones. Since the 1950s additional risks had been experienced, such as loss of coastal land for crops and houses and reduced productivity of the land and marine areas.

a. Perceived significance of climate related risks.

The perceived significance of experienced climate related risks are given in Table 6.3. A closer examination of participants’ descriptions of impacts revealed that most perceived the significance of risks associated with hotter days and stronger damaging winds as generally ‘medium’⁴¹. Risks associated with sea level rise and shorter, heavier rainfalls were perceived to have had a ‘low to medium’ level of significance.

ii). Opportunities.

The majority of participants also discussed the opportunities associated with these changes, mainly instances of sharing and reciprocity between neighbouring families and easier ways of accessing food (see Table 6.2). The members of SFG01 recalled how there was a lot to eat during Cyclone Heta (2004) because the electricity went off and all the frozen foods had to be used. An elderly participant (SN002) laughed as he remembered his experience of the 1966 cyclone and how he had taken advantage of so many breadfruits and coconuts which had fallen due to the strong winds. He said,

⁴¹ These categories are explained in Chapter 4, Table 4.8, page 113.

“I remember the 1966 cyclone clearly. I was playing pool down in the coast (referring to the coastal part of the village) in the afternoon when the cyclone warning was announced on the radio. I didn’t pay much attention to it until the breadfruit tree outside the house fell (laughed). I came out and gathered some breadfruit then walked here (referring to the inland part of the village where he now lives). The wind was getting stronger as I was walking. There were many coconuts on the trail and some were falling as I was walking (laughed). Well I just went and prepared myself a yoke and carried them here. It was just as well because the minute my mother saw me she told me to go and prepare our evening meal (laughed). It took me a long time to light the fire because of the strong wind (laughed)” (October, 29, 2014).

B. Dimensions of climate change likely to be experienced.

Table 6.1 also lists climate related changes that surveyed residents perceived as likely to occur in the future. The findings revealed that most generally perceived a future climate situation that will be similar to what they are experiencing now. A slight difference is evident in the ranking of current and future sea level rise and shorter heavier rainfall as risks. This finding suggests that most participants perceived that shorter bursts of heavier rainfall is more likely to be experienced while sea level rise is less likely to be experienced. The main reason for this belief is because most respondents now reside in the inland parts of the village therefore they will be less likely to notice sea level rise.

Table 6.1: Current and possible future climate related changes frequently mentioned and emphasized by interviewed residents of Saanapu.

Changes that were experienced	Possible future climatic changes that were perceived to occur
1. Hotter days 2. Stronger damaging winds 3. Sea level rise 4. Shorter heavier rainfall	1. Hotter days 2. Stronger damaging winds 3. Shorter and heavier rainfall 4. Sea level rise

1. Likely impacts and their significance.

Table 6.2 enables a comparison of participants’ perceptions of the impacts of climate change they have experienced and those they ‘think’ are likely to occur. Changes in the ranking of certain impacts suggest slight variations in how participants imagine future climate scenarios compared to their current experiences. The loss of coastal lands and properties, which has been significant to the majority of participants, is perceived, by most, as likely to reduce in future. This is because most have now shifted inland. Reduced productivity of the land is perceived to be a major issue that would possibly occur in the future, together with damage to crops and other properties. The occurrence of new diseases and inadequate water supplies are perceived to have emerged as significant concerns in the next fifty years. There was an

outbreak of a new disease, ‘chikungunya’ at the time of the field survey, so this could explain why this was in the minds of people. The village’s alternative sources of water are located on the coast, which could be the main reason why they foresee water supply as being a challenge in the future. Possible opportunities that are likely to occur in the future would be newer ways to access food and other resources and stronger and diversified networks (see Table 6.2).

Table 6.2: Impacts of climate change frequently mentioned and emphasized by surveyed residents of Saanapu.

Current impacts Risks 1. Damage to properties 2. Loss of coastal land 3. Reduced productivity of the land 4. Diminishing marine resources Opportunities 1. Access to food and other resources 2. Stronger and diversified networks 3. Improvement in infrastructure	Perceived possible future impacts Risks 1. Reduced productivity of the land 2. Damage to properties 3. Occurrence of new diseases 4. Inadequate water 5. Loss of coastal land Opportunities 1. Access to food and other resources 2. Stronger and diversified networks
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Variations are also evident in how most participants’ perceive the significance of current versus future climate related risks. According to most, possible risks associated with hotter days and stronger damaging winds are perceived to have a ‘medium to high’ level of significance to the residents in the future. Risks associated with incidences of shorter heavier rainfall are perceived to remain ‘low to medium’, while those relating to sea level rise are mainly perceived to decrease in significance (see Table 6.3). As indicated earlier, the reason for this is because most of the inhabitants of the village have now shifted inland.

Table 6.3: Perceived significance of risks associated with current and possible future climatic related events by interviewed Saanapu residents.

Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days	Medium	Medium- High
2. Stronger damaging winds	Medium	Medium-High
3. Sea level rise	Low- Medium	Low
4. Shorter and heavier rainfall	Low- Medium	Low- Medium

6.2.5 Crises management system based on *faamatai* and its key coping strategies

A. Extended families: mobility, diversification and mental and spiritual strength.

1. Mobility

The extended family network and its communal ownership of resources (notably land) had made it easier for many residents to shift residence to the inland part of the village. As discussed earlier in this section, the inhabitants of Saanapu started shifting inland in the 1950s, with many more moving after the 1990s cyclones. Others moved after the 2009 tsunami. All of those interviewed had shifted to lands which were mostly designated for their plantations, so the transition had been smooth. An elderly woman (SN004) described how both her and her husband shifted inland in the 1970s because they wanted to develop their plantation in order to better support their family. There was already a lack of space in the coastal part of the village as there were too many people living there, but with very little land. She said,

“There was water both in the front and the back of where most people lived as the sea was in the front and the mangrove area at the back so there was no space for us to bring up our young children. We’ve always had our plantation here so we decided it’s best to come and live here and develop our plantation. There was a small open house here but it was not suitable for a family to live in so we built a slightly bigger one for ourselves. We had another small open house to prepare our food. We lived on the fruits of our plantation. We supplied the family in the coast with food, mainly taro and coconuts, and sold dried coconut at the Coconut Mill at Vaitele. My husband built an oven which baked the coconut kernels before they are packed and transported to the mill. We live next to the road here so it was easier to transport our products to sell in town. When the mill was closed we shifted to selling taro, taro leaves, coconut and vegetables at the market. When the taro blight came in the 1990s we shifted to bananas. We’re old now and our children have grown up so we don’t work as we used to...Our eldest son went overseas to work and sent remittances to help our family. Now all our children have grown up and some of them have gotten jobs in town while others help us with the plantation and other chores” (November 1, 2014).

2. Diversification

Diversification has also been important. The extended family network at Saanapu operates in the same way as in other villages with different members of the family carrying out a range of responsibilities to ensure reliable access to food, water and proper shelter. Most of those that were surveyed described how they have family members employed in town and overseas- and others cultivate plantations or catch fish to provide food for the family and at times would sell their products for money. Most also farm pigs and chickens and other families have cattle farms and shops. Many also stated that some females in their families

who were not working would weave traditional fine mats and sell these for money. Remittances from overseas relatives were another source of income that was mentioned by many residents. In the following quote SN004 talked about how her sons who were working abroad had provided the money to rebuild their home. They had also used materials from their old house to build an open *fale* [house] and extend their outdoor kitchen. She said,

“We completed building this house in 2004. Our sons who are working overseas sent us money to help build it. Our other house which was a closed wooden house was old and needed repair. That used to have two bedrooms and a sitting room. Now we have extended it and have used some materials from the old house to build our small open *fale* at the back as well as to extend our outdoor kitchen” (November 1, 2014).

Diversification was also evident in the way farmers talked about the cultivation of their plantations. Recently, there have been slight changes with most households reducing the use of weed-killer and planting multiple newer varieties of taro, bananas and seasonal vegetables which have become available in recent years. At the same time, most described that older methods such as mixed cropping (all sorts of plants in a plantation), weeding and piling dried leaves around the taro, are still very crucial to the planting process.

3. Mental and spiritual strength

Mental and spiritual activity has been important mainly for elderly residents with many stating that morning and evening prayers and church services on Sunday were part of their weekly routine. One of the elderly participants commented that when they first moved inland it had always been a goal to build a church, because this was a key aspect of their life when they were living on the coast. Their church was built in the 1980s. All of those interviewed attend church activities each week and are members of various church groups. According to most respondents, church activities had not only been a source of spiritual strength, but had provided mental support during difficult times.

B. Village groups and churches: managing the environment, diversification and developing mental and spiritual strength

1. Managing the environment

As in other villages, all Saanapu households are represented by their chiefs on the village council, which meets every month. There have been efforts by the village council to deal with issues of reduced productivity of the land and diminishing marine resources by establishing its mangrove conservation area and forest reserve. The reserve was established with assistance from the government and external agencies such as UNDP and GEF.

Additionally, the council had developed rules that prohibit the unsustainable use of mangroves, water sources and marine resources. For instance, destructive fishing methods, such as use of dynamite and *ava niu kini* (*Derris elliptica*), had been banned by the council. Another elderly male (SN002) commented,

“The village had always considered the sustainability of our resources very important but in recent years there have been instances where people have not heeded village rules so this is something everyone should consider. In the 1990s the government assisted our village in the establishment of our mangrove conservation area. We worked together with the government in setting up rules to manage this area. Since then, Saanapu had been responsible for the management of this area... The village has long banned some unsustainable fishing methods such as the use of dynamite and *ava niu kini* (*Derris elliptica*) for fishing. Some people grow *ava niu kini* in their plantations. They dig the roots of the crop, mix it with water and pour it on the sea. Soon you will see that part of the sea would be milky white, like coconut cream has been poured on the sea. And then you will see fish starting to pop up and float on the surface, dead. Even the small fish are dead. People take what they want and leave the rest. Dynamite has the same effect. Some people used to buy it from Apia for \$40. Other people would sell it in the village. Well! Well! Soon after the dynamite explodes you will see dead fish. Coral and small fish would also be killed... Another fishing technique that was also banned, for about 20 years now, is called *faamoa*. This method of fishing involves crushing certain parts of the reef while a fishing net lies await on the other side. Angelfish and damselfish living in the coral would escape in the direction of the net and therefore be trapped. In earlier days a big basket would be woven with coconut leaves and then coral would be placed in it. It's only angelfish and damselfish that would swim into other corals (laughs). They would shift from coral to coral until they get to the coral that are in the basket. The shift to nets has created problems because they are much bigger and people have then crushed larger areas of coral. In those days, people from Salamumu (nearby village) would come and practice *faamoa* on parts of our reefs all the way to Vaiee.... It's very easy to note these events going on because many canoes would be congregating in the sea. They would try and get away, but we see them” (October 29, 2014).

2. Diversification

The village council and women's committee, which also meet every month, had also been quite proactive in conducting inspections of plantations. The committee conducts inspections of food gardens and household amenities twice a year. It also holds weaving groups which produce fine mats for the government's annual *faalelegapepe* [public display of fine mats]. Some women share resources such as pandanus for weaving mats. The women's committee also played a role in the delivery of health programmes to village residents, with its committee house being the venue of government health programmes each week. The village's female government representative said,

“The nurses visit to conduct their clinics at the women’s committee house every Tuesday and Wednesday. The doctor visits every Thursday. If there are special visits then the doctor will tell me and I go to inform each family in the village. For example: vaccinations for children etc... The women’s committee house and hospital are open from Tuesday to Friday and close on Monday. Used every Thursday for dispensary facilities, such as pharmaceuticals, visiting dentists, optometrists and other specialists...” (SN003, November 3, 2014).

3. Developing mental and spiritual strength.

Most residents agree that the supportive role of churches has been very useful during events such as cyclones and the 2009 tsunami. The majority of people belong to a church and are members of various church groupings such as church committees, choir and youth committee, Sunday school teachers’ group and Sunday school. These groups provide assistance to members facing hardship. Earlier in this section SN001 talked about how during and after Cyclone Heta and Cyclone Evan, those whose houses were destroyed had sought shelter at their house or in the church.

C. Assistance from the government and external agencies: managing the environment, disaster relief, infrastructural development and diversification

As evident in other coastal villages, the government had provided assistance in terms of providing piped water supply, electricity and roads. It also helped the village council in establishing the village’s mangrove and forest conservation areas. After the 2009 tsunami, the government rebuilt the village seawall, with assistance from foreign donors, as well as the homes of a few families which had been destroyed. Disaster relief assistance was provided after the 1990s cyclones and after the tsunami. Other assistance includes the provision of health clinics and weaving programmes, as previously stated.

6.2.6 Preparing for possible future climate changes

Most participants suggested that the majority of current coping strategies would also be relevant to endure future climate change. Strengthening networks of family and village remains the most important strategy. Both elderly and young participants also emphasized the importance of families diversifying livelihoods and developing behaviour of preparedness. Like those interviewed in other villages, many insisted that the village council needs to be more proactive in its role of managing vital resources such as forested areas and water sources. The council could also encourage diversification by conducting regular inspections of plantations and village hygiene (see Box 6.4). Only two people mentioned mobility, because they still lived on the coastal part of the village. Younger residents stated

that some new methods and ways of doing things could be helpful in the future. For example, wearing cooler clothes, installing fans, and using rubbish trucks for inorganic waste disposal.

Box 6.4: Excerpt of a focus group discussion with youth at Saanapu (SFG01, November 6, 2014).

Moderator: “Can you talk about strategies that might help you cope with the future impacts of climate change?”

- AN “Well, reducing the burning of rubbish could be one way to ‘reduce the greenhouse effect’ (said in English). We must help ‘reduce carbon dioxide, methane’” (said in English).
- VL “Yeah, there were government programmes that were held in our village that could also help. There was a programme by the Ministry of Health and a ‘reforestation programme’ (said in English) which encouraged the planting of trees”.
- PE “Yes, these were held at the district college and also at the church hall”.
- VL “Mmm...”
- TE “mmm” (and nods in agreement).
- AN “Another way is to plant trees, big shady trees that can cover the land and offer shade”.
- PE “Or do small things like drink water and find places that are cool to rest”.
- VL “The village council should also reinforce penalties for people who cut the forests. At this time the council does not really monitor and enforce punishments. Most people do whatever suits them”.
- PE “It’s true that there is some form of monitoring, but it was not like before when people were more careful”.
- AN “People should plant more trees because trees give out ‘oxygen’” (said in English).
- TE “Mmm, this is where people get cool air”.
- AN “Remember it’s also ‘oxygen’ (said in English) that greatly helps protect the ‘atmosphere’ (said in English) from the burning heat of the sun”.
- PE “People must also prepare for cyclones, nail shutters on windows of houses, stock up on food...”
- VL “Yes, harvest root crops and stock these”.
- PE “The piped water supply is usually off during cyclones so people need to collect and conserve water. Fill containers and drums with water and save these”.
- TE “We must also prepare alternative sources of light. Kerosene lamps, cyclone lamps, candles, torches because the power supply could be disrupted. The gas should be filled for the gas ovens in order to prepare food. Also kerosene and coal ovens would also come in handy”.
- VL “The ‘advertisements’ (said in English) on the television and radio would also be important because they remind people of things to prepare for in the event of a cyclone. They also warn people that a cyclone is coming”.
- PE “There should be more cooperation between the council and other village groupings. There should be more talking. There should be consensus decision making where people talk and discuss things that could benefit the village. Different people in the village should be present in these discussions and voice their opinions. Opinions of elders, elderly people, chiefs, untitled men or the strength of the village”.
- AN “The young people, youth should also be present. And women too”.
- VL “Yes I agree. This is important because at this time, there is a lack of cooperation between these groupings. It is an important thing to do in order for everyone to work together...”
- PE “There should be more village inspections and monitoring of resource use in the village. This would encourage families to grow food crops, develop their families and maintain cleanliness and hygiene. The village council and women’s committees do these now, maybe once a year, but maybe these should done twice or three times a year”.

6.2.7 Summary of findings from Saanapu.

The majority of residents interviewed at Saanapu showed a good awareness of climate related changes such as hotter days, stronger damaging winds, sea level rise and shorter heavier rainfall, and had experienced related risks and opportunities. All agreed that the latter are likely to continue in the future, but most perceived that risks associated with sea level rise would be lower in the future as they had shifted inland. Risks relating to hotter days and stronger damaging winds are perceived as likely to be more significant in the future.

Faamatai networks of family, village and church groups had been especially important in the inland relocation of Saanapu residents and the development of their families. Similar to other villages, Saanapu's experience of Cyclones Ofa and Val in the 1990s and the 2009 tsunami had accelerated the shift of people inland. Communal ownership of lands has also enabled a smooth transition for many, from their coastal lands to inland areas which were mainly used for plantations. Remittances from family members working overseas and in Apia have enabled most to build houses, while others provided food by working the land and fishing. Village, church groups and government have also provided support when necessary. Many participants suggested that all residents have a role to play in preparing for future climate change.

6.3 Maagiagi

6.3.1 The village

Maagiagi is located on the southeastern side of the Apia Urban Area (AUA). The village is in two parts: the main settlement, informally named Aukilani, is more densely settled and squeezed onto the edge of a steep escarpment overlooking the Vaisigano river valley; and the lower valley settlement lies along the banks of the Vaisigano River, and is known as Ueligitone (Vaovai ma Vaitai) (Government of Samoa and CIM Plan Committee for Vaimauga i Sisifo District, 2007) (see Figure 6.2). There is limited physical access to Ueligitone, being either by a footpath alongside the Latter Day Saints (LDS) church, or by a road from Vailima to the west. In Ueligitone, water pipes run the length of the river valley, dividing the area in two. Another pipeline runs from the inland part of Aukilani and then connects to the lower pipeline in Ueligitone. Tracks for vehicles run along the pipeline routes. Its location in the Vaisigano River valley makes Ueligitone prone to flooding (Government of Samoa and CIM Plan Committee for Vaimauga i Sisifo District, 2007). Many houses were damaged and lives lost in a flash flood during Cyclone Evan in 2012 (Government of Samoa, 2013).

Maagiagi is part of the traditional village which includes the coastal villages of Moataa and Vaiala. During the first half of the twentieth century, land at Maagiagi was mainly used by Moataa and Vaiala residents to cultivate plantations. In the latter half of the twentieth century, families who were cultivating in the area started building permanent residences there. The village has grown as more people from Vaiala and Moataa have shifted into the area. In the past two decades, other people who were not from Moataa and Vaiala, and therefore do not have traditional connections to the land, have shifted into the village and settled in the lower part of the village known as Ueligitone (see Figure 6.2). Maagiagi's population was 948 in 1961 (Samoa Bureau of Statistics, 2016), but by 2011 it had more than doubled with 2128 people now residing in the village (Samoa Bureau of Statistics, 2011).

Much of the village is customary land with some parts containing three hydro-power stations and water intakes now owned by the government. Customary lands were jointly governed by the village councils of Moataa and Vaiala, but are now managed by the Maagiagi village council, which has been operating autonomously since the 1990s. In 1921 and 1929, parts of Maagiagi were acquired by the New Zealand colonial administration for the development of hydro-electric power. The Alaoa hydro-power station was built in 1949. Two more hydro-power stations, Samasoni and Fale o le Fee, were built between 1979 and 1982 (Electric

Power Corporation (EPC), 2013). In addition to these, a number of water intakes, such as the reservoir and water treatment plant at Alaoa, exist and are operated by the Samoa Water Authority (SWA) to cater for water supply for the AUA (see Figure 6.2).

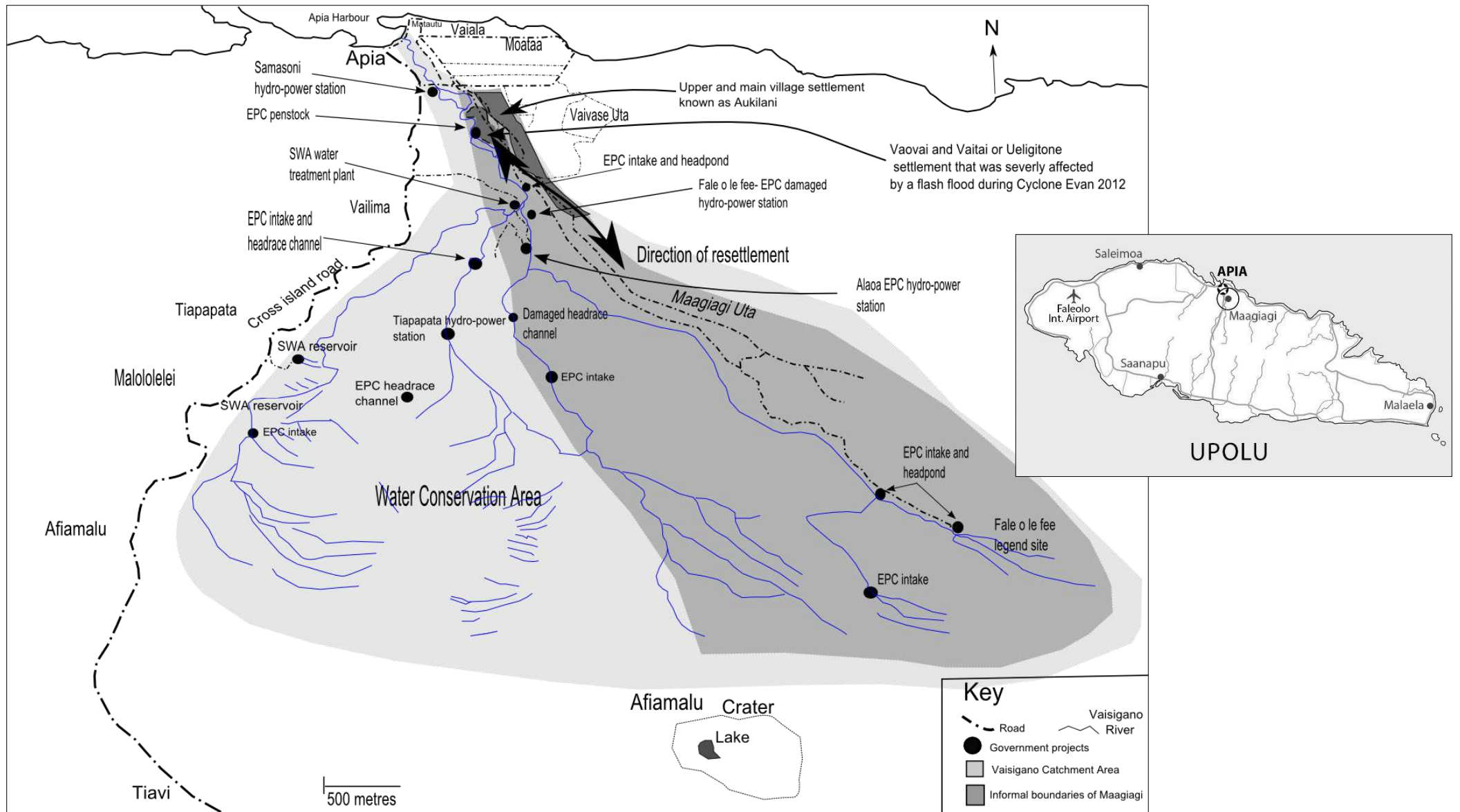
The majority of Maagiagi residents have been receiving free water, as most parts of the country did until the early 2000s, when the SWA introduced water meters. In addition, it was the only village receiving free electricity between 1997 and 2012. The installations of water meters went smoothly, but the government's announcement in 2012 that residents should install cash power meters and start paying for electricity, sparked resistance from many residents and created a dispute between the government and the village council (see Appendix 4). When I visited Maagiagi in 2014, water meters had been installed for the majority of those living in Aukilani. A few families in Aukilani, and the whole of the Ueligitone area source unmetered water from the Vaisigano River through pipes that supply water to the hydro-electricity stations and the wider AUA. In addition, all residents had installed cash power meters and were paying for electricity. The village's economy is a mixture of commercial and subsistence activities. Family income is mainly earned from jobs in businesses and schools in the urban area, from selling food and other primary produce, and remittances from relatives living abroad.

6.3.2 Summary of research carried out at this village.

Nine key informant interviews and three focus groups were held at this village (see Box 6.5). Field observations of the village were carried out by driving and walking with a few members of the village.

6.3.3 General environmental issues.

Inadequate water and damage to properties are the main challenges faced by residents of this village. These were mainly caused by cyclones such as Cyclone Ofa in 1990, Cyclone Val in 1991 Cyclone Evan in 2012 which most participants attributed to climate change. Non climate related changes, such as the 1993 taro blight, also damaged crops. Other factors that have contributed to inadequate water supply have been the increased clearance of lands for settlements and cattle farms, poor village governance of water supply and disputes between the council and the government (see Appendix 4).



Box 6.5: Details of study participants from Maagiagi.

<u>Interviewees</u> 75 year old male (MG001) Family- mother, grandmother (widow) Village- member of the women's committee Church- Jehovah's witness preacher, translator Skills- retired teacher 70 year old male (MG002) Family- father Village- untitled man Church- deacon Skills- retired security guard, farmer (plantation, pigs, chickens) 68 year old female (MG003) Family- mother and grandmother Village- member of the women's committee Church- member of the congregation Skills- caregiver 55 year old male (MG004) Family- father Village- member of the untitled men's group Church- church member (Jehovah's witness) Skills- audio visual technician, farmer (plantation) 54 year old male (MG005) Family- chief, father Village- member of the village council Church- pastor of the Latter Day Saints Church Skills- security guard, farmer (vegetables, chicken) 43 year old female (MG006) Family- wife of a Maagiagi man Church- leader of the church women's committee (LDS) Skills- caregiver	41 year old male (MG007) Family- husband of a Maagiagi woman Church- member of the LDS church Skills- cleaner and gardener 37 year old male (MG008) Family- single male Village- member of the untitled men's group Church- member of the church youth Skills- security guard, farmer (plantation) 31 year old female (MG009) Family- mother Church- member of the women's committee Village- member of the women's committee Skills- secretary <u>Focus group participants</u> Focus group 1 (MFG01) • 2 females and 3 males • Age- late 30s to early 40s • All are members of the Latter Day Saints church Focus group 2 (MFG02) • 2 males and 2 females • Age- early 30s to mid 40s • All are employed in the private sector Focus group 3 (MFG03) • 2 males and 3 females • Age- late teens to mid 20s • 3 attend high school and 3 are University students
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6.3.4 Perceptions of climate change

A. Dimensions of climate change experienced by surveyed residents.

Hotter days and longer dry spells and stronger damaging winds were the most frequent and emphasized climate related changes suggested by most interviewed residents at this site (see Table 6.4). Most surveyed residents implied that, in the past twenty years, the days had become hotter. Some of the phrases used to describe the heat were:

i) *Ua ese mamao le vevela pe a faatusatusa i aso la...ua matua tele le vevela*
translated

as ‘the heat is very different compared to previous times...the heat is greater’.

ii) *Ua ta mu i le vevela* translated as ‘The heat burns’.

iii) *Ua amata ona ila tagata i le la* translated as ‘People can feel or are hurt by the heat’. The word *ila* means being affected by pain or ‘be hurt by’.

In addition, there have been stronger and more damaging winds and cyclones, as well as shorter and heavier bursts of rainfall which many suggested were part of the changing climate that they are experiencing. Particular events that were mentioned by the participants as being significant were Cyclone Ofa in 1990, Cyclone Val in 1991 and Cyclone Evan in 2012.

1. The impacts of climate change experienced by surveyed residents.

These participants’ descriptions of the current impacts of climate change suggested both risks and opportunities as was also evident in the comments of those surveyed in the other study sites.

i). Risks

As listed on Table 6.5, the majority of those interviewed identified inadequate water supply and damage to crops and houses as risks associated with recent climatic changes. When interviewed, most Maagiagi residents implied that, in the past twenty years, global warming had both directly and indirectly led to a worsening in the quality and reliability of their water supply. Slightly hotter and longer dry seasons had contributed to diminishing water supplies because of evaporation in the Vaisigano Catchment Area (see Figure 6.2)⁴². Consequently, Maagiagi’s tap water supply which had been the village’s sole source of water had become increasingly unreliable and dirty in the past few decades. Informants born in the village commented that tap water used to be cold and fast-flowing, but in the past ten years it had become very warm and the flow from the taps was either slow or non-existent. Words such as ‘dead taps’, ‘hot, warm water’, ‘dirty water’ and ‘water rationing’ were frequent in most of the responses. These were further supported by the words of those who had married into the village in the 1980s and 1990s. For example, in the following excerpt (see Box 6.6), the individuals SM and TS placed emphasis on certain words and phrases such as ‘flows very fast’ to ‘dead’ and ‘very very warm now’, which denote the lower quality of the water now, compared with when they came to the village. PK stated that the village tries to ration water

⁴² The Vaisigano Catchment Area is one of only two water catchment areas providing water and electricity for the Apia Urban Area (AUA).

during the dry season because of ‘reduced supplies from inland’. The participants’ statements which indicated the causes of the problem included ‘intense heat’, ‘reduced supply of water from inland’, rationing supplies and ‘climate change’, which can both be directly and indirectly related to global warming.

