The Impacts of Climate Change on the People of Vatukarasa and Sovi Bay, Viti Levu, Fiji

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Abstract

Climate change is one of the biggest threats facing communities around the globe in the 21st Century. Small island developing states, including all Pacific Island Countries, are often represented as being among the countries that are most exposed to its effects. This thesis seeks to better understand the impacts of climate change on two coastal communities, Vatukarasa and Sovi Bay, on the south coast of Viti Levu, the main island of Fiji. These two communities are composed of *iTaukei* (indigenous Fijians) and Indo-Fijians, respectively. They share a number of current and likely future problems caused by climate change although there are some differences in their levels or types of exposure reflecting different cultural backgrounds, livelihood strategies and social networks. The effects of climate change are holding back the development aspirations of the communities, a process that is likely to worsen in the years ahead. Developing sustainable and effective adaptation strategies will need to consider both the commonalities between the two communities and the differences. Some contemporary resource management practices also contribute to the environmental degradation caused by climate change and changing these is already recognised by community members as important first steps towards adapting to climate change effects. The thesis explores the potential for traditional knowledge to be embraced in adaptation that is community based. It also recognises that some adaptation options are likely to be expensive and beyond the financial capacities of the communities without some forms of external assistance, from local and national government sources as well as the international community.

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Glossary

Balolo	Edible sea worms (*Palola viridis*)
Baravi	Coastal area
Bele	Highly nutritious green leafy vegetable (*Abelmoschus manihot*)
Borosou	*S*mall jungle chilli (*Solanum repandum*)
Cagolaya ni vavalagi	Similar to ginger and used for medical purposes
Cakaulevu	Great sea reef
Dalo	Edible tuber (taro, *Colocasia esculenta*)
Dawa	Tree with edible fruit (*Pometia pinnata*)
Dela ni yavu	Mountain associated with the *yavu* of an *i tokatoka*. Formal term for home.
i Tokatoka	Extended family. Subgroup of a *mataqali*
i Taukei	Indigenous Fijians
Ivi	Also known as the Tahitian chestnut (*Inocarpus fagiferus*) with edible kernal
Kawakawa	Rock cod(*Epinephelus polyphekadion*)
Kai viti	Indigenous Fijian (*iTaukei*)
Kere kere	To request from family or friends, component of reciprocity.
Koro	Village
Koro ni vasu	Mother's village
Kuita	Octopus Spp.
Kukaloa	Small mangrove black crab (*Metopograpsus messor*)
Kumala	Sweet potato (*Ipomea batatas*)
Lairo	Sand crab (*Cardisoma carnifex*)
Lali	Wooden drum
Lolo	Coconut cream
Lotu	Worship of Christian God or Church.
Lovo	Earth oven
Makai	Corn (*Zea mays*)
Mana	Mangrove mud lobster(*Thalassina anomala*)
Manu ni cagi	Bird of the wind
Matanitu	A political unit. Traditionally it related to a large alliance of *vanua* and today refers to the Government of Fiji
Mataqali	Kinship group or clan made up of related *itokatoka*.
Moli maderini	Mandarin
Oqo	Barracuda (*Sphyraena qenie*)
Qari	Green mangrove crab
Qele ni teitei	Garden lands or farms
Qoliqoli	Customary near shore marine rights or fishing grounds
Roko Tui	Head of a province
Salala	Indian Mackerel (*Rastrelliger Kanagurta*)

Saqa	Treveally (*Caranx* spp.)
Sautu	Good life and wellbeing
Sevusevu	A ceremonial offering of *yaqona* (kava) by a visitor to the host
Solevu	*Traditional and ceremonial exchange of gifts*
Soli	Gift
Sulua	Octopus
Tabua	Whale tooth which is highly valued in ceremonial exchange
Talanoa	To talk, chat, or share information
Tamata dina	A person of integrity who can be trusted
Tavioka	Cassava (*Manihot esculenta*)
Tikina	Administrative district
Turaga-ni-koro	Head of a village
Uto	Breadfruit (*Artocarpus altilis*)
Uvi	Yam (*Dioscorea spp*.)
Vanua	Land or territory and the people who belong to it.
Vavai dina	Taro, an edible tuber
Vavai Loa	Taro, an edible tuber
Veikau	Forest land or bush land
Voivoi	Pandanas sp., the leaves of which are used for weaving mats, etc.
Wai tabu	Marine protection area or ‘no take zone’
Yanuyanu	Island or island groups
Yaqona	Kava (*Piper methysticum*) Traditional Fijian drink
Yasana	Province
Yavu	Ancestral house foundation. Raised mound on which traditional houses were built.
Yavusa	Kinship unit comprising two or more mataqali
Yavutu	Founding ancestor’s house sites

Listof Acronyms

ADB	Asian Development Bank
ALTA	Agricultural Landlord and Tenant Act
AMCEN	African Ministerial Conference on Environment
CBA	Community-based adaptation
CCA	Climate Change Adaptation
CCCPIR	Coping with Climate Change in the Pacific Island Region
CCES	Climate Change and Environmental Sustainability
CDCP	Centre for Disease Control and Prevention
COP	Conference of the Parties
CROP	Council of Regional Organisations in the Pacific
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTCN	Climate Technology Centre and Network
CVA	Climate Vulnerability Assessment
EDE	European Development Fund
EEZ	Exclusive Economic Zone
ENSO	El Niño-Southern Oscillation
ESD	Education for Sustainable Development
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FNFP	Fiji National Provident Fund
FRDP	Framework for Resilient Development in the Pacific
GCCA	European Union and Global Climate Change Alliance
GDP	Gross Domestic Product
GHG	Greenhouse gases
GIZ	Gesellschaft fur Internationale Zusammenarbeit
GWA	Gender and Water Alliance
ICCCAD	International Centre for Climate Change and Development
ICLEI	International Council for Local Environmental Initiatives
IFAD	International Fund for Agricultural Development.
IISS	International Institute for Strategic Studies
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter-Tropical Convergence Zone
JNAP	Joint Climate Change and Disaster Risk Management National Action Plan
LDCs	Least Developed Countries
MPA	Marine Protected Area
NAPA	National Adaptation Programme of Actions
NCEI	National Centres for environmental information
NDCs	Nationally Determined Contributors
NGOs	Non-Government Organisations
NIWA	National Institute of Water and Atmospheric Research
NLTB	Native Land Trust Board

ODPM	Office of Disaster Preparedness and Management
PACC	Pacific Adaptation to Climate Change Programme
PACE-SD	Pacific Centre for Environment and Sustainable Development
PICCAP	Pacific Islands Climate Change Assistance Programme
PICTs	Pacific Island countries and territories
SIDS	Small Island Developing States
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment Programme
SRDP	Climate and Disaster Resilient Development in the Pacific
TEK	Traditional Environmental Knowledge
UN	United Nations
UNDP	United Nations development Programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
USNCDC	United states National Climatic Data Centre
USP	University of the South Pacific
WFP	World Food Programme
WG II	Working Group 2 of IPCC
WHO	World Health Organisation
WMO	World Meteorological Organisation
WPM	West Pacific Monsoon

CHAPTER 1
Introduction

> *"The Pacific island states have the moral authority to tell the world that climate change needs to be reversed, because the Pacific island states are leading by example… Not only are they building resilience and investing in adaptation to protect their citizens, their communities and their culture to protect their environment, but they are fixing for themselves very ambitious targets in relation to mitigation."*
>
> (António Guterres,UN Secretary-General speaking at the High-level Political Dialogue of the Pacific Islands Forum on 15 May 2019, quoted in United Nations, 2019: ii).

In this thesis I explore the "The impacts of climate change on the people of Vatukarasa and Sovi Bay, Nadroga, Fiji Islands". I investigate whether or not *iTaukei* and Indo-Fijian communities at these two respective locations are affected differently by climate change. "Climate change is arguably the most serious challenge facing humanity" (Chapman et al., 2006: 17). The thesis examines the strategies that could be implemented to reduce or minimise the likely impacts of climate change on island communities. It seeks to explain how the study sites are exposed, and why, in some cases, they are vulnerable, to the likely effectsof climate change. The communities at these two sites mainly depend upon agriculture, fisheries and tourism and all these subsistence and/or commercial activities are likely to be impacted by the changing climate and rising sea-level. This chapter outlines the significance of the study and why research of this nature is important. The chapter also sets out the aims and research questions of the thesis and concludes with an outline of its organisation.

1.1 Statement of the Research Topic

The thesis examines how the living styles, the livelihoods and cultural practices, of *iTaukei* and Indo-Fijians have changed in recent times. This is important as on the

one hand changing climate change may have contributed to these changes while on the other hand social, economic, political and cultural changes may have affected the exposure and vulnerabilities of the communities to the effects of climate change. The thesis will also examine how*iTaukei* and more recent migrants (the Indo-Fijian community) might respond to these impacts including embracing and reinforcing traditional knowledges and cultures as important foundations for the communities' resilience to climate change.

Traditional and indigenous knowledge in Fiji is based upon beliefs, practices and acquired skills that are passed on from elders and parents to youngsters. Traditional and indigenous knowledges are important because they are well understood by the local communities, stimulate community participation and are more likely than other knowledge systems to engage chiefs and other leaders who can provide more in-depth information on environmental and resource management (Thaman, 2000; Australian Human Rights Commission, 2008). Traditional and indigenous knowledges are, or could be, practiced by indigenous people to better adapt to changing climate and to become more resilient to its likely impacts (Fujieda and Kobayashi, 2013; Clark, 1990; Cagivinaka, 2016). Traditional knowledge can provide the basis for cost-effective and successful adaptation measures, which can be seen as pivotal in sustainable development and for local livelihoods, well-being and food security by conserving the diversity of domesticated and wild plants and animals (Nakashima et al., 2012).

Additionally, the research seeks to identify adaptations that would assist the Fiji Government, the Ministry of *iTaukei* Affairs, the Ministry of Multi Ethnic Affairs, the Commissioner Western-Lautoka, the District Officer-Nadroga/Navosa, the Nadroga Provincial Council, the Rural Indian Advisory Council-Sigatoka Rural and the private sector in their development endeavours to ensure sustainable survival of the people of Vatukarasa and Sovi Bay.

1.2 Evidence of global warming

Climate scientists overwhelmingly agree that humans are causing recent global warming. The consensus position is articulated by the Intergovernmental Panel on Climate Change's (IPCC) statement that "human influence has been the dominant cause of the observed warming since the mid-20th century" (Qin et al 2014: 17). Hundreds of scientists around the world are stating with high confidence that the world's temperature is rising and will continue to rise for decades and well beyond the 21st century (IPCC, 2014b-WG II AR5). Climate change and global warming

are occurring in a limited time frame, which is unprecedented, and it is the rate of change that is causing the greatest threat to human existence (Clarke, 2008; Fleurbaey et al., 2014). The earth's temperature has increased by approximately 0.8°C in the last one hundred and fifteen years (Royal Society, 2014) and it is likely to continue increasing in the future (IPCC, 2014a-WG III AR5).

"Coasts are projected to be exposed to increasing risks, including coastal erosion, due to climate change and sea-level rise. The effect will be exacerbated by increasing human-induced pressures on coastal areas" (IPCC, 2007a: 12-WGs I, II and III AR5). The island states of the Pacific, Atlantic and Indian Oceans are likely to be hit the hardest by the likely impacts of climate change because of their small and exposed economic bases (Schipper and Burton, 2009). As the concentrations of carbon-dioxide and other greenhouse gases are increasing, the world is likely to become warmer and further rise in the sea-level is imminent (IPCC, 2014b-WG II AR5; Vardiman, 2007). "Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" (IPCC, 2014f: 8-WGs I, II and III AR5).

Recent observations show that sea-surface temperatures and tropical cyclone intensity have increased in the last 30 years (Charan et al., 2016). "The problem isn't just that the temperature is rising: it is that the rise is taking place at such a phenomenal speed...there is little time for different species to change their behaviour in response to rapidly changing conditions" (Jarman, 2007: 8). Observations from satellites show an approximately ten percent decrease in the earth's snow cover since the 1960's (Charan et al., 2016).

1.3 Projecting future climate

Identifying future changes in some components of the climate system, whether internally generated or externally forced is called climate prediction (Kirtman et al., 2013). Today most scientists believe and agree that climate change is not only a fact, but also a crisis, solutions for which cannot be left for tomorrow, but have to be dealt with and addressed immediately (Ourbak and Magnan, 2018; Knauer, 2007). The increase in the atmospheric concentrations of greenhouse gases (GHGs): carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4) since the pre-industrial era have been driven largely by human activities (IPCC, 2014f).

During the 1986-2005 period all the Pacific island countries (PICs) showed a rise in air temperature within the range of +0.5–1.0°C. The ocean surface temperature in the region has also increased (Australian Bureau of Meteorology and CSIRO, 2014). In the future, warming will be greater on land than over the ocean surface (Hewitson et al., 2014). The world is likely to be impacted by both slow onset changes and sudden events and both these climate change manifestations are likely to be associated with a wide range of hazards (Tompkins et al., 2005; UNESCO, 2017). The IPCC (2007b-WG II AR4) stated that three-quarters of the tropical forests could disappear, crop production and yield are likely to decrease, and more intense and frequent droughts would make the situation worse. Some countries are also likely to experience above the global average temperature increase (United States Environmental Protection Agency, 2014).

1.4 Pacific island countries at the frontline of climate change.

PICs because of their location, demographic patterns and geophysical characteristics are regarded as a barometer, because they are exposed and many are vulnerable to the early impacts and effects of global warming (Ferris et al., 2011; Schramm and Loehman, 2011; Baker-Jones et al., 2013; SPREP, 2015a; Weir and Virani, 2010). "Between 1900 and 2015 the Pacific islands region experienced 325 natural disasters, directly affecting 7 million people, 9,200 deaths, ½ million homeless and total damage of USD 4 billion" (Manley et al., 2016: 3).

The small Island countries are surrounded by ocean and have small land masses and poorly developed coastal infrastructures (Fujieda and Kobayashi, 2013; Gulberg, 2006). The greatest challenge that coastal communities are facing is climate change (Australian Government, 2011; IPCC, 2014d-WGs I, II and III AR5). Some countries are already experiencing the adverse impacts which are likely to intensify in years to come (Burton et al., 2011; IPCC, 2014d-WGs I, II and III AR5). Coastal communities depend very much on coastal and marine ecosystems and climate change and sea level rise are likely to destabilize and degrade these ecosystems and may even force people to relocate or move further inland (Campbell, 2014). Climate change is likely to threaten the small island countries' ways of life and may even threaten their survival as viable living places (Barnett and Campbell, 2010).

Island countries are sensitive to climate change. Cyclone risk is high and economic damages caused by them are extensive for many countries in the region (Filho,

2015; Seneviratne et al., 2012). The lives and livelihoods of people in most Pacific island communities are very much linked to the sea and as the oceans are warming, becoming more acidic, and sea level is rising, their social, economic, cultural and even national identities are being affected (Charan et al., 2016; Tompkins et al., 2005).

Being at the frontline of climate change, island nations are among the most exposed and are set to be impacted the most, yet they contribute least to global warming (Drønen, 2015; Vidal, 2013). Even with a small change in climate variables many PIC coastal communities are negatively affected (Tompkins et al., 2005). Most islands are experiencing climate change impacts on communities, infrastructure, water supply, coastal and forest ecosystems, fisheries, agriculture, and human health (ADB, 2010; 2011; IPCC, 2014a-WG III AR5; Mimura et al., 2007). Their lives and livelihoods are linked to the Pacific Ocean; their ways of life are threatened by global warming and rising sea levels (Ferris et al., 2011). The impacts of climate change are likely to further intensify in years to come. Many Pacific island countries are just a few metres above the high-water mark, so half a metre of rise in the sea level is likely to increase storm surges, intrusion of saltwater, inundation of important coastal areas and threaten coastal communities (ADB, 2010).

The changing climate in conjunction with existing over-exploitation of natural resources, due to rapidly rising populations and economic change is likely to have a devastating effect on the island resource bases, thus reducing the GDP of most Pacific island countries (Filho, 2015). The characteristics of small islands contribute to their exposure and, in some cases, vulnerability to the impacts of climate change, extreme events and sea-level rise (IPCC, 2007a-WGs I, II and III AR4). Both, high volcanic islands and low-lying atolls are at risk and are exposed and vulnerable to sea level rise, as their populations, agriculture and major industries are concentrated in coastal areas (ADB, 2011; World Bank, 2013). The impacts of climate change are likely to be felt by many generations of Pacific island peoples, as their countries have high sensitivity to external shocks, low adaptive capacity and high exposure and vulnerability to natural disasters (ADB, 2010; IPCC, 2010).

Being at the frontline of climate change is likely to result in deterioration of coastal resources of small islands, through coastal erosion and coral bleaching which in turn are likely to affect local resources such as fisheries. Roads and government

facilities such as schools and medical and health centres are likely to be damaged by rising sea levels. There is likely to be greater risk of injuries from extreme events and increased risk of water-and food-borne diseases. There will also be an increased likelihood of reduced labour productivity, which is then likely to reduce food security, and may lead to malnutrition and create further poverty (IPCC, 2014e-WG II AR5).

1.5 Significance of the study

"Islanders, especially in the Pacific region, have a strong relationship with the land and ocean so changes in climate can represent a threat not only to the physical environment but also to their culture and customs" (Australian Bureau of Meteorology and CSIRO, 2011: 2). Climate change is not only likely to impact the environment, but it is also likely to exacerbate existing social inequalities (WHO, 2010). The greatest number of tropical cyclones in the Pacific region occurs between New Caledonia, Vanuatu, Tonga and Fiji (Agrawala et al., 2003; NIWA, 2008). Extreme events like tropical cyclones and flooding have challenged coastal communities around the globe and changing climate and rising sea levels are making the matters worse (Ekwurzel, 2006).

Climate change and sea level rise are likely to be, if not already, major problems for Fiji Islands as more than 90 percent of the population and urban areas are situated in coastal areas (Climate Institute, 2007- 2010 a). The coastal areas of Fiji are mostly flat, low lying and fertile and the interiors of the larger islands such as Viti Levu and Vanua Levu are hilly, stony and rugged, built on lava deposits, and apart from river flood plans, are largely infertile and unsuitable for farming. In Fiji Islands people rely on natural resources for their daily needs. Subsistence farming and coastal and deep-sea fishing are the daily activities for most of the rural people of Fiji and many of these are likely to be affected negatively by climate change (World Agroforestry Centre, 2011).

The rate at which climate is changing, the emergence of new patterns of resource use and increasing intensity of human activities are impacting on ecosystems in ways or at rates that they are not able to adapt naturally. These changes are threatening community food production and are major hurdles for economic development to proceed in a sustainable manner. Some of the effects of climate change are already being observed in the Pacific and with time the scale and scope of these impacts are likely to increase (Australian Government, 2011). Island

communities are facing many stressors that are affecting their sustainable development, use of natural resources and adaptive capacity (Bennett et al., 2015). The thesis is of particular value and interest because it reports on the similarities and differences of the experiences of two culturally distinct communities living in almost the same local environment. The research also addresses an important gap in the current climate adaptation scholarship on Pacific SIDs as there are few empirical studies that examine how gender norms shape vulnerability, adaptive capacity, and adaptation strategies within and between different types of Pacific communities.

1.6 Aims of the Research

The aim of this research is to explore the "The impacts of climate change on the people of Vatukarasa and Sovi Bay, Nadroga, Fiji Islands" and to identify whether or not these two communities are being affected differently. Both the sites, Vatukarasa and Sovi Bay, are located on low lying areas and are close to the sea. It is likely that greater impacts would be on coastal villages and coastal settlements like Vatukarasa and Sovi Bay respectively. This is among the first research, where the impacts of climate change are compared between members of the two major communities in Fiji Islands. I investigate whether or not *iTaukei* and Indo-Fijian communities at these two respective locations are affected differently by climate change and in doing so I intend to assess, examine and identify the following:

1) To assess and evaluate the vulnerability of the *iTaukei* and Indo-Fijian communities to climate change and whether or not they are affected differently.
2) To examine and evaluate the likely impacts of climate change on health, agricultural activities and coastal fisheries.
3) To identify and evaluate the likely social, economic and political impacts of climate change on the *iTaukei* and Indo-Fijian communities.
4) To identify and evaluate existing adaptation strategies and what further could be done to reduce the likely impacts of climate change at Vatukarasa and Sovi Bay.

1.7 Research questions

The following questions have guided my research.

1) Are *iTaukei* and Indo-Fijian communities of Vatukarasa and Sovi Bay vulnerable to the impacts of climate change and if so, why?
    a) What is climate change and what will be its effects?
    b) How is climate change and sea level rise affecting the coastal communities of Vatukarasa and Sovi Bay?
    c) How are coastal fisheries and agricultural activities affected by climate change and sea level rise at Vatukarasa and Sovi Bay

2) Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay?
    a) What are the similarities and differences between *iTaukei* and Indo-Fijian society?
    b) Which community (*iTaukei* or Indo-Fijians) is more dependent on natural resources?
    c) Are *iTaukei* agriculture and fisheries different from Indo-Fijian agriculture and fisheries?
    d) How is the health of the people of Vatukarasa and Sovi Bay affected by climate change?
    e) Are the number of diarrhoeal and dengue fever cases increasing or decreasing at Vatukarasa and Sovi Bay?

3) What adaptationoptions have been implemented and what further could be done to reduce the impacts of the climate change on both the *iTaukei* and the Indo-Fijian communities at Vatukarasa and Sovi Bay?
    a) Has community-based adaptation been effective for both the *iTaukei* and Indo-Fijian communities at Vatukarasa and Sovi Bay?
        i. What is community-based adaptation?
        ii. To what extent is community-based adaptation practiced in Vatukarasa and Sovi Bay?
        iii. What possibilities are there for implementing further community-based adaptation in Vatukarasa and Sovi Bay?
    b) Why is traditional knowledge important for resilience and adaptive capacity?
        i. What is traditional knowledge?

ii. What traditional knowledge do *iTaukei* and Indo-Fijians have?
iii. How can traditional knowledge be applied to community-based adaptation?

1.8 Thesis organisation

The thesis is organised into nine chapters. Chapter Two outlines and evaluates the key theoretical concepts mainly pertaining to human's roles in climate change. It seeks to address why is it important to understand exposure and vulnerability in the context of climate change. I examine the concepts of vulnerability and resilience in this chapter and how these can be used to help develop effective adaptation strategies and why it is equally important to know and understand the different types of vulnerabilities that exist. The chapter sets the theoretical or conceptual platform to address the research questions "Are *iTaukei* and Indo-Fijian communities of Vatukarasa and Sovi Bay vulnerable to the impacts of climate change and if so, why? "Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay? And, "what adaptation options have been implemented and what further could be done to reduce the impacts of the climate change on both the *iTaukei* and the Indo-Fijian communities at Vatukarasa and Sovi Bay?

In Chapter Three I outline the physical, socio-economic and cultural impacts of climate change. By doing this I am setting the platform to address the research questions"Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay?" and "How is the health of the people of Vatukarasa and Sovi Bay likely to be affected by climate change?" The chapter also considers how and why Pacific Island communities are at the frontlines of climate change. Chapter Four provides a brief description of Fiji Islands, its location and population composition. This chapter also focuses upon how, for *iTaukei*,lands and villages are considered to provide a place of security indefinitely. However, the location of their villages, which are mostly close to the sea, may expose them to the likely impacts of climate change. The chapter provides background to the investigation of the research question "Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay?"

Chapter Five describes the physical, socio-economic and cultural components of the study sites. Chapter Six outlines the research methodology used to gather or to obtain the data for this thesis. I have employed a qualitative research methodology,

namely focus group discussions, *talanoa* sessions and participant observation. In Chapters Seven (climate change impacts) and Eight (adaptation to climate change) I bring together the data gathered and attempt to synthesise information from the literature review and discuss their relevance to research questions. Chapter Nine contains the summary of the findings of my research, directly relating the findings to the aims and objectives of the thesis and answers the research questions.