Box 6.6: Excerpt from a focus group discussion conducted at Maagiagi (MFG02, October 5, 2014).

SM: “The way that I see this, because I arrived in this village in 1992, and, I saw, there have been many changes. The first change that I want to talk about is water. At the time that I first arrived, the taps were fast (emphasized). The tap water flowed all the time all the time (emphasized). The water flowed very fast (emphasized). But this time the tap is mostly dead (emphasized), dead (emphasized), the taps are dead (emphasized)... Most of the time they are dead and no one knows the cause of this. That is the most serious change that I have experienced from when I first came to this village in 1992 till now, 2014. The tap would be off from the morning. Well, like today, I went home, my children said that there was no tap water from the morning, but the tap was on when we left for work at 8am. So the tap must have been off after that time until I went home at 3pm today and until I left to come here at 5pm”.

PK: “Well, my view is kind of similar. Well this sort of thing, because SM has said, it is caused by the water. The thing is, our village at this time is trying to ration our water. There is hardly any water as well. So what happens is, the tap water is turned off for one part of the village and the other part would receive water. It’s like they alternate... this happens particularly during the dry season, when we are at the dry season, when there would be a reduced supply of water from inland”.

SM: “Our water is not metred”.

PK: “Our water is not metred. The chiefs of the village are the ones that control and manage our water supply...well the village is quite big (did not finish)”.

SM: “Yeah, well when the rain is heavy then the taps would come alive and there would be no shortage of water, but when the heat is intense then (did not finish)”.

PK: “Well, you can easily tell. The water comes from sources inland. This is an issue that is currently being discussed between the government and us. I am uncertain whether other villages are getting water from our water sources, but I am sure our village is getting water from there. Our village manages this water supply”.

TS: “Another thing, the water that we are talking about. When I used to shower from the taps of Maagiagi in those days, in addition to getting a skull fracture, the water is really icy cold”.

PK: “Oh it used to be very cold (raises voice)”.

TS: “But at this time, even if one takes a shower close to midnight, it is like the taps of other villages, they have become very warm (emphasized)”.

SM: “Very very warm now (said it the same time as TS)”.

TS: “But in those days I put my hand in first to test the water, and it would be very cold and fast. But now, as PK and my sister SM said, that is a change that we have experienced as a result of changes in the climate. There have been great changes (emphasized)”.

A personal visit to the water sources at Maagiagi in November 2014 verified the participants’ comments. Even though my visit was during the rainy season, water levels in streams and reservoirs were low (see Figure 6.3). According to the residents who accompanied me to these sites, most streams would normally be fast-flowing in November, but in recent years this had not been the case.



Figure 6.3: The diminishing store of water is evident in the Afiamalu crater lake located close to Maagiagi (Source: after Google Earth, 2015).

The duration of heavy rainfall in recent years has also impacted on water quality. In 2012, heavy rainfall during Cyclone Evan caused landslides and damaged government-owned pipes and reservoirs at Maagiagi. This led to flash flooding on December 13 that destroyed populated parts of Ueligitone and nearby areas along the Vaisigano River (see Figure 6.2). A 70 year old untitled man, whose home and property were damaged in the cyclone, described the intensity of water flow in the river and pipes, and the impacts on home and properties. He said,

“The winds were blowing from the south and it seemed to blow the waters from the upper part of the village down here. The normal route of the river could not contain the huge amount of water so it flooded this area. The big water pipes that run in front of our house had also burst and water flowed from there to here. Water was flooding the house from both the front and back. Water from the cliff had flooded the back of

our house before, but this was the first time we had seen water rushing from the front of the house and started rising upwards to about 1.5 metres. It was muddy and filled with huge logs from uprooted trees and other debris. We fled to the houses located up there (he pointed to houses located up the cliff). Nothing was safe except parts of our house. All our belongings were swept away- furniture, clothes...our chickens were swept away and our banana plantation was gone” (MG002, October 6, 2014).

a. Perceived significance of climate related risks

As shown on Table 6.6, the participants’ descriptions of the risks associated with hotter days, longer dry spells and stronger damaging winds suggested all of the changes have had a ‘medium’⁴³ impact on their lives.

ii). Opportunities

Climate change impacts which were considered positive, by the surveyed participants are also listed in Table 6.5. A few elderly respondents described opportunities associated with the 2012 flash flood, such as fresh soil deposits, which enabled the growth of crops near their homes. Also the availability of housing assistance from some churches in the village has helped some rebuild and/ or improve the quality of their homes. Many perceived the current risks they are experiencing will continue into the future. Some were concerned that the productivity of the land may reduce in the future, particularly during the dry season when the land would be hotter and therefore drier.

B. Dimensions of climate change likely to be experienced

As evident in the second column of Table 6.4, the majority of interviewed residents suggested that the climate changes they are experiencing now would continue to occur in the future. The temperature would continue to rise, causing greater incidences of hotter days, as well as unpredictable and stronger cyclonic winds.

Table 6.4: Current and future climate related changes frequently mentioned and emphasized by interviewed Maagiagi residents.

Changes that were experienced 1. Hotter days and longer dry spells 2. Stronger damaging winds	Future changes that were perceived to occur 1. Hotter days and longer dry spells 2. Stronger damaging winds
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1. Likely impacts and their significance

As shown in Table 6.5, there was a small change evident in the participants’ perceptions of future impacts of climate change compared to the current impacts they are experiencing. An

⁴³ These categories are explained in Table 4.7, page 112.

additional risk that most identified would be reduced productivity of the land due to the likely increase in temperature. The current risks they are experiencing such as inadequate water and damage to properties will also continue into the future (see Table 6.5). Opportunities such as access to food and stronger networks were also perceived to continue in the future (see Table 6.5).

Table 6.5: Impacts of climate change frequently mentioned and emphasized by interviewed Maagiagi residents.	
Current impacts Risks 1. Inadequate water 2. Damage to properties Opportunities 1. Access to food and other resources 2. Stronger and diversified networks	Perceived impacts Risks 1. Inadequate water 2. Damage to properties 3. Reduced productivity of the land Opportunities 1. Access to food and other resources 2. Stronger and diversified networks

Table 6.6 shows a shift in the perceived significance of risks associated with hotter days, longer dry spells and stronger damaging winds. Most perceived the significance of risks associated with hotter days and longer dry spells as well as stronger damaging winds to increase from ‘medium’ to ‘medium high’⁴⁴ in the future.

Table 6.6: Perceived significance of risks associated with current and future climatic related events from surveyed Maagiagi residents.		
Climate- related events	Significance of risks associated with current events	Significance of risks associated with future events
1. Hotter days and longer dry spells	Medium	Medium-High
2. Stronger damaging winds	Medium	Medium- High

6.3.5 Crises management system based on *faamatai* and its key coping strategies

A. Extended families: diversification

1. Diversification

Diversifying sources of water has been evident at the extended family level and water has become a significant component of the household budget. In addition to inadequate piped water supplied by the government, some families have installed their own water tanks (see Figure 6.4), while others have purchased or hired water cooling machines from companies in Apia. Some had been drawing water from parts of the Vaisigano River which resumed flow

⁴⁴ These categories are explained in Table 4.8, page 113.

after Cyclone Evan. Other informants stated that they often visited their relatives in neighbouring villages, or in other parts of the village, to bathe and fill their containers.



Figure 6.4: A family- owned water tank at Maagiagi.

Many interviewed residents commented that the collection and storage of water have become significant aspects of daily life. Remembering when tap water will flow has also become very important. In Box 6.6, the individual SM, who is a middle aged woman, mentioned checking with her children if and when the tap had been on during her absence from home. This was to help her determine when there would be water supply. Knowing that there was no water supply during the day meant that she had to collect and store water when flow resumed at night, so there would be sufficient water during the following day for her and her family. The majority of informants stated that at times when the tap was on, or when it rained, they would fill any container that could hold water: bath-tubs, soft drink containers, buckets, bottles, gallons, jars and the like (see Figure 6.5).

In terms of usage, there had been a marked change in the way water is used since people became aware of the impact of global warming on water supplies in Samoa. Most acknowledged that they had taken water for granted when it was abundant, but now see it as a valuable resource. For example, most participants indicated that in their households, one person would usually use one bucket of water to shower. Water used for washing clothes and dishes is saved and used for the toilet.



Figure 6.5: One family is using the bath-tub to hold water for household use.

B. Village groups and churches: diversification and disaster relief

1. Diversification

Village and church groupings, such as women's committees, youth groups and untitled men's clubs have become important networks for many residents to mobilise assistance and resources when needed. Some of these networks have also helped some families to improve their homes, develop plantations and secure alternative sources of income and food.

During cyclones, the Red Cross and the Latter Day Saints church have provided emergency assistance such as food, medicine and housing materials. Church buildings are shelters for many during cyclones. Additionally, the LDS church had built water tanks, which were used by many of those interviewed, during times of water scarcity (see Figure 6.6).



Figure 6.6: Water tanks at the Latter Day Saints church compound at Maagiagi.

C. Assistance from the government and external agencies: managing the environment and infrastructural development

There is also little evidence of government efforts to specifically improve Maagiagi's water supply, or provide assistance towards establishing a secondary water source for the village within the water catchment area. However, the government had tried to improve the water supply for the wider AUA which includes Maagiagi by reducing water wastage through the establishment of water meters. A report by the SWA stated that in addition to pipe leaks, high consumption rates in non-metered areas such as Maagiagi was a significant contributor to a high level of Unaccounted For Water (UFW) (Samoa Water Authority (SWA), 2005). A household study conducted by Tauaa (2008) revealed that there was a high consumption rate of water in many Maagiagi households. A household of five people could consume up to 500 litres a day, which is considered high by developed countries' standards. Many people took more than 15 minutes to shower and some would be engaged in washing or bathing young children which can take up to 30 minutes. During this time the tap is continuously running implying water wastage. In addition, there were other reports of Maagiagi residents taking increasing advantage of free electricity. Many households and churches had installed air conditioners while others had established businesses such as laundromats, shops and water and ice suppliers, which consume large amounts of water and electricity. The installation of cash power and water meters was part of government's actions to manage and control direct

and indirect water use, and involved strategies designed to cope with environmental changes that were affecting water quality and to ensure supplies of good quality water for all.

The progress of government efforts to improve its water treatment, storage facilities and pipelines at Alaoa were disrupted by flooding events such as Cyclone Evan 2012, the lack of available funding⁴⁵ and scant cooperation from those living at Maagiagi. However, much recovery work has been done since then. The government has started rebuilding the water treatment facility at Samasoni, which was destroyed by Cyclone Evan that supplies water to most Maagiagi households and the wider AUA. In 2014, chlorination facilities were installed in the water treatment plants at Fuluasou, Alaoa and Malololelei to improve the quality of water supply.

In addition, forest reserves have been established in the area surrounding the SWA reservoir and hydropower station at Alaoa. Government clean-up activities have been undertaken to improve the state of parts of the Vaisigano catchment area. Also, awareness programmes, mainly through the media, have been conducted to raise public awareness of the importance of preserving water catchment areas. However, most of these efforts have been challenged due to unsustainable clearance activities happening upstream (Baisyet, 1990; SWA, 2005; Tauaa, 2008).

6.3.6 Preparing for possible future climate changes

Ensuring adequate water supply is the most pressing concern for most residents interviewed and efforts to conserve and recycle water developed at the household level would be useful strategies for the future. Similarly, water tanks provided by churches would continue to help most residents. However, many suggest that improving the role of the village council and connections between Maagiagi village and government are most crucial to preparations for future climate related risks. The village council needs to work together with the government to resolve land-related issues and negotiate alternative water supplies for the village. I found little, if any, evidence of village-based strategies to improve water supply or develop a secondary source of water for residents. While government sources (EPC, 2013) stated that

⁴⁵ Much of the financial assistance received after Cyclone Evan has been directed towards rebuilding hydropower stations rather than the water pipeline and storage systems. In November 2013, the Asian Development Bank (ADB) announced that it will be providing US\$23.8M to rehabilitate three small hydropower plants on the island of Upolu- Samasoni 1.9MW, Fale ole fee 1.7MW and the 1MW Alaoa (ADB, 2014).

the residents have always been allowed access to water in the Vaisigano catchment area, the village council had formally applied to government for assistance to reserve part of the catchment as an alternative water source for the village. In addition, there is an absence of village efforts to establish forest reserves to protect water catchment areas. For example, there were no village rules regulating unsustainable farming and cultivating methods especially in water catchment areas, even though studies (Baisyet, 1990; Tauaa, 2008) have stated that tree felling, and clearance for agriculture and farming were commonly practised by customary landowners on land within the catchment area. The village's Coastal Infrastructural Management Plan (2007) noted that the village's water supply is unreliable and often polluted during flooding and that there was no secondary source of water. The solutions proposed in the CIM document proposed the installation of water tanks and use of water delivery trucks by residents living in areas with unreliable access to water (Government of Samoa and CIM Plan Committee for Vaimauga i Sisifo District, 2007). When I visited in 2014, none of these solutions had been implemented by the village council. There were no plans for the installation of village water tanks or use of water delivery trucks. The majority of those interviewed stated that both options were expensive and they could not afford them.

A number of residents suggested that there is a lack of capacity at the village council level to manage their piped water supply. Non-metered pipelines, which most stated are managed by the village council, are not formally recognized by the government because they have not been registered under the country's Independent Water Scheme (IWS), suggesting these pipelines are being operated informally. These residents also suggested that the village council has no systematic way of rationing the water supply, nor rules and related penalties that prevented people from tampering with the pipelines. Similar issues have occurred in relation to the government owned pipelines. Maagiagi people had tampered with the pipeline and had caused disruptions to the tap water supply of other parts of Maagiagi, as well as neighbouring villages (pers.comm., AM, 2014).

6.3.7 Summary of findings from Maagiagi

Maagiagi residents who were surveyed also demonstrated a good awareness of climate related changes, especially hotter days and longer dry spells and stronger damaging winds. Facing inadequate water supply had made residents more sensitive to hotter days and longer dry spells and stronger damaging winds and their impacts. In contrast to the other study sites, Maagiagi is unique in the sense that it demonstrates the increasing challenge of inadequate water faced by residents of villages located in the Apia Urban Area (AUA) due to the

combination of climate-related changes, urbanization and loss of rights to village resources. The village is located within a major water catchment area in Upolu but its residents face inadequate water because the government now uses the village's water sources to feed the growing AUA. These experiences have caused many to reconsider their use of water, whereby at the household level families are prioritising water in their household budgets and developing alternative ways to source and conserve water. Local churches are also providing water tanks which many residents had been accessing especially during challenging times.

A key finding which had emerged is the urgent need for the Maagiagi village council to improve and find alternative water sources for village residents. Crucial parts of this process include improving governance of the village and its resources, implementing efforts to sustainably manage water catchment areas within village boundaries, resolving differences with the government, and negotiating access to government owned water sources, seeking funding or water tanks from local organizations and external agencies.

6.4: Sili

6.4.1 The village

Sili lies on the banks of Sili river (see Figure 6.7) which is located in the south of Savaii. The river is fed from inland streams that all meet at Sili and end in a waterfall that flows straight into the sea. The settlement is split on the two sides of the river where flat land is available. The majority of the village households initially settled the western side of the river, however, there are now more houses and church buildings found on the eastern side. On this side, the road has been tar-sealed and connects the village to the island's main south road. Another access road on the eastern end connects Sili to the coastal village of Puleia. The access road which connects the western side of the village to Gautavai (on the coast) is in poor condition. During cyclones and heavy rain Sili river floods over its banks and into Sili, Gautavai and Puleia affecting many houses and plantations. The river crossings and bridges have all been destroyed by floods, including a ford that was built early in 2006 (Government of Samoa and CIM Plan Committee for Palauli le Falefa District, 2007).



Figure 6.7: Children playing in the main river crossing at Sili.

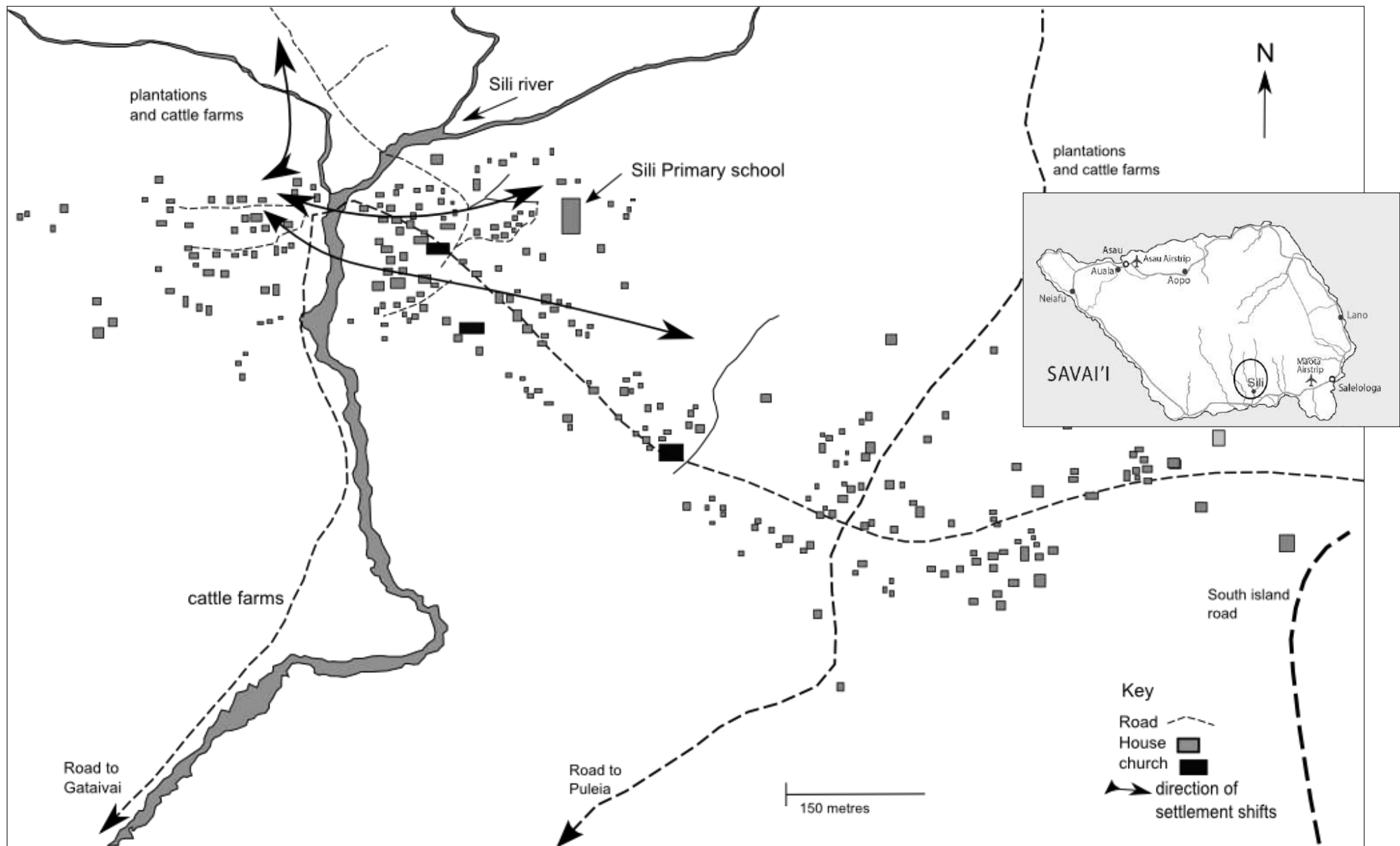


Figure 6.8: A map showing the Sili river and its tributaries as well as the extent of human activity on the geography of the area (Source: after Google Earth, 2016).

The population of Sili has more than doubled from 433 in 1961 (Samoa Bureau of Statistics, 2016) to 1099 in 2011 (Samoa Bureau of Statistics, 2011). The village has five different churches and is the largest settlement in the district. The village water supply is independently managed by the village with assistance from the European Union through the government's Independent Water Scheme (IWS). Members of the village are trained by IWS to maintain the pipelines, while the village pays these people through water payments from families (pers. comm., ST, 2014). There are also electricity and telephone connections. Agriculture, livestock and prawn fishing, as well as other employment and remittances provide income and sustain the lives of the villagers.

6.4.2 Summary of research carried out at this village.

As shown on Box 6.7, eight key informant interviews and two focus groups were discussed at this site. Field walks and drives to the inland parts of the village were also conducted with the village's government representative.

Box 6.7: Details of study participants from Sili.

<u>Interviewees</u> 75 year old female (SI001) Family- mother, grandmother Village- member of the women's committee Church- member of the women's committee Skills- midwife, traditional healer, farmer (vegetables, chickens) 74 year old male (SI002) Family- chief, father and grandfather Village- member of the council Church- deacon Skills- farmer (plantation, pigs, chickens) 65 year old male (SI003) Family- chief, father and grandfather Village- member of the village council committee, government representative Church- deacon Skills- shop-owner, farmer (plantation, pigs, chickens) 61 year old female (SI004) Family- mother and grandmother Village- member of the women's committee Church- member of the women's committee Skills- traditional weaver, farmer (vegetables, chicken, pandanus) 50 year old female (SI005) Family- mother Village- member of the women's committee Church- member of the women's committee Skills- teacher	49 year old female (SI006) Family- mother Village- member of the women's committee Church- church member, member of the women's committee Skills- weaver, farmer (vegetables, chicken) 47 year old male (SI007) Family- father, chief Village- member of the village council Church- member of the church youth committee Skills- farmer (plantation, pigs, chicken) 41 year old male (SI008) Family- father Church- member of the church Skills- truck-driver, farmer (plantation, pigs, chicken) <u>Focus group participants</u> Focus group 1 (SIFG01) Late teens to early 20s 2 males and 2 females All are attending higher education and members of the youth Focus group 2 (SIFG02) All are between 20-30 years old 2 males and 2 females All are employed in nearby businesses
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6.4.3 General environmental issues.

Damage to properties and pests (African snail and invasive weeds) has been the main challenges faced by Sili. All of those interviewed referred to Cyclones Ofa and Val as the most destructive cyclones out of all the cyclones they had experienced, and attributed these changes to climate change. Most of those interviewed at Sili also identified changes associated with human activities as contributing factors; for example, clearance of lands and forested areas for settlements, agriculture and cattle farming.

6.4.4 Perceptions of climate change

A. Dimensions of climate change experienced by surveyed residents.

In contrast to the other sites, the majority of participants from Sili did not spend much time talking about dry spells. Most associated dry spells with other parts of Samoa. Shorter heavier bursts of rainfall and stronger damaging winds were the two main climate-related changes mentioned by most Sili residents who were interviewed (see Table 6.7). Most regarded the latter events not as isolated phenomena, but as part of climate change. A 65 year old male (SI003) said,

“There is a great change in these days...the rain that is now occurring aye, the rain is getting heavier. Here in our village, you see the sun in say, at most, one or two days of the week. But when the rain falls, well, this is what it is like, rain, heavily (started to rain heavily during the interview). Normally it would be hot and dry in other parts of the country but it would be raining here...you know the dry spells that recently affected other parts of the country? Our village did not experience that. It rains frequently here in this village. It mostly rains. It is difficult to dry things because of the rain. The women are often frustrated because they spread their pandanus leaves outside to dry but they end up being mouldy from the constant rain (laughs out loud). When I visited the other villages, it would be hot and sunny there but it was raining when I left here...But, yes, things that are broadcasted on the TV. The impacts that are starting to affect us, because of those nuclear things, poisonous things by some countries are being mentioned, a? It is like these things are causing the changes, and they have thinned the air/ atmosphere up in (did not finish). That is beginning to create problems for us” (October 25, 2014).

1. The impacts of climate change experienced by surveyed residents.

i). Risks

Those interviewed at Sili mentioned that damage to properties was the main risk associated with climate change (see Table 6.8). The destruction of homes and food crops associated with Cyclones Ofa and Val was frequently mentioned. The churches and homes of residents which were mostly located on the western side of the river were destroyed by flooding during these cyclones. An elderly chief (SI002) of the village said,

“Most of our village lived on the other (western) side of the river before the 1990s. Our church was located there also. After the 1990s cyclones many families started to shift here (eastern side) and further inland...oh the river bursted and the water flowed right into our houses, flooding and washing away most of our things. And the wind blew many roofs of houses off...Our food crops were fine because while the top parts of taro were flattened, the taro was safe underground. Only the breadfruits, bananas and giant taro were affected. Our village had a tourist project at the time Cyclone Val hit. We built open fale (houses) on the river bank. This line of open fale were all blown into the river when the winds shifted after the eye of the cyclone passed...” (October 24, 2014).

Most participants pointed out the appearance of new pests as another risk. This was not mentioned by those interviewed in other sites. According to interviewed Sili residents, pests have affected food gardens and plantations in particular, the African snail which tends to multiply especially after rainfall. Other challenges included the arrival of the taro blight in 1994, shortly after the cyclones, which completely destroyed their taro plantations. Further, they mentioned invasive species of weeds like *tuise* [*Kyllinga polyphylla*], *fue lautetele* [*Merremia peltata*] and the *fuesaina* [mile-a- minute or *Mikania micrantha*] which are a common sight in the inland parts of the village.



Figure 6.9: Weeds- a common sight in the inland parts of Sili: *Merremia peltata* and *Mikania micrantha* cover the ground.

a. Perceived significance of climate related risks

As shown in Table 6.9, most perceived the significance of risks associated with shorter and heavier rainfall and stronger damaging winds as ‘medium level’.

ii). Opportunities

Many of those interviewed also mentioned opportunities associated with climate related events (see Table 6.8). These are similar to the opportunities mentioned by those interviewed in the other surveyed sites. In particular, the availability of food and other resources, and stronger and diversified networks during challenging times, especially during cyclones were identified. Most people that were interviewed whose houses were destroyed by cyclones Ofa and Val received assistance from family members working overseas or in Apia to rebuild their homes. They also recalled the arrival of food assistance from overseas countries. An elderly woman (SI001) said,

“Oh the gifts (referring to aid) from overseas countries were heavy after the cyclones. I remembered the helicopters coming with tents and food. Every family made sure that they were there at the time of distribution... people came with buckets to be filled with flour, rice, sugar... cans of herring, sardines...” (October 24, 2014).

B. Dimensions of climate change likely to be experienced.

There was no change evident in the way these respondents perceived future climate change compared to their current experiences. As evident in Table 6.7, shorter and heavier rainfall events and stronger damaging winds are perceived, by the majority of participants, to also occur in the future.

Table 6.7: Current and future climate related changes frequently mentioned and emphasized by surveyed residents of Sili.

Changes that were experienced 1. Shorter and heavier rainfall 2. Stronger damaging winds	Future climatic changes that were perceived to occur 1. Shorter and heavier rainfall 2. Stronger damaging winds
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1. Likely impacts and their significance

As shown in Table 6.8, most participants suggested that the climate change impacts they are experiencing now are also likely to occur in the future. Most suggested they are likely to face the same risks of damage to properties and pests in the future as a result of climate change. In the same way, future climate changes might also create similar opportunities such as access to resources and networks.

Table 6.8: Impacts of climate change frequently mentioned and emphasized by those surveyed at Sili.

Current impacts	Perceived impacts
Risks	Risks
1. Damage to properties	1. Damage to properties
2. Pests	2. Pests
Opportunities	Opportunities
1. Access to food and other resources	1. Access to food and other resources
2. Stronger and diversified networks	2. Stronger and diversified networks

Table 6.9 shows an obvious change in the way most respondents perceive the significance of likely risks associated with possible future climate change. Most perceived the significance of risks associated with shorter and heavier rainfall and stronger damaging winds to increase from ‘medium’ to ‘medium-high’⁴⁶ in the future (see Table 6.9).

Table 6.9: Perceived significance of risks associated with current and future climatic related events from surveyed participants at Sili.

Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Shorter and heavier rainfall	Medium	Medium- High
2. Stronger damaging winds	Medium	Medium- High

6.4.5 Crises management system based on *faamatai* and its associated coping strategies

A. Extended families: diversification, mobility and mental and spiritual strength

1. Diversification

Like the other communities surveyed, many residents suggested that diversification has been a major feature of the extended family that has been important to securing food, water and shelter during challenging times. Most families have members who are working to earn an income. At the same time, some members would fish for prawns and sell these to nearby tourist businesses. Additionally, most also have their food gardens next to their houses and plantations on separate lands further inland from where they reside. The food gardens mostly contain vegetables, fruit trees, taro, breadfruit and bananas. Many also raise pigs and chickens at the back of their houses. Some families have cattle farms on separate lands. Since the taro blight in 1993, many are planting different and more varieties of taro in addition to yams, giant taro and bananas. Older techniques of planting taro are still widely used. *Loiloi*- planting the taro singly against the side of the hole, is an older technique that is

⁴⁶ These categories are explained in Table 4.8, page 113.

still commonly used in this area especially in wet areas closer to the river. Farmers described how planting root crops had been helpful for food supply during past cyclones as the root crops are not damaged by the cyclones.

2. Mobility

The availability of customary ownership of land has enabled people to shift residence. Since the 1990s cyclones, many families have shifted away from the banks of the river. Many more had shifted to the eastern part of the village, while some moved further inland to places where their plantations are located (see Figure 6.8).

3. Mental and spiritual strength

Elderly participants pointed out that the development of mental and spiritual strength has been very important. Daily morning and evening prayers and attending church twice on Sunday has been a common practice in the families of those interviewed. Most described that their faith has been important when their properties were mostly destroyed by Cyclones Ofa and Val in the 1990s. Since then, an elderly chief explained that the village holds a combined church service at the beginning of each year which all of the different churches attend, and most would remember those who had passed away and the challenges faced in previous years. The sermons provided during the service had been important in empowering people to work hard and be supportive of each other in the year that was about to begin. The chief said,

“The aim of the service which is held annually on New Year’s Day is to celebrate what has been achieved by the village so far and pray for blessings upon all the villagers in the year to come. Different people are selected to pray on different issues. For instance, that the village will continue to be prosperous, that its lands and waters will continue to be blessed. Another issue to pray for villagers to continue to work hard and have the heart to serve and help others...”

B. Village groups and churches: managing the environment, diversification and developing mental and spiritual strength

1. Managing the environment

There are village based activities that contribute to the development of resilience at the levels of extended family, village and church. The village council holds monthly meetings, which mainly discuss the management of village resources, mainly its river and forested areas. The village has been firm in its decision to manage their river and has rejected previous government offers to take up the management of water supply. A former government representative of the village said,

“The government requested to own our river and offered us money but the council rejected it when they learnt the government wanted to build various stations inland, at the source of the river. We said to them, what about building your station or whatever it is at the mouth of the river? But they said no. We realised that they wanted to capture all of the water inland but what about us? The wealth of our village is its water and lands. Many families catch prawns from the river and sell these to nearby tourist businesses for families. They now sell for a \$7.00 a pound to get money...So it was decided that we would reject the government proposal...the EPC started tar sealing the road leading to where the station would be built but this was ceased when we rejected the government’s offer. We had piped water supply from Satupaitea (neighbouring village) but our village decided we would have our own piped water supply” (SI002, October 24, 2014).

The situation at Sili greatly contrasts with that at Maagiagi where the government manages the water sources. At Sili, each chief from every family contributes \$5.00 for the maintenance of the village piped water supply. This money is for the salary of the plumbers who are residents of the village.

2. Diversification

Women’s committee activities include the inspections of food gardens and the implementation of weaving groups. Village rules and council inspections have also helped minimize unsustainable farming and cultivation methods, for example, banning the use of chemicals and protecting forested areas from clearance.

3. Developing mental and spiritual strength.

Elderly participants pointed out that the development of mental and spiritual strength has been very important and church related activities have been an important part of village life. Like many other villages, churches at Sili have provided shelter and disaster relief assistance both during and after the occurrence of cyclones. The CCCS youth group has a ‘peanut garden’ project that engages the youth and earns money for the church.

C. Assistance from the government and external agencies: infrastructural development

There is evidence that the government has assisted in tar-sealing some, but not all, of the roads in the village. There was a request in the villages CIM-Plan in 2007 for the construction of an appropriate crossing bridge, but this had not been done. The Independent Water Scheme (IWS) has assisted the village in developing its own piped water supply since the village rejected government offers for the management of its river. In the past couple of years, IWS has laid the pipelines from the village water source to where the residents live,

and provided training for local residents who would be maintaining the pipelines (pers. comm., ST, 2014).

6.4.6 Preparing for possible future climate changes

Most respondents suggested that what they are currently doing is part of preparation for future climate change. Diversifying food sources and shifting away from flood-prone parts of the village are relevant. Concerns about the future sustainability of the village have led to actions at the village level to try and replant the banks of the river to prevent erosion and minimize the likely impacts of flooding. In addition, there is a need for the continuous enforcement of village rules which ban the use of weed-killers in the cultivation of crops and clearance of forested areas. It is evident from observations that more work is needed to reduce the unsustainable clearance of areas for cultivation and cattle farms. A significant decision had been the establishment of the Sili IWS whereby the village has formalized ownership of its river. Many suggested that it is important for the village council to ensure there is continuous capacity building for the plumbers and constant upgrading of the pipes that supply water. Moreover, the council should continuously develop rules for the sustainable use of water and effectively monitor them.

6.4.7 Summary of findings from Sili

Sili is a unique case because, unlike the other villages, shorter and heavier rainfall events and damaging winds were the main dimensions of climate change that most residents had experienced. While most had heard about global warming and how hot it had been in other parts of the country, they indicated that they had not noticed it in their village. Their exposure to Cyclones Ofa and Val has made them aware of the increasingly unpredictable nature of damaging winds. As noted by residents surveyed in other villages, Cyclones Ofa and Val generally caused the greatest damage to residents' properties. In recent years, the African snail and invasive weeds have become common pests. These were perceived, by most, to continue into the future.

Faamatai structures have played an important role in the development of coping strategies with families, as well as village and church groups being proactive in diversification, developing mental and spiritual strength, and managing resources such as land and water. The occurrence of Cyclones Ofa and Val caused many households to shift away from river banks into safer parts of the village. In recent years, the village has formalized its ownership of its river, and has implemented ways to provide piped water supply from local sources to its

residents. Both the council and local churches are also developing ways to empower village families to diversify livelihoods and develop mental and spiritual strength. All of these are vital aspects of preparing for future climate change.

6.5: Aopo

6.5.1 The village

Aopo is located in northwestern Savaii. The village settlement is concentrated inland along the main road, with houses on both sides of the road, but its territory covers a large area that extends further inland to Mt Silisili and down to the coast. The coastal part of Aopo, which stretches approximately 20 kilometres, is characterized by a reforested area, lava fields and cliffs. A volcanic eruption in 1760 destroyed parts of the village, including large areas of arable land and offshore reefs (see Figure 6.10). An area of 190 square km was covered by the lava flows (Taylor and Talia, 1999). Like Auala, the forests of the village were logged in the 1970s and 1980s by the Potlatch Timber Company (see Appendix 1), and reforested when the company left and the Samoan government took over. Much of the coastal area is inaccessible, but there are tracks used by the villagers during fishing trips.

Away from the coast, plantations dominate the area. These are located on both sides of the main road. *Auala galue* [work roads] leading to the village plantations extend inland. Works to widen these roads were conducted at the time of the fieldwork. The village has electricity and telephone services, but outlying areas do not. The village receives little rainfall throughout the year and is prone to drought and bush fires. In the past, drinking water was mainly obtained from streams, but now most residents depend on rainwater collected in tanks and containers. Tap water, which is brackish, was reticulated by the government in the 2000s and comes from a borehole in the neighbouring coastal village of Letui (see Figure 6.10) (Government of Samoa and CIM Plan Committee for Gagaifomauga III District, 2007).

The village population has increased from 115 residents in 1961 (Samoa Bureau of Statistics, 2016) to 369 in 2011 (Samoa Bureau of Statistics, 2011). There is a primary school and two churches, and the majority of villagers are involved in plantation work and fishing. A few people work in nearby tourist businesses. A major source of income is remittances from relatives working in Apia and overseas. The road is important because it provides access to other parts of the district where there is a hospital and schools.

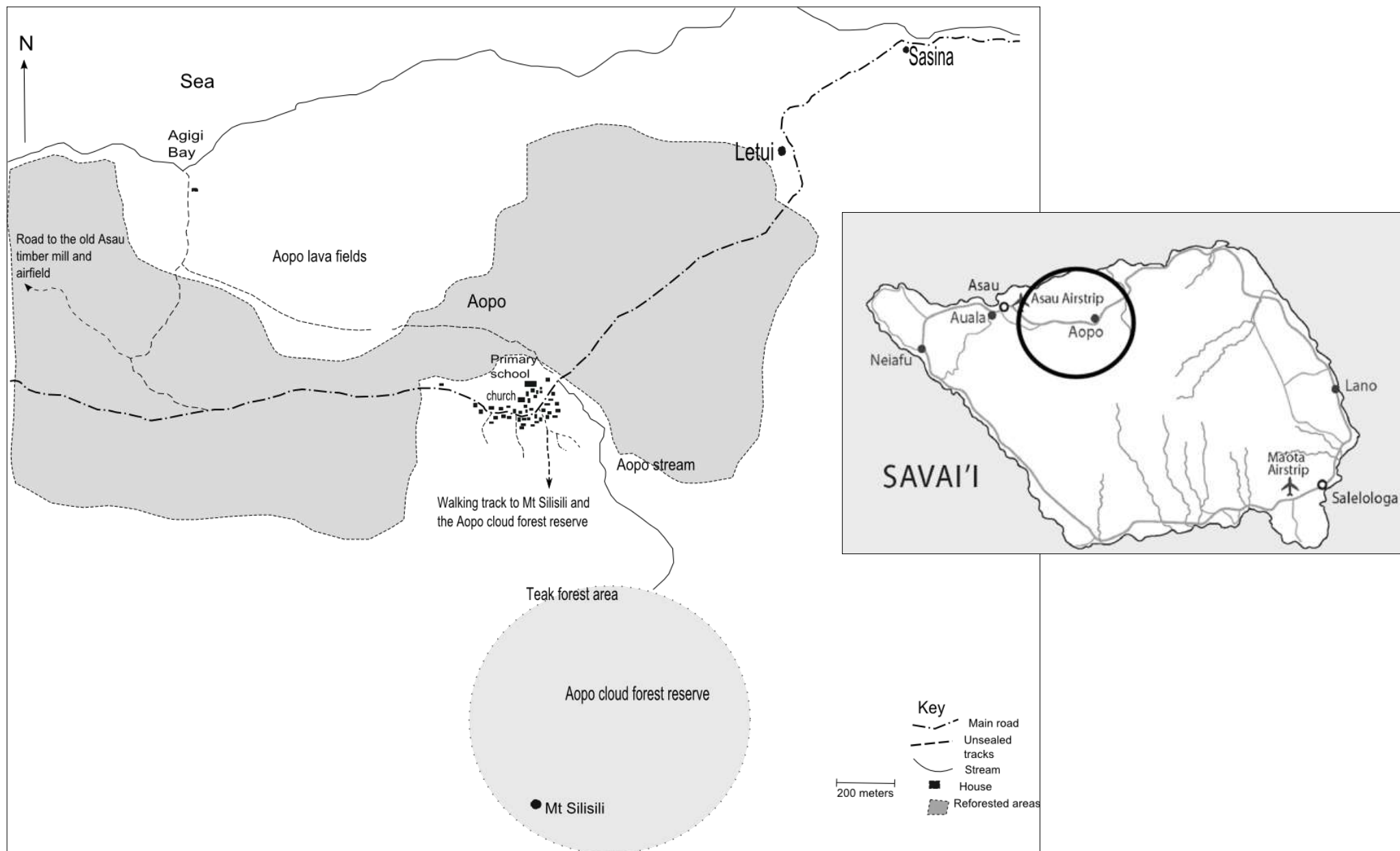


Figure 6.10: The Aopo settlement concentrates in the middle part of the village (Source: after Google Earth, 2016).

6.5.2 Summary of research carried out at this village.

Six key informant interviews and two focus groups were held at this site (see Box 6.8). This was accompanied by walks and drives, with local residents, to different parts of the village, mainly the Aopo Stream and Agigi Bay.

Box 6.8: Details of study participants from Aopo.

<u>Interviewees</u>	
70 year old male (AP001) Family- chief, father and grandfather Village- member of the village council Church- Member of the church committee, deacon Skills- farmer (plantation, chickens)	53 year old female (AP005) Family- mother Village- member of the women's committee Church- member of the church choir, member of the women's committee Skills- weaver, farmer (chicken, food garden, pandanus)
65 year old male (AP002) Family- chief, father Village- member of the village council, member of the village's tourist site committee Church deacon Skills- fisherman, farmer (plantation, pigs, chickens)	48 year old male (AP006) Single male Village- member of the untitled men's group Church- member of the youth Skills- fisherman, farmer (plantation and pigs)
<u>Focus group participants</u>	
66 year old female (AP003) Family- mother and grandmother Village- member of the women's committee Church- Member of the church youth, member of the women's committee Skills- traditional weaver, farmer (vegetables, chicken, pandanus)	Focus group 1 (AFG01) 4 males All are farmers and fishermen Aged between 30 and 40 years old All, except one are members of the Assembly of God Church
55 year old male (AP004) Family- father, chief Village- member of the village council Church- church member, member of the church father's club Skills- fisherman, farmer (plantation, pigs, chicken), sells vegetables, cocoa and coconut oil informally	Focus group 2 (AFG02) 4 females between 18- 25 years old Two are attending school while the others have completed schooling Some are members of the Assembly of God church while others are members of the Congregational Christian Church Two have recently started work in a tourist facility in a nearby village (attended the same high school the previous year)

6.5.3 General environmental issues.

Inadequate water and damage to properties are the major issues faced by most Aopo residents. Historical events such as volcanic eruptions, cyclones and fires and human activities such as deforestation and reckless burning have been contributing factors. In recent decades, climate related changes have also occurred. According to most residents, fires have become more frequent, mainly due to the combination of hotter and longer dry seasons, the reduced number of native trees and reckless burning by people during these times. Government reports reinforce the comments by Aopo residents explaining the increase in fires mainly due to longer, drier spells, diminished native forests and burning activities during the dry seasons (UNDP and MNRE, 2010). Specific events that were mentioned by residents included the 1902 volcanic eruption, cyclones in 1966, 1990, 1991 and the Big Fire in 1983. There was also mention of fires that occurred in the late 1990s and 2000s.

6.5.4 Perceptions of climate change

A. Dimensions of climate change experienced by surveyed residents.

Longer and hotter dry spells, erratic and low rainfall and strong damaging winds were the major changes identified by residents of Aopo as having occurred in recent decades (see Table 6.10). The most significant change that was indicated was prolonged and hotter dry spells. Some farmers stated during the dry season the soil had *maveve* [cracked] and the grass had turned brown *pei na faga i se fagavao* [as if it had been sprayed with paraquat, a chemical that kills weed] (see Box 6.9).

Box 6.9: Excerpt of a focus group discussion with farmers at Aopo (AFG01, October 16, 2014).

- FT “We usually leave for our plantations at dawn. About 5:30 or 6am. We advance before the heat of the sun because here in our village it can get really hot in the day. We are used to this. The dry season begins here earlier in the year and lasts until September. That is the time of the dry season when the sun is at its hottest. Our rainy season normally begins in October and right throughout the festive season. We time the cultivation of our crops accordingly to these seasons. During the dry season, it is quite difficult to grow crops. As the rest of the country has observed in previous years, it is common for fires to occur in these parts because of the lack of rain during that time. During the dry season we don’t spend much time planting during the day. We only work from say 6am until 8am and then wait until the evening when the sun’s heat is lighter. We come home and do other odd jobs around the house during the day and then go back to our plantations in the evening”.
- SU “Yes we tend to go twice to our plantations. We come and rest here and then go back”.
- FT “The grass starts to turn brown in June and will remain that way until this time. Now you see that the grass has turned green because there had been rain in recent days. The days of the *palolo* have arrived aye? Anyway around the middle of the year starting from June until September. The grass is brown like someone had sprayed it with weed-killer but it is due to the heat. The soil becomes *completely dry* [emphasizes these words] and is no longer wet. The rain will not enter the soil... the soil is dry because there is no rain. During this time we cannot plant taro using an *oso*. The trick we usually do is we use sticks or a crowbar to dig holes. We dig holes using sticks or a crowbar then place corms inside these holes. The soil cracks easily because it is dry. We call this planting technique *tuiefu*”.
- MA “Changes in the climate has caused us to slightly change our work patterns. We go in the morning, come and then go again in the evening. When we were younger that was not the case with our elders. The land used to be lush and green, but now it’s only inland, closer to the mountain ridges that remains that way during the time that this guy already explained. From June until September, when you go to the areas we cultivate, the grass is usually withered because of the heat. It was not like that before”.

Government reports (MNRE, 2013) note that prolonged dry spells and related drought had been frequent, particularly in the rain shadowed north- western areas of Savaii, where Aopo

is located, between April and October. The comments by Aopo residents accord with government reports, which state that fires occurred during the dry seasons of 1997-98, 2001-02, 2002-03 and 2010. The majority of residents agreed that these events are evidence of climate change.

1. The impacts of climate change experienced by surveyed residents.

i). Risks

As Table 6.11 shows, the main climate related risks experienced by surveyed residents were inadequate water and damage to properties. Most participants suggested that water shortage during the dry season had always been a challenge for them, but this had been exacerbated in the past two decades by prolonged dry spells and related forest fires, cyclones and low rainfall. These changes have caused parts of the Aopo stream which was the village's main source of water until the late 1990s to dry up before the start of the rainy season. A 70- year old chief from Aopo spoke about diminishing stream supplies before and during the dry seasons, and how this situation had worsened in recent years. Consequently, fewer people have been able to use stream water during the dry season since the late 1990s. He said:

“The stream... flows strongly during the rainy season, at the end and beginning of the year. But as the dry season begins the flow of the stream would be slower and would eventually stop leaving behind water holes that we would use. During the dry season people mostly start using the water in parts of the stream closest to the village. When those water holes dry up we would shift our water collection upwards, to the next water hole, and the next, slowly shifting to the inner and upper parts of the stream [laughs]. The names of these places are Matafai, Vaisima, Vanu, Papalululu, Vaisaele, Vaieli, Vaipunua. Vaipunua is our village's most inland water source. The villagers used this water source very carefully until the rains arrive... Most of the villagers know that when they reach Vaipunua the rains would soon fall. Now most of these water sources dry up during the dry season. Maybe there are some parts that contain water, but most tend to quickly disappear” (AP001, October 15, 2014).

The last phrase of the quote ‘most tend to quickly disappear’ implies that any water received as rainfall was easily lost through evaporation because of the intense heat. A discussion with young farmers who had collected water from the stream until the late 1990s corroborated the elderly chief's observations. The farmers noted the diminishing supply of water in the stream at the time they were collecting water. The respondent, Faaiuga (see Box 6.10) used the terms ‘small’, ‘still’, ‘ponds’ to suggest that the water sources they were currently using were

no longer part of a flowing stream, as described by the chief (earlier). Rather, they were fetching water from a small section of the stream that contained water.

Box 6.10: Excerpt of a focus group discussion with farmers at Aopo- AFG01 (October 16, 2014).

- FT “Another challenge that we face here in our village, which is related to climate change, is our water supply. Our whole family, which is about 30 people, depends on one water tank. That is our family here plus my parents and siblings who live in that house [pointing to the house next door]. Well if the water in our tank runs out during the dry season, well that means [did not finish this statement]. Our village does not really like drinking the water from the taps because it is a bit saline. Our piped water supply comes from Letui”.
- MA “Yes, it is not really saline, but it is definitely not the same as rainwater, so we do not like drinking it. My family relies on our water tank for drinking because that is water that we collect from the rain. We use tap water for bathing and washing the dishes and our clothes but the tank [water] is specifically saved for drinking”.
- FT “We used to collect water from the stream. We lived during the time of ‘fetching water’ [laughs]. Well when we were young that was about the time that ‘fetching water’ was slowly dying out [mmms and nods from the other participants] before ‘this blessing’ that we now have, arrived [referring to water tanks and tap water]. That was the time when we used the bamboo. You may be aware that the Fijian bamboo is found here in our village. So what we do is we knock/ pound the insides of the bamboo and knock the top node in and then we pour water into it”.
- SU “Well because these things- the bucket and the wheel barrow- are new to our eyes [laughs]. But it had always been the bamboo. A long bamboo would be from about here [pointing to where he was sitting] to there [pointing to where I was sitting- about 2 meters] and then you bring *ti cordyline fruticose* leaves and use it to plug the mouth of the bamboo then you carry it on your shoulder”.
- FT “The water sources are like small ponds, water holes”.
- MA “They are streams”.
- FT “They are like still ponds, excuse the language, they are like holes where water had been captured. Then I go and get that water and use to bathe. This rainwater is brought home, boiled and then we drink it”.
- MA “Yes, after the bamboo then the bucket came, and we took this to the stream and filled them with water and carry it back in a yoke”.

Low and erratic rainfall, especially during longer dry seasons in the past decade, have also impacted on water supplies. The well-known Samoan phrase “*E taliilagi vai o Aopo*” [Aopo waits for water from the sky], signifies the importance of rain to Aopo residents and implies residents’ familiarity with the patterns and timing of rainfall. Most indicated that the wait for rain to replenish water supplies has become longer because there has been diminishing

rainfall received over the past ten years. Rain is normally expected to start falling in September, but, in the past ten years the onset has been delayed, sometimes into October and November, and there has been steady reduction since then, with erratic falls⁴⁷. The majority of residents interviewed said they had rarely collected water from the village stream in the past decade because by September, October and November, it was difficult to find water there. A 65 year old farmer said,

“There is a well-known Samoan saying which refers to Aopo and these things. *E taliilagi vai o Aopo* [Aopo waits for water or catches water from the skies]. We waited for the skies, we caught water from the skies [raises voice] wait for the rain, eh? then we would find water so we could drink. The meaning of what I am saying is that we valued these water sources, parts of the stream because it was there that we found water, water was captured there. Now in recent years, parts of the stream had died much quicker, before the rains arrive. Most people do not go to the streams anymore because they know it is difficult to find water there during this time” (AP002, October 15, 2014).

When I visited the Aopo stream in October 2014, most parts of the stream were dry and a few sections contained water that was undrinkable and insufficient to support the village population. The photographs on the next page (see Figure 6.11) show the water holes that Aopo residents largely depended on for water before water tanks were built in the 1990s. There was no evidence of management efforts at the site of the stream but most respondents mentioned both the village and government have developed reforestation in the areas surrounding the upper parts of the stream.

Most interviewed residents stated that in the past ten years, less rain water had been collected in tanks and containers during the dry season because the rainfall was insufficient to replenish these supplies. The interviewee, Faaiuga (see Box 6.10) implied this when he described how thirty members of his family would carefully ration drinking water from one water tank during the dry season and that brackish tap water would become the next alternative when fresh supplies ran out. As stated previously in Chapter 3, recent government reports (UNDP and MNRE, 2010; MNRE, 2013) have documented the increasing frequency of erratic and low rainfall receipts, particularly during the El Niño phase of the El Niño Southern Oscillation (ENSO), and related these to global warming, substantiating what Aopo residents had said.

⁴⁷ Residents at Auala and Saleimoa said similar things. All these sites are located on the north-western parts of Upolu and Savaii which according to government reports, had experienced increasingly longer dry spells in the past decade.



Figure 6.11: A local chief indicates that many more parts of the Aopo stream had dried up during the dry seasons of recent years.

Extreme events, such as the 1990s cyclones, also caused deterioration in the water supply. Cyclone Ofa (1990) and especially Val (1991) destroyed much of Aopo's native forest cover that remained after logging and agricultural expansion between the 1960s and late 1980s (see Box 5.6). This further reduced the capacity of land drained by the Aopo stream to capture and store water. A male resident of Aopo said:

“After the cyclone, all you could see was destruction. The forest was cleared. Trees had overturned or broken in half. Almost all lost their leaves. You can see Asau from here because there were hardly any more trees standing. There were no trees that used to block your view. You can see right down to the sea and also right up the mountain. Nothing blocks your view...” (AP005, October 17, 2014).

Many residents indicated that lack of foliage exposed the land to the heat of the sun, so that whatever water was received was quickly evaporated by the sun. Another elderly female said that the stream had died because hardly any trees had survived. Trees are important in capturing precipitation and transferring water into the stream, as well as protecting the water from evaporation by the sun. However, tree loss has exposed rocks which store water, causing them to crack and water to be lost into the ground or evaporated. She said:

“... the loss of trees. That caused parts of our stream to die. Our village used these things. My story is true. These were our drinking water sources but one hardly finds water here, here in these parts now. Some of the rocks that captured and held the water had also cracked making it difficult for the water to pond but these were the things that Aopo survived on...That was why Aopo valued these streams...there are many (emphasized) uses of trees to these water sources. The rain falls on leaves, and these are transferred into the stream” (AP003, October 15, 2014).

In addition, the increasingly frequent forest fires of the past decade have not only destroyed parts of Aopo's native forest, but disrupted the recovery of reforested parts of Aopo and further reduced the ability of the land to capture and conserve water.

a. Perceived significance of climate related risks that were experienced.

The participants' descriptions of climate-related events and their impacts suggested that hotter days and prolonged dry spells have had a 'medium-high' impact on their lives (see Table 6.12). These had slightly greater impact compared with risks associated with strong winds which have had generally 'medium' impacts on interviewed residents.

ii). Opportunities

As observed in other study sites, many of those interviewed at Aopo also alluded to some benefits of these changes, and cyclones in particular, for example an important outcome of

the 1990s cyclones was that most families in the village received water tanks, tarpaulins and food assistance from the government and external agencies (see Table 6.11). Some said that strong winds made it easier to collect coconuts, breadfruit and firewood, while others said there were fewer mosquitos after a forest fire. A 66 year old woman's account of the Big Fire in 1983 (see Appendix 1) said,

“The fire in 1983 was the most frightening event. Most frightening event. Cars could not move on the road. The whole place was so hot. Oh, and during that time, there were no mosquitoes to be seen (laughs). Oh, because one annoying thing our village in those days were mosquitoes. There were so many mosquitoes, but they somehow disappeared during that time (laughs). They disappeared because the whole forest was on fire’ (AP003, October 15, 2014).

B. Dimensions of climate change likely to be experienced.

Table 6.10 shows that climate related changes currently experienced by most residents are seen by most to continue in the future. Hotter days and longer dry spells are likely to occur as well as stronger damaging winds (see Table 6.10).

Table 6.10: Current and future climate related changes frequently mentioned and emphasized by interviewed Aopo residents.	
Changes that were experienced	Future climatic changes that were perceived to occur
1. Hotter days and longer dry spells 2. Stronger damaging winds	1. Hotter days and longer dry spells 2. Stronger damaging winds

1. Likely impacts and their significance

Slight changes are noticed in participants' descriptions of current and possible future impacts of climate change. As seen in Table 6.11, many suggested that reduced productivity of the land is likely to occur in the future. Inadequate water and damage to properties are also likely to continue in the future.

Table 6.11: Impacts of climate change frequently mentioned and emphasized by surveyed Aopo residents.	
Current impacts	Possible future impacts
Risks 1. Inadequate water 2. Damage to properties Opportunities 1. Access to food and other resources 2. Stronger and diversified networks	Risks 1. Inadequate water 2. Damage to properties 3. Reduced productivity of the land Opportunities 1. Access to food and other resources 2. Stronger and diversified networks

Changes are apparent in the way participants perceived the significance of risks related to future climate change compared to how they view the significance of current climate change risks. Table 6.12 indicates the belief of most participants that the significance of risks associated with hotter days and longer dry spells is likely to be extreme in the future. Prolonged dry spells are perceived to increase in magnitude, from ‘medium-high’⁴⁸ to ‘high’, while the risk of stronger and more damaging winds would remain the same (see Table 6.12).

Table 6.12: Perceived significance of risks associated with current and possible future climatic related events from surveyed Aopo residents.

Climate- related events	Significance of risks associated with current events	Significance of risks associated with possible future events
1. Hotter days and longer dry spells	Medium-High	High
2. Stronger damaging winds	Medium	Medium

6.5.5 Crises management system based on *faamatai* and its key coping strategies

A. Extended families: diversification and managing the environment

Most residents described a variety of strategies developed to cope with global warming. The role of social networks in developing diversification and managing the environment were key themes that emerged from participants’ responses.

1. Diversification

The findings show households developing new and multiple ways to collect and store water, demonstrating diversification. Older and younger participants said that up until the 1990s, bamboo canes (see Figure 6.12) had been the most common method of collecting and transporting water from the stream to the home. Two elderly residents recalled their experiences. An elderly chief said,

“When I was young, we used to go with those things called bamboo that is found here. Big bamboo canes. Fijian bamboos that grow here, you would find bamboo bushes everywhere. Their canes are very big. People would use these to collect water from the stream. The top node is removed, but not the bottom one and (did not finish this statement) well some bamboos would be like 2 meters long, from there (pointing to where I was sitting) to here (pointing to where he was sitting)...Yes we knock off the top nodes so there would be holes on top of the bamboos. Then we pour water inside (laughs), plug the mouth of the bamboo with *ti* [*Cordyline fruticosa*] leaves eh? slung it over the shoulder and carry it home. When we get home, we would pour it into buckets and pots...” (AP001, October 15, 2014).