1.9 Summary

This chapter has briefly outlined evidence of global warming and how increasing global temperature is impacting both physical and biological systems. Rising temperature is not the main problem, but the rate at which it is increasing is of the greatest human concern. The chapter also discussed future climate change and set the platform to unpack the concept of "PICs at the frontline of climate change". Cyclone risk is high and economic damages can be huge and climate change is likely to worsen existing exposures and create new risks for Pacific Island communities

The chapter has also outlined why Fiji, and in the case of this research, particularly Vatukarasa and Sovi Bay, are important locations to investigate the impacts of climate change. Both these sites are low-lying and are close to the sea. The chapter also focused upon the significance of the study and why research of this nature is important. I have formulated the research questions in this chapter.

The next chapter analyses the key theoretical concepts pertaining to humans' roles in climate change. It seeks to address the following questions: What is climate change and what will be its effects and why is it important to understand vulnerability in the context of climate change? The chapter also emphasises the interrelations between climate change and human security. Another major component of the next chapter is adaptation, what it is, and why it is important.

CHAPTER TWO

Responding to climate change

> *"Climate change is one of the most hotly debated issues of this century. Politicians have risen and fallen on its wake, elections have been fought around it, and international leaders have come under unprecedented scrutiny by civil society for their action – or inaction – in addressing it"* (Saul et al., 2012: 1).

2.1 Introduction

This chapter analyses the key theoretical concepts pertaining to humans' contributions to climate change. It reviews the literature on climate change including the roles played by humans in its causation and more importantly in the context of this research, the effects on people and the things they can do to offset them. It seeks to address the following questions: What is climate change and what will be its effects? Why is it important to understand vulnerability in the context of climate change? How can this help to develop effective adaptation strategies and why is it equally important to identify the relationships between different types of vulnerabilities? The chapter emphasises the interrelations between climate change and human security.

It follows then, that another objective of this chapter is to have a better understanding of adaptation, what it is and why it is important. Adaptation, which occurs in environmental (physical and biological) and human systems is an ongoing process in which the systems or part of them respond to many factors and stresses. Adaptation to climate change refers to individuals, communities or systems changing behaviours, actions and practices to reduce climate vulnerability and to become more resilient (Adger et al., 2005; IPCC, 2014c). In this research, while I am focusing on bottom-up approaches, I am also seeking to identify ways to combine bottom-up and top-down approaches so that communities, stakeholders and government agencies could work together to find and implement the least expensive and most effective adaptation strategies. Here I see adaptation having two major components. One includes and combines scientific and local knowledge to reduce the likely impacts of climate change. The second involves getting local

communities and government agencies working hand-in-hand to reduce their vulnerabilities to climate change.

The chapter also analyses the relationships between climate change, climate variability and climate vulnerability. I review the literature keeping in mind what adaptation strategies could be implemented at community level and what it means to reduce vulnerability and become more resilient. By doing this I am setting the platform to address the research questions. "Are *iTaukei* and Indo-Fijian communities of Vatukarasa and Sovi Bay vulnerable to the impacts of climate change and if so, why? "Are the *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay, and if so, in what ways? And, "what adaptation options have been implemented and what further could be done to reduce the impacts of the climate change on both the *iTaukei* and the Indo-Fijian communities at Vatukarasa and Sovi Bay?

Climate change adaptation is important as the impacts are likely to intensify in future (Australian Government, 2011; Bruckner et al., 2014; International Federation of Red Cross and Red Crescent Societies, 2013). It is the poorest communities that are likely to be impacted the most and as the impacts are likely to intensify in future, these poorest communities are likely to experience greater climate change shocks and stresses (Clement et al., 2011; Monnereau et al., 2015; Ranger et al., 2014; Tirado et al., 2015). I will also distil the literature on why adaptation is necessary and what are its barriers and limitations, as successful adaptation will only be possible if we understand these. The chapter briefly examines the role of mitigation in climate change impacts and vulnerability. Last but not least, the chapter concludes with an outline of the approach to my thesis and the gaps that I am seeking to fill.

2.2 Climate change

> "The need for urgency is obvious. Our world is in distress from the extreme weather events caused by climate change – destructive hurricanes, fires, floods, droughts, melting ice, and changes to agriculture that threaten our food security. All consistent with the science that now tells us that 2016 was a record year for carbon concentrations in the atmosphere." Voreqe Bainimarama in his opening remarks at COP23 (Bainimarama, 2017 quoted in COP 23, 2017: n.p. para. 3. https://cop23.com.fj/fijian-prime-minister-cop23-president-remarks-assuming-presidency-cop23/).

The Intergovernmental Panel on Climate Change (IPCC, 2014a) defines climate change as *"*a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer". The United Nations Framework Convention on Climate Change (UNFCCC), in Article 1, defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Here the UNFCCC indicates that human activities are changing the atmospheric composition in addition to some aspects of climate variability being caused by natural and external forces, such as volcanic eruptions and modulation of the solar cycles.

Increasing concentrations of greenhouse gasses in the atmosphere are causing long-term climate change (Bruckner et al., 2014; Chivers, 2010; IPCC, 2018; MacCracken and Richardson, 2010; Ministry for the Environment. New Zealand, 2017;Myhre et al., 2013; Richardson et al., 2011; Singh and Kumar, 2012). The years 2014, 2015, 2016, 2017 and 2018 were found to be the five warmest years to-date. Nine of the ten warmest years have occurred since 2005 (National Centres for Environmental Information (NCEI), 2018).The warmest (approximately 1.1^{o}C above the pre-industrial era) was 2017 although the years 2016 and 2017 are virtually indistinguishable because the difference (less than one hundredth of a degree) is less than the statistical level of error (World Meteorological Organization, 2018). "Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle...in global mean sea level rise, and in changes in some climate extremes...It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century" (IPCC, 2013: 15).

Climate change is having deleterious effects on both human and natural systems (Barange and Perry, 2009; Chehoski, 2006; IPCC, 2014f; Schneider and Root, 2002; United Nations High Commission for Human Rights, 2014; UNICEF, 2012). It is extremely likely that human activities, such as burning of fossil fuels are causing the greatest changes in climate (Adger et al., 2009; Australian Government, n.d.; IPCC, 2018; MacCracken and Richardson, 2010; Ministry for Environment, New Zealand, 2016;Pearce et al., 2017; Pelling, 2011; Pew Center on Global Climate Change, 2011; Qin et al., 2014). Climate change is likely to cause increasing losses in the Pacific island nations, which are already suffering from

economic, social, political and environmental privations (Aalbersberg et al., 1993; Mortreux and Barnett, 2009).

Climate change is having impacts, but different regions are affected differently (Barnett and Campbell, 2010; Bosello et al., n.d.; Lotawa, 2014; Schneider et al., 2007). Some areas/regions may experience more intense tropical cyclones, while other regions may experience droughts, some areas may see an increase in vector borne diseases, while others may experience coastal erosion due to rising sea levels (Barnett and Campbell, 2010). Many areas or regions may be affected by more than one type of impact such as vector borne diseases, like dengue fever, and coastal land loss due to rising sea levels (Abate and Kronk, 2013;Richardson et al., 2011;Ruth and Ibarrarán, 2009; UNFCCC, 2007). The Pacific region, by the end of 2090, is likely to have more extreme rainfall events, more hot days and warm nights, fewer droughts and increased sea levels (Australian Government, 2011). Climate change may well be the greatest political, economic, environmental and moral challenge of our time and in the future (Lotawa, 2014; Steveson, 2012; Stowell, 2005; Torres Strait Regional Authority (TSRA), 2014; Zhang, 2009) The main characteristics of climate change are summarised in Box 2.1.

The impacts of climate change are likely to be far-reaching and largely irreversible (Baird, 2008; Broecker and Kunzig, 2008; Elliot, 2010; Geophysical Fluid Dynamics Laboratory (GFDL), 2016; UNFCCC, 2007). People from the developing world, who are amongst the poorest, are most vulnerable in terms of exposure to more extreme events, hunger, sickness, food availability, malnutrition and starvation and have limited capacity to adapt (Adger et al., 2009; Food and Agriculture Organization of the United Nations, World Food Programme and International Fund for Agricultural Development (FAO, WFP and IFAD), 2012., IPCC, 2014d; Hannah et al., 2010; Kunreuther et al., 2014; Pelling, 2011: World Bank, 2010).

It is important to observe that climate change is a global problem (Saul et al., 2012). Any individual, a group of people or nations on their own (with few exceptions) will not be able to significantly reduce the concentrations of greenhouse gases accumulating in the atmosphere; it can only be possible through a collective global approach (Karling, 2007). All countries would need to act collectively and immediately to stabilise greenhouse gas concentrations in the atmosphere to minimise the severe impacts of climate change on current and future generations' lives. Future climate (means and variability), which is likely to vary annually and

from decade to decade, will depend upon past, present and future anthropogenic emissions (IPCC, 2014f; Ministry for Environment, New Zealand, 2016).

Box 2. 1 The main characteristics of climate change

- Increase in average global temperature.
- Changes in cloud cover and precipitation particularly over land.
- Melting of ice and glaciers and reduced snow cover.
- Increase in ocean temperature and acidity.
- Increase in sea level.
- Increase in tropical cyclone intensity.
- Increase in vector-and water-borne diseases.

Source: Adapted from IPCC, 2014e: 4-6.

2.3 Climate variability

According to the IPCC (2014a: 1257), "climate variability refers to variations in the mean state and other statistics (such as standard deviation, the occurrence of extremes, etc.) of the climate...Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability)." Changes in climate that occur within a month, a season or a year are climate variability (Roeth, 2011). Climate is variable and never identical; one year may bring heavy rainfall and the next year may bring prolonged drought (Parry and Carter, 1998). External climate variability (caused by variations in natural or human external forces) occurs over long time periods, whereas internal natural climate variability (caused by natural internal processes) occurs from months to decades (short time periods) (African Ministerial Conference on Environment (AMCEN), 2011; World Meteorological Organization. 2017).

Changes in the magnitude and/or frequency of extreme events and in other aspects of climate variability are likely to have significant impacts on the distribution, prevalence and survival of crops, weeds, pests and human and livestock diseases (Thornton et al., 2014). Where people reside, how they generate their income, wealth and livelihoods is influenced by climate variability, and their decisions on how to respond to such climatic patterns can have consequences for their economic, political and personal welfare and social wellbeing and conditions (UNFCCC, 2007; Van Noordwijk et al., 2011). Understanding climate change and variability is

significant for designing adaptation strategies and policies (Thornton et al., 2014; Pelling, 2011).

In the Pacific region, the South Pacific Convergence Zone (SPCZ) (characterised by heavy rainfall from Solomon Islands to Cook Islands), the Inter-Tropical Convergence Zone (ITCZ) (a low pressure belt at the thermal equator where the north-east and south-east trade winds converge, bringing heavy precipitation) and West Pacific Monsoon (WPM) (caused by large differences in the land and ocean temperatures, the arrival of monsoon changes very dry to very wet conditions in the western Pacific) are large-scale features that influence climate. These three large-scale climate features are influenced by the El Niño-Southern Oscillation (ENSO), which is the main factor causing year to year climate variability in the Pacific region. ENSO impacts the strength and location of the major climate features, such as winds, rainfall, temperature, sea level, ocean temperature and cyclone activity contributing to climate variability (Australian Bureau of Meteorology and CSIRO, 2011; International Research Institute for Climate and Society, n.d.; Latif and Keenlyside, 2008). El Niño and La Niña are opposite phases of the southern oscillation. Each El Niño and La Niña has different impacts and different phases of ENSO could result in droughts and floods at the same place but at different times (NIWA, 2016).

All biological, physical and human systems on the planet are affected by climate variability and change (Richardson et al., 2011; Thornton et al., 2014; United Nations Environmental Programme, 2013). Climate change and climate variability are closely connected, and it is wise to deal with them together. Climate change is likely to increase climate variability in most regions and locations. Climate variability may even help us to better understand the impacts that climate change is likely to create and to what extent the present exposures may be exacerbated (Leary et al., 2008a; Pelling, 2011). Accordingly, many countries (developing and developed), feel that they are under threat from climate change, and are increasingly focussing on adaptation (Adger et al., 2006). Climate variability in the short term will outweigh long-term climate change effects, as climate variability encompasses the full range of deviation from the mean conditions of the climate, which could be in the form of hot or cold, or wet or dry periods. Present and future patterns of climate variability may be the same, similar or significantly different (Closset et al., 2017; Van Noordwijk et al., 2011).

2.4 Vulnerability

The IPCC defines vulnerability as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC, WG 11, 2014b; 5). A vulnerable system may be very sensitive to even small changes in climate, where the sensitivity has the potential for the system to experience significant harmful effects and available adaptation measures are severely constrained (Cardona et al., 2012; Davis, 2011; Ferraro, 2010;Hutto et al., 2015). A well understood vulnerability context is important for communities' resilience-building and enhancing climate change adaptation at community level. Institutions can play a major part in enhancing people's adaptive capacity (Hoffmann et al., 2017; Thornton et al., 2014). To assess vulnerability, first it is necessary to understand it, so as to plan, provide resources needed and to take necessary adaptation measures (Ali, 2013; Cannon, 2008; Hoffmann et al., 2017; Martine and Daniel, 2013; Pelling, 2011).

Vulnerability depends upon the degree of exposure and how sensitive a community or an ecosystem is to the impacts of climate change (IPCC, 2014b; UNDP, 2016c).. A common approach is to see vulnerability as a function of the interplay between exposure and sensitivity on the one hand and adaptive capacity on the other (e.g. Vulnerability = (Exposure + sensitivity) – Adaptive Capacity) (Fellmann, n.d.).

Vulnerability is case-dependent and location-specific and when it interacts with extreme weather events, or certain thresholds are exceeded in cases of long-term change, risk may emerge. When a system is vulnerable, it has two main elements: first, the system is exposed and second a process, a factor or an event threatens that system (Barnett and Campbell, 2010). The degree to which a community is vulnerable to climate hazards depends upon the community's adaptation measures (Martens and Chang, 2010; Thornton et al., 2014). Directly measuring and fully investigating vulnerability is not possible as it does not have an absolute value. Social, political, economic and physical and institutional factors and processes play important roles in vulnerability, but not all of these can be quantified (Cannon, 2008; Closset et al., 2017; Hannah et al., 2010; Hoffmann et al., 2017; Liverman, 1990; Maybeck et al., 2012).

I define vulnerability to climate change as the inclination, liability, condition, ability or tendency to be negatively impacted by climate change or climate risks. Vulnerability, which varies widely across regions, sectors and communities,

includes insecurity, being defenceless, powerless, exposed to shocks, stresses and risks and unable to respond or recover or having difficulty in adapting to, or coping with such consequences (Chambers, 1989). Human vulnerability can be seen as a result of a wide range of geographical, environmental, biological, socioeconomic, political, institutional and other factors, which can vary temporally and spatially (Cardona et al., 2012; Füssel, 2005; Pelling, 2011; Thornton et al., 2014).

When economic growth declines vulnerability might increase. Vulnerability is often associated with ill-health, malnutrition, inability of breadwinning adults to work, loss of earnings, deferring medical treatment and increasing medical bills (Chambers, 1989). However, as Chambers (1989; 33) observed thirty years ago.

> "Vulnerability, though, is not the same as poverty...but defencelessness, insecurity, and exposure to risk, shocks and stress...vulnerability has remained curiously neglected in analysis and policy, perhaps because of its confusion with poverty. Yet vulnerability, and its opposite, security, stand out as recurrent concerns of poor people which professional definitions of poverty overlook".

Vulnerability is multi-faceted (Office of Disaster Preparedness and Management, 2013; USAID, 2011). Vulnerability to climate change includes the degree of exposure to a hazard, income levels, governance arrangements, type of livelihood, how sensitive a community is to the hazards, how much a community is negatively impacted by being sensitive and exposed to such hazards and its capacity and ability to adapt to the changes (Adger et al., 2007; Ali, 2013; Australian Government, 2015; Engle, 2011; Leary et al., 2008b; Manley et al., 2016; Martens and Chang, 2010;Schipper and Burton, 2009; Smit and Wandel, 2006), as indicated in Figure 2.1. Many Pacific Island countries are portrayed as being exposed due to a wide range of constraints, risks and hazards because these island countries are small, fragmented and isolated (Barnett, 2001; Barnett and Campbell, 2010). However, this view fails to take into account the positive attributes of small island states and the agency of the people who inhabit them.

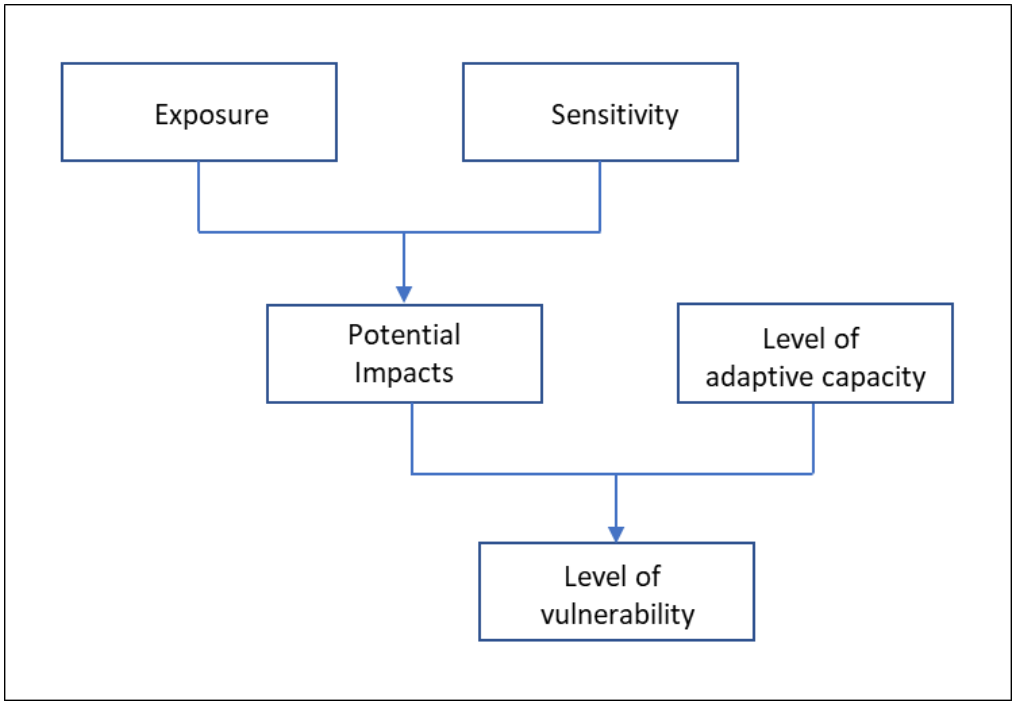

Figure 2. 1Vulnerability and its components. Source: Adapted from Australian Government, 2015: ix

Vulnerability can be subdivided into four major types (United States Agency for International Development, 2011). First is physical vulnerability, such as orientation, design and materials used in construction of houses and roads. For example, the Fijian *bure* is less likely to collapse in cyclones and in earthquakes but is more likely to catch fire than a concrete house, which is more likely to collapse in an earthquake (Campbell, 1984; 2006; Khan, 2012). Second is social vulnerability, in which people or a community are unable to deal with the negative impacts of climate change. An example is Indo-Fijian females and young children who are more likely to die and be more severely impacted by extreme events, such as flooding and cyclones because they cannot leave their homes without the permission of the elder males of their houses**.** Third is economic vulnerability which reflects the financial status of individuals and communities. As poor families are forced to live in substandard houses and insecure environments, they are often more exposed, and some become sensitive to disasters, because they lack the resources to build sturdy homes and to pay insurance for structures, such as houses and other fixed assets (Office of Disaster Preparedness and Management (ODPM), 2013). Similarly, people whose livelihoods are restricted have limited resources to cope with stresses and shocks resulting from climate extremes. Fourth is environmental vulnerability, where people are forced to live in marginal areas, which make them exposed, sensitive and vulnerable to the likely impacts of climate

change (Food and Agriculture Organization of the United Nations, 2015). A good example of this is people forced to live in low lying areas exposed to floods and those on unstable slopes.

The vulnerability of a system, individual, group or state is also determined by its physical setting, availability of resources, and access and entitlement to such resources (Lavell et al., 2012; Schipper and Burton, 2009). For example, a farmer's vulnerability and stress depends on various factors, such as the nature of landholding, size of the farm, social networks, availability of machinery, access to credit, soil fertility and quality, and farmer's education, knowledge, health and age (Cardona et al., 2012; Leary et al., 2008b; Zebisch et al., 2005).

Vulnerability can be also defined or looked at in two ways. One is internal vulnerability which can be a consequence of reduced household income, inability to cope without incurring damages and losses, defencelessness, inadequate social networks and limited access to information and the other is external vulnerability which can be due to poor national policies, risks, stress, shocks, lack of international aid and economic globalization to which an individual or a family is subjected (Chambers, 1989; Füssel, 2009). Social inequalities can be reflected in different levels of climate vulnerability (Ruth and Ibarrarán, 2009), such as exposure and inadequate capacities. Examples of inequalities causing increased exposure include when people are forced to live in areas which may be less expensive but more exposed to extreme events. People forced to live in marginal areas and overexploiting natural resources, such as mangroves, may cause these areas to become increasingly degraded. Many peri-urban, informal housing areas (squatter settlements) in PICs are in marginal locations. Social inequalities are influenced by such factors as people having no or restricted property rights, few entitlements, limited empowerment and inadequate access to natural resources and these factors increase vulnerability and reduce people's coping capacities. Marginalized people often have little access to credit facilities and government officials, have little or no information regarding public insurance, and, even if they could have the information, they may not be able to afford to respond to climate change (Barbara and Keen, 2017; Bryant-Tokalau, 1995; Campbell, 2014; Kiddle et al., 2017; Ruth and Ibarrarán, 2009).

A community's characteristics, such as ability to withstand and recover from effects, influence its coping ability (adaptive capacity), which in turn determines its vulnerability to the likely impacts of climate change. From this perspective

vulnerability can be described thus: “Vulnerability = Risk x Coping Inability (the higher the risk, the higher the vulnerability; the poorer the coping ability, the higher the vulnerability)” (McGregor et al., 2013: 181). Vulnerability may be seen as the opposite of resilience. Thus vulnerability and resilience are at two ends of a spectrum, where in between, the risks and coping ability, determine whether a community leans more towards being vulnerable or resilient. Typically, communities will exhibit elements of both vulnerability and resilience.

Many scholars have defined climate vulnerability in numerous different ways, but the most prominent interpretations are outcome vulnerability (an end-point, top-down approach that concentrates on physical aspects of a system that will be affected) and contextual vulnerability (a starting point interpretation that follows a bottom-up approach identifying characteristics of social and ecological systems that make a system vulnerable) (Adger et al., 2006; Füssel, 2009; Füssel, 2009; O’Brien et al., 2004).

Starting-point vulnerability focuses on how susceptible an entity is to the impacts of the climate change and on the other hand end-point vulnerability is the level or degree of damage likely to be experienced after the event has occurred or unfolded (Okpara et al., 2016). Starting-point vulnerability examines the vulnerability that exists prior to adaptation and can be used to identify adaptation strategies. In comparison end-point vulnerability refers to vulnerability which still exists after adaptation has taken place and impacts of climate change are still being observed (Kelman et al., 2011; Kelman et al., 2015; Kelman and West, 2009; Nygaard et al., 2004; Warrick, 2011).