⁴⁸ These categories are explained in Table 4.8, page 113.



Figure 6.12: Hollow bamboo canes that were commonly used to collect water.

Since then buckets and wheelbarrows had also been used (see Box 6.10). Families who own cars would travel to relatives living in neighbouring villages to bathe and collect water from there. Most households own water tanks in which rainwater is collected and stored for drinking and cooking purposes only. The most common type is a 5,000 litre cement water tank (similar to those found at Auala- refer to Figure 5.10) which, according to most residents, were built by the Japan International Cooperation Agency (JICA) in 1998 in response to a request from the pastor of the CCCS at Aopo. Some families own two water tanks bought with money received from relatives working in Apia and overseas. In addition, reusing and recycling empty containers to store water have always been important to the residents for the collection and storage of water. Empty buckets, pots, bottles and all sorts of plastic containers are washed and set aside to be filled when rain falls. Water from vines growing in the forest is commonly drunk by farmers when working in their plantations. In addition, coconuts, oranges and pineapples are widely consumed to help quench thirst. The tapped water supply, which is brackish, is mostly used for washing dishes and bathing. This water is also used by some households for their flush toilets, but most households have composting toilets that do not require water.

The village stream provides alternative supplies of water for some families, especially for bathing and washing clothes during the rainy season, droughts and after cyclones. The majority of interviewed residents are still widely aware of the names and locations of these water sources. Parts of the stream which contained water were mainly used by some farmers

for bathing and washing. During the rainy season, young people use this water for bathing, while some women would use it for washing clothes.

Recycling water, especially during the dry season, is significant in Aopo households. Water is commonly recycled after washing dishes and clothes. Instead of letting the tap run continuously, most people washed dishes or clothes in a tub or bucket of water before rinsing them in another bucket of water. The used water is either saved to wash dishes at a later time, or used to flush toilets. Water is carefully rationed during the dry season, with the tank reserved for drinking, while water from the tap and sometimes from the streams would be used for washing and bathing. Children are taught not to waste water. AP002 said,

“During the dry season, the whole household would nearly bathe from one bucket (laughs). Most people would use the tap and save the tank. The tank would only be used when the tap supply is off. At most times, the tap comes on and we are still rationing the water from the tank... Here, wasting water was the thing that would get children in trouble (laughs). When I was growing up wasting water was the most common thing that would get most children in trouble (laughs)” (October 15, 2014).

2. Managing the environment

The majority of residents mentioned that since the 1990s they had started replanting and conserving both native and foreign trees, as they believed these are crucial to capturing and storing water, thereby reducing the dryness of the land. An elderly farmer said,

“ The Ministry of Forestry is carrying out reforestation programmes here at Aopo. What most of us here have been doing is we go and register with the Ministry at the cost of SAT10 (NZD5) and then they give us trees to plant. The Ministry delivers the plants and we plant them. Many people have been doing that. They are replanting trees on the lands they are living on as well as where they cultivate. The trees that were delivered include *kava* (*Piper methysticum*), *magaui* (*Garuga floribunda*), *asi* (*Syzygium inophylloides*), *mahoki* (*Swietenia mahagoni*), *poumuli* (*Flueggea flexuosa*) ...to me this is important in order to cover the land and hopefully help it capture and store water when it rains....” (AP002, October 15, 2014).

Sustainable land preparation techniques that reduce the dryness of the land are also being practised by many farmers, and this was observed during my field visit. Many said that they do not burn the land or most trees anymore as these activities had dried the land making it susceptible to fires. Instead, they had cleared only a few trees, weeds and vines beneath the trees and then cultivated their crops (see Figure 6.13). The foliage of the trees helped to prevent rapid evaporation of the moisture in the soil.

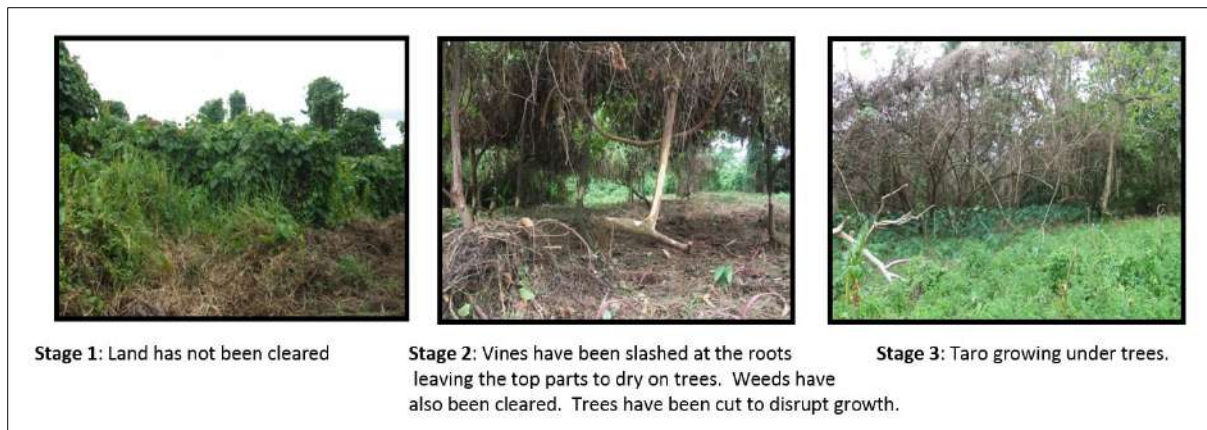


Figure 6.13: Different stages of clearing land and planting crops at Aopo.

B. Village groups and churches: diversification and managing the environment.

1. Diversification

The regular inspections of plantations by both the council and untitled men's group have helped encourage families to cultivate crops for food and income. At the time of my visit, the village had signed a deal with Ah Liki Company Limited to upgrade access roads and develop taro plantations for exports. Most farmers interviewed are involved in this project and talked about its potential benefits for their families. There was evidence of continuous discussions between the village council and government agencies regarding water shortage and related solutions. For example, the village Coastal Infrastructural Management Plan (Government of Samoa and CIM Plan Committee for Gagaifomauga III District, 2007) affirmed the need for villagers to install water tanks and use water delivery services, and for the government to investigate water sources for tapped water supply. In the mid-2000s, the government installed the village tap water system which supplies brackish water which is mostly used for washing and bathing.

The women's committee have been very active in conducting regular weaving sessions and according to female residents that were interviewed, all women, except for pastor's wives and school girls, take part in these activities. These had been helpful to the development of families. A couple of female residents interviewed commented that learning this skill and weaving their own fine mats means they no longer look for fine mats when needed for church and family activities. Selling some of their fine mats had also earned income to help their families.

Churches have been vital in supporting the development of families in the village. As mentioned in the previous section, in the late 1990s a request from the pastor of the Aopo CCCS saw Japan International Cooperation Agency (JICA) providing water tanks for most of the village households and many families still use these tanks to store water. The Assembly of God Church encourages the cultivation of plantations through its Father's Group. Once a month, the group would visit a plantation of one of its members where they would help with either the clearance of parts of his land or the growing of his crops. Members had often shared crop seedlings and knowledge, as well as provided mental support by sharing their plans and concerns with each other. Respondents mentioned that their plantations had been their main source of food supply, and selling cocoa and, at times, vegetables from their gardens had also earned them income to meet church and family obligations.

2. Managing the environment

The village council had also focused on efforts to protect the area's remaining forests in order to restore the land's ability to capture water, particularly in the Aopo stream, and also to prevent bush fires. Reforestation and conservation of native trees are conducted by the council and untitled men's group on village lands. These are also encouraged on family owned lands through village council inspections of reforestation and conservation of trees within plantation lands. Village rules and related penalties for sustainable land use also exist. For example, burning the land during the dry season and using chemical herbicides are prohibited.

In the 1990s, the Aopo village council, with assistance from the government, signed a conservation covenant with the Swedish Nature Foundation (SNF) to establish the Aopo Cloud Forest Reserve (see Figure 6.10). The covenant prohibited deforestation in the reserve. In return for financial assistance, the village allowed the SNF to manage the reserve for twenty years. The term of the covenant ended in the mid-2000s and ownership of the reserve was returned to the village. Since then, the village had been managing the reserve as an eco-tourist site. People visiting the reserve would pay SAT35 to the village and SAT100 to the tour guide. Members of the untitled men's group take turns to guide the tourists. A chief and member of the village committee for the reserve commented:

“Our village now has one development up there where Mt Silisili is located. It was a foreign reserve. The reserve is about 6 miles large...the government of Sweden and our village established the reserve. The village initially received money from the

Swedish government, a lump sum of SAT40,000.00. This was used to build houses for the pastors...But now our village is managing it as a tourist site. The village is earning money from people that want to visit and explore the reserve... The reforested area from here down to Agigi is also reserved... The cutting of trees and clearance of land is not allowed within these areas. This has great value for the trees, because that is the main reason why the reserves were set up...to save the trees from cutting” (AP002, October 15, 2014).

The council and untitled men’s group also maintain the area by planting trees and removing invasive species from the reserve. These activities take place a couple of times each year.

The council and untitled men’s group had also been active in disaster management as demonstrated during the Big Fire in 1983, and frequent fires that had occurred in recent decades. Most of those interviewed described that when fires had occurred, most men would spend most days and nights camping out in the areas that had been affected and they would only return when the fire had been completely extinguished.

C. Assistance from the government and external agencies: managing the environment and infrastructural development

The findings showed evidence of assistance provided by the government and external agencies, such as the SNF and JICA, mainly in providing alternative water sources and re-developing forested areas. Much of the area that was cleared by the Potlatch company was later reforested and declared a reserve by the government through its Forestry Division, now under the Ministry of Natural Resources and Environment (MNRE). As previously stated, the government had also helped the village to establish its Cloud Forest Reserve and had continued to provide technical support in the maintenance of the area. MNRE, Ministry of Agriculture and Fisheries (MAFF) and the Department of Fire Services have centres at neighbouring Asau which had provided tree seedlings for reforestation and emergency support when fires occurred in the area. Piped water supply had been developed, together with roads and electricity supply.

6.5.6 Preparing for possible future climate changes

Key themes which emerged from the interviews with residents in regards to future response were the need for strengthening social networks, diversification, hard work and preparedness and managing the environment. Over the years, households have diversified sources of water, as well as ways to manage water use which would help them cope with the likelihood

of water shortage in the future. Current efforts to develop plantations, food gardens and weaving sessions would also help ensure food supply and income in the future. Managing land use, reforestation and establishing forested reserves are also important activities that are not only carried out by families, but the whole village, to ensure the sustainability of their lands and forested areas, as well as the redevelopment of its stream.

A key concern for the future was the implementation of large development schemes that would again involve deforestation. In 2007, the village sold part of its teak forest reserve to Bluebird Lumber (Sesega, 2009) and at the time of my visit, access roads, leading to the forest, were being widened by the owner of that company. Local residents did not mention the sale of the forest reserve, but only that the owner of the company is helping them develop their taro plantations for export. This sale could pose serious challenges in future, although some currently see it as an opportunity to improve their livelihoods.

6.5.7 Summary of findings from Aopo

Residents' experiences of deforestation, cyclones in the 1990s and forest fires had made them aware of recent increases in temperature as demonstrated by generally hotter days and longer dry spells. As observed in all of the other study sites, *faamatai* structures have also been significant to the survival of Aopo residents. There have been efforts by residents with the help of community groups, such as the church groups and village council, to develop individual and communal resilience. Techniques for accessing and storing water have evolved and diversified. Most residents are still aware of village rules regarding the use of the stream and related water collection methods, however, these water sources are reducing in importance because residents have adopted and adapted other methods such as storage tanks and reticulated water supplies. Additionally, both households and the village have developed ways to sustainably use and manage the land and forested areas. All of these are important to preparing climate related risks that may occur in the future. However, a local decision to sell parts of forested areas in the future would possibly compromise the latter efforts.

6.6: Conclusion

This chapter has presented evidence to demonstrate that communities' experiences of previous events, including climate change, could enhance their capacity to cope with possible climate related changes. As with the findings in Chapter 5, all of these villages had experienced Ofa and Val and the taro blight in the 1990s, suggesting the national impact that these events had across Samoa. Also, like those living in coastal villages, the majority of

residents suggested that since the 1990s cyclones other climate related changes have become more noticeable.

6.6.1 Inland residents' perceptions of climate change

The majority of interviewees in three of the inland villages commented that the days had been intensely hotter, and used various Samoan terms and phrases to express that they had not only felt but heard that the heat had been increasing. Maagiagi and Aopo residents not only suggested hotter days, but also longer dry spells. Like the coastal village of Auala, residents of Aopo, who lived in the north-western end of Savaii island, not only mentioned 'hotter days', but also 'longer, drier seasons' (see Table 6.13). The farmers who were interviewed at Aopo noted the changing nature of the soil, 'cracking' due to the sun and the grass, turning brown as if it had been sprayed with paraquat.

Table 6.13: Dimensions of climate change experienced by those surveyed in four inland communities in Samoa. The listed items were frequently mentioned and emphasized by respondents.

1. Saanapu	2. Maagiagi	3. Sili	4. Aopo
Hotter days	Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Stronger damaging winds			
Sea level rise			
Shorter and heavier rainfall			

In contrast, the majority of Sili residents recognized that while heat is increasing, they did not mention specific explanations of the heat. Rather, they used ambiguous phrases such as 'the heat is getting stranger'. Most ascribed greater heat as a characteristic of other places in Samoa, but not Sili. The residents of Sili suggested that in recent decades, shorter and heavier rainfalls had become more frequent (see Table 6.13). This was also reported by residents of Saanapu, but the frequency of such events had been smaller compared with Sili. As illustrated in the above quote, short spells of heavy rainfall happened often in a week at Sili, but not at Saanapu. Many Saanapu residents observed an increased incidence of short heavy downpours of rain in the afternoon for half an hour, and then the sun would shine again. This would be followed by hot and dry conditions. In contrast to Sili, those interviewed at Maagiagi and Aopo suggested rainfall receipts had been small and erratic, especially during the dry season.

Stronger, damaging winds were also frequently mentioned by the majority of participants from across these inland villages. Many talked about their experiences of cyclones that previously affected the country: mainly cyclones Ofa and Val in the 1990s and later, cyclones Heta (2004), Olaf (2005) and Evan (2012). The majority of participants had experienced loss and destruction of property during the 1990s cyclones, but only the residents of Maagiagi and Saanapu mentioned that wind had damaged some of their properties in recent years, specifically, Cyclone Evan 2012. Most of these residents talked about changes in rainfall and wind patterns, rather than sea level rise, mainly because they live inland and had not directly experienced it. Only a few participants, particularly fisherfolk and farmers cultivating in coastal areas at Saanapu, noted increased inundation and erosion of parts of their lands, food gardens, homes, churches and family graveyards. In addition, parts of the lagoons were becoming deeper and there had been a decline in the number and variety of fish and shellfish. These had been especially evident after the 1990s cyclones and after the 2009 tsunami.

Risks and opportunities associated with climate related events were also described by participants. Damage to properties was the most frequently mentioned risk at Saanapu and Sili, while inadequate water supply was seen as the most significant risk at Aopo and Maagiagi. Other risks that were mentioned included reduced productivity of the land and the appearance of pests, mainly the African snail and invasive weeds. Saanapu residents mentioned more risks than the other three villages because most residents of this village had once lived on the coast and therefore had also noticed risks such as loss of coastal land and diminishing marine resources. The positive impacts of climate change that were frequently mentioned included access to food and other resources. Almost all respondents commented positively on receiving food, clothing, water tanks, farming equipment and crop seedlings, housing materials and more from relatives, government and external agencies during and after cyclones (see Table 6.14).

Risks associated with hotter days and longer dry spells were perceived by most to be 'medium', except at Aopo where it was seen as 'medium-high'. Most perceived risks relating to stronger damaging winds as 'medium'. Shorter but heavier rainfall events had only been noticed at Sili and Saanapu, with Sili residents perceiving related risks as 'medium' and Saanapu residents perceiving these as 'low-medium'. Sea level rise was only experienced by some Saanapu residents, who perceived related risks as 'low-medium' (see Table 6.17).

Risks	Table 6.14: Impacts of climate change experienced by those surveyed in four inland communities in Samoa. The listed items were frequently mentioned and emphasized by respondents.			
	1. Saanapu	2. Maagiagi	3. Sili	4. Aopo
	Damage to properties	Inadequate water	Damage to properties	Inadequate water
	Loss of coastal land	Damage to properties	Pests	Damage to properties
	Reduced productivity of the land			
	Diminishing marine resources			
Opportunities	Access to food and other resources			
	Stronger and diversified networks			
	Improvement in infrastructure			

The location of the settlement accounted for variations in the experiences of climate change and related perceptions of impacts across the four villages. Additionally, it is evident at Aopo and Saanapu that their exposure to previous challenges had caused many residents to demonstrate heightened awareness of some dimensions of climate change compared with Maagiagi and Sili. For example, Aopo residents were slightly more sensitive to rising temperatures, perceiving the significance of hotter days and longer dry spells as ‘medium-high’. This is because they live in the driest part of the country and had been exposed to deforestation and destruction by volcanoes, deforestation, forest fires and cyclones. Saanapu residents, on the other hand, had experienced other dimensions of climate change, because most were living on the coast and dealing with the enduring challenges of storm surges during cyclones and recently sea level rise.

The same dimensions of climate change were thought likely by most respondents to continue into the future (see Table 6.15). Hotter days was the most frequently mentioned and emphasized change in three out of four villages, with Aopo noting both hotter days and longer dry spells. Sili residents perceived shorter and heavier rain storms to be a significant future concern. The latter was also perceived to be a future concern by residents of Saanapu. Stronger damaging winds were another significant concern for people in all of the villages. Those interviewed at Saanapu perceived it would be more likely that they would experience shorter heavier rainfall in the future than sea level rise. This is because most are now living inland and further away from the coast.

Table 6.15: Dimensions of climate change perceived to possibly occur in the future by those surveyed in four inland communities in Samoa. The listed items were frequently mentioned and emphasized by respondents.

1. Saanapu	2. Maagiagi	3. Sili	4. Aopo
Hotter days	Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Stronger damaging winds			
Shorter heavier rainfall ↑			
Sea level rise ↓			

With regards to future impacts, inadequate water supplies and damage to crops and property were among the most frequently mentioned risks in most of these sites. Others included reduced productivity of the land, which was the most frequently mentioned risk in Saanapu, and pests which was another significant risk in Sili. Reduced productivity of the land was identified as a new likely risk in Maagiagi and Aopo. The majority suggested future changes might also bring desirable opportunities, such as better access to resources and improvements of social networks, while no one mentioned improvement in infrastructure (see Table 6.16).

Possible risks ↑ Issues have shifted upwards in ranking because they were more frequently mentioned and emphasized. ↓ Issues have shifted downwards in ranking because they were less frequently mentioned and emphasized. A new issue was mentioned.	Table 6.16: Impacts of climate change perceived likely to occur by those surveyed in four inland communities in Samoa. The listed impacts were frequently mentioned and emphasized by respondents.			
	1. Saanapu	2. Maagiagi	3. Sili	4. Aopo
	Reduced productivity of the land ↑	Inadequate water	Damage to properties	Inadequate water
	Damage to properties ↓	Damage to properties	Pests	Damage to properties
	Diseases	Reduced productivity of the land		Reduced productivity of the land
	Inadequate water			
	Loss of coastal land			
	Access to food and other resources			
Stronger and diversified networks				

The majority of participants perceived that the risks associated with most dimensions of climate change would be greater in future. The impact of hotter days and longer dry spells is perceived to increase from ‘Medium-High’ to ‘High’ at Aopo. At Saanapu, where the

majority of the village now reside inland, the perceived significance of risks associated with future sea level rise changed from ‘Low- Medium’ to ‘Low’ (see Table 6.17).

Table 6.17: Perceived significance of risks associated with current and future climate-related events.

STUDY SITES 1-8 LISTED FROM COASTAL TO INLAND	Perceived significance of risks associated with current climate- related events		Perceived significance of possible risks associated with future climate- related events	Change: > greater < less = no change
Site 1. Saanapu	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Low	<
	4. Shorter and heavier rainfall	Low- medium	Low- Medium	=
Site 2. Maagiagi	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 3. Sili	1. Shorter and heavier rainfall	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 4. Aopo	1. Hotter days and longer dry spells	Medium- High	High	>
	2. Stronger damaging winds	Medium	Medium	=

6.6.2 Crises management systems of inland communities and key coping strategies

Faamatai and related structures of family, village and church groupings, and government and external agencies have facilitated ways to ensure the management of previous crises. These connections have enabled many families to progressively diversify their livelihoods, access lands to build homes when needed, build up their mental and spiritual strength and manage their environment and related resources (water, forests and marine areas).

Like those surveyed in coastal villages, most of the people surveyed in inland villages were members of extended family households sustained by various sources of food and income. Resources and skills are shared and have ensured the survival of most households during times of crises. Most of these families have members who are employed locally or abroad, and most also have food gardens, plantations and backyard farms. As observed in coastal

villages, techniques of cultivating root crops have only slightly changed, but the majority of older methods are still being used. For instance, newer methods that have been adopted at Aopo include reforestation and slashing roots of vines, while at Maagiagi there had been use of paraquat (weedkiller). Older methods that had become more important in recent years include *tuiefu* [planting crops in the dry season], mixed cropping and farming, planting between rocks, *vaitoaga* [supplementary crops grown between harvests] and *polili* [immediately replanting the taro after the tuber has been removed from the *tiapula* top part of the taro]. In areas adjacent to streams, such as Sili *loiloi*, or planting in natural swamps and seepages also continues. Adoption of new varieties of taro and other plants had also been occurring in all communities.

Most households in all four villages now have access to piped water supply and other alternative local sources. Sili residents receive piped water supply from its river. The diversification of water sources and collection techniques had been a priority for families living in Aopo and, more recently, at Maagiagi where inadequate water is an ongoing challenge. Aopo residents had experienced inadequate water supply for a longer period of time, and consequently had developed multiple ways of collecting water compared with Maagiagi residents. Most Aopo households had shifted from collecting water using bamboo pipes before the 1990s to now including water tanks and piped water supply in their mix of strategies.

The availability of customary owned lands in each village had enabled most households to avoid previous risks by shifting places of residence. While relocation of residence has been evident in most villages, this was particularly prominent in Saanapu, where most residents had shifted inland since the 1950s.

Village groups and churches have played a supportive role in most of these communities. Village councils, untitled men's groups and women's committees have been very active at Saanapu, Sili and Aopo in the development of activities to empower diversification of households. Councils of these villages have also been able to implement strategies to manage resources, as in the case of Sili's village owned water supply, as well as the forest reserves at Saanapu and Aopo. Local churches have been instrumental in the development of water supplies at Aopo and Maagiagi, as well as helping to grow mental and spiritual strength in all of these villages.

Government and external assistance have been more evident at Aopo and Saanapu. These villages have experienced challenges in the past and have developed rather closer connections with the government and external agencies. For example, the government had built Saanapu's seawall and provided water tanks, housing materials, crop seedlings and farming equipment to village households affected by the tsunami. At Aopo, the government helped with reforestation of its lands cleared by logging activities and the establishment of its Cloud Forest Reserve. Government continues to offer technical support in the management of this Reserve. There were slightly fewer connections between the government and external agencies at Sili and Maagiagi. Here, family, village and church connections helped most interviewed residents endure previous challenges.

6.6.3 Inland communities preparing for future climate change

According to most respondents, the activities they are doing now and the connections they have been forming (mainly *faamatai* connections) are all part and parcel of preparations for future climate change. Diversification, mobility and developing mental and spiritual strength are key aspects of survival strategies that are evident in most communities. There is also evidence of many respondents considering efforts to manage the environment through practising sustainable cultivation techniques and establishing forest reserves. These will be important to ensuring sustainability of the land, forests and water sources. The relocation of Saanapu residents inland is important to the safety of residents from the likely impacts of future sea level rise and storm surges. Sili's decision to manage its river and water supply for village residents has been important in securing continued access to this key resource.

The government has been quite proactive in the establishment of reserves, vital infrastructure and technical support for these villages. However, most respondents suggested concerns about the role of the village council. For example, some concerns were evident at Maagiagi, where most suggested that the council needs to resolve tensions with the government and look for alternative water supplies for the village. At Aopo, while the council and other groups had been working hard to conserve and re-develop lands and forested areas, the council's decision to sell parts of these reforested areas seriously compromises their current efforts to ensure the sustainability of these important village resources.

Chapter Seven. Evaluating the ‘resilience’ of Samoan communities

7.1. Introduction

It was suggested in Chapter One that resilience underlines the capacity of individuals and systems to evolve with and adapt to environmental changes. Moreover, people can acquire resilience through their experience of living in challenging conditions. I sought to validate these claims by examining perceptions of climate change as well as identifying coping strategies in eight villages in Samoa. This chapter discusses the research findings in the light of the study’s objective and research questions stated in Chapter One as well as the theoretical framework outlined in Chapter Two.

This chapter begins with a discussion of how the study’s conceptual framework and approach enabled this investigation to provide empirical evidence which extends our understanding of Samoan resilience at the national and local scales. Involving non-equilibrium insights, which emphasize the evolutionary and complex nature of systems as well as the significance of disturbance to resilience, in the theoretical framework enabled this study to establish and provide a deeper understanding of the resilience of surveyed island societies. Likewise, the use of the cultural ecological approach which underscores the importance of social indicators, place and holistic approaches assisted the study to provide a deeper understanding of island resilience. The holistic approach deployed in this research, which conceptualized the individual within the buffering layers of the extended family and the supportive networks of village and government, has revealed not only multi-level networks, but multiple strategies to help people endure challenges and develop future preparedness.

The second part of the chapter discusses the study findings in the light of indicators of resilience outlined in Chapter 2 namely connections, perceptions, diversification, mobility, mental and spiritual strength. The study’s findings discovered that village crisis management systems, based on *faamatai*, have already been established and the majority of those interviewed were well aware of the various dimensions of climate change, their impact and related significance. *Faamatai* has enabled most households to develop such recognized strategies and qualities as diversification, mobility, mental and spiritual strength, in order to cope with extreme environmental events and the impact of climate change. By examining previous risks and what individuals had done in response to these risks, participants were able to predict the likely significance of possible future risk events and devise appropriate

strategies. Most respondents suggested that strengthened networks, particularly links between village councils, churches and government, will be crucial in the future development of these strategies. As the systems have evolved and developed multiple connections with external parties, there is a need for everyone to be more alert and more responsible in carrying out their roles within their families and in the village and church groups to which they belong. The final part of this chapter highlights best practices as well as unsustainable decisions that could compromise the future sustainability of families and communities. It also discusses key aspects of the system and related strategies that need improvement.

7.2 ‘Non-equilibrium’ resilience, cultural ecology and conceptualizing the resilience of Samoan communities

The success of this study’s theoretical approach, which is grounded on non-equilibrium resilience and cultural ecology, is evident in the wealth of empirical information that had been gathered which not only establishes but extends our understanding of Samoan resilience at the national and local scale. Several features of the approach, which are discussed throughout this chapter, enabled this investigation to establish that these island communities are resilient, as well as to provide a deeper understanding of their dynamic and highly complex nature. Firstly, involving non-equilibrium perspectives in the theoretical framework allowed the study to extend its focus beyond the narrow focus on island vulnerabilities and establish the resilience of islands based on the notions that they are dynamic systems comprising complex buffering capacities. The non-equilibrium idea that disturbances play an important role to developing buffering capacities of systems enables this study to strengthen its claim that island societies are resilient as they occupy small and isolated landmasses which are frequently affected by environmental disturbances. Using the cultural ecological approach was equally important as it shifted the study’s focus towards assessing the resilience of islands using social rather than physical and macro-economic indicators of resilience. As discussed in the next section, these indicators were connections, awareness and sensitivity to changes, mobility, spiritual and mental strength and diversification. Cultural ecology also emphasized the importance of holistic and place-based approaches. The holistic approach that was used emphasized the interconnectivity of resilient strategies as well as the role of connections in understanding the extent of existing resilient practices. Furthermore, grounding respondents’ experiences in the ‘places’ they were gathered has revealed ‘spatial differences’ in the perceptions of study participants which subsequently enabled a deeper understanding of the complex ways climate change impacts places. By exploring human

perspectives and experiences of selected island societies, the study findings revealed these places experience frequent and sometimes unpredictable disturbances, many of which are climate related events. These events play a significant role in strengthening connections, developing greater awareness of climate related risks and other resilient behaviour as detailed in the next section.

7.3 *Faamatai* connections and the current resilience of Samoans

The study's findings confirmed the assertion made in Chapter 3 that *faamatai* has evolved and adapted connections with external institutions, notably the church and central government, and these have long helped local residents minimize and avoid risks. Conceptualizing the individual within the social structures of *faamatai* emphasizes not only the 'holistic' but, more importantly, the 'bottom-up' nature of *faamatai*, which cannot exist without the individual and vice versa. Evidence from the eight villages indicates that the multi-level connections of *faamatai* have enabled the majority of those interviewed to develop a heightened awareness of climate change and to devise such survival traits and strategies as diversification of livelihood, mobility and mental and spiritual strength (see Figure 7.1).

These findings not only confirmed claims that relationships or connections are significant to the resilience of individuals and social ecological systems (Holling, 1973; Berkes and Folke, 1998; Gunderson and Holling, 2002; Berkes *et al.*, 2003; Folke, 2006; Walker *et al.*, 2004; Waller, 2001; Mahoney and Bergman, 2002; Kidd and Shahr, 2008; McElheran, 2011), but also show that this is the most significant indicator of a resilient human system. While the literature on resilience identifies key characteristics and indicators of resilience, there is a tendency for many observers to compartmentalize or generalize discussion. Drawing on ideas of holism proposed in selected cultural ecological studies (Waddell, 1975; Chapman and Prothero, 1985; Watson, 1985; Hauofa, 1993; Lilomaiava- Doktor, 2015; Liki, 2015), this study argues that researchers will not be able to fully assess the breadth of the strategies being carried out if social networks or connections are subordinated or ignored in the discussion.

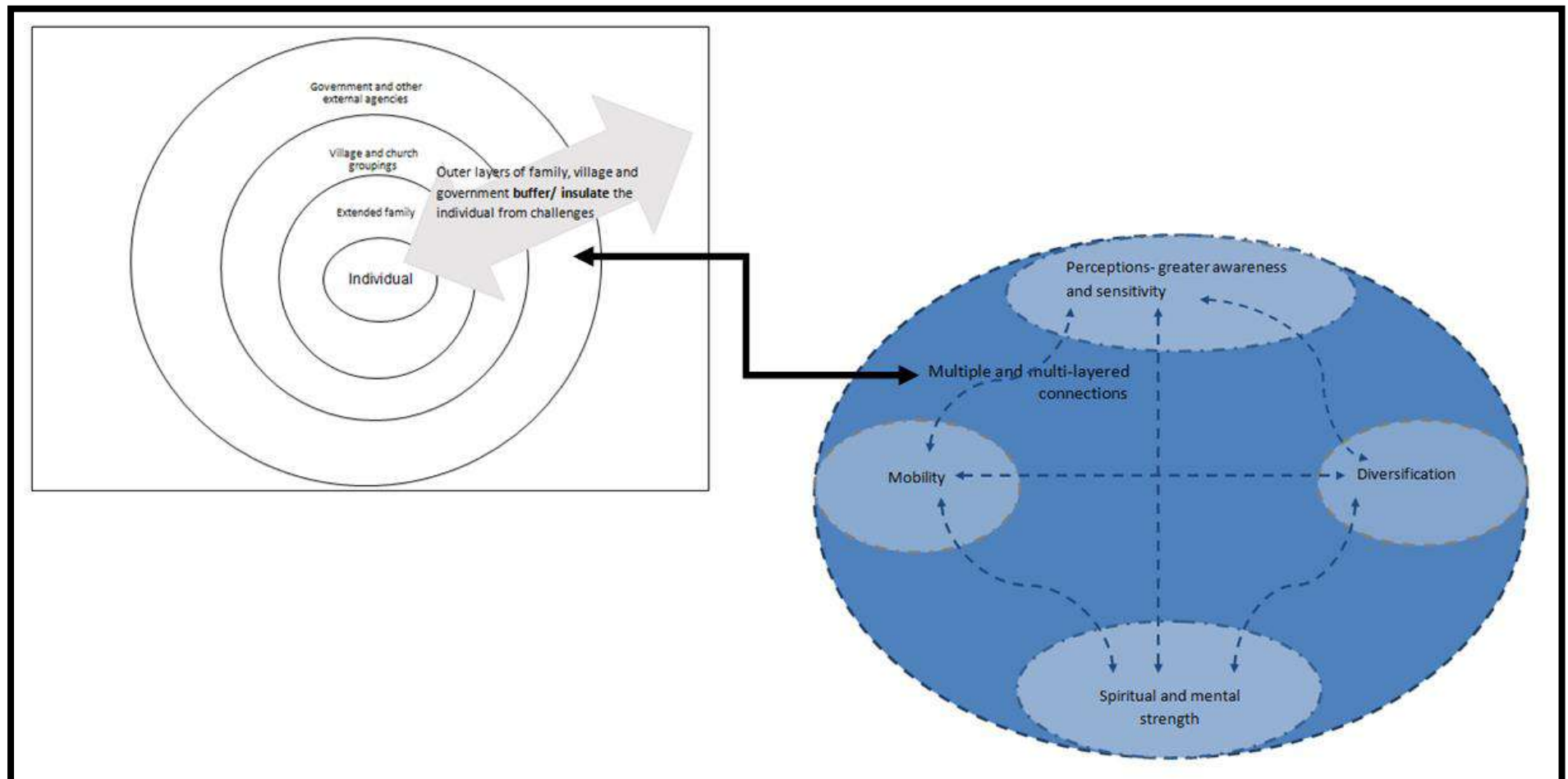


Figure 7.1 The multiple and multi- layered connections operating within *faamatai* structures of family, village, church, central government and other external institutions are enabling Samoans to develop key adaptive strategies namely awareness and sensitivity to environmental changes, diversification, mobility and spiritual and mental strength.

7.3.1 Awareness and sensitivity to current climatic changes

A. Awareness of the current dimensions of climate change

The study findings show that respondents have a heightened and in-depth awareness of climate change thus confirming that awareness and sensitivity to changes is a significant indicator of island resilience. Social connections and exposure to environmental disturbances have been crucial to the development of such climate change awareness. Knowledge is shared by means of telling and observing during daily activities, such as through: domestic chores, children's games, morning and evening prayers, family meetings and cultural activities. The participants also learned about climate change during village and church related activities, such as during meetings of the village council, untitled men's group, or women's committee, inspections of plantations and village surroundings, women's weaving sessions, work projects and the like. Additionally, exposure of respondents to a variety of disturbances, including those associated with climate change, has created a heightened and in-depth awareness of the various dimensions of climate change. All eight villages have endured long term and extreme challenges, including climate related events, revealing 'the unpredictable, and sometimes, chaotic nature of the environment' (Holling, 1973). For the majority of those interviewed, the frequent occurrence of damaging winds, notably Cyclones Ofa and Val in the 1990s, which most authorities have attributed to climate change, has made them more sensitive to various dimensions of climate change.

Situating the respondents' descriptions of climate change within their villages showed marginally different experiences of climate change across these places. Table 7.1 outlines the various dimensions of climate change that the respondents of the eight surveyed villages are experiencing. Slight increases in air temperature and more unpredictable wind and rainfall patterns characterize the experiences of respondents living in most of the surveyed villages. However those who lived, as well as those still living in coastal areas, had also noticed a slow rise in sea level. One village's experience of climate contrasted with the rest of the surveyed villages. Most of those surveyed at the inland village of Sili suggested their experience of climate change is mostly characterized by shorter and heavier rainfall and damaging winds rather than increasing temperature. The location of Sili inland and on the southeastern part of Savaii ensures frequent rainfall and a reliable supply of water.

Table 7.1: Dimensions of climate change experienced by those surveyed in eight communities in Samoa. The listed dimensions were frequently mentioned and emphasized by respondents.

Note: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
Hotter days and longer dry spells	Hotter days and longer dry spells	Hotter days	Hotter days	Hotter days	Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Shorter and heavier rainfall	Stronger damaging winds	Shorter heavier rainfall	Stronger damaging winds				
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise	Sea level rise			
Sea level rise		Sea level rise		Shorter and heavier rainfall			

Those living in ‘more challenging environments’ noticed more evidence of or were slightly more aware of particular dimensions of climate change. For example, individuals living in areas, susceptible to coastal and climatic processes referred to more dimensions of climate change compared with those living inland (see Tables 7.1 and 7.6). Those living on the coast experienced three or four dimensions of climate change, while inland residents experienced two. Respondents living in ‘more challenging environments’, were slightly more aware of particular dimensions of climate change. As described in Chapters 5 and 6, residents of Aopo and Auala, located in the drier north-western part of Savaii and previously exposed to intensive deforestation, cyclone devastation and forest fires, offered more detailed explanations of ‘hotter days and longer dry spells’. Those living at Maagiagi whose water resources have been alienated also stressed the occurrence of hotter days and longer dry spells. Those interviewed at Saanapu and Malaela, located on the south coast of Upolu and affected by the 2009 tsunami, were slightly more aware of sea level rise.

B. Awareness of the current impacts of climatic changes

i) Recognizing risks and their significance

All of those surveyed in this study also recognized the impacts of various dimensions of climate change which strengthens the claim that these people are highly aware and sensitive to climatic changes. Also, organizing the respondents’ descriptions of risks and opportunities associated with climate change into the villages they were resident in revealed slightly varied spatial experiences which provide a deeper understanding of how climate change impacts places in complex ways. Table 7.2 indicates that respondents who lived or are still living in coastal areas frequently mentioned and emphasized the risk of damage to properties.

Contrastingly, respondents who lived inland and those living at the north-western part of Savaii stressed the risk of inadequate water.

The significance of risks associated with current climate change

In-depth awareness of climate change impacts is demonstrated by varying levels of risk significance which are evident in most participants' descriptions of different dimensions of climate change and their impacts. Table 7.8 shows the significance of risks currently associated with hotter days and longer dry spells, stronger damaging winds, and shorter but heavier rainfall was generally perceived as medium by most of the respondents across the eight surveyed villages. Risks associated with sea level rise were generally perceived as low and were mentioned most often by those living on the coast. Residents of Malaela, which were greatly impacted by the tsunami, perceived the current risks of sea level rise as somewhat more significant when compared to the rest of the surveyed sites.

ii) Recognizing opportunities

The findings showed that most respondents did not simply dwell on the damaging effects of the events that they had experienced. They also described associated opportunities: notably, tighter and novel social connections, new food supplies and infrastructural development (see Table 7.2). For instance, most residents related how cyclones had also been enjoyable experiences, when they had lived with neighbouring relatives and shared food. All of those who experienced Cyclones Ofa and Val in the 1990s said that this was the first time they had ever seen a helicopter, and they still vividly remembered people receiving food aid and tents. These cyclones also marked the beginning of intensive infrastructural development, such as the building of seawalls and roads. These were noticed mainly by respondents living in coastal areas. I found this particularly interesting because it suggests that exposure to challenges did not make the respondents 'fatalistic' or 'helpless' but rather made them more optimistic in their outlook on life. This finding supports claims made in several psychological studies which have argued for the importance of disturbance, struggle and pain in the development of a person's character. 'Adversity and hardship provide motivation and knowledge' for people to move forward (Waller, 2001; Mahoney and Bergman, 2002; Kidd and Shahr, 2008; McElheran, 2011).

Table 7.2: Climate related impacts experienced by those surveyed in eight communities in Samoa. The listed impacts were frequently mentioned and emphasized by respondents.

Samoa. The listed impacts were frequently mentioned and emphasized by respondents.

Risks	Note: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
	1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
	Damage to properties	Inadequate water	Damage to properties			Inadequate water	Damage to properties	Inadequate water
	Diminishing marine resources	Damage to properties	Pests	Diminishing marine resources	Loss of coastal land	Damage to properties	Pests	Damage to properties
	Reduced productivity of the land			Inadequate water	Reduced productivity of the land			
	Diseases				Diminishing marine resources			
Opportunities	Access to food and other resources							
	Stronger and diversified networks							
	Improvement in infrastructure							

Evidence of in-depth awareness and sensitivity to climate change provided in this section challenges the conclusions of some studies which state that islanders, especially those living in rural communities, have a limited awareness of climate change and do not consider it a local priority: for example, Nunn (2009); Kuruppu and Livermann, (2011) and Nunn (*et al.*, 2013). As stated in Chapter 1 (see Section 1.2) the goals and methods used by those studies were reductionist because they mostly focused on the ‘scientific concept’ of climate change. In contrast, this study yielded a more detailed understanding of respondents’ perceptions of climate change by deploying the concept of resilience from a non-equilibrium perspective and grounding the analysis of results in the places where they were gathered.

7.3.2 Diversification

The findings also showed that multiple and multi-layered connections within *faamatai* are enabling diversification activities to occur at the extended family and village levels, considerations which are detailed below.

A. The role of extended families

i) Multiple roles and responsibilities of extended family members

A multiplicity of roles and responsibilities, along with cooperation amongst family members, are key to survival at the family level. Most respondents are members of extended family households where some people are farmers and fisherfolk at times engaged in informal economic activities, whilst others work in the formal economy. Engagement in multiple

activities reduces the risk of people becoming dependent on a single food or income source and, therefore, increases the chance of at least some household members surviving a catastrophic event. These activities exemplify the notion of ‘occupational multiplicity’ evident in the economic practises of islanders in the Caribbean as observed by Comitas (1963), Frucht (1967), Bennell and Oxenham (1983), Trouillot (1988) and Baldaccino and Bertram (2009) (see Chapter 2, Section 2.3.2).

ii) Various food sources and planting techniques

Diversification and geographical separation of food sources are other key survival strategies implemented at the extended family level. Both techniques lessen the risk of all food crops being destroyed in a single storm. The majority of participants stated that they own a plantation, usually located inland, but also have a vegetable garden, piggery and a chicken run at the back of their main house for daily food supply and traditional activities. The majority own the lands they cultivate, except for a few households, for example at Saleimoa, where people cultivate church-owned lands. As described in Chapter 2, Waddell (1975) observed similar patterns of agriculture in his study of how Enga people adapted to frosts in Niu Gini, whereby the Enga would move between the two locations in connection with garden work. However, while the Enga exercised usufruct rights to these lands, the majority of Samoans normally own both parcels of land.

A key aspect of combined food gardens and plantations is mixed cropping or, according to Thaman (1990; 1995), ‘agroforestry’, whereby a plantation or food garden has a variety of crops, such as taro, yams, cassava, bananas, cocoa and coconuts, and different types of trees which the household uses for a variety of purposes. Some are useful for building small open houses, while others are used for cultural ornaments and objects. There are also various medicinal plants. Growing various crops and trees ensures that alternative food supplies are available when other food crops have been destroyed. During the taro blight and previous cyclones, taro crops were destroyed so many families reverted to yams, breadfruit and bananas as alternative sources of food. To ensure a constant source of food, crops are mostly grown in stages, with root crops first followed by bananas.

The findings of this research reveal complex layers of ‘adaptive behaviour’ with regard to cultivation techniques. In some instances, new ideas or products have been adopted while in others, older methods have become more important. Changes in behaviour were more

noticeable when the impact of the risk event had been great. For instance, in terms of food cultivation, the most noticeable change has been the adoption of new varieties of taro now grown across the selected sites. This is largely the result of the taro blight of 1993 that destroyed the main local varieties. According to Buck's observations (1930), initially described in Chapter 3 (see Section 3.3.2C), five main varieties of taro were grown across the country in the early 1900s. Farmers who were interviewed for this research stated that all these varieties were destroyed in 1993 and are no longer planted. Instead, they now plant different and many more varieties of taro supplied by the government or sourced from relatives and friends. Most of these varieties were developed through taro breeding programmes funded by the South Pacific Commission and the Agriculture Department in Samoa (see Chapter 3, Section 3.4.1). Varieties mentioned by most farmers include: *polo voli*, *P1*, *talo mumu*, *Samoa 1*, *Samoa 2*, *samasama*, *tiapula lanu meamata*, *Savaia*, *Tuisuga*, *talo lauiila*, *Talo Tanumalala*, *talo Salani*, *talo Aufaga* and *talo Fusi*. These newer varieties have enabled many people to plant taro behind or next to their homes.

In places where there had been environmental disturbance, such as from fire or deforestation, some farmers had reverted to older practises captured in earlier studies of Samoa by Watters (1958) and Buck (1930). Farmers interviewed at Aopo and Asau had recently reverted to older methods of cultivating crops after a phase of intensive clearance and logging of forested areas between the 1960s and 1990s. Most said that due to longer dry spells and the increased risk of fires, they do not burn the land during the dry season. Rather they simply clear vines beneath the trees and cultivate the soil. Big trees are protected to provide shade for plantations which many say are kept small to provide just enough food for the family. In rocky areas, crops are planted between rocks. Buck (1930) referred to this planting method in his study of Asau (located between Auala and Aopo) and cited a local saying from this part of the island: "*Ua faahuai le talo*", [like making holes for the taro].

According to farmers and fisherfolk interviewed in other villages, most of the techniques that they currently use have always been based on older methods of farming and fishing. The *oso* [digging stick] remains the main item of equipment for digging holes to plant taro. Slight changes have been made to the *oso* by some farmers. For example, some said that wrapping the tip of the *oso* with metal made it work better now the ground is drier and therefore much harder during the dry season. Many farmers agreed that some traditional farming methods practised for more than a century are now more important, as parts of their land are drier

during the dry season (Table 7.3). Many of these techniques were observed in studies of Samoa in the early 1900s, such by Buck (1930) and Watters (1958). As mentioned in Chapters 5 and 6, examples of these include, *tuiefu* [planting crops in the dry season], mixed cropping and farming, planting between rocks, *vaitoaga* [supplementary crops grown between harvests] and *polili* [immediately replanting the taro after the tuber has been removed from the *tiapula* top part of the taro tuber]. Mulching, which involves spreading cut weeds and dry leaves around taro plants to keep the sun off the ground and restrict the growth of weeds, is still used by many. In the village of Sili, where many farmers cultivate plantations next to streams, *loiloi* or planting in natural swamps and springs, continues. Newer methods that have been adopted, include reforestation, slashing roots of vines and the use of ‘paraquat’ (a weedkiller) as well as table salt to kill African snails (see Table 7.3).

Table 7.3: Techniques of planting root crops stated by interviewed farmers.

Older techniques used to plant root crops	The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
	1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
	<i>tuiefu</i>	<i>faalua le talo</i>	<i>faalua le talo</i>	<i>tuiefu</i>	<i>polili</i>	mixed cropping	<i>loiloi</i>	<i>tuiefu</i>
	<i>polili</i>	<i>tuiefu</i>	<i>polili</i>	<i>polili</i>	mixed cropping	<i>vaitoaga</i>	<i>polili</i>	<i>polili</i>
	<i>vaitoaga</i>	<i>polili</i>	<i>tuiefu</i>	mixed cropping	<i>vaitoaga</i>	mulching	mixed cropping	<i>vaitoaga</i>
	mixed cropping	mixed cropping	mixed cropping	<i>vaitoaga</i>	mulching	burning	<i>vaitoaga</i>	mixed cropping
	mulching	<i>vaitoaga</i>	<i>vaitoaga</i>	mulching				mulching
		burning (banned during the dry season)	mulching					burning (banned during the dry season)
		mulching						
New methods	weedkiller	Slashing roots of invasive vines	salt to kill African snails		Slashing roots of invasive vines		salt to kill African snails	Slashing roots of invasive vines
		Reforestation					Slashing roots of invasive vines	Reforestation

A comparison of earlier studies (Buck, 1930; Watters, 1958) with my findings reveals slight changes in the timing of planting and harvesting. According to Buck’s (1930) observations in northwest Upolu and Savaii, early planting of crops occurred in May and June and the crops would normally be harvested in December. Another crop would be planted in December before the cyclone season starts. Yam planting dominates during the other months: notably November, December, January, May, June, July and August. My research findings revealed slight, but significant, variations to these patterns. Early planting now occurs in June or July. The time of harvesting has also slightly changed with some farmers beginning to harvest their crops earlier in November. December planting often allows

harvesting in April or at the end of March (see Chapter 5, Table 5.4). Seasonal crops, mainly vegetables, are also more commonly grown today. These changes show adaptive behaviour to changing environmental conditions.

iii) Multiple water sources and collection techniques

The majority of households have access to several water sources and have developed multiple water collection techniques. Most have a piped water supply and access to village pools, springs, village and church-owned water tanks (see Table 7.4). In places, such as Aopo and Auala, where the water supply has long been inadequate, all interviewed residents stated that their families have one or more water tanks as well as water-filled drums and containers. Older techniques for collecting water, such as the use of bamboo canes at Aopo (see Chapter 6: Section 6.5), and water tasting when the tide recedes at Auala (see Chapter 5: Section 5.3), are remembered by many. At Maagiagi, where residents had only recently faced irregular and, at times, inadequate piped water supply, most households had begun to use bottles and various containers to collect water, while some had installed water tanks. Alternative sources of water are church-owned water tanks, bought water from companies in town, and accessible parts of the Vaisigano river where water still flows.

Table 7.4: Sources of water and collection techniques in the surveyed villages.

	The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
	1. Saleimoa	2. Auala	3. Lano	4. Malaia	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
Water sources	Most families have piped water supply	Most families have piped water (saline)	Most families have piped water supply	Most families have piped water supply	Most families have piped water supply	Most families have piped water supply (mostly rationed during dry season and dirty during wet season)	Most families have piped water supply which is managed by the village	Most families have piped water (saline)
	Few families have water tanks	Most families have one or more water tanks	Some families have water tanks	Most families have water tanks	Many families have water tanks	Few families have water tanks	Few families have water tanks	Most families have one or more water tanks
	Some water filled drums and containers	Most have water filled drums and containers	Some water filled drums and containers	Most have water filled drums and containers	Most have water filled drums and containers	Most have water filled drums and containers (some are bought from water companies in town)	Few have water filled drums and containers	Most families have water filled drums and containers
	Village pools and springs Malua, Toftuola, Logoua, Fuilala, Makei, Fuimaave (see Figure 5.1a: 108).	Village pools and springs Safua and Vaovai (see Figure 5.2a: 130; Figure 5.2f: 142)	Village pools and springs located on the coast and along the wetlands (see Figure 5.3a: 150)	Water sources are located within the wetland.	Village pools and springs- Tosoga, Vaileva, Matamanu, Punapuna, Talosa, Le Puna, Fiaatua, Faanunu- are located within the mangrove area (see Figure 6.1a: 171).	Some people source water from parts of the Vaisigano River (see Figure 6.2a: 186)	Sili river is an alternative water source (see Figure 6.3b: 203)	Aopo stream is an alternative water source (see Figure 6.4c: 213)
	Church water tanks	Village water tanks (see Figure 5.2h: 146)	Church water tanks	Church water tanks	Church water tanks	Church water tanks	Village owned piped water supply	Church water tanks
		Church water tanks					Church water tanks	
Collection techniques		Waiting until the tide recedes and then tasting water before collection				Remembering the times when the tap supply would be on		Bamboo canes
		Recycling/ reusing water				Recycling/ reusing water		Recycling/ reusing water

B. The supportive role of village groups, churches and government agencies in diversifying food and water supplies

Activities at the village level by various village and church groups have been important in the development of most families. Village meetings and activities, such as inspections of plantations and food gardens by the council, untitled men's group or women's committees, have played a vital role in the diversification of food supplies and other resources. Most village groups have already developed and are now managing alternative water sources on which residents rely during times of crises. For example, pools, springs, streams and water tanks were evident in most of the villages that were visited. Some villages, such as Sili, now have a tapped water supply for its residents, drawing from village-owned water sources.

Most of the surveyed villages have established, in partnership with the government and international agencies, conservation schemes to ensure the sustainability of village-owned resources. The majority of these involve preserving parts of forests and marine areas from development (see Table 7.5). Some of these protected areas, such as the Aopo Cloud Forest Reserve, have been turned into village-owned tourist projects, which provide alternative income for residents. Reforestation and sustainable land use have been encouraged, at Aopo, Auala and Sili, all of them enforcing village rules to ban the use of chemicals and burning of the land.

Table 7.5: Village conservation schemes in the surveyed villages.

Village conservation schemes	The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
	1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
		Tilapia farm	Mangrove area	Wetland area	Mangrove area	Forest	Forest	Forest
		Mangrove area	MPA	MPA				
		Marine Protected Area (MPA)						

The findings also showed government assistance in the selected villages which is helping with the diversification of food and water supplies. There was evidence of water tanks, housing materials, crop seedlings and farming equipment in the tsunami affected areas of Saanapu and Malaela, while at Auala there had been provision of water tanks, portable lavatories and crop seedlings. The government had also supported the conservation and sustainable use of village resources by helping villages like Aopo, Saanapu, Malaela, Auala and Lano establish forest reserves, mangrove conservation areas and Marine Protected Areas. Where there was little evidence of government intervention, village and church connections helped most interviewed residents endure.

7.3.3 Mobility

Mobility has been another key coping strategy. The findings revealed multiple family connections and the collective nature of land ownership enabled most interviewed residents to ‘shift between residences’, or to build other houses and cultivate their plantations on lands separate from where they currently reside when the need arose. This practice known as *faa-aigalua* [to have two residences or families] demonstrates the fluidity of human movement noted earlier by Chapman (1985a; 1985b), Chapman and Prothero (1985), Watson (1985), Hauofa (1993) and Lilomaiava-Doktor (2009). *Faa-aigalua* is enabled by how most Samoans have access and rights to lands where their homes are located as well as to lands where their plantations, food gardens or farms are cultivated. Further, all Samoans have access rights to land via their father’s and mother’s lineages. These study findings reveal the complexity of customary land ownership in Samoa and how this system has enabled many of the study participants to develop and shift between places of residence when necessary, not only within but also outside village boundaries, when faced with environmental challenges. *Faa-aigalua* also indicates that many of these residents are in a continuous state of ‘transitioning’ between places, with many individuals identifying with several places as ‘home’ rather than one particular place. Sites are never abandoned, but are often visited when people do not reside there anymore and this is indicated by the ‘two headed arrows’ in the sketch-maps of the study sites (see Chapters 5 and 6). For instance, at Saanapu, while most people have settled on what were their plantation lands before the 1970s, they still own and visit their lands in the coastal part of the village. The effect of the 1990s cyclones prompted many families living in the surveyed coastal villages to build second houses on their plantation lands, which are mostly located inland. Those residing in inland areas, mainly Sili, had since the 1990s, usually shifted to their other lands on the eastern part of the river valley or further inland. The 2009 tsunami caused many more families to build residences inland at the village of Malaela, while flooding during Cyclone Evan (2012) had seen some families, who live on the Vaisigano riverbank building second houses in upper inland parts of the village. At Saleimoa, where most inland areas have already been alienated, some families are cultivating plantations and building houses on their customary lands in other villages. Some are cultivating plantations for free on church owned lands. Others bought freehold lands in areas near Apia, where they have built houses and cultivated plantations. The study shows that in some of the villages, government assistance in the development of roads, electricity and water supply in all of the surveyed villages is facilitating the current shift of people inland.

7.3.4 Mental and spiritual strength

Exercise of mental and spiritual strength is another key coping strategy that many participants mentioned. For most of them, attending church on Sunday and daily services are part of the household routine. The elderly members and parents who were interviewed talked about the significance of such times in imparting knowledge and sharing ideas with young people. The evening is when most members of the family come together, stop their chores for the day and gather for worship. Most respondents who were parents said that during this time they talk to the younger members of the family about their experiences and how difficult things were when they were growing up, thereby teaching them not to take for granted what they now enjoy. Time for worship also comprises sharing family stories, such as who their ancestors were, where their family lands are located, and how they lived in the past. These discussions include imparting cultural values of respect, sharing and love (see Chapter 5: 136).

Many respondents talked about the importance of worship and family-sharing in developing calmness, hope and optimism during periods of challenge. Here, the study findings contest Nunn's (2009: 213) claim that Christianity is "...a hindrance to meeting the challenges of climate change... an excuse for inaction." Those affected by the tsunami, especially at Malaela and by flooding during Cyclone Evan at Maagiagi, mentioned the important role of spiritual strength in easing feelings of worry and panic and in giving them the strength to move on. Church leaders and local Christian churches have also provided support in other ways. Calmness, optimism and faith were observed in the way people talked about their experiences of previous extreme events. Most were relaxed even when talking about the destruction of their homes and properties. Many would laugh as they remembered. What comes across is that most had accepted these events as integral parts of living, growing up and surviving in Samoa.

Local churches have been active in the provision of spiritual and mental support, as well as by offering disaster relief assistance. For example, churches were refuges for residents during previous cyclones and helped provide water sources to villages where water supplies had been inadequate, such as Aopo and Maagiagi. Many respondents were also members of church groups: youth, Sunday school, women's committees' activities, choir and father's clubs. These groups foster social connections which have helped many respondents, either by providing mental and spiritual support or general encouragement in the development of plantations and food gardens, thereby developing strength in residents to survive difficulties.