Starting-point vulnerability involves analysis of problems and finding effective solutions for the problems, primarily using social science. A starting-point interpretation of vulnerability is the level of people’s ability to act and respond to climate stimuli and not to be exposed or sensitive to the likely impacts of climate change (Füssel, 2009; O’Brien et al., 2004; Okpara et al., 2016). Starting-point vulnerability considers people as “active agents” who could respond and adapt to the likely impacts of climate change (Nygaard et al., 2004;Warrick, 2011). Using the concept of starting-point vulnerability, addressing present climate variability and change will help reduce future vulnerability to climate change (Füssel, 2005). As starting-point vulnerability focuses on how vulnerable an entity is, it implies that starting-point vulnerability is a form of social vulnerability and thus could be used effectively to predict the impacts of climate change on daily activities and

livelihoods. Starting-point vulnerability is important because it helps to identify and understand the extent of vulnerability to climate change at localised levels (Madu, 2012).

End point vulnerability focuses on net climate change impacts, taking into consideration the likely future adaptive responses (Okpara et al., 2016). It is taken as the residual of climate change after deducting adaptation (O'Brien et al, 2004; Thornton et al., 2006), and initially identifies the biophysical impacts of climate change on a system from defined emission projections (Green et al., 2012). The differences between end-point and stating-point vulnerabilities are further elaborated in Table 2.1.

Table 2. 1 Differences between end-point and starting-point vulnerabilities

End-point vulnerability	**Starting-point vulnerability**
Looks at the benefits of climate change adaptation.	Looks at ways in which societies' vulnerability to climate hazards could be reduced.
Looks at net impacts of climate change in different regions.	Tries to find out why some groups are affected more than others by climate hazards.
Adaptive capacity determines vulnerability.	Vulnerability determines adaptive capacity.
Looks at adaptation to future climate change.	Looks at ways to adapt to current climate change.
Mostly deals with the natural science of climate change.	Mostly deals with the social science of climate change.

Source: Adapted from Füssel, 2009: 6

2.5 The impacts (consequences and outcomes) of climate change.

> "The term impacts is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate changes

> or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. The impacts of climate change on geophysical systems, including floods, droughts and sea level rise, are a subset of impacts called physical impacts" (IPCC, 2014d: 124).

Climate change is likely to affect our communities, marine and terrestrial resources and our living standards (Aalbersberg et al., 1993; Raygorodetsky, 2011). It is likely to undermine sustainable development, increase pressure on environments and natural resources and decrease the economic and social well-being of especially marginalised people and groups (Pelling, 2011; UNFCCC, 2007; UNDP, 2002). Climate change impacts can be both, slow and sudden onset (Gero et al., 2013), as shown inTables 2.2 and 2.3.

Climate change is likely to impact especially those people who are vulnerable to, and are struggling to cope with, current climate variability and extreme weather events (Adger et al., 2006; Filho, 2015; UNFCCC, 2007). Increasing sea surface temperatures and changes in salinity and ocean circulation patterns are likely to affect fish abundance, distribution and population growth (Clarke, 2008; SPC, n.d (c)). Climate change and rising sea-level are likely to exacerbate inundation, inland flooding, coastal erosion, and damage to vital infrastructure, housing and other assets, thus impacting on the social, natural, physical and economic well-being of settlements, villages, districts and countries (Aalbersberg et al., 1993; Barnett and Campbell, 2010; Handmer et al., 2012). Human productivity is likely to be affected by adverse climate, the body is less likely to work efficiently when it is humid and hot (SPC, n.d. (c); Tol, 2014). Climate change is likely to impact agriculture in various ways, such as increased variability of rain, increased temperatures, increased intensity and frequency of extreme weather events and changes in water availability (Barnett and Campbell, 2010; Meybeck et al., 2012; Oxfam Australia and New Zealand, 2009; UNFCCC, 2007).

Table 2. 2 Some examples of slow onset impacts.

Sector	Climate change	Climate change impacts
Water resources.	Changes in precipitation and sea level rise.	Decreased water supply quality and quantity, reduced soil moisture and saltwater intrusion into fresh water sources.
Terrestrial biodiversity.	Sea level rise.	Inland migration of mangroves.
Increasing temperatures.	Intensified hydrologic cycle.	Dry regions to become drier and wet regions to become wetter.
Marine biodiversity.	Increased sea temperature and sea level rise.	Adverse effects on sea grasses and coral bleaching.
Fisheries.	Increased sea temperature, sea level rise and ocean acidification.	Death of coral reefs and sea grasses causing reduced fish catches. The loss of shell-forming species, coral reefs and reef-dependent fisheries affects food security, trade and tourism.
Tourism.	Changes in temperature, rainfall patterns, extreme events and sea level rise.	Changing visitor trends, sea level rise may bring about the loss of beaches.
Human settlements and infrastructure.	Sea level rise and extreme events.	Coastal inundation and erosion, damage to property, infrastructure and livelihoods.

Source: After UNFCCC, 2012: 8-11

Table 2. 3 Some examples of sudden or extreme event impacts

Sector	Climate change	Climate change impacts
Agriculture and forestry	Changes in rainfall patterns	Very intense rainfall may cause flash floods and landslides. Worsening drought conditions in the dry seasons.
Health	Exposure to diseases and stresses	More causes of vector-and water-borne diseases. Increased causes of hypertension.
Tourism	Changes in intensity of tropical cyclones.	Damage to tourism infrastructure and disruption of tourist operations after major cyclones and floods. Decrease in tourist arrival, having significant impact on local economy.

Source: Tompkins et al., 2005: 26

Climate change may impact different locations, communities, and even different members within a community and sectors differently (see Table 2.4). Changes in precipitation are likely to affect the frequency, distribution and intensity of droughts and floods (Verner, 2012; Barnett and Campbell, 2010). Global warming is also likely to negatively affect natural ecosystems. Many marine and terrestrial species are shifting, or have shifted, their geographic ranges, which is impacting on their migration patterns, seasonal activities and species interactions (IPCC, 2014b; SPC, n.d. (c)). Climate change is likely to impose heavy costs on human populations in terms of damages to property and infrastructure and human health (Adger et al., 2009; Campbell, 2019; Muttarak and Lutz, 2014; Pelling, 2011). Approximately 25 percent of all the plants and animal species which scientists have studied are likely to become extinct if temperature (global) increases by 1.5-2.5^{0}C" (Renowden, 2007).

Table 2. 4 The impacts of climate change on different sectors in the Pacific region.

Sector	Climate change impacts
Local resources	Deterioration of terrestrial and marine resources, through coastal erosion of beaches, coral bleaching, flooding (river and coastal) droughts, increasing hot events, and ocean warming and acidification.
Infrastructure and settlements	Now most settlements are located along coastal areas, shifting growing populations into more exposed locations (sea level rise, coastal inundation and erosion, high tide events, storm surges and tropical cyclones). Roads and government facilities such as medical and health centres are also likely to be affected.
Health	Greater risks of injury and disease. Increased risk of water-food-and vector-borne diseases. Increased likelihood of reduced labour productivity, which is likely to reduce food security and may lead to malnutrition.
Agricultural and animal husbandry	Rising temperatures may increase invasion by non-native species, which could prove devastating to agriculture and fisheries (in conjunction with drought conditions) may also lead to more exposure to fire. May lead to drier areas, which could increase salinization and which in term could reduce availability of fresh water. Both crop and livestock production are likely to decrease, affecting food security.
Water resources	Communities may not be able to meet water demand during low rainfall periods. Extra funds will be needed to up-grade water infrastructure to meet local demands.
Coastal areas and marine ecosystems	Likely to exacerbate sedimentation of coastal ecosystems, such as coral and sea grass beds. Increasing sea temperatures and acidification are likely to cause coral bleaching.
Forestry	Changes in precipitation, temperature and tropical cyclones (increased intensity) may directly and indirectly affect the productivity, distribution and growth of forests, through diseases and fires.
Tourism	Climate change can affect tourists' travel decisions, which can impact host countries' handicraft, agriculture or construction industries.

Source: Adapted from IPCC, 2014e.

2.6 Adaptation: Living with climate change.

> "*Vakarauni se SigaToka*" - Prepare while there is time (Remling and Veitayaki, 2016: 2)

"Since the IPCC's Fourth Assessment Report (AR4), demand for knowledge regarding the planning and implementation of adaptation as a strategy for climate risk management has increased significantly" (Park et al., 2012 quoted in Klein et al., 2014: 904). Adaptation is the ability of a unit to gradually transform its structure, functioning or organisation to survive under hazards threatening its existence (Baird, 2008; Burton et al., 2005; Oliver-Smith, 2009). In international policy discussions climate change adaptation has become a significantly important topic over the last decade, especially to find ways and means, where an individual, community and all affected could better adapt and become more resilient to the likely impacts of climate variability and change (Williams et al., 2015). Adaptation is an ongoing process and includes activities that enable institutions, communities and individuals to cope with the changing effects of climate change (Bohle et al., 1994; Campbell, 1996, 1997; Chambwera et al., 2014; Hart, 2011; Smith et al., 2010). Disaster risk management and disaster risk reduction have many significant synergies with adaptation to climate change (Huber and Gulledge, 2011; Jones and Preston, 2010; Kelly and Adger, 2000; Klein et al., 2007; Manley et al., 2016; Prabhakar et al., 2009).

For the purpose of this thesis I define adaptation as adjustments or actions taken to minimise the damages caused by climate change to both natural and human systems and exploiting opportunities to gain from such changes. Environmental change and adaptation are nothing new. Coordinated efforts to protect the climate system for present and future generations date back to the late 1980s (IPCC, 2010). Socio-economic systems and humans have always adjusted their behaviour to external pressures. But the rate at which climate is changing and the scale of impacts is a new challenge for all systems (Parry and Carter, 1998; Pelling, 2011).

One of the most challenging problems facing humans is adapting to climate change (IPCC, 2014b; Ayers and Forsyth, 2009). Allwood et al. (2014: 1251) describe adaptation as "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects". There are two major approaches to adaptation. One is an impact-led approach and the other a vulnerability-led

approach, and they play different roles in adaptation (Warrick, 2011). In an impact-led approach, adaptation focuses on reducing exposure to climate change. It is more or less a top-down approach and involves an end-point analysis identifying impacts remaining after adaptation. This approach determines to what extent climate change is a problem and helps to find out what would be the cost of adaptation (Noble et al., 2014; Warrick, 2011). In a vulnerability-led approach, adaptation focuses on building communities' resilience and coping capabilities. It is both a bottom-up and top-down approach. It is a starting point of analysis that seeks to deliver what adaptation actions are needed. In this approach adaptation strategies and measures are assessed keeping in mind local capacities and capabilities and development plans and processes. To achieve this there is a need foremost to understand the factors that underlie vulnerability. Reducing present vulnerability will reduce future climate change vulnerability (Noble et al., 2014; O'Brien et al., 2004; Warrick, 2011).

Adaptation may include building infrastructure which can withstand natural hazards such as floods, storm surges and cyclones (Ayers and Forsyth, 2009). For example, structures could be built on elevated ground so as to be less prone to flooding. The resilience of food supply could be increased if farmers planted multiple crop species or varieties as some crops may be more or less affected by droughts or cyclones. In the Pacific, if people could grow more resilient staple crops such as yams and taro compared to sweet potatoes and cassava and preserve and store food in safe places, they would reduce vulnerability and increase food availability and food security (Campbell, 1984, 2006; Leary et al., 2008b).

Adaptation is having the ability to deal with the unavoidable impacts of climate change and to build capacity to reduce or minimise costs (Bryan and Behrman, 2013; New South Wales Government, 2013; Robinson and Gilfillan, 2017; Smith et al., 2010). Adaptation includes proactive actions to moderate harmful impacts of climate change and to create or exploit beneficial opportunities (IPCC, 2007a). It involves getting ready and being better prepared as well as increasing ability to adjust to climate change and to moderate potential or resultant damages by taking advantage of opportunities, adjusting to live with, and recovering from, the adverse impacts of climate change (Leary et al., 2008b).