7.4 *Faamatai* and the future resilience of Samoans: future trajectories

The findings highlight the important point that environmental challenges, including climate change, are not entirely detrimental to the human psyche and way of life. Rather, as argued by Gunderson and Holling (2002), Berkes and Folke (1998) and Folke (2006) amongst many others, exposure to challenges creates opportunities for renewal and ‘emergence of alternative trajectories’.

7.4.1 Awareness of future climate related scenarios

A. Awareness of the future dimensions of climate change

The study findings demonstrate that experience of challenges develops the human capacity to imagine future scenarios. ‘Heightened sensitivity’ and the ‘ability to look forward and predict changes’ are characteristics of resilient individuals (Pike *et al.*, 2010). By drawing on their experiences, most respondents were able to envisage those dimensions of climate change that they are likely to experience. Table 7.6 shows that the dimensions of climate change that most Samoans are currently experiencing were thought likely by most respondents to continue into the future. With the exception of one village, increasing of temperature patterns is perceived by most residents as their greatest future concern. Hotter days were perceived most likely to occur by residents of seven villages; with residents of four villages (Saleimoa, Auala, Maagiagi and Aopo) noting the likelihood of both hotter days and longer dry spells. Contrastingly, Sili residents perceived shorter and heavier rain storms as the most significant dimension of climate change they are likely to experience. More damaging winds were another future concern for people in all of the villages, especially Auala, Malaela, Saanapu, Maagiagi, Sili and Aopo. Shorter heavier rainfalls were also perceived to be a future concern by residents of Saleimoa, Lano and Saanapu. An interesting finding is that sea level rise featured as the least significant concern in five of the eight surveyed villages, with Saanapu residents perceiving this dimension to be less of a concern in the future (see Table 7.6).

Table 7.6: Dimensions of climate change perceived to possibly occur in the future by those surveyed in eight communities in Samoa. The listed dimensions were frequently mentioned and emphasized by respondents.

Note: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
Hotter days and longer dry spells		Hotter days			Hotter days and longer dry spells	Shorter and heavier rainfall	Hotter days and longer dry spells
Shorter heavier rainfall	Stronger damaging winds	Shorter heavier rainfall	Stronger damaging winds				
Stronger damaging winds	Sea level rise	Stronger damaging winds	Sea level rise	Shorter heavier rainfall ↑			
Sea level rise		Sea level rise		Sea level rise ↓			

B. Awareness of the likely impacts of future climatic changes

i) Recognizing likely risks and their significance

All impacts that participants have been experiencing were generally perceived as being likely to continue in the future. However, there were some noticeable differences when respondents' perceptions of the future impacts of climate change were compared with their perceptions of current climate change impacts. Some impacts were perceived to be of more concern in future, while others were perceived to be less significant suggesting the shifting and complex nature of human perceptions. As shown in Table 7.7 an inadequate water supply was identified as a new risk at Saleimoa, while reduced productivity of the land was perceived likely to occur in three villages: Auala, Maagiagi and Aopo. New diseases were seen as likely to occur by Saanapu residents. Reduced productivity of cultivated land was perceived to be a greater concern at Saleimoa and Saanapu. Diminishing marine resources were thought likely to be less significant by Saleimoa and Malaela residents, while damage to properties was of less concern to Saanapu residents. The majority of respondents suggested future changes might bring desirable opportunities, such as better access to resources and improvements in social networks. No-one mentioned improvements in infrastructure as a likely opportunity associated with future climate change.

Table 7.7: Likely impacts of future climate change perceived by those surveyed in eight communities in Samoa. The listed impacts were frequently mentioned and emphasized by respondents.

Risks								
↑ Issues have shifted upwards in ranking because they were more frequently mentioned and emphasized. ↓ Issues shifted downwards in ranking because they were less frequently mentioned and emphasized. A new issue was mentioned.	Note: The study sites are organized according to their location from the coast. A coastal village would have the majority of its population living within 2 km of the coast. An inland village would have most of its population living more than 2km from the coast.							
	1. Saleimoa	2. Auala	3. Lano	4. Malaela	5. Saanapu	6. Maagiagi	7. Sili	8. Aopo
	Damage to properties	Inadequate water	Damage to properties		Reduced productivity of the land ↑	Inadequate water	Damage to properties	Inadequate water
	Reduced productivity of the land ↑	Reduced productivity of the land	Pests	Inadequate water ↑	Damage to properties ↓	Damage to properties	Pests	Damage to properties
	Diminishing marine resources ↓	Damage to properties	Inadequate water	Diminishing marine resources ↓	Occurrence of new diseases	Reduced productivity of the land		Reduced productivity of the land
	Diseases				Inadequate water			
	Inadequate water				Loss of coastal land			
Opportunities								
Access to food and other resources								
Stronger and diversified networks								

Likely significance of risks associated with future climate change

By thinking about the severity of risks associated with different dimensions of climate change, and the responses that communities had developed since these events occurred, many respondents were able to reflect on the probable significance of future climate related events. Table 7.8 shows that the majority of participants sensed that risks associated with hotter days and longer dry spells, stronger damaging winds and shorter heavy rainfall, would be greater in future. People living in coastal villages, where the majority of Samoa's population still resides, thought that risks associated with sea level rise would increase from 'Low' to 'Low-Medium' in future. In contrast, at Saanapu, where the majority of village people reside inland, the perceived significance of risks associated with future sea level rise declined from 'Low- Medium' to 'Low'. Residents of Aopo perceived that risks associated with stronger damaging winds would remain the same, and Saanapu residents also perceived risks associated with shorter heavier rainfall in a similar way.

Table 7.8: Perceived significance of risks associated with current and future climate change.				
STUDY SITES 1-8 LISTED IN ORDER FROM COASTAL TO INLAND	Perceived significance of risks associated with current climate- related events		Perceived significance of possible risks associated with future climate-related events	Change: > greater < less = equal to
Site 1 Saleimoa	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Shorter and heavier rainfall	Medium	Medium- High	>

	3. Stronger damaging winds	Medium	Medium - High	>
	4. Sea level rise	Low- Medium	Medium	>
Site 2 Auala	1. Hotter days and longer dry spells	Medium	Medium-High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Medium	>
Site 3 Lano	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Shorter heavier rainfall	Medium	Medium- High	>
	4. Sea level rise	Low- Medium	Medium	>
Site 4 Malaela	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Medium	Medium	=
Site 5 Saanapu	1. Hotter days	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
	3. Sea level rise	Low- Medium	Low	<
	4. Shorter and heavier rainfall	Low- medium	Low- Medium	=
Site 6 Maagiagi	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 7 Sili	1. Shorter and heavier rainfall	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium- High	>
Site 8 Aopo	1. Hotter days and longer dry spells	Medium	Medium- High	>
	2. Stronger damaging winds	Medium	Medium	=

7.4.2. Strengthening *faamatai* connections

The findings showed connectivity and continued sharing of information between village councils, churches and the government has been crucial to the development of current strategies that could deal with risks associated with future climate change (discussed later in this section). At the same time the findings revealed recommendations for some aspects of *faamatai* to be improved. *Faamatai* has fostered resilience and ‘adaptability’ to external forces since the 1800s and, as changes occur, it is crucial for Samoans to continuously reassess the system’s ability to face emerging challenges. While the literature on resilience focuses on the need for intelligent leadership (Pike, 2002; Pike *et al.*, 2010; Gunderson,

2000), this study's findings suggest that people need to look beyond those who are leaders and re-examine their own roles as individuals within local systems as they 'groom' and select their leaders. Many respondents insisted that young people should be hard working, obedient, cooperative and caring to elderly members of the family. Elderly persons, parents and holders of chiefly titles should encourage family gatherings, especially daily evening services, to foster relationships, build social memory and enable the sharing of knowledge and skills. Holders of chiefly titles also need to be responsible caretakers of family resources, provide love and care for family members, and ensure there is honest and effective communication of concerns between the family and the village council.

Many respondents stressed the importance for individual Samoans to be alert and proactive in decision-making within their families, especially in the selection of holders of chiefly titles, as these would be their representatives on the village council. The responsibility of village councils to manage resources and ensure the wellbeing of village residents is important, so individuals should seriously think about the character traits of those whom they select to make decisions at the village level. It is important to choose individuals who are caring, impartial, alert and visionary. At the same time, they should be well connected with good networks and adequate reserves of social capital. In order to make sound decisions, social memory and knowledge of the village environment and history are crucial in the selected individual. Some level of education is also needed to properly understand and engage with external parties, such as the Samoan government and external agencies. Family members also need to be proactive in ensuring leaders are held to account for their decisions and actions. Most of these characteristics were similar to what was stated in studies by Pike (2002), Pike and colleagues (2010), and Gunderson (2000). These suggestions are important for everyone to consider at the individual and family levels because, as mentioned in Chapter 3, the Village Fono Amendment Bill 2015 proposed amendments which would grant legal recognition to the authority of the village council to draw-up village constitutions, impose curfews and approve activities on village lands. These amendments would certainly strengthen the power of the village councils in the management of village affairs.

7.4.3 Diversification for future food and water supplies

As discussed previously, multiple and multi-level activities had already been effected in all of the villages to enable diversification of food and water supplies. These efforts not only help residents endure current challenges but more importantly they allow residents to prepare for

possible risks associated with future climate change. For example, the current installation of water tanks by families, churches and external agencies and the development of multiple water collection techniques in the dry areas of Aopo, Auala and Maagiagi are helping the residents of these villages prepare for possible hotter days and drier spells in the future. Sili's decision to manage riverflow and water supply for village residents has been important in securing continuing access to water supplies. The current struggle by Maagiagi council to reclaim the ownership of its water sources is an important move by the village to secure future alternative water supplies.

Equally important is the government's role in providing piped water supply, electricity, health care, disaster relief and emergency help, and in assisting villages to establish reserves that would help with the development of future food and water supplies. Village conservation areas, such mangrove and forest reserves and Marine Protected Areas (MPA), as well as village rules to guard against unsustainable land use, are important for ensuring food and water security for residents.

Maintaining ownership of village resources, such as water sources, village lands and marine areas, and effective monitoring of the uses of these resources, is crucial to continued diversification and the sustainability of peoples' livelihoods. However the study findings revealed challenges to livelihoods have emerged in some villages, whereby ownership of key resources has been lost. Village councils are obligated to effect decisions and seek alternative ways to ensure village residents are able to access resources such as food, land and water. For example, Saleimoa's council needs to ensure that negotiations continue and that clear arrangements are made with the Congregational Christian Church of Samoa (CCCS) to secure lands for its residents to shift to in future. The latter process is important, and proper documentation is needed to prevent conflict in future. The CCCS has an obligation to these residents, many of whom are church members, to offer clear conditions for the use of church lands. Details of recent resettlement programmes by the government and the Catholic Church in the Apia Urban Area could be useful here (see Latai-Niusulu, 2015). The Maagiagi village council needs to resolve tensions with the government and seek ways to secure alternative water supplies for the village residents. Possible strategies that the council might consider include applying to the Civil Society Support Programme (CSSSP), Red Cross or USAID for funds to buy community water tanks; in this regard educated members of the community could assist in the preparation of funding proposals. Another option would be to request

access to parts of the Vaisigano river which the village could manage as a water source. At Aopo, the council's decision to sell part of their reforested areas has seriously compromised current efforts to ensure sustainable land use in their area. The village urgently needs to start thinking about ways to cope with commercial logging and its adverse environmental effects.

While many respondents commended governmental and external agencies for the development of village infrastructure, some residents expressed concern that several of these projects could compromise homes and livelihoods. Furthermore, others questioned the relevance and sustainability of some conservation projects, for example tilapia farms. Most respondents suggested the need for longer and more 'engaging' consultations, in which local knowledge and expertise are included in government decision making and planning, to ensure the sustainability of such initiatives. Most also suggested the need for government assistance in the provision of fishing equipment, improving community water sources and crop seedlings.

7.4.4 Future mobility

In regards to future mobility, the increase in establishing alternative places of residence on lands located away from coastlines and rivers will be important in helping residents reduce the risk of flooding, inundation and storm surge. Continued access to customary owned lands as well as the ability to arrange leases or purchase privately owned lands will enable many to be mobile in the future. As mentioned in the previous section, councils of villages where customary ownership of lands has been lost should be proactive in seeking alternative lands for their residents to build houses as well as cultivate plantations. The assistance offered by the Samoan government through developing infrastructural support, such as building new inland roads on the south flanks of Upolu, had been crucial in facilitating these shifts. However, government also needs to improve inland access in places like Auala, Lano, Maagiagi and Sili. Moreover, government also needs to assist in the provision of adequate water supply, electricity and health care in these areas.

7.4.5 Developing mental and spiritual strength

Individual and extended families, local churches and related groups have been particularly helpful in the development of mental and spiritual strength as well as providing disaster relief aid when needed. Current routines of morning and evening services in the family and church activities on Sunday and during the week are crucial for spiritual and mental development

necessary to endure difficult times in the future. These activities must therefore continue to occur at the family and church levels. Village and church groups must play their part in supporting spiritual and mental development activities. One way is through implementing evening curfews to ensure there is time for family services and gatherings.

Sharing of knowledge and skills also needs to be fostered at the village level. Churches and villages have done well in building structures, such as community *fale* [houses] churches and church halls, as spaces for people to meet and converse. However, these must be effectively used for regular consultation and for meetings to share information. Members of the village council and leaders of church groups must ensure that elders and local experts (for example, farmers, fisherfolk, traditional healers and weavers) are present and able to share their knowledge and experience with younger members of the village and during consultations with government and external agencies. These sessions would give younger members of the community a recognized voice in decision-making.

7.5 Conclusion

This study has identified a way to investigate the resilience of islands by combining non-equilibrium insights of resilience and a cultural ecology research approach. The holistic and place based approach has revealed a heightened awareness among research participants of the various dimensions of climate change. By examining the perceptions of research participants, we were able to see how climate change had impacted places in different ways and with varying degrees of intensity. Moreover, we see likely ways in which climate change could affect these places and their residents in future.

The study findings also indicate how coping strategies are inherent in the Samoan system of *faamatai* and the local structures of extended family, village and church groups. The holistic approach of this study captured the variety of survival mechanisms developed at the extended family level, and the supportive roles of village and church groups. The resilience of an island community lies in the diversity of strategies and the inter-connectedness of human efforts. Support from the government and external agencies is also important, but secondary to local structures of village and extended family groups.

The results of this research have shown that village residents anticipate slight changes in the intensity of some dimensions of the climatic changes that they had already been experiencing. Much of what they had done to endure earlier risks remains relevant as they prepare for

future impacts. In addition, new ideas and techniques have been merged with existing strategies. Insights from this chapter have demonstrated the existence and importance of a bottom-up approach to the development of resilience to climate change. It is important for external agencies not to impose new and different strategies unless the majority of residents have been consulted and all likely implications are fully discussed. More importantly, individuals should recognize that they have a central role to play and the responsibility to play it in the survival of their families and villages in the light of current and future climate changes. The insistence of most respondents for all Samoan residents to reconsider their roles as individuals, members of extended families, village and church members, and Samoan nationals highlights the multiple and multi-layered roles of the ‘individual within *faamatai*’ and the importance of this for survival in a challenging environment. This finding suggests at the notion that the system will implode if individual Samoans, who are at the centre of this system, fail to continuously re-evaluate their roles and responsibilities within their families, villages, churches and in government and external agencies. On the other hand, it is also evident that if individuals are able to make better choices and adapt on their own, there is a possibility that the community might constrain such adaptive behaviour if community structures and processes fail to keep up with the changes.

Chapter Eight. Persisting through changes: Conclusion and recommendations

8.1 Introduction

Human geographers have long emphasized the significant role of human perspectives in informing our understanding of places and how they change. However, studies which accurately feature the perspectives of islanders are especially rare in the context of climate change. This thesis has developed an approach to assess the resilience of islands to climate change using the perspectives and actions of islanders. The approach, analytical tools and study findings of the thesis are in themselves a critique and intervention which challenge notions of stability which underline concepts of ‘vulnerability’ and ‘resilience’ in the literature on climate change and islands.

This chapter concludes the thesis by providing a summary of the study and outlining its key contributions and recommendations. The first section of the chapter revisits the study’s argument and briefly explains the methodology and methods that were used. The chapter then summarizes the main findings in relation to the research questions that were asked. The third section of the chapter discusses the theoretical and methodological contributions of the thesis to the literature on resilience, climate change and islands. Additionally the study’s empirical contribution to knowledge on climate change adaptation and resilience in Samoa is also detailed. This section also outlines recommendations which emerged from the study findings, for local residents, community leaders and members of relevant national and international institutions. The chapter ends with suggestions regarding future research possibilities.

8.2 Summary of the argument and methodology

The aim of this thesis is to deepen understanding of the resilience of island societies to climate change using a cultural ecological interpretivist approach. It is a response to recent propositions made in the literature for more studies to evaluate the adaptability of island societies to future climate change (Nurse *et al.*, 2014; De Souza *et al.*, 2015). Drawing on ‘non-equilibrium’ insights of resilient systems (Holling, 1973; Torry, 1979; Grabher and Stark, 1997; Holling *et al.*, 1998; Berkes and Folke, 1998; Gunderson and Holling, 2002; Berkes, *et al.*, 2003; Folke, 2006; Pike *et al.*, 2010 and Simmie and Martin, 2010) the thesis recognizes that islands are faced with frequent and unpredictable environmental challenges,

including climate related changes, but it argues that being exposed to these challenges does not necessarily cause islanders or island societies to be wholly vulnerable. Based on empirical findings from fieldwork conducted on two islands in Samoa, this thesis contends that exposure to past disturbances, some of which are part of climate change, have caused most societies to be more resilient and more capable of dealing with possible impacts of future climate change. This argument is demonstrated in the study's hypothesis which stated: *"Islanders have for centuries had to cope with difficult and unpredictable environments and they have developed a range of coping strategies to strengthen sustainability. Thus, they would be better prepared to deal with current and future climate change."*

In this thesis I have adopted a 'cultural ecological interpretivist approach'. Specifically, I have used a holistic approach- a conceptual framework and strategy within which the resilience of island societies is considered as an element of an interconnected and dynamic system of physical and social processes operating in specific places. As we saw in Chapter Two, the indicators of resilience that are identified in studies of ecological systems, individuals and socio-ecological systems are generally similar to the survival strategies indicated in cultural ecological studies of adaptable societies living in harsh environments, such as the Arctic and African Sahel. Most of these indicators notably, social networks, traditional knowledge, mobility and mental and spiritual strength, have been considered in this study's assessment of the resilience of contemporary island societies. Care has been taken to avoid viewing these indicators in isolation, as their 'interconnectivity' is so important to providing a more realistic representation of how they contribute to the resilience of islanders.

Locally derived concepts and understanding have been used to inform the interpretations and discussion of these indicators to portray the holistic nature of island societies. Taking a 'non-equilibrium' perspective and applying the indicators to examining the adaptability of I-Kiribati and the Maldivians revealed a general picture of resilience. Both atoll nations face possible adverse impacts of climate change amidst other developmental challenges that they have been experiencing. A closer look shows that I-Kiribati and Maldivians are not only at the forefront of the global fight against climate change, but are actively developing national policies and strategies to address and prepare for possible future impacts. Strategies developed to cope with previous historical challenges on these atolls are helping communities to endure current challenges and prepare for future climate change. Grounding the assessment of Samoan resilience 'in place' was more practical in the sense that 'nuanced

experiences' of certain places and systems are hence more adequately considered. As shown in Chapters 3, 5 and 6, the investigation has delved into a particular 'place' and provides a closer look at the evolving nature of particular social systems 'holistically' and 'spatially', as shown by the way *faamatai* is handling the challenges which eight villages in Samoa are experiencing.

In order to gather information in Samoa and carry out the analysis, I used a qualitative methodology and a largely interpretive research design. Different types of villages, coastal, inland, urban and rural, were considered in the selection of my eight study sites, so the data represents varied experiences from across the country. Those who were surveyed were of different ages and gender, lived in different parts of the village, and were engaged in different roles and responsibilities in their families, villages and churches. This was done to enable 'triangulation' of the information, and enabled me to cross-check information between different community members. Interviewing government officers, representatives of civil societies and external agencies also contributed to the validation process, as some of these people have been involved in community outreach programmes. Further, comparing what study participants said with the contents of available government and other documents was another way of ensuring the validity of information.

Cultural protocols implemented during preparation for the fieldwork, and in carrying out the interviews and focus groups were important in ensuring the validity of the research findings. As a Samoan, I was well aware of cultural expectations surrounding the gathering of information, such as proper clothing, language used, appropriate behaviour, traditional gifts, and I tried to follow these in order to gain the trust of those I intended to interview. Interviewing people in their homes and taking walks with some of them helped me contextualize what the participants were saying. Narrative-descriptive methods were used to organize and interpret the study findings. Various analytical tools were employed to extract themes from the raw data and determine which ones are significant, including primary and secondary coding, content analysis, deconstruction and multi-level comparative analysis. These same tools were used to develop an assessment framework to determine the significance of risks associated with various dimensions of climate change. The results were presented in Chapters 5 and 6, then discussed and linked to the literature in Chapter 7.

8.3 Summary of study findings

The two research questions asked at the beginning of the thesis helped in gathering the information to assess the hypothesis and develop the study's argument. The first research question aimed at assessing peoples' perceptions of climate change in the context of other drivers of environmental change that they may have experienced and the sources of their knowledge. This stated; What changes, associated with climate change, do islanders think are currently taking place and which of them are likely to occur in the future? With regard to the first research question, the findings indicated there was a heightened awareness of several dimensions of climate change across the surveyed sites: notably, hotter days and longer dry spells, shorter heavier rainfall, stronger damaging winds and sea level rise. All participants described more than one dimension of climate change and, as evident in comparisons made in Chapters 5, 6 and 7, these viewpoints differed across the surveyed study sites, depending on the location and situation of the village. This was also observed in participants' descriptions of impacts associated with climate change and their significance. The case study approach and analytical tools used enabled me to tease out nuances in peoples' perceptions of climate change. For instance, the most frequently mentioned and emphasized dimension of climate change was rising temperatures, yet this had not been experienced in the same way in all of the villages. Participants in the villages of Auala and Aopo mentioned hotter days and longer dry spells, while those living at Lano mentioned hotter days. Very few residents at Sili talked about the heat, as they were more concerned with inadequate rainfall and water supply. These differences also featured in participants' perceptions of possible future climate change and its impacts. The study's findings showed that the majority of participants understood that the dimensions of climate change which they are currently experiencing are likely to intensify in the future and, for most of them, damage to property and an increasingly inadequate water supply would continue. At the same time, climate change may also bring opportunities, such as access to food and other resources and stronger, more diversified social networks. The study also found that peoples' experiences of disturbing environmental events, some of which were climate-related, have created greater awareness. In addition, various sources of knowledge existed among the communities that were surveyed. Multiple and multi-layered connections within families, villages and nation-wide create a greater awareness of the dimensions of climate change.

These findings contested statements in the literature about islanders and their knowledge of climate change (Nunn, 2009; Nunn *et al.*, 2013; Kuruppu and Livermann, 2011). Chapters 5

and 6 of the thesis demonstrated the complexity of participants' perceptions of climate change and how climate change impacts on places differently. As stated in the discussion chapter, the reason for the contrasting perspectives is due to the differences in the aims and methods employed. My concern was not whether the participants understood the science behind global warming, even though the study findings revealed that most participants had a general understanding of the theory. As the findings revealed, people could describe climate change and its dimensions, and were familiar with their impacts and implications. Future studies should examine peoples' perceptions of climate change, by translating the concept of 'global warming' in common and simple terms. My conversations with research participants started with me simply asking them to talk about 'the current *vevela* (heat) in Samoa.'

The second research question, which was asked in order to ascertain resilient behaviour, stated 'How have islanders coped with previous disturbances including those which are climate-related? What strategies are they currently employing? And, what do islanders want and need to cope with future global warming?' The study found that the majority of surveyed participants have coped well with previous challenges and are remarkably 'proactive' in devising coping strategies. In all of the surveyed villages, strategies include diversification of food and water sources and collection techniques, being geographically mobile, having more than one place of residence, and developing mental and spiritual strength. Using an approach which placed the individual within *faamatai* networks revealed that resilient strategies are mostly developed at the extended family level. Village councils and churches play a crucial supportive role in the development of these strategies at the village level and there was also evidence of government assistance.

Presenting the findings within the content of village case studies permitted me to show slight variations in participants' experiences and the types of strategy they were employing at the family and village levels. As discussed in Chapter 7, these differences are mainly due to the location of the village and the challenges respondents had experienced. There is evidence of mobility in all of the villages, with most people living along the coast shifting inland or out of the village to escape the impact of Cyclones Ofa and Val and the 2009 tsunami. Similar patterns are evident in settlements close to river banks. Those who had faced enduring and or extreme challenges were more inclined to move; for example, most residents of Saanapu and Malaela shifted to an inland site. Reconsideration of land and water use are evident in all of the communities, especially in villages that have been facing long-lasting challenging

conditions, such as Auala and Aopo, or extreme events in the past few years, namely Maagiagi and Malaela. Contextualizing the findings also enabled me to see varying levels of assistance from government and external agencies across the surveyed villages. The government is actively providing infrastructural support: for example, electricity, water, roads in most of the study sites. It is also helping most villages in the sustainable management of their marine and coastal areas, forests and water sources and in the development of livelihood programmes. In all of the coastal villages, the government has constructed seawalls. Most of these strategies are building the capacity of individuals to cope with future climate change.

All eight communities surveyed are looking forward to and thinking about the future, and devising ways to deal with new challenges. For most, the key to developing preparedness to cope with future climate change involves improving social connections. Most interviewed residents suggested that processes of consultation and sharing information need improvement at the family and village levels, and also between village and government institutions and external agencies. At the extended family level, elderly members of families, parents and holders of chiefly titles must play their roles to ensure these activities occur. The implementation of evening curfews, by the village council and untitled men's group, would allow time for families to share and foster connections and knowledge. The words of one research participant emphasize the value of these activities. An elderly woman said,

“Every family must ensure they have evening services. This is so important. The first classroom is the home, where there is sharing of family stories, local stories, distribution and sharing of food. Whatever food you have share it. If its bananas that you are having then share the bananas. Those families should also share. That part of Samoan life is very important- for the continuous connections of families. The Samoan phrase *mativa faafesagai* means facing each other in hardship and poverty. Teach the children the importance of such things- to have heart for their families, their villages” (MG001, 29 September, 2014).

Churches and villages have done well in building spaces such as community *fale* [houses], churches and church halls as spaces for people to meet and strengthen social connections, share knowledge, and develop social memory. However, more action is required, by village and church leaders, so that these community spaces are utilized to foster connections and, more importantly, develop social memory. These activities would help prevent the poor decision-making that has caused concerns in some of the villages. The findings revealed alienated lands at Saleimoa, loss of rights to water sources at Maagiagi and logging of native

forests at Auala and Aopo. Evidence shows that reflecting on and learning from these experiences has helped people reconsider their practices and decisions, however the process must be ongoing to ensure future sustainability. As indicated by many research participants, these experiences must be shared, especially with younger residents of villages so they remember and use these lessons in future decision-making.

8.4 Key contributions to the literature

8.4.1 Theoretical and methodological contribution

A. Deploying the cultural ecological approach to determining the resilience of social systems

This thesis has extended theoretical understanding of resilience, by challenging the current paradigm that defines resilience as a return to equilibrium using a cultural ecology lens and interpretivist research design. As explained in Chapter 2, existing studies of resilience have helped to determine indicators of resilient systems, while some have proposed general ways of demonstrating the ‘adaptability’ and ‘transformative nature’ of systems in response to change. Gunderson and Holling (2002) have suggested using the concept of ‘panarchy’ to demonstrate how systems generally behave in response to various levels of disturbances. This has largely influenced the way other scholars have described changes to social ecological systems (for example, Folke, 2006), and the transformation of regional economies (McGlade *et al.*, 2006; Pike *et al.*, 2010; Simmie and Martin, 2010). However, several authors (for example, Resilience Alliance, 2007; Wilson, 2012) have acknowledged that the development of approaches to examine the resilience of social systems is at an early stage. As this thesis has shown, more can be learned about the resilience of social systems if a cultural ecological interpretivist research is used. Cultural ecology asserts the adaptability of human societies and shifts the focus of resilient studies to exploring human-derived or social indicators of resilience rather than physical indicators. This approach also emphasizes the importance of using holistic methods which recognize the interconnectivity of structures and processes within systems operating within specific ecological locales. These ideas shaped the study’s approach and design. The key aspects of the approach are as follows.

1. The first phase requires the identification of key social ‘buffering’ structures which exist in a particular place and determine how these have evolved into the present time. This necessitates not only a detailed but a longitudinal assessment of social structures that define a particular place. This is a unique aspect of this study as it has shown the value of taking a

longitudinal approach to reveal historical disturbances that have occurred in a place and, more importantly, features of a social system that has persisted and those which had evolved. For example, Chapter 3 has demonstrated that *faamatai* has persisted through changes which have occurred over the past two hundred years. At the same time, changes have been developed whereby *faamatai* in contemporary Samoan society is now characterized by the multi-layered arrangement of extended families, villages and churches, as well as government and external agencies.

2. The second phase of the approach identifies the value of including human perceptions and behaviour in the assessment of the resilience of systems. As mentioned in earlier parts of this thesis, human geographers have long argued the importance of examining human perspectives and systems to inform our understanding of places and how they change. For example, Yi Fu Tuan (1991: 684- 685) stated “our society tends to discount the psychological, even though we know from common experience that changes in perception and attitude can seem to alter an environment more markedly than if it had been physically changed”. The last three chapters demonstrated that we can shed light on how climate change is impacting on places, in slightly different ways, by examining human perceptions and behaviour. As described in Chapter 4, participatory research methods, as well as fluency in local languages and cultural protocols, are important in the gathering of research information. Equally important is the use of constructive and interpretive methods of analysis that scrutinizes the ‘words’, ‘silences’ and ‘body language’ of each research participant. As this research had done, one could use the words of the participants to construct analytical tools as well as develop ways of presenting study findings.

3. The third phase of the approach not only emphasizes the contextualization of human perceptions and behaviour ‘in place’ but proposes a way of doing so. The study suggests that situating the individual and his or her perceptions within existing social structures and connections could enable a more adequate understanding of their resilience and subsequently the resilience of the places in which they reside. As explained in Chapter 3, Figure 3.11 demonstrates that the individual is at the centre of a set of complex social connections which are illustrated by the concentric rings. These social connections act as ‘buffering layers’ which could help the individual to cope with environmental challenges. The system is not hierarchical and highly flexible and there are complex interactions within the circles and between the circles. A resilient system or individual is where all or some of these layers are present and are working harmoniously.

As evident in Chapters 5 and 6, individuals and their perceptions and actions of climate change, were situated within the context of Samoan social structures; notably the extended family, village, church, district and nation. By doing this, the study was able to demonstrate the resilience of the individuals surveyed and their villages. Central to this resilience is the Samoan system of *faamatai* which has proven its robustness by adapting to internal and external changes over the past 200 years. As discussed in Chapter 7, multiple and multi-layered connections that have been added over the years are developing knowledge of climate change and related strategies such as diversification, mobility and mental and spiritual strength (see Figure 7.1).

The research approach which this study has developed could possibly be useful in the assessment of the resilience of other places, especially where there are strong communal bonds and social memory. The approach would need to be adapted accordingly, to specifically include the social systems which are in place in other countries today. However as this study has demonstrated, key aspects are important to consider when developing bottom up approaches which give voice to community residents. In order to give voice to community residents, it is absolutely crucial that researchers recognize and meet local cultural expectations and related protocols or what is considered ethical behaviour in particular locales. Knowledge of the local language and what is considered culturally appropriate behaviour is particularly vital to gaining an in-depth understanding of the information that is gathered for research and establishing the validity of research findings. For instance, as this study shows verbal consents and invitations are considered more appropriate in some contexts compared to written communication. Furthermore, this study asserts that specific actions such as reflecting on the appropriate dress, language, behaviour and reciprocity are an important part of carrying out research at the community level. Equally important to gathering qualitative information are considerations of the necessary respect to show and protocols to observe when entering certain physical spaces in study areas as well as the appropriate seating positions in meetings.

B. Considering non-equilibrium insights and the cultural ecological interpretivist approach in investigating the resilience of islands to climate change

This study has provided important empirical information on Samoan adaptability and resilience to climate change and other environmental changes which informs understanding

of islander awareness and sensitivity to climate change, adaptive behaviour and the buffering capacities of islands. This study also contributes to the climate change and islands literature by proposing the use of non-equilibrium perspectives and a cultural ecological interpretivist approach (outlined in the previous section) to challenge the narrow focus on island vulnerabilities and conceptualize the resilience of islands. The thesis has deconstructed and interrogated theoretical underpinnings of the concept of resilience and, as introduced in Chapter One, the study found that the Resilience Index that has been developed to determine the resilience of islands is largely based on the idea of maintaining an imagined state of national stability. The Index prioritized neo-classical indicators such as macro-economic stability and market flexibility and quantitative methods and has subsequently provided little insight into how island societies adapt (Briguglio *et al.*, 2004; 2006; 2009; 2010; Briguglio, 2014). This study suggests that rethinking resilience from a non-equilibrium and cultural ecological lens could provide a more accurate portrayal of contemporary island societies and how they are enduring challenges and anticipating future climate change. As stated in Chapter 2, ‘non-equilibrium’ insights have been applied in many studies concerning the resilience of ecological systems, regional economies, individuals and socio-ecological systems. Notions of resilience based on social systems achieving a predicted state of ‘equilibrium’, have lead authors in this field to emphasize the dynamic nature of systems in which each individuals play a significant role in the development of resilience (Holling, 1996; 2005, Grabher and Stark, 1997; Gunderson and Holling, 2002, Berkes and Jolly, 2001; Folke, 2006; Gonzales, 2006).

Several themes and contributions have emerged from this study which should be considered in the assessment of island resilience to climate change- both in Samoa and elsewhere. First, island societies must be considered as complex and dynamic entities. Second, characteristics of islands such as their small size, isolation, few resources and frequent exposure to environmental challenges could enable islanders to be more resilient as challenges also bring opportunities needed for societies to develop preparedness, reorganize or even effect transformations. Third, social indicators of resilience must be used to determine and assess the buffering capacities of islands namely connections, mental and spiritual strength, awareness and sensitivity, diversification and mobility. Fourth, a deeper understanding of island resilience is enabled by a holistic and place-based approach which recognizes the interplay of all of the mentioned social indicators in particular ecological locales. More

importantly, the holistic approach should consider existing connections that are operating in particular locales and how these enable the development of adaptive behaviour and resilience.

8.4.2 Empirical contribution to knowledge of Samoan resilience to climatic and other environmental changes

To the best of my knowledge, this is the first study which has examined the adaptability and resilience of Samoan societies from a non-equilibrium perspective and using a cultural ecological interpretivist approach. The approach taken in this study has yielded vast amounts of very rich and detailed empirical information about climate change adaptation and the resilience of Samoan communities that is needed to inform both local community activities, as well as related national, regional and international policies.

The resilience of Samoan society shows in the way that Samoans have continued to survive and the nation's population has grown. Its social system, *faamatai* continues to evolve and adapt with environmental changes, sustaining the lives of the majority of those residing on the islands as well as those in other countries. As outlined in Chapter 3, significant biophysical and social changes have occurred in Samoa over the past two hundred years, some of which have dramatically transformed the face of the island group. But not all these changes have been detrimental to Samoan society. Over the past two hundred years, *faamatai* adapted links to external forces, as in the arrival of missionaries and the establishment of colonial government. As described in Chapters 5, 6 and 7, the social institutions of church and government have also played important roles in the development of strategies to help village residents deal with past and present risks, and prepare for future disruption. The church plays a crucial role in the development of mental and spiritual strength in its members and the village has helped by managing local resources. For its part, the government has funded vital infrastructure, health care, piped water supply, disaster relief and emergency assistance. The combined activity of these institutions has been crucial to the development of risk awareness and strategies to minimize the impact of risks. This would also be crucial to the development of strategies to endure the possible impacts of future climate change.

The study identifies specific activities that need to be developed and where these developments should take place. As noted in Chapter 7, the study has shown that everyone has a role to play in ensuring preparedness and development of relevant strategies. For this

reason, the recommendations in this research target all members of Samoan society and not just a single group of people: residents and leaders of families and villages, as well as those working in government and external institutions. Key recommendations are as follows:

i). Village residents need to be proactive in family, village and church activities: A key recommendation of this thesis is that individual Samoans must remain proactive in their extended families, villages and churches. Actively participating in these gatherings is important to the establishment and maintenance of connections that could assist the individuals during difficult times. Additionally, by actively participating in these activities, individuals can be encouraged to exercise their rights and responsibilities in the selection of leaders in their families, villages and churches. Furthermore, these sessions will allow them to closely interact with their leaders and share their concerns, evaluate their roles and responsibilities, and continuously provide feedback and advice.

Individual Samoans should also carefully exercise their rights in the selection of village and church leaders and parliamentarians. As stated in Chapter 3, the Village Fono [Council] Amendment Bill 2015 recently tabled in parliament, proposes to strengthen the legal authority of village councils to draw village constitutions and approve development activities, for example infrastructural developments, in the village. These roles and responsibilities of the council demand that people in these positions must possess in-depth knowledge of their village's history, physical environment, other village residents, and any changes that have impacted the latter. These people must also have some knowledge of village strategic plans, government legislation and development policies and strategies. At the same time, they must possess and practice love and kindness for others, especially those who are weak and in need of help, be fair and impartial in their decision making and ensure continuous reciprocity among members of society. These values are central to the system of *faamatai*, as described in the following quote by Aiono Le Tagaloa (1992: 121-122). She said,

“The Samoan, especially the *matai*, is encouraged to look at all angles, at all sides of an issue, especially those that might effect those who are not his immediate kin. An example is when a *matai* is given the responsibility of distributing food and wealth within his *aigapotopoto*. Being human, a *matai* would be tempted to give himself and his kin some advantage, and there are some who do just that. The system insists and encourages the *matai* to be a ‘good *matai*’ and to follow the tenets of culture and tradition that applauds the *matai lufilufi mealelei* or *tufa lelei*, i.e. the *matai* who distributes and shares the food and wealth with all the members of the *aigapotopoto*, leaving little or nothing for self”.

ii). Village councils, government representatives and church leaders need to develop local knowledge and strengthen connections: It is important for members of councils, government representatives and church leaders to continuously develop and share knowledge of the history and environment of their village and the changes that have been experienced by the village. They must familiarize themselves with the village residents, listen and address their concerns and practice love, reciprocity and fairness. It is also crucial for them to develop knowledge of development policies and plans at the village and government levels, as well as government legislation. This knowledge will be crucial to making sound decisions.

Churches have been proactive in implementing ‘sharing sessions’ and ‘knowledge building’ exercises during Sunday youth nights and Sunday school activities. As mentioned in Chapter 6, the village of Sili has already established an annual church service, held at the beginning of every year, which celebrates the achievements of the village residents. This study recommends that council members and church leaders use such activities as a foundation for developing and implementing regular ‘knowledge- building’ sessions to foster connections and develop social memory amongst all village residents. These could also be held during council monthly meetings, untitled men’s meetings and women’s committee meetings.

It is important to ensure the presence of elders, farmers, fisher-folk, traditional healers and weavers in these sessions, so they can all share their knowledge with the rest of the village particularly the youth and children. These sessions must focus on discussing important aspects of the village such as its history and environmental features. More importantly, they must seek to identify key priorities and concerns in village decisions and in the development of village strategy documents such as the CIM-Plans and Village Sustainable Plans.

Village strategy documents now exist and inform government development plans: for instance, the CIM Plans, Village Sustainable Plans and Disaster Management Plans. This study recommends that it is the responsibility of council members and government representatives to ensure that all village residents are aware of the importance of these documents, understand their content and take part in reviewing the documents. A review of these documents revealed that the information contained in these documents is quite general. While future strategies are identified, there is a lack of information on the specific environmental features of most villages, or the historical changes (physical and social) and significant impacts that the village has experienced. These, I argue, are crucial pieces of

information to inform decisions and implementation of any future strategies. There are many opportunities to discuss these documents and seek the input of village residents given the regular meetings that occur in the weekly and monthly routine of most villages: for instance, Sunday church, Sunday youth night, council monthly meetings, untitled men's meeting and women's committee meeting. Council members must further ensure that the priorities and concerns of residents are clearly stated in the village strategy documents.

Another key recommendation for village councils is to seriously consider the environmental impacts of infrastructural developments in their planning and negotiations with the government. Moreover, the relevance of proposed development initiatives to the lives of village residents before they are implemented must be understood. Now that village councils will be given the legal authority to approve this at the village level, village residents must be proactive in ensuring that proper procedures are observed.

Council members and church leaders must continue to foster close relationships and cultivate 'partnership initiatives' that contribute to risk awareness and sustainable development strategies. 'Together', they will play a vital role in the development of spiritual and mental strength amongst village residents. Councils, church leaders and government representatives of Saleimoa must continue their negotiations with the Congregational Christian Church of Samoa (CCCS) in regards to the possibility of returning some of its lands, which the Church had taken, so that families who do not have properties inland can develop plantations and build second homes. At the same time, it would be useful to discuss these matters at the village level, especially with families who do not own any land in the inland parts of the village, in order to ensure transparency of the process. It would also be useful to consider and learn from the experiences of other authorities and other places. The Catholic Church of Samoa has recently resettled some of its church members who were leasing church lands at Taufusi to Moamoa. These residents were given free quarter acre parcels and SAT30,000 (approximately NZD16,800) to shift their properties (Latai- Niusulu, 2015).

Village councils and local churches must strengthen connections with the government and other external agencies because these agents have the funding capacity and expertise that could help support local development initiatives. The study's findings have shown the government has been playing an important role in the provision of piped water and electricity supplies, health care and roads in all of the surveyed sites. In the case of disasters like

cyclones and the tsunami in 2009, the government provided much needed emergency disaster relief. Government ministries such as MWSCD and MAF have been particularly helpful in the development of vital community livelihood initiatives such as weaving programmes and vegetable food gardens.

Councils, church leaders and government representatives of Maagiagi must consider negotiations with the government, Civil Society Support Programme (CSSP) and other external funding agencies regarding water sources for Maagiagi residents. As indicated in previous chapters, there are a few options to consider:

- i) negotiate a part of the Vaisigano water catchment for the village to develop as an alternative water source for its residents.
- ii) apply to CSSP or some other external funding agencies for funding to purchase village water tanks.

iii). Samoan government and external funding agencies need to develop a nuanced understanding of local communities and their key concerns and priorities: To develop sustainable and relevant strategies to climate change, it is absolutely vital that government considers the knowledge and experiences of local residents and communities. This study has demonstrated the depth and richness of residents' knowledge of the various dimensions of climate change and its impacts and implications which means there is so much the government could learn by engaging with local residents and village leaders. The study also revealed different experiences across the eight villages surveyed which means the task of gathering this information requires sufficient time and commitment from government officers and leaders. Evidence shows that recent government engagements with village councils have been limited by funding and the application of top down processes (Latai, 2008).

In order to tap into the diverse knowledge of communities, and to ensure the relevance and sustainability of government climate change strategies and related activities, government must continue to strengthen connections with local communities, in particular, village leaders such as council members, leaders of the women's committee and untitled men's groups and pastors. Assistance that targets the development of livelihoods was commended by residents, and the study recommends these be continued as part of future climate change adaptation projects, for example, with provision of farming equipment, vegetable seedlings and other edible crops. Moreover, climate funding should target the development of village inspections

of food gardens, plantations and protection of water sources. Activities promoted through the MWSCD include weaving programmes, development of food gardens and health clinics. The MAFF has facilitated provision of seedlings for reforestation, and the Agriculture and Fisheries Show, have been well received by participants, so these could be used as the basis for future climate change adaptation initiatives.

The government needs to reconsider the way it spends its finances in relation to climate change adaptation. Climate change funding must not largely be spent on building seawalls and coastal roads. Rather, it must also support other climate change adaptation initiatives such as village, church and family activities, which strengthen social networks and build social memory. The study also identified patterns of movement that are occurring now and are likely in future. To facilitate these shifts, government assistance to improve the quality of inland access roads is needed at Auala, Lano, Maagiagi and Sili. The government as a developer is legally obliged, under the Planning and Urban Management Act (PUMA) 2004, to go through the formal consent process, and publicise the likely impacts of any major development activity, before undertaking the construction of any infrastructure.

8.5 Reflections on the research approach and future research possibilities

As demonstrated in the previous three chapters, the ‘strength’ of the approach that was taken was that it produced quality empirical data that answers the research questions and supports the study hypothesis. To the best of my knowledge, I am not aware of any study that has attempted to apply this approach to assess the resilience of island societies to climate change. As such, it offers important insights into how we might understand the impacts and implications of climate change and related strategies from the perspectives of those who are directly affected by these changes.

There were also a few challenges and limitations faced during this study. The main challenges were dealing with large amounts of data that were gathered and finding logical ways of analysing and presenting these findings. This was in part to do with my research questions, which sought to understand both perceptions of climate change and coping strategies, and in part to do with the decision to investigate eight villages. While the process of gathering data was relatively smooth, the analysis and presentation phases of the research were often quite time consuming because of the volume of information to synthesize.

Generating results and finding ways to organize and appropriately present these in the thesis was time consuming.

I fear that by allowing more space in the thesis for the presentation of empirical findings, there is a risk that the thesis was not as engaging in terms of theoretical discussion. However, the decision to present the findings ‘within’ the places they were gathered, and then comparing and contrasting them, were in keeping with the aim of this research which is to deepen understanding of the resilience of island societies to climate change. Yi Fu Tuan (1991: 684- 685) stated “...it is simply not possible to understand or explain the physical motions that produce place without overhearing, as it were, the speech- the exchange of words- that lie behind them.” Thus, as evident in Chapters 5 and 6, I have included many long quotations and textboxes and photographs so the reader could ‘hear’ the voices of my research participants and ‘see’ the study sites that were investigated. Comparative analysis was done using summary tables. These results, close to their ‘raw’ state provide the empirical basis for the study recommendations discussed in the previous section which targets both activities at the family and village levels, as well as the national government level.

Finally, the study was very specific in its scope, as it focused on eight villages in the two main islands of Samoa. The research approach and strategy were developed and tailored to the Samoan context where the study was undertaken. The study findings cannot be directly compared to other island societies because the situations of other islands are different.

With regards to future research possibilities, and in light of the limitations and challenges detailed in the previous section, I think there is an urgent need not only to examine the resilience of island societies to climate change, but to develop appropriate ways in which this can be done. These efforts are crucial to addressing the lack of adequate information on island resilience, especially in the context of climate change. The chapter on small islands in the latest IPCC report acknowledges the need for information which acknowledges “...the heterogeneity and complexity of small island states and territories (Nurse *et al.*, 2014).” Systemic changes are both complex and ongoing, and the rate and magnitude of expected climate change requires us to continuously reflect on appropriate ways of moving forward (Amundsen, 2012). I am hopeful that the approach taken in this study and its findings will encourage further studies which seek to understand and portray the ‘dynamic’ nature of

island societies by capturing ‘changes’ in islanders’ perceptions and strategies. Studies which are grounded on the perspectives of islanders would be useful to inform human practices and decision-making at various levels of society. Crucial to these enquiries is the use of holistic and place- based approaches, appreciating local concepts and narrative-descriptive tools to assess and present study findings. The tools which I developed here to examine the resilience of individuals needs further development and would certainly be a useful exercise to undertake in future research exercises which might project current experiences with climate change into the future, and imagining future scenarios and how that could empower people to think more about the future and not just the current time. This can also assess qualitatively, the ‘significance’ of current and likely events according to how people perceive risks.

Climate change is undoubtedly a significant challenge, but its dimensions and impacts are not new to the residents of islands. Ways of ‘being’ resilient in the face of such challenges are inherent in *faamatai* and the structures of extended families, village and church groups, as well as in their external connections namely the government and external agencies. The crown of thorns starfish, *alamea* paradoxically symbolizes disturbances and the necessity of seeking solutions ‘within’¹. If it is to develop appropriate interventions for climate change, the government must develop a more nuanced understanding of local knowledge by strengthening connections with village councils, local churches and extended families. By tapping into these local ‘reserves’ of knowledge, and tightening partnerships with village councils, churches and extended families, government agencies should not only develop sustainable solutions to climate change, but also empower local leaders and residents as they face both current and future challenges. At the same time, it is important that village councils and churches continue to work together with government. The Samoan concepts of *soalaupule* [consensus or consultative decision making] and *autasi* [consensus agreement], which are central to *faamatai* decisions, insist on the ‘inclusion’ of everyone and ‘assurance that all parties are satisfied’. These could well serve as guiding principles for the development of increased resilience through stronger connections between people.

¹ The Samoan phrase *E fofo a alamea*¹, which means ‘the crown of thorns starfish cures itself,’ directs those who inadvertently step on the starfish to turn it over and step on its underside and let the *alamea* [crown of thorns starfish] suck the poison out.

For more than a century, the sustainability of Samoan society has depended on the persistence and development of strong bonds and reciprocal flows of environmental and other important information between people, the church and government agencies. If these links are compromised- for example, by an accelerating pace of urbanization through internal and external migration- the adaptive web of consultation and support, known as *faamatai*, could be irreparably damaged. If so, this would inevitably detach Samoans from the traditional mores and structures of their home villages, lessen their resilience, and pose even greater risks to the nation than the direct and indirect effects of climate change in the remaining decades of the 21st century.

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Personal communications:

MN. (2014) Principal Officer, Ministry of Natural Resources and Environment (MNRE), interviewed November 5.

AM. (2014) Senior Officer, Samoa Water Authority (SWA), interviewed November 6.

ST. (2014) Member, Samoa Independent Water Scheme (IWS), interviewed November 14.

Appendices.

Appendix 1: The loss of native forests at Auala and Aopo.

Commercial deforestation, clearance for agriculture and livestock development, cyclones and forest fires has led to the loss of native forests at Auala and Aopo. Commercial deforestation of native forests at the north-western coast of Savaii began when an American company, Potlatch Forests, built a timber mill at Asau. In 1967, an Act of Parliament approved the commercial leasing of timber rights to foreign companies, which allowed Potlatch Forests to harvest timber from the native forests of Auala and Aopo, between 1967 and 1976. The company built a state of the art sawmill at Asau, developed electricity and water for the region, upgraded Asau airport and built an airfield and road next to the barrier reef at Asau Bay (see Figure 5.5). When Potlatch departed in 1976 (Shankman, 1999), other companies took over the mill and continued logging timber for export until a government ban was imposed in 1990 (Ward, 1995).

The cumulative impact of deforestation by timber millers on forested areas has been significant, particularly on the north-western coast of Savaii where more than 90% of all logging occurred (United Nations Development Programme (UNDP) and MNRE, 2010). The majority of elderly residents interviewed suggested unsustainable practices introduced soon after the mill was established were significant factors in the loss of their forests. As demonstrated in the quote below, sustainable agricultural practices such as slow, partial clearance and timely and selective burning of trees, were replaced by rapid and complete clearance of acres of land. In the course of a day, large areas would be fully cleared of smaller trees and other plant species so that the machines could access the bigger trees that would be milled for timber. An elderly chief and farmer from Auala, who once worked at the mill said,

“Well the thing that must be remembered well, the ‘shrubs’ (spoken in English) the small (emphasized this word) trees, small, even the trees like the post here (referring to the post of the house we were in), it’s like one ‘run’ (spoken in English) of the machine, the ‘bulldozer’ (spoken in English) to fetch say five logs that ‘fell’ (spoken in English) over there, and that would destroy all these other plants, eh? These trees that the future of how many thousands of people rely on, eh? many thousands of children, ‘even’ (spoken in English) children that had not been born yet, their future had been destroyed at this time. Now when you count from the year they began logging until this time, the impact is great... In the 1990s the resource was further away with logs coming from Salai, coming from Sasina...at this time, I am certain that there are native trees up there (pointing inland), but they cannot get them unless they have ‘helicopters’ (spoken in English) and... (did not finish) (October 20, 2014).”

Clearance by individuals for settlement, agriculture and livestock development also contributed to the loss of forest areas. Many studies (Ward, 1995; Ward and Ashcroft, 1998; Shankman, 1999; UNDP and MNRE, 2010) stated that this had been the most significant cause of the loss of forested areas in Samoa. The UNDP and MNRE (2010) report stated that the rate of clearance for agriculture was extremely high between 1977 and 1990, and that individual clearance had been the main cause for Samoa losing a third of its lowland forests. This was disputed by comments from the majority of interviewed residents who firmly believed that commercial deforestation had been the major cause of the reduction of native

forests. As indicated by the quote above, much of the damage occurred when Potlatch was in operation. Moreover, the introduction of the chainsaw by Potlatch made it easier and faster for farmers to clear their lands, and this became part of agricultural clearance at Auala after Potlatch departed. According to the informant above,

“People used to cultivate the land in the forests but it was in ‘slow motion’ (spoken in English) compared to the timber mill’s activities because there were no chainsaws to cut down the trees. The methods that were used, was the axe, and fire. If there was a big tree that the axe cannot cut, then one would resort to burning it down. But you burn at the time when burning should occur, you do not burn during the dry season. When you burn, you burn the tree several times, but it would still stand until it topples over on its own. I remember those days, those days of elderly men, they do not cut down all the trees in their plantations. Many trees were saved and were not (did not finish). But when the mill came, it ‘introduced chainsaws, even me myself’ (spoken in English) I owned a chainsaw which I used to clear my land a? Yes. Because it was easier then. When the chainsaw arrived, most trees were cut down, clear. ‘Full clear’ (spoken in English) everything. That was how I was before but now that I am wiser (laughs)...(October 20, 2014).”

The remaining forested areas that survived the logging companies were destroyed by the ‘Big Fire’ in 1983 and later, Cyclones Ofa and Val in the 1990s. The fire in 1983 lasted several months, and affected not only Auala and Aopo but the neighbouring villages of Asau, Sasina and Letui. Government (UNDP and MNRE, 2010) and local sources indicated that these events were caused by the practice of burning land during the dry season and El Niño related droughts. According to Auala and Aopo residents, that was the worst forest fire they had experienced in their lifetime. A chief of Aopo said,

“The whole forest burned for months. The fire lasted up to five months. There was smoke everywhere. The smoke blocked out the sun. The sun looked like a ball of fire in the sky...I think the temperature went up to 40 degrees at the time. Most of us, men, did not sleep at home because we were out putting out the fire. We slept out in the forest, where we were working to put out the fire. As soon as daylight comes we would wake up and start again (October 21, 2014).”

“A resident of Auala who used to work at the timber mill also said,

“Those that worked at the mill (including me) were all firefighters at the time. Every day we would mobilise at 4am and then we were transported inland and worked there, putting the fire out till 9pm. Some nights we did not come home...The fire travelled below the ground so we used diggers to create ‘firebreaks’ (spoken in English) or holes that were 20 meters wide to prevent the fire from spreading...Sometimes when we turned our backs a *aloiafi* [spark] would fly from one side, carried by the wind, and create a fire in another place. We also used wet barks of banana trees, dirt, seawater to put out the fire (October 17, 2014).”

Ward (1995) estimated that 45% of the merchantable timber remaining in Savaii, prior to Cyclone Val, was snapped off by the cyclone. A 40 year old male resident of Aopo said,

“After Val, we could see Asau from here. You look and there were hardly any trees left standing...I could clearly see everything. You can see straight up the mountain

and down to the sea. Much of the forest areas had been destroyed (October 16, 2014).”

A 60 year old male stated that the devastating impact of Cyclones Ofa and Val on the forest saw logging activities completely stopped. His plan of becoming a commercial farmer was also disrupted. He said,

“Logging activities went on and on, after the Potlatch company left, and then Cyclones Ofa and Val hit. Cyclone Val was the cyclone that destroyed the timber mill, the forests and put an end to all these things (laughs- referring to activities relating to logging). There were no more logging companies after that. I was a truck driver when the cyclone hit. Those days our land (referring to plantations) was really good. There was cocoa, orange, those things (did not finish). Because cocoa found here, when they bear fruit, they look like flower bouquets, when they bear fruit, they are like bouquets. What I mean is that, it was like that at the time when that cyclone (referring to Val) hit. I mean that was the time that our surroundings like cocoa and orange plantations were severely affected. Because the meaning of my story, during that time when it was the season for oranges, I said to myself, I will resign from my work a? And I would come and pick my oranges and (did not finish) because they were hanging, the branches were hanging low like this (pointing to the ground). Then I came and said to my wife, I would go and apply for leave, I would leave and go and take orange loads, and then (begins to laugh and say) the cyclone hit. Lo and behold, there was nothing left. The orange trees were all uprooted or overturned, all destroyed even the cocoa, broken. It was like a bomb was detonated in our village due to Ofa and Val...What had remained of the forest behind our village was damaged by the cyclone. The leaves and branches of the trees were gone. Some were broken in half or had overturned. We could see the hills from here (laughs). Before we could not see, like now a? we cannot see the hills but after the Cyclone we could see all the way inland (October 12, 2014).”

The forested area of Savaii declined by 20% between 1954 and 1990 (Food and Agriculture Organization of the United Nations (FAO), 2005). Between the 1950s and late 1980s the proportion of the total land area of Western Samoa which was under forest cover declined from 74 to 55 percent (Ward, 1995) (see Figure A1). The most dramatic change is evident on the northwest coast of Savaii where Auala and Aopo are located, with the majority of forests cleared by 1990.