For any adaptation to be successful there is a need to engage a large number of stakeholders and the adaptation should be community based, focusing on its members' interests, level of acceptance and leadership (Cardona et al., 2012;

Rakshit, 2010; Bryant-Tokalau, 2018). Governments could play a vital role and all challenges and potential conflicts would need to be addressed proactively. When adaptation measures are planned, the present disaster management policies, activities and practices of the communities that they intend to serve have to be taken into consideration (Gender and Water Alliance, 2003).

At the national level, adaptation includes identifying systems, sectors and regions vulnerable to climate change and finding means and measures to increase resilience and coping capacity of these systems, sectors and regions (Australian Government, 2015). Reducing poverty, improving climate knowledge and productive practices can help in sustainable development and climate change adaptation. Climate change adaptation can take various forms and strategies, which can be implemented by individuals, groups or by states and these forms and strategies can be motivated by many processes and factors, resulting in desired outcomes, such as maintaining well-being or livelihoods, increasing economic opportunities, conserving resources and improving health and safety (Le Cornue et al., 2018; Pelling, 2011).

There is a need for more in-depth social science research in the Pacific to improve communities' knowledge about climate change, its effects and solutions to them (Barnett and Campbell, 2010). Local community members should have greater input in decision-making processes and traditional knowledge should be incorporated with modern scientific knowledge to reduce the likely impacts of climate change. Minimising the impacts, recovering with least delay, reducing vulnerability and building resilient communities are the foundations of adaptation to climate change.

The United Nations Environment Program has identified eight climate change impacts assessment and adaptation strategies, summarised in Table 2.5. When discussing adaptation, five "W's and one "H" are very important. These are, **w**ho is impacted/affected, **w**here is the risk, **w**hen is the risk likely to be the greatest, **w**hy is the system or ecosystem is at risk, **w**hat could be done to minimise the vulnerabilities and **h**ow could the necessary measures be implemented to make people more resilient to changing climate is the foundation of any successful adaptation. These factors may determine whether the adaptation would include proactive measures or reactive (ex-poste) adaptation.

Table 2. 5 Adaptation strategies

Bear losses	Here no adaptation strategy is implemented because those affected may not have the means to carry out such adaptation, are of the opinion that the cost of adaptation is higher than the expected damage from the impact, or they are not aware of the likely impacts.
Share losses	The losses are shared amongst the wider community and extended family. Examples include kinship support, relief funds and insurance.
Modify the threat	Implementing measures that reduce impacts by modifying the environment such as building flood banks and sea walls.
Prevent effects	Implementing measures that reduce the effects by avoiding hazards. Often these involve changes in land use so that houses and other developments are on higher land that is not (or less) exposed.
Change land use	Planting crops that are more drought and/or salinity resistant or converting urban land at risk of flooding from residential development to recreational space.
Research	New adaptation possibilities may be opened through research, such as that into more resistant and earlier maturing crops.
Educate, inform and encourage behavioural change.	Through education and public information in local languages. Adaptation strategies could be encouraged, such as changes in planting season, zoning of rivers and roof catchment and quality of water could be improved by having a foul tank.

Source: Adapted from Pittock, 2005: 135-136

The stronger the coping abilities, the better the adaptation capacity, thus making a system more resistant to the likely impacts of climate change and having a wider range of conditions it can withstand before failing (Dankelman, 2010; Pelling, 2011; UNFCCC, 2007; World Bank, 2013b). Adaptation activities that could be included in policies and programs to reduce a system's vulnerability and to ease adverse impacts are summarised in Box 2.2.

Climate change is likely to have negative impacts upon large numbers of people, systems and sectors and thus adaptation is necessary (Martine and Daniel, 2013; Mimura et al., 2014). Table 2.6 summarises adaptation measures that may be taken to minimise the negative impacts on people, systems and sectors in the Pacific.

Box 2. 2 Some adaptation activities that could reduce a system's vulnerability.

- Strengthen human and institutional capacities.
- Extend buffer zones against sea level rise.
- Discourage investments that would increase vulnerability in systems sensitive to climate change.
- Promote flexibility of managed systems to accommodate and adapt to climate change.
- Learn from, and enhance resilience and adaptability of, natural systems.
- Reverse maladaptive trends in development and resource management and use.

Source: Adapted from Secretariat of the Convention on Biological Diversity. 2003: 75

Table 2. 6 Adaptation measures that could be taken to minimise the likely impacts of climate change on people, systems and sectors in the Pacific region.

People, systems and sectors	Adaptation measures
Infrastructure and settlements	Development (roads and government facilities) to have fixed set-back distances from high-water marks, and buildings closest to high-water mark constructed on raised posts. Water supply systems built to cope with increased rainfall variability. Structures built to standards that withstand hurricane force winds.
Health	Development and improvement of disease surveillance and health services systems. Increasing and maintaining public and political awareness of the effects of climate change on public health. Conducting programmes and developing methods to break the chain of disease transmissions. Eradication and prevention of water and vector-borne diseases affected by climate change by improving water supply and destroying potential vector breeding grounds. Building health care institutions in disaster and disease prone areas. Organising of more out-reach programmes to improve relationships between local communities and medical staff.

Agriculture and animal husbandry	Improvement of soil and fertilisation management and development of carbon efficient farming systems. Increasing crop diversity to reduce overall effects of extreme events. Development and introduction of early maturing, salt and drought tolerant, crops, and practicing sustainable farming. Increasing vegetation cover, preventing soil erosion, better soil protection and preservation of soil moisture and fertility levels. Improvement in manure and water management systems. Better management of grasslands, such as rotational grazing and even grazing ban could be implemented in some areas.
Water resources	Promoting water efficiency and conservation and sustainable water resource development. Constructing new water resource infrastructure and erection of embankments for flood protection. Installation of effective warning systems for flash floods and debris flows. Improvement of water storage, such as eliminating water losses through leakage. Promotion of water recycling and collection of more rainwater.
Coastal and marine areas	Developing and elevating embankments to prevent saltwater intrusion. Prohibition of mining of gravel, coral and beach sand. Mangrove rehabilitation to reduce wave energy, thus reducing soil erosion. Elevating houses above flood levels. Construction of hard measures, such as seawalls and soft measures, such as beach nourishment and mangrove creation. Coastal reforestation to strengthen the stability of coastlines and biodiversity enhancement. Where no other options are available retreat of settlements and economic activities from at risk areas may be required. Improving and implementation of relevant laws to constantly enhance marine ecosystem conservation and rehabilitation.
Forestry	Development of policies and regulations to reduce forest fire. Installation of early fire warning systems.

	Preventing deforestation, strengthening forest management and forest coverage. Introduction of plant species less prone to droughts, floods, pests and forest fire. Creating and protecting natural reserves Rehabilitation of degraded ecosystems to reduce climate change risks.
Tourism	Include measures relating to infrastructure, water resources and coastal management, listed above. The construction of hotels and other tourist facilities to be carried out as per the recommendations of the Environmental Impact Assessment Reports. Have effective waste treatment plants and systems. Minimise resource use and waste production.

Source: Adapted from Filho, 2015: 385-388.

2.6.1 Proactive and reactive adaptation

Resilience to long-term climate change can be increased by adaptation to current climate variability (Adger et al., 2007). Some adaptations are implemented knowingly, some unknowingly, and some are taken before the impacts, some during and some after the impacts are felt. The types of adaptation depend upon when they are implemented, what their objectives are and the motives for such actions (Klein et al., 2014). A useful distinction can be made between proactive and reactive adaptation (Aboriginal Affairs and Northern Development Canada, 2010; IPCC, 2007b-WG II AR4; Klein, 2001). Reactive adaptation and proactive adaptation measures may not result in perfect adaptation, as there may be some residual impacts, which will be inevitable, but these two responses could complement one another (Adger et al., 2006).

Proactive adaptation includes anticipatory measures, including ways and means to engage vulnerable communities, local governments and other stakeholders to seek ways to reduce or minimise the future impacts of climate change in advance of them occurring (Adger et al., 2006; Klein, 2001). Proactive adaptation (risk management and periodic assessment) involves looking for strategies, formulating them into policies (and programmes) and putting them into action, so as to reduce or avoid the future impacts of climate change (Leary et al, 2008b). The aim of adaptation should be to avoid harm rather than to compensate after the damage has

been done (Adger et al., 2006). Proactive adaptation, if well planned, is likely to reduce future risks, impacts and damages from changing climate. It involves long-term decision making and is preferable to reactive adaptation because of its ability to minimise or prevent future impacts and damages (Eastering et al., 2004).

Reactive adaptation includes actions or activities carried out after the impacts are observed or felt (Adger et al., 2006; Klein, 2001). In reactive adaptation the impacts set the agenda. Reactive adaptation seeks to regain stability and is at times linked to resilience, a system's ability to bounce back from damages to its original state. This may be possible in the short term, but in the long term it may not be possible as climate change is likely to increase the magnitude and/or frequency of disruption requiring increasingly greater recovery efforts but with shorter periods between events (Eastering et al., 2004).

Both proactive and reactive adaptation could be further categorised into public and private adaptation. Public adaptation is initiated and facilitated by governments, such as enforcement of building regulations and ordinances (proactive) and giving free seeds and fertilizers to farmers whose crops were destroyed by tropical cyclones or floods (reactive). On the other hand private adaptations are steps taken by individuals, businesses or groups. Adaptation to climate change, whether it is proactive or reactive is important because it increases resilience and reduces adverse impacts (UNFCCC, 2011).

2.6.2 Top-down and bottom-up approaches

"Top-down assessments are used to measure the potential impacts of climate change using a scenario and modelling driven approach. Bottom-up assessments begin at the local scale, address socioeconomic responses to climate, and tend to be location specific" (Dessai and Hulme, 2004 quoted in IPCC, 2014b: 850). Top-down approaches (mostly based on larger scale models and using future climate scenarios) may not be the best methods for community-based adaptation, because they do not include local institutions and communities, and thus have limited access to local-level data and local knowledge about changing environments and associated risks (Bryan and Behrman, 2013; Füssel, 2009; Nair and Bharat, 2011). However, a top-down approach can be an important link between the scientific community and decision makers (Raiser, 2014). On the other hand, bottom-up approaches start from the level of the local community and adaptations are

implemented keeping in mind the past and present experiences and the likely future impacts of climate change.

In bottom-up approaches (using local tools, local climate datasets and participatory methods) more emphasis is placed on the social context of the community where interactions between humans and environmental systems are focused (Füssel, 2009; New Zealand Climate change Centre, 2010; Nottage et al., 2010). As a bottom-up approach, community-based adaptation provides the community with an opportunity to assess and identify the likely impacts and to use local knowledge, historical experiences and resources to reduce the likely impacts of climate change and to become more resilient (Reisinger, 2009). The bottom-up approach can result in increased adaptive capacity and can produce more successful adaptation measures against climate change (Dumaru, 2010; McNamara et al., n.d.; Nair and Bharat, 2011).

In developing countries, such as Fiji, the adaptation approach is mostly top-down, from the government to the community. However, at the community level it is the bottom-up approach that is likely to be more effective as well as a very important tool for disaster risk assessment and reduction. It is the community members, who are often in a better position to make more relevant and sustainable decisions to reduce, minimise, isolate or eliminate the likely impacts of climate change (Dumaru, 2010). Whatever the process of adaptation may be, public intervention is very important to make it successful (Leary et al., 2008a).

Adaptation to climate change is diverse, context-dependent and complex in nature, so there is no single approach to adaptation. As noted, the two most common approaches are bottom-up and top-down, but in practice at the community level a combination of both approaches may be most useful (Mimura et al., 2014; IPCC, 2014b-WG II AR5). The combination of top-down and bottom-up adaptation depends upon the capacity of donors, governments, non-government agencies and others to reach communities, which have low adaptive capacity, where some of assistance is most likely to be required (Schipper and Burton, 2009). It is advisable to assess adaptation in a development context. Low-cost, on-going and culturally appropriate methods are likely to be best to increase or enhance communities' resilience to likely climate change impacts (Nakalevu et al., 2005).

2.7 System exposure, sensitivity and adaptive capacity

The concepts of adaptive capacity, vulnerability, adaptation, resilience, sensitivity and exposure are all interrelated (Republic of Fiji, 2014; Smit and Wandel, 2006). People who are marginalised socially, institutionally, politically and economically are likely to be more vulnerable to the impacts of climate change and the same people are likely to find it difficult to adapt to the adverse effects of climate change. Vulnerability to climate change is not due to a single cause but is a combination of social processes and socioeconomic conditions (IPCC, 2014a). Exposure to climate risks, sensitivity to these risks and adaptative capacity can be used to help assess overall climate vulnerability (Asian Development Bank, 2009; Fortini and Schubert, 2017; Petersen et al., 2014). Exposure and sensitivity determine the potential impacts of climate change and adaptive capacity combines with exposure and sensitivity to determine vulnerability of the system (Brooks, 2003; Smit and Wandel, 2006; Thornton et al., 2006; Weis et al., 2016).

2.7.1 Exposure

IPCC (2014b: 5) defines exposure as "the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected." An entity would only be vulnerable to the impacts of climate change when it is exposed and does not have the potential to adapt. If it is exposed and has the means to modify structures (social and material) and change behaviours to prevent losses through adaptation it is not vulnerable to the likely impacts of climate change (Cardona et al., 2012; Filho, 2015; Republic of Fiji, 2014; Pelling, 2011).

Exposure is being in a position to experience climate-driven factors or processes and changes in climate that may affect a resource or a system (Closset et al., 2017; Fellmann, n.d.; Hart, 2011; Hutto et al., 2015; Lavell et al., 2012; Maybeck et al., 2012; Miller et al., 2010). The pattern of settlements, for example, in a hazard-prone landscape, may make humans more or less physically exposed to the negative impacts of climate change (Adger et al., 2009; Cardona et al., 2012). Small Island States and low-lying coastal areas with large populations and infrastructure are exposed to a number of climatic hazards, which are likely to be exacerbated by global warming and climate change (Barnett and Campbell, 2010; IPCC, 2014a; World Bank, 2013b), as indicated in Table 2.7.

Table 2. 7 Examples of hazards in Pacific Island countries

Geophysical		Biological	
Climatic	**Geological**	**Floral**	**Faunal**
Drought	Earthquakes	Fungal disease	Ciguatera
Flood	Erosion	-Sigatoka disease	Dengue fever
Frost	Landslides	Infestations	Malaria
Heat wave	Tsunami*	-weeds	Infestations
Tropical cyclones	Volcanic eruptions	- invasive species	-cane toads
High waves			-rhinoceros beetles

The shaded items are those which may be affected by climate change. It should also be noted that tsunami may be higher relative to land elevation and that reef damage and mangrove loss may offer less protection to areas affected by tsunami. Source: Adapted from Barnett and Campbell, 2010: 30.

Pacific Island countries, especially the small island states, have characteristics that make them more exposed and, in some cases vulnerable, to the likely effects of climate change, extreme events and sea level rise (Mclver et al., 2016; Oxfam Australia and Oxfam New Zealand, 2009). Many rural Pacific Island communities live near the coast, often in low lying places, easily affected by tides, storm surges, tropical cyclones and rising sea levels (Oxfam Australia and Oxfam New Zealand, 2009). Much prime agricultural land in many Pacific Island countries islocated on coastal or river plains which are often threatened by sea level rise, beach erosion, inundation, salt spray and intrusion of saltwater or by river flooding (UNFCCC, 2007).

Human health (physical and mental) is affected directly and/or indirectly, when people are exposed to disasters such as intense tropical cyclones, storm surges, increased extreme rain events and droughts (Australian Government, 2015; Cardona et al., 2012; Nottage et al., 2010). Water quality and quantity could be affected by intrusion of salt water from a rising sea. Climate change is also likely to increase surface run-off, washing away more sediment, nutrients and pollutants into rivers (reducing agricultural productivity), increasing eutrophication and reducing the number of fish and prawns (degrading aquatic and marine ecosystems). On the other hand, droughts could cause lower water levels in rivers and rising seas may

push saline water further inland, increasing intrusion of saltwater into farms (Pelling, 2011; U.S. Environmental Protection Agency, 2015).

Agriculture, fisheries and human systems are thus likely to be exposed to impacts upon a range of sectors such as water resources (decreased water availability for communities, reduced soil moisture, soil salinization), human settlements (increased risk of flooding from both rising sea level and increased rainfall and damage to buildings and infrastructure), energy and industry (more energy needed to cool buildings, especially in higher summer temperatures), human health (more people exposed to water-and vector-borne diseases and heat stress) and insurance and other financial services (higher insurance premiums due to more intense extreme events such as tropical cyclones and flooding) (IPCC, 2014b). Physical exposure in the context of climate change is increasing due to spatial expansion of natural hazards, such as extra-tropical cyclones, areas affected by droughts, and delta regions affected by salinization and/or floods (Cardona et al., 2012; Füssel, 2009; IPCC, 2012b). Communities are exposed to various stresses, summarised in Table 2.8, which shows that climate change is only one of the stresses that communities may be affected by. These effects may be cumulative and many of these stresses may magnify the effects of the others.

2.7.2 Sensitivity

Sensitivity is an ecosystem's, a social system's or an economic system's degree of reaction to climate stimuli (Adger, 2006; Colman and Braganza, 2013;Filho, 2015; Hart, 2011;Hoffmann et al., 2017). Sensitivity represents changes (rapid, stepwise or gradual) in sectors, systems and regions in response to climatic processes and factors that are affecting them (Pidcock, 2014). Small climate changes can have significant effects on sensitive sectors, systems and regions with severe consequences for both planetary ecology and human society (Adger, 2006; Australian Government, 2015; Ferraro, 2010; Maybeck et al., 2012;Pelling, 2011Republic of Fiji, 2014). A sensitive system can have both adverse and beneficial outcomes from changes to its environment and the effects can be both direct, such as changes in crop production caused by changes in temperature (range, mean or variability) and indirect, such as sea level rise increasing the frequency and intensity of coastal flooding (Adger, 2006; IPCCC, 2007b; Meyback et al., 2012).

Table 2. 8 Examples of stresses that communities may be exposed to:

Sphere (area of activity)	Category (shared characteristics)	Stress
Biophysical	Climate change	Extreme weather events such as tropical cyclones. Changing rainfall patterns-floods and droughts. Coral bleaching. Increased freshwater in mangrove areas making water less salty and even with sea level rise. Intrusion of saltwater in fresh water supply. Coastal or beach erosion and inundation. River flooding and riverbank erosion.
	Environmental	Increased sedimentation. More pollution in the ocean. Landslides. Deforestation, desertification and biodiversity loss.
Socio-economic, livelihoods and food security.	Economic	Rising cost of living. Unemployment. Increasing debt. Reduced income from farms and fisheries. Reduced food security from declining agricultural and marine productivity.
	Social	Health problems, leading to unemployment and financially dependent on others.
	Governance and conflict.	Destructive and or illegal fishing practices. Conflict within and between communities.

Source: Adapted from Nathan et al., 2015: 131-132.

Both natural and human systems are likely to be sensitive to climate change (Richardson et al., 2011). Natural systems that are sensitive to climate change include coral reefs (sea level rise, warmer water temperatures and ocean acidification prompt coral bleaching, which makes them less able to combat diseases), and mangroves (sensitive to rising sea level and likely to suffer disruption

and retreat). Some of these changes may be significant and the damages may be irreversible (IPCC, 2014b).

In terms of human systems, mental, physical and community health are likely to be sensitive to climate change as well as livelihoods dependent upon agriculture and fisheries (food security), and forestry. Human system sensitivity to climate change also depends upon and varies with environmental conditions, geographic location, social networks, time and economic conditions. A warmer climate can increase the risk of illness (more vector- and water- borne diseases) and even death due to excessive heat (affecting especially pregnant women, the sick, people with special needs, children and older adults). More intense and/or frequent extreme events, such as tropical cyclones, droughts and floods can threaten and endanger human health and safety (IPCC, 2014b; United States Environmental Protection Agency. 2017). For some populations, in some regions and in some locations (especially near coastal areas), sensitivity and exposure to climate change are both high (Australian Government, 2015; Cardona et al., 2012; Pelling, 2011). Human settlements, especially in coastal zones, are likely to be highly sensitive to climate change effects, such as sea level rise, and changes in frequency and intensity of tropical cyclones.

The extent of damage or risks posed by climate change depends on the community's degree of dependence on ecosystems and resources for its members' daily needs and wants, how sensitive the ecosystems and resources are to changing climate, and the community's ability and capacity to cope with and adapt to the damages and impacts (Barnett and Campbell, 2010). There are many ways (such as exposure to vector-borne and water-borne diseases, decreased water availability, reduction in potential crop yields and increase in the risk of flooding) by which humans, biological and physical systems could become sensitive to changing climate (IPCC, 2014b).

2.7.3 Adaptive capacity.

According to IPCC (2014d: 118) "adaptive capacity is the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences". Successful adaptation depends on two considerations. First is "building adaptive capacity", which includes training, increasing knowledge and information about climate change and second is "implementing adaptation", which includes passing of laws, and policies,

identifying strategies, such as changing livelihood practices, settlements, building sea walls etc, that could be adopted and then implementing them individually or collectively (Pelling, 2011; Tompkins et al., 2005).

Adaptive capacity is shaped by different factors and processes (political rights, economic status, health and social conditions, access to information, traditional knowledge and/or scientific knowledge) and there are no single factors or processes that could be universal determinants, as different factors and processes function differently in different and specific situations (Cardona et al., 2012; Warrick, 2011). Adaptive capacity reflects a system's resilience, where increasing resilience reduces vulnerability (Adger, 2006; Adger et al., 2007; Brooks et al., 2025; Filho, 2015; IPCC, 2007b-WG II AR4). Adaptive capacity includes a community's ability to learn from and reorganise its wants and needs to meet, live and survive in changing conditions resulting from climate change (Barnett, 2001; Hogarth and Wójcik, 2016; Republic of Fiji, 2014; Smith et al., 2010;Warrick, 2011). Adaptive capacity is not the actual adaptation, but the ability of a system, community or individual to change in order to minimise negative impacts and to maximise the benefits from the changing climate (Brooks, 2003; Brooks et al., 2005; Mitchell and Tanner, 2006; Pelling, 2011). Adaptive capacity is the ability of a system to adjust, seek opportunities, reduce damages and to accept the negative impacts of climate change and live with them (Adger et al., 2007; Hart, 2011; IPCC, 2007b; IPCC, 2012b; Pelling, 2011).

Adaptive capacity depends upon a system's behaviour (both the biophysical and social elements), the resources it has and the technologies at its disposal (IPCC, 2014b; Smith et al., 2010). It also includes the preconditions that are needed to achieve, enable and to have the required adaptive strategies to deal with and adjust successfully to the anticipated impacts, variability and extremes of climate change (Fellmann, n.d.; Hogarth and Wójcik, 2016). It is important to know that it is always difficult to measure adaptive capacity and its efficiency as similar levels of adaptive capacity will result in different outcomes where impacts are of different types or magnitudes (Leary et al., 2008a; Warrick, 2011). Both developing and developed countries are impacted by climate but societies with high adaptive capacity (many of which are in developed countries) often can respond to challenges at a faster rate than societies with lower adaptive capacity (IPCC, 2007b-WG II AR5; Pelling, 2011; Reisinger, 2009).

A better understanding of adaptive capacity is important for assessing and monitoring the progress of adaptation, in order to identify and to allocate where more resources are needed, so the system can more effectively adapt to the changing climate (IPCC, 2014a). Knowledge about impacts of climate change can help to raise awareness of the needs of certain members within a community. Thus, how knowledge is obtained, analysed, used and shared can be vital and necessary determinants of adaptive capacity (Smith et al., 2010). For adaptive capacity to be more practical and effective there is a need for the system to search for and support new practices (Cardona et al., 2012; Hogarth and Wójcik, 2016; Leary et al., 2008b). As climate change is likely to continue to cause social and environmental changes, communities will need to change some present practices, behaviours, and resources, and in extreme cases, may even have to abandon existing practices and adopt totally new ones. Some of the measures that could be taken to enhance adaptive capacity are: awareness raising about climate change and sea level rise; strengthening community cohesiveness and bonding; and revitalising indigenous and traditional ecological knowledge to better cope with and adapt to climate change (Filho, 2015).