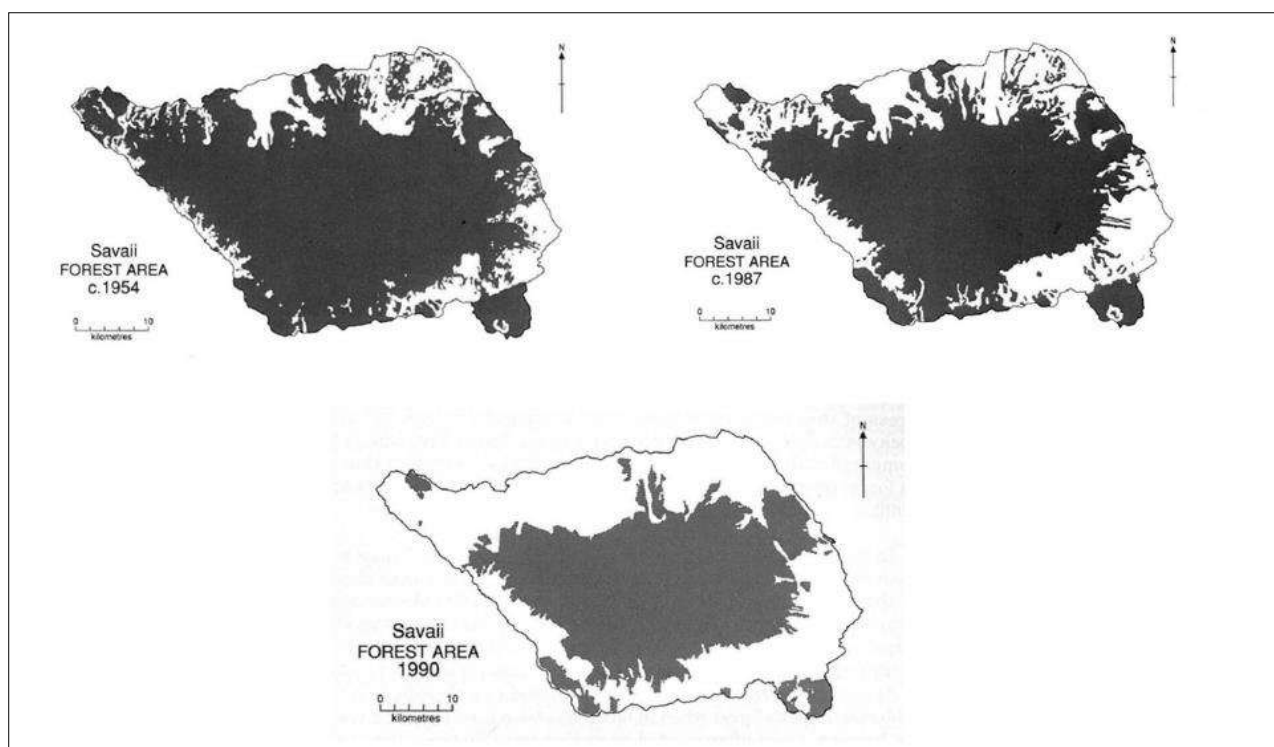


Figure A1: Maps showing the reduced forest areas in Savaii from 1954- 1990 (Source: Ward and Ashcroft, 1998).

Appendix 2: Samoan and English versions of the interview schedule

Faatalatalanoaga agai i fesuaiga o le siosiomaga ma ona aafiaga i alalafaga o Samoa. O le a se tulaga o iai nei le mafai o nofoaga, alalafaga ma aiga e lavatia ai suiga o le siosiomaga?

O le a sau maitau i le vevela ua iai nei Samoa pe a faatusatusa i tausaga ua tea- mai le taimi o e laititi, talavou e oo mai i le taimi nei? Ua iai se suiga poo tumau pea?

O a ni tala aave poo ni tusitusiga ua e silafia o loo taua mai ai le vevela ua iai nei Samoa? Aisea e te talitonuina ai pe leai foi ia faamatalaga?

E mafai ona e talanoa i ni aafiaga o le vevela o aso fai-soo ia oe ma lou aiga? I le faatinoina o feau masani, gaioiga i aso uma, faatinoina o faalavelave faale-aiga, faale-ekalesia ma faale-nuu?

E mafai ona faasoa mai sou silafia i ni **mafuaaga** o suiga, pe leai foi, ua maitauina i le vevela o le lalolagi? Vaai le silafia i le fesootaiga o mea nei ma le vevela o le lalolagi...Gaosia ma le lafoaiina lea o kasa kapone oona i le ea [ma le va nimonimo?] Mafiafia o le afuafu o loo puipuia le lalolagi ma ave malolosi o le la ona o le faatupulaia o kasa oona i le ea ma le vanimonimo, Fesuisuiaiga masani lava ia o le tau ua leva ona tupu ma e tupu pea

E mafai ona faasoa mai sou silafia i ni **aafiaga** o le faatupulaia o le vevela o le lalolagi? [afa malolosi, siitia o le sua-tai...] Vaai le silafia i le fesootaiga o mea nei ma le faatupulaia o le vevela o le lalolagi?

Afa fulifao, Matagi to faatautau, Siitia o le suasami, Tai oooo, galu mauualuluga e lofia ai laufanua mauualalalo, Mai [sualua] o vaipuna o loo faamoemoe iai le fofoga taumafa, Suia o le oona o le suasami ona o kasa oona [ocean acidification], Tafia o laufanua I le talafatai, Timuga mamafa ma lologa, Lama- mugala e ono mago ai le palapala ma leai ai se vai, Mu o le vaomatua

O a ni aafiaga na e molimauina muamua ma ua e talitonu ua tele ina aafia ai oe ma si ou aiga? Aafiaga faa-vaitaimi (pupuu) ma uumi (faifaipea).

Gaosiga o mea taumafa, Vai, Laau toto ma manu fafaga, Eletise, Mea totino e pei o fale, lavalava, Mafaufau ma lagona, Fesootaiga tau le aiga

O a ni gaioiga ma ni fuafuaga o loo faia e oe ma lou aiga ina ia gafatia ai nei aafiaga ma suiga? Gaioiga ma fuafuaga I aso taitasi, masina poo tau vevela, tau afa, taimi o lamala, oge ma le le lava o le faasoa....Mo aafiaga e tupu faa-vaitaimi, e mafai ona e saunoa i ni au gaioiga, mafaufauga ma lagona, fuafuaga a o lei tupu lea mea, i le taimi na tupu ai, ma ina ua maea? Mo aafiaga faifaipea/ uumi e pei o le siitia o le sua-tai, o a ni fuafuaga mamao ma ni gaioiga o loo faatinoina? I vaitau poo taimi faapea o ai sa faamoemoe iai mo se fesoasoani? O ai sa tali mai?

I se tilotilo agai i luma, poo le 50 tausaga i le lumanai, o a ni vaega taua/ gaioiga/ fuafuaga mamao e ao ina tapena iai aiga, alalafaga, ekalesia ma le malo ina ia lava sauni tagata uma mo aafiaga o le tau i le lumanai?

O ai e ono maua mai ai se fesoasoani i le faatinoina o au gaioiga ma fuafuaga? Aisea e mautu ai lou finagalo o le a tali mai i sou manao?

O a ni gaioiga/ tu faaSamoa lava ia e ao ina faatauaina ina ia mafai ai ona gafatia e lou aiga suiga o le tau i le lumanai?

O ai ni vaega e te manatu o loo manaomia tele ai se fesoasoani aua le ola atiae mo le lumanai? O ai e te manatu e ono faigofie ona fesoasoani mai i lea itu ma e te faatuatuaina lana faasoa mai?

O a ni vaega o le faalateleina o le malamalama i suiga o le tau o loo e manaomia? O fea se nofoaga e te manatu e ao ina fai ai lea faasoa ma faigofie ai ona e malamalama? Ae a sou manatu i le faatinoga o le faasoa?

E iai ni vaega e te fia fesiligia ai au? Pe o ni vaega sa e manatu ou te fesiligia ai oe?

Nisi fesili e ono fesiligia ai faifaatoaga ma tagata o loo galueaina le laueleele ma le sami-

Fai-faatoaga: E mafai ona e talanoa I lou agavaa faa-faitoaga? O anafea na amata mai ai- ua fia nei tausaga? O le a se mafuaaga o lou iai i lea ituaiga galuega?

Pe faapefea le atinaeina o lou tomai? O se mea sa tuulima mai tuua po o lou ia lava sogasoga?

Poo e manatua ni taimi na oge ai, faamai o le lega, oo mai o le sisi afelika- o a ni faiga/ gaioiga sa faia e toe tau faaleleia ai mea toto? O a ni mea o e manatua I le vaitaimi na oo mai ai le lega I Samoa? Aea le sisi afelika- e mafai ona faamatala aafiaga o ia mea I luga o au faatoaga?

O a ni mea taua e mafai ona e faasoa i soo se fai faatoaga e ao ona faatino I le faatoaina o fanua o le nuu nei?

Fai-faiva: O anafea na amata ai ona e fai-faiva? Ua fia nei tausaga? O le a se mafuaaga ua e faatinoina ai lea galuega?

Pe faapefea ona maua ma atiae lou tomai ma le agavaa? O se taleni sa tuulima mai e matua poo lou ia lava sogasoga? O a ni galuega faatino e atiae ai lea tomai?

E mafai ona saunoa I le sauniga o le faiva? Taimi e masani o faatino ai? O ogasami e masani ona fagotaina? Aea ituaiga ia ma isi mea e fagotaina ma tele ina maua I le ogasami o le alalafaga nei?

O a ni vaega taua o le ogasami o le alalafaga e tataua ona iloa e soo se faifaiva?

O a ni suiga o le gataifale ua e maitauina? Aea ni suiga ma ni aafiaga o le vevela?

O a ni gaioiga ma ni fuafuaga e ao ina faatinoina ina ia mafai ai ona gafatia ia suiga? Ae a I le tilotilo I le isi 50 tausaga lumanai?

O ai e masani ona tua iai pe a manaomia se fesoasoani? E te mautinoa o le a tumau lea fesoasoani I le 50 tausaga lumanai?

E mafai ona e talanoa i ni polokalame o loo faatinoina i nuu i le taimi nei?

Oa ni polokalame e te silafia e aoga mo le gafatiaina o suiga o le tau?

Oa ni faafitauli o loo e maitauina i polokalame o loo faatinoina mo le gafatiaina o suiga o le tau? Pe faapefea ona faaleleia? O ai e gafa ma le faaleleia?

ENGLISH VERSION OF THE INTERVIEW SCHEDULE

SOME QUESTIONS ABOUT YOURSELF AND WHERE YOU LIVE

Age category:

Your sex [do not have to ask this question]:

Village/Location:

Principal occupation:

Your community responsibilities and activities:

Any other information that may be relevant:

Can you talk about the heat in Samoa? What has been your experience? Are there any changes you have noticed?

Can you talk about any information you have heard regarding the heat in Samoa? Can you tell me whether you believe such information or not and give reasons.

Can you describe if, and how, the heat has changed your daily routine and activities in the home or other activities in the village etc

In your opinion, why do you think there has been a change, or not in the current patterns of heat? Can you talk about the impacts and likely implications of such changes?

Note if the participant mentions any of the following words or phrases for **processes** or even ask them later...Cyclones, Emissions of carbon dioxide into the atmosphere, The green-house effect, King tides and inundation by sea water

Can you describe what you are currently doing to endure these impacts? What do you normally do when there is too much heat? what about when it rains heavily? Or when cyclones occur?

To the best of your knowledge, how will Samoans **survive [cope and endure]** the likely **consequences** of global warming? To survive future hot days, dry spells, cyclones, flooding etc

Do you believe that Samoans are **prepared** for global warming and sufficiently **resilient** to survive its consequences?

Have you received sufficient information to form an opinion about the likely **consequences** of global warming on the people and environments of Samoa? Who or what do you think could help you learn more about this matter?

In your opinion, who should be responsible for ensuring that Samoans recognize and understand the likely **consequences** of global warming to themselves and the country? Where and how do you think the communication of this information should take place?

Appendix 3: Samoan and English letters of invitation to participate in key informant interviews and focus group discussions.



Autu o le Suesuega- “Fesuaiga o le siosiomaga ma ona aafiaga i alalafaga o Samoa- o le a se tulaga o loo iai le ‘mafai’ o se nofoaga ma ni faalapopotoga e ‘feagai ai’ pe ‘lavatia’ suiga o lona siosiomaga?”

Tusi valaaulia mo faatalatalanoaga e faia ma sui o alalafaga

[insert relevant date]

Talofa lava! Ua ou tusi atu i le ava ma le faaaloalo tele e talosagaina sou avanoa mo se faatalatalanoaga ma lau afioga i le autu ua taua i luga. O se vaega lea o loo taulai iai lau suesuega o loo faia nei i le Iunivesite o Otako i Niu Sila.

Ua laga se manatu e faatinoina lea faatalatalanoaga ona e talitonu le taofi, i le tele o le tomai ma le iloa o loo i e o loo alala ma papa aao i alalafaga, i suiga o loo tutupu i lo latou lava lotoifale ma lo latou alalafaga, aemaise i auala e ‘feagai ai’ pe ‘lavatia’ ai foi ia suiga. O le ala lea o le fia maua o se avanoa e te faasoa mai ai i ni suiga faale siosiomaga ua e maitauina ua aafia ai le lotoifale o le tou alalafaga. I le ma lea, ia faasoa mai lou malamalama ma le tomai i ni auala o loo mafai ai ona lavatia ia suiga. E talitonu le agaga o le a talia se faatalaauula atu.

Ma le faaaloalo tele

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O lenei suesuga ua faatagaina e le Komiti o suesuega aloaia a le Iunivesite i Otako. Faafesootai le numera telefoni 03 479 8256 poo le imeli gary.witte@otago.ac.nz mo ni faamatalaga auiliili.

ENGLISH VERSION

Topic of the study: “Exploring the resilience of communities to climate change in Samoa.”

[insert relevant date and personal details]

Talofa lava! My name is Anita Latai, a Lecturer at the National University of Samoa, who is currently pursuing PhD studies in Geography within the University of Otago, New Zealand. A significant aspect of this work is conducting a research study and producing a thesis that contributes original knowledge to an existing discipline. My study [please refer to the topic stated above] involves interviewing personnel from relevant government and non- government organizations, as well as members of the community. It is in this regard that I am writing to request your assistance in participating in an interview discussing the issue of climate change resilience in Samoa.

The interview will involve an open-questioning technique and will last c.1 hour. The precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops. The interview will be conducted face to face, preferably in your home and will be recorded on tape and stored within the Department to ensure confidentiality is retained. Please be assured that all information obtained during the interview will be used for the purpose of my research project only, and instead of using personal names, a set of codes will be used during recording, analysis and discussion.

Finally, please be advised that your written permission is required before interviews begin, however, should you refuse at any time and wish to withdraw, then the information will not be used. Should you require further information about this project, please feel free to contact myself or my supervisors, Professor Tony Binns and Professor Etienne Nel. Our addresses are given below. Thank you.

Yours truly,

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Department of Geography
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Email Address:
anita.latai@postgrad.otago.ac.nz

or

Professor J. A (Tony) Binns
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Professor Etienne Nel
Department of Geography
University Telephone Number:
+64 3 479 8548
Email Address:
etienne.nel@otago.ac.nz

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Samoan and English letters of invitation to participate in focus group discussions.



Autu o le Suesuega- “Fesuaiga o le siosiomaga ma ona aafiaga i alalafaga o Samoa- o le a se tulaga o loo iai le ‘mafai’ o se nofoaga ma ni faalapopototoga e ‘feagai ai’ pe ‘lavatia’ suiga o lona siosiomaga?”

Tusi valaaulia mo faatalatalanoaga e faia ma autalavou [kopi oloo galueaina]

[insert relevant date]

Lau Susuga

Ekalesia

Afioga e,

E muamua ona ou faatulou i lau Susuga i le faafeagaiga ma le faletua- o e o loo tauasuina le ipuvai o le ola i le alalafaga.... Ae ou te lei sui tonu le mata o le niu pe faga tonu le malama, e muai momoli le viiga ma le faafetai i lo tatou Tapaau sili, ona o lana tausiga i lo oulua soifua ma sou ola ua tatou aulia manuia mai ai lenei vaega o le tausaga. Faamalo le soifua! Malo foi le lagi e mama!

Ua ou tusi atu i le ava ma le faaaloalo tele, e talosagaina sou avanoa, e faatinoina ai se polokalame ma le lua autalavou i soo se aso i le va o Setema- Novema, 2014. O le autu o lenei polokalame o *“fesuiaga o le siosiomaga ma ona aafiaga i alalafaga o Samoa- o le a se tulaga o loo iai le ‘mafai’ o se nofoaga ma ni faalapopotoga e ‘feagai ai’ pe ‘lavatia’ suiga o lona siosiomaga?”* O se vaega lea o loo taulai iai lau suesuega o loo faia nei i le Iunivesite o Otako i Niu Sila.

Ua laga se manatu e faatinoina lea polokalame ona e talitonu le taofi, i le tele o le tomai ma le iloa o loo i e o loo alala ma papa aao i alalafaga, i suiga o loo tutupu i lo latou lava lotofale ma lo latou alalafaga, aemaise i auala e ‘feagai ai’ pe ‘lavatia’ ai foi ia suiga. O le ala lea o le fia maua o se avanoa e fefaasoai ai ma sui talavou o le Ekalesia i Auala ina ia faalauteleina sou iloa faapea le malamalama o sui auai, i suiga faale siosiomaga ua aafia ai motu laiti o le lalolagi e pei o Samoa. I le ma lea, ia faatalanoa auala o loo mafai ai ona lavatia ia suiga i Auala. O se vaega taua o lenei polokalame, o se faamalosiau, ia ina tumau le ola tapena ma le ola tautua aua le au i luma o aiga ma alalafaga.

Faamolemole tagai ifo i se ata faataitai o le polokalame ua lomina i le isi itulau o lenei tusi. E talitonu le agaga o le a talia se faatalauula atu.

Ma le faaaloalo tele

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Taiala mo faatalatalanoaga ma sui o alalafaga

Faatalatalanoaga e faia ma autalavou

Vaega autu o le polokalame

1. Faatulima
2. Semina puupuu (15- 20 minute):

Autu: *“Fesuiaga o le siosiomaga ua tusitusia ma molimauina ua aafia ai motu laiti o le lalolagi e pei o Samoa.”*

Saunia: Anita Latai

3. Fesili ma Tali (10- 15 minute)
4. Fetufaaiga i vaega (30-40 minute)

5. Aotelega o le fetufaaiga
6. Faafetai ma tapunia le polokalame
7. Tauaaoina o se meaalofo

Fesili mo le fetufaaiga

1. O a ni suiga o le siosiomaga ua molimauina i le tou afioaga (i le 5- 15 tausaga talu ai, mai i le tausaga e 2000; poo le 15- 30 tausaga talu ai, mai i le vaitau o le 1990)? O a ni suiga televavave ua tutupu (faataitaiga- fausia o se auala, afa, fausia o le falesa) O a ni suiga e umi faatoa aliae ma iloa e tagata (faataitaiga- suiga i meataumafa, aia o gataifale, suiga i le seleselega o laau taumafa)
2. O a ni aafiaga o ia suiga i le olaga o e o loo aumau i le alalafaga? O a ni aafiaga o suiga televavave? O a ni aafiaga o ni suiga umi?
3. Pe faapefea ona feagai le alalafaga ma ia suiga? O a ni auala/ amioga/ faiga/ faatinoga/ metotia e lavatia ai suiga pupuu? O a ni auala/ amioga/ faiga- faavae a le nuu/ agaifanua e lavatia ai suiga umi?
4. O le a se sao o alalafaga i le puleaina/ puipuia o lo latou siosiomaga?
5. Pe o lelei le lagolago a le malo ma faalapopotoga eseese i Samoa i le ola o tagata o le alalafaga? O faamalieina manaoga o le alalafaga i polokalame/ auaunaga a le malo ma nisi faalapopotoga

ENGLISH VERSION

Topic of the study: “Exploring the resilience of communities to climate change in Samoa.”

[insert relevant date]

Talofa lava! My name is Anita Latai, a Samoan who is currently pursuing PhD studies in Geography within the University of Otago, New Zealand. A significant aspect of this is writing a thesis addressing issues of interest within the relevant discipline. It is in this regard that I am requesting an audience with the Congregational Christian Church youth group at [insert village name] to discuss the research topic- **Exploring the resilience of communities to climate change in Samoa.**

The study involves two parts; first semi- structured interviewing and secondly, focus group discussions with members of the community. The latter involves an open-questioning technique where the precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops.

The group discussions will be facilitated by myself and any other interested persons from your youth group. Please find attached a draft outline of the suggested programme and the questions that would be discussed. Any information discussed and obtained during the discussions will be stored within the Department of Geography at the University of Otago to ensure confidentiality is retained. Any follow up sessions will be via email correspondence where the same process applies. All information obtained will be used for the purpose of the dissertation only and, instead of using names, a set of codes will be used during recording, analysis and discussion.

Finally, please be advised that a verbal indication of your approval to participate in the study is required before the discussions begin, however, should you refuse at any time and wish to withdraw, then the information will not be used. Should you require further information about this project,

please feel free to contact myself or my supervisors Professor Tony Binns and Professor Etienne Nel. Our addresses are given below. Thank you.

Yours truly,

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[Note: The above statement should not be included if the project has been considered and approved at departmental level]

OUTLINE AND QUESTIONS FOR FOCUS GROUP DISCUSSIONS

Please note that this draft outline will be attached to the invitation to participate in focus group discussions

A. Programme for focus group discussions (DRAFT)

General introductions

Seminar Presentation (15- 20 minutes)

Topic: A review of environmental changes and related issues in small island developing states (SIDS). Presenter: Anita Latai.

Discussion (10- 15 minutes)

Focused group discussions (40 minutes- 1 hour)

- Introductions
- Discussions begin
- Summary of the discussions

Concluding comments and acknowledgments

Presentation of gifts/ monetary donation

B. Guiding questions for the group discussions (DRAFT)

1. Discuss any significant changes that have occurred to the village in the past 5- 15 years (since 2000), and in the past 15- 30 years (since the 1990s). Consider and discuss changes in the way the village looks in terms of housing, roads, sea, land,

trees, lagoon, reefs, soil? What about peoples' behaviour in terms of planting, fishing, weaving, traditional healing, preparing food? What about the weather? Accessibility of resources, safety, predictability, species availability, diversity.

2. Discuss how the village has coped with these changes. Describe any strategies that the village has developed and implemented to cope with these changes. Describe any challenges and successes faced when coping with changes.
3. Do you feel that you actively participate in the development and implementation of village responses to changes?
4. Describe any programmes introduced by government and other organizations that have assisted your village in terms of managing/ coping with the changes you referred to earlier.
5. Do you feel your needs are adequately recognized and supported by programmes and plans implemented by government and other organizations?

Appendix 4: Details of the dispute between the Maagiagi village council and the government.

1921- 1929- Parts of Maagiagi were acquired by the New Zealand colonial administration for hydro- power development under Ordinances 8 and 3 (Electric Power Corporation (EPC), 2013). The transfer occurred when the traditional landowners mostly resided at Vaiala and Moataa and using Maagiagi for their plantations. Maagiagi was therefore governed by the village councils of Vaiala and Moataa. The agreement to allow water and land at Maagiagi to be used for power and drinking water supplies for the wider urban area made sense because the pipelines transported water and electricity to the wider Apia area which includes Moataa and Vaiala who traditionally own this land.

1949- Alaoa hydro-power station was built. The Prime Minister claimed the power station was open in 1959, three years before independence (Malielegaoi cited in Tavita, 2011).

Early 1970s- water intakes currently managed by the Samoa Water Authority (SWA) were built.

1979- 1982- Samasoni and Fale o le Fee hydro- power stations were built.

1981 Construction of the penstock at the Fale o le Fee station. Maagiagi villagers complained that their crops were destroyed and compensation was not paid.

January 28 Meeting between the Prime Minister (Tupua Tamasese Efi who is now the Head of the State), EPC, Department of Lands Survey and Environment (DLSE) and Maagiagi villagers. During this meeting the PM asked the DLSE to allocate 100 acres of land to the Maagiagi villagers (EPC, 2013). EPC also granted the village free power supply in perpetuity (Grant, 2013; Melei cited in Keresoma, 2013). Both parts of the compensation did not materialize at this time. There is no record of any land given to Maagiagi villagers as compensation (EPC, 2013).

1997- Maagiagi village approached the government regarding free power supply. The Prime Minister at the time, the late Tofilau Eti Alesana and Minister of Works, Leafa Vitala granted the village free electricity (Melei cited in Keresoma, 2013). The majority of residents had meters which measured the amount of electricity they were using but these were not measured by the EPC.

2011 (July 29)- Alaoa power station upgraded. Prime Minister announced that the Alaoa power station is located on government land, which covers more than 4000 acres from the Loto Samasoni head pond to the mountain ranges. The land was transferred to the government on November 18, 1921. Downstream from the power station is the main SWA reservoir and a forest reserve (Malielegaoi cited in Tavita, 2011).

2012- The government informed Maagiagi residents to switch to cash power meters and to start paying for electricity. The first part of this process involved the reading of existing meters before the cash power meters were to be installed. There were reports of households at Maagiagi taking advantage of free electricity. Many households and churches had installed air conditions while others had established businesses such as laundromats, shops, water and ice suppliers which consumed large amounts of water and electricity.

June 8th- EPC officers were sent to read the electricity meters at Maagiagi. The officers began to read the meters but were forced to cease their activities because some village residents started to throw stones at them. The police were called to the

scene and the Police Commissioner, who resided at Maagiagi, spoke with members of the village council who subsequently permitted the EPC officers to proceed with their work. Some families agreed to install cash power meters but the majority of the village resisted. Members of the Maagiagi village council stated in the media (Keresoma, 2012) that there was resistance because such government action violated an agreement made between the village and government in 1983 that free electricity was compensation for the use of their lands. In August, the government claimed that Maagiagi owed about USD2million (SAT4.8m) in electricity and that compensation for land and outstanding payments for electricity are two separate issues. The village responded by blocking the roads into the village, preventing the instalment of cash power metres and EPC workers from accessing the Alaoa and Fale o le Fee hydro-power stations. The government then decided that the electricity supply would be disconnected to families who did not want to install cash power meters. In addition, the government sacked Maagiagi's government representative *pulenuu*.

August 23rd - Maagiagi village council met with the Prime Minister to request a pardon from their debt. In return, the village would accept the installation of cash power meters. The village also requested that their *pulenuu* be reinstated. The Prime Minister responded that pardoning the outstanding payment is not simple as other villages also have outstanding electricity bills but the matter would be referred to an appointed committee for a decision. The *pulenuu* was immediately reinstated.

August 24th- Members of the EPC and McClean's Electrical company, which had been contracted to install cash power meters, arrived at Maagiagi. Maagiagi's *pulenuu* stated that the officers were asked to leave because the village has yet to finalise its decision on the installation of cash power meters. He also declared that this meeting would decide what would happen to those villagers who spoke too soon during the meeting with the Prime Minister.

Maagiagi village lodged a complaint to the Ministry of Natural Resources and Environment (MNRE) that the families did not receive compensation for the lands acquired to build the hydro- power stations.

Meeting between the Maagiagi village committee, Chairperson of the Land Board Management, Attorney General, Police Commissioner and the Assistant Chief Executive Officer (ACEO) of MNRE to assess the complaint about not allocating 100 acres of land as discussed on January 28, 1981. The ACEO explained that 8 acres of land were acquired for the hydropower plant schemes by the NZ Colonial Administration and compensation was paid but there is no record of such compensation. The Attorney General explained that according to the Taking of Lands Act 1964, complaints regarding land acquisition and related compensations must be lodged within five years after the land had been acquired. If not then the complaint is invalid.

September 6th- The Prime Minister stated in media reports that the switch to cash power meters would commence on September 11th. Those who interfered in this would be breaking the law and would be imprisoned. Maagiagi would appoint a committee that would propose and negotiate with the government appropriate ways to pay its debt. Maagiagi's *pulenuu* was dismissed for the second time.

December 12th- Cyclone Evan flooding destroyed hydro-power stations and water intakes and homes at Maagiagi. About 25 families were living by the penstock and

dam area of Samasoni at the time of Cyclone Evan flooding. Some villages were cultivating land in the catchment area of Alaoa and next to the Fale o le Fee power station. All the houses by the Samasoni penstock were washed away by the flood. The villagers were concerned that flooding in this part was severe because of the dam (EPC, 2013).

November 2013- The Asian Development Bank (ADB) announced it would be providing funding for the Samoa Renewable Energy Development and Power Sector Rehabilitation project. The first component of the project would rehabilitate the three hydro-power plants at Maagiagi, which were damaged by Cyclone Evan 2012 (EPC, 2013; ADB, 2014).