2.8 Resilience

IPCC defines resilience as "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential functions, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (IPCC, 2014b: 5). Increasing resilience is one way of reducing the adverse impacts of climate change (Closset et al., 2017; Pelling, 2011). Resilience may be seen as the opposite of vulnerability. A population, a system or a household is resilient, when it is not sensitive to climate change and variability and/or has the ability or potential to cope with or adapt to changing environmental situations to which it is sensitive (Davis, 2011; Maybeck et al., 2012). Resilience is an individual's or a community's ability to cope with slow onset stressors, absorb sudden shocks and recover from the adverse impacts of climate change (Hogarth and Wójcik, 2016; IPCC, 2014a).

Resilience is the ability of a community or a system or part of a community or part of a system to know, feel and to be affected by, and to recover from such impacts; as it adapts, absorbs stresses, anticipates, accommodates and maintains normal functions, reorganises and, recovers from shocks, and copes with risk, to again

attain the original state or end-up being in a better state, with the least time involved (Hutto et al., 2015; IPCC, 2012b). The higher the resilience, lower the vulnerability (by reducing both exposure and sensitivity) and the lower the resilience higher the vulnerability (Closset et al., 2017; Maybeck et al., 2012; Miller et al., 2010; Pelling, 2011). Resilient communities and resilient ecosystems can better cope with social and external physical stresses, which can be a pathway for sustainable development (Pelling, 2011)

Resilience, like vulnerability is a long-term process, not only requiring a better understanding of past, present and future states of climate variability and change but also taking into account traditional and historical relations betweencommunities and their environmental conditions. Accordingly, it is important to know why and how communities in the past had taken a particular set of actions, how those actions are affecting present generations and how contemporary actions will affect future generations. All these are very important for having a better long-term understanding of climate vulnerability and resilience. People feel happy and proud that they are ready, taking control of the situation and avoiding losses. When people do things on their own, using local resources, knowledge and ability, it increases their enthusiasm and desire to become more resilient to the likely impacts of climate change (Kelman et al., 2015). A resilient community can withstand, recover quickly from and adapt to the devastating effects, impacts and shocks of a natural hazard and continue to survive and live normally (USAID, 2011).

2.9 Climate change and sustainable development.

The term “sustainable development” means that the present generations’ needs are met, without compromising the needs of future generations and having fairness and equity within and across generations (IPCC, 2014d-WG I, II and III AR5). Sustainable development has three dimensions, namely economic, social and environmental, that are mutually interdependent. If one is negatively impacted, it will negatively affect the other two. The implementation of sustainable development projects or activities should therefore take into account these three elements jointly and not in isolation (Planning Practice Guidance. n.d.;World Bank, 2015b). Sustainable development requires enhancing and pursuing development pathways that are resilient to the likely impacts of climate variability and change (Chandra, n.d.; Denton et al., 2014; Holling et al., 1998; IPCC, 2007c; Zhang, 2009). “There is an urgent need in SIDS to address the constraints to sustainable development, including scarce land resources, which lead to difficult land and

agriculture use decisions; limited freshwater; education and training needs; expanding health and human settlement requirements; inordinate pressures on coastal and marine environment and resources; and limited means available to exploit natural resources on a sustainable basis" (Koshy et al., 2008: 11)..

Climate change affects ecosystems, economies and the well-being of people, while sustainable development improves and maintains the well-being of ecosystems, economies and people (Boer, 1996; Kelman and Gaillard, 2010; McGregor et al., 2013). With sustainable development, the needs of contemporary and future generations can be balanced (Fleurbaey et al., 2014). Sustainable development prevents the misuse, degradation and destruction of environments for short term and immediate gains and helps to prevent practices that are likely to create new, and bring about the re-emergence of past, problems (IPCC, 2007a). It involves a community's ability to change practices for social well-being, social support, infrastructure renewal and community-building (James et al., 2012; Victor et al., 2014; Zhang, 2009).

Climate induced natural extremes and impacts of climate change are likely to undermine sustainable development (Charan et al., 2016; United Nations, 2020). Any development that is to be sustainable has to look for ways and pathways and engage in activities, whereby the development is resilient to the negative impacts of climate change. All development needs to take into account the likely impacts of climate change and sea-level rise and find processes and factors to optimise the situation (Pittock, 2009). For any development to be sustainable, adaptation and mitigation should work hand in hand (Denton et al., 2014; Nyong et al., 2007).

Economic and social development depends on sustainable development and management of natural resources, which are crucial to the quality of life of our Pacific people. The three major concepts of sustainable development are: "1) the concept of development (socio-economic development in line with ecological constraints), 2) the concept of needs (redistribution of resources to ensure the quality of life for all) and 3) the concept of future generations (the possibility of a long-term usage of resources to ensure the necessary quality of life for future generations)" (Klarin, 2018: 76).

For PICs, climate change is a major threat and hurdle for sustainable development (Barnet and Campbell, 2010). If the impacts of climate change are not taken into consideration, when dealing with communities' daily activities, such as agriculture and fisheries, then sustainable development would not be possible as climate

change adaptation and sustainable development mutually reinforce each other (IPCC, 2007b-WG II AR4). The measures that could be taken to further enhance sustainable development are summarised in Box 2.3.

2.10 Adaptation thresholds

Adaptation may be seen as the response to risks, hazards and/or threatened vulnerability thresholds. A threshold is a point beyond which a system fails to recover. Every society has some degree of risks and different thresholds are socially and physically constructed (Pelling, 2011). All socio-ecological systems have their own coping systems. When they are able to cope, they will be in a desirable state and when they can't cope they enter an undesirable state. This changing from one state to another depends upon how close it is to the threshold and how wide the gap is between the two states (Marshal et al., 2010).

Box 2. 3 Measures to enhance sustainable development

- Increasing access to resources.
- Increasing food security and reducing poverty.
- Reducing inequalities in wealth and resources between groups.
- Improving access to information and education.
- Improving infrastructure such as roads, renewable power supply and public transport.
- Ensuring that responses to climate change adaptation are comprehensive and inclusive of the people, not just technical.
- Involving all parties to ensure that actions are related and meet local needs and resources.
- Improving institutional capacity and efficiency.

Source: Adapted from Pittock, 2009: 144

"Tipping point" is a concept which refers to thresholds, where a small perturbation can trigger a significant response in a system, moving a system from one stable equilibrium state to another state, which may or may not be stable or reversible. Some tipping points, such as physical tipping points may have a point of no return. Both physical and social tipping points can trigger economic shocks (Pelling, 2011; Russill and Nyssa, 2009). The geological record and climate modelling provide

significant evidence for “tipping points”, where without applying any additional force, or with tiny change, rapid changes occur in the climate system, altering its state. When a threshold is reached, and whether it would be rapid or gradual is not yet known (National Academy of Science, 2018; Russill and Nyssa, 2009). Increases in temperature are likely to impact both human and natural systems. Some impacts that are likely to occur at different temperature thresholds are summarised in Table 2.9.

There are two major categories of thresholds as far as climate change adaptive actions are concerned. First is the one where adaptive actions are taken and the negative effects of climate change are reduced. Second is the one where adaptive actions are taken but are unable to reduce climate change vulnerability. At this point, adaption has reached its limit and will no longer be successful in reducing negative impacts of climate change (Adger et al., 2009; Pelling, 2011). “Determining critical adaptation thresholds is important to assist decision and policymakers to establish priorities and schedules for adaptation (Auld, 2008b; Haasnoot et al., 2009; IPCC, 2012b; Kwadijk et al., 2010; Mastrandrea et al., 2010). The 1.5℃ threshold which is at the centre of PICs and other SIDS concerns is further discussed in Chapter Three (Section 3.8.6).

Table 2. 9 Impacts that are likely to occur at different temperature thresholds

Temperature	Impacts
1°C	Increased water shortage, coral bleaching and coastal flooding.
2°C	In addition to above. Approximately 20 – 30 percent species at high risk of extinction and more cases of diseases.
3°C	In addition to above. Reduced food security. Increased burdens on health systems.
5°C	In addition to above. Major extinction of species. Severe shortage of food. Major changes in ocean circulations, loss of 30 percent of coastal wetlands and major coastal inundation and flooding.

Source: Adapted from Nordhaus, 2013: 203

2.11 Summary

There is an important relationship between climate change, variability and human security. Our actions are affecting our environment and the environment is influencing us and will continue to do so. This has always been the way but since the recent past and into the future the magnitudes and rates of environmental change appear to be unprecedented. Unless humans find ways and means to make themselves more resilient to the likely impacts of climate variability and change these effects may become increasingly negative. Communities will need to be able to better cope and adapt to changes in mean conditions and to extreme climatic events that are likely to become more frequent and/or intense in future. In this thesis I take the position that combining top-down and bottom-up adaptation approaches is likely to be best for Fiji with local communities leading and taking control of the situation.

The next chapter emphasises the dynamic relationships between the sea and coastal communities. It considers how and why Pacific Island communities are at the frontline of climate change, how their daily activities are affected and what climate drivers and other processes make coastal areas, systems and communities increasingly exposed to the effects of a changing climate? The different impacts of climate change on women who are often excluded from power and not included in decision making processes are also outlined as are the roles of regional and international organisations inhelping communities better adapt to climate change.

CHAPTER THREE

Climate change in the Pacific Islands region.

> "*The South Pacific being the hub of climate change associated environmental and social developments is irrefutably one of the world's most predisposed regions when it comes to climate and weather induced disasters*" (Boege, 2011, cited in Charan et al., 2017: 19).

3.1 Introduction

This chapter emphasises the dynamic relationships between the sea and coastal communities. It also considers how and why Pacific Island communities are at the frontline of climate change, how their daily activities are affected and what climate drivers and other processes make coastal areas, systems and communities exposed to changing climate? By doing this I am setting the platform to address the research objectives. "To examine and evaluate the likely impacts of climate change on health, agricultural activities and coastal fisheries" and "To identify and evaluate the likely social and economic impacts of climate change on the *iTaukei* and Indo-Fijian communities".

The impacts of climate change are likely to be felt globally and locally in future. In general, both global and local drivers can be expected to result in an increase in the impacts of climate change. The impacts are likely to be on land (intrusion of salt water and erosion), marine resources and ecosystems (mangrove, fish habitats, coral reefs and sea grass), health (increase in water and vector borne diseases), agriculture (reduced yields due to droughts and tropical cyclones, salinization and floods) and in turn on the wellbeing of island communities (Connell, 2018; Mimura et al., 2007). The chapter also explores the different impacts of climate change on women, their exclusion from power and they're not being included in decision making processes (Ruth and Ibarrarán, 2009).

The chapter also examines how regional and international organisations are helping island countries to build and strengthen local, national and regional capabilities to

better adapt to the likely impacts of climate change. Rapid and slow onset climatic hazards have left behind and will be leaving behind losses, damage and suffering, which local communities would find difficult to compensate for and recover from without the assistance and help of national, regional and international organisations.

3.2 The South Pacific Region

The Pacific region has approximately 7, 500 islands divided into three main cultural areas, namely Melanesia, Micronesia and Polynesia (see Figure 3.1). The countries in the region may have different topographies, cultures and economies (United Nations Environmental Programme, 2004; Encyclopædia Britannica, Inc. 2017; Food and Agricultuel Organisation, 2008), but they all are exposed to the likely impacts of climate change, which will affect communities' physical, economic, cultural and social life, resulting in hardship and significant economic losses (ADB, 2015a; The Climate Reality Project, 2019). "There is widespread consensus that climate change is extremely dangerous for small island developing states (SIDS). This has been well recognized in research and policy for over 20 years" (Barnett and Campbell, 2010: 1).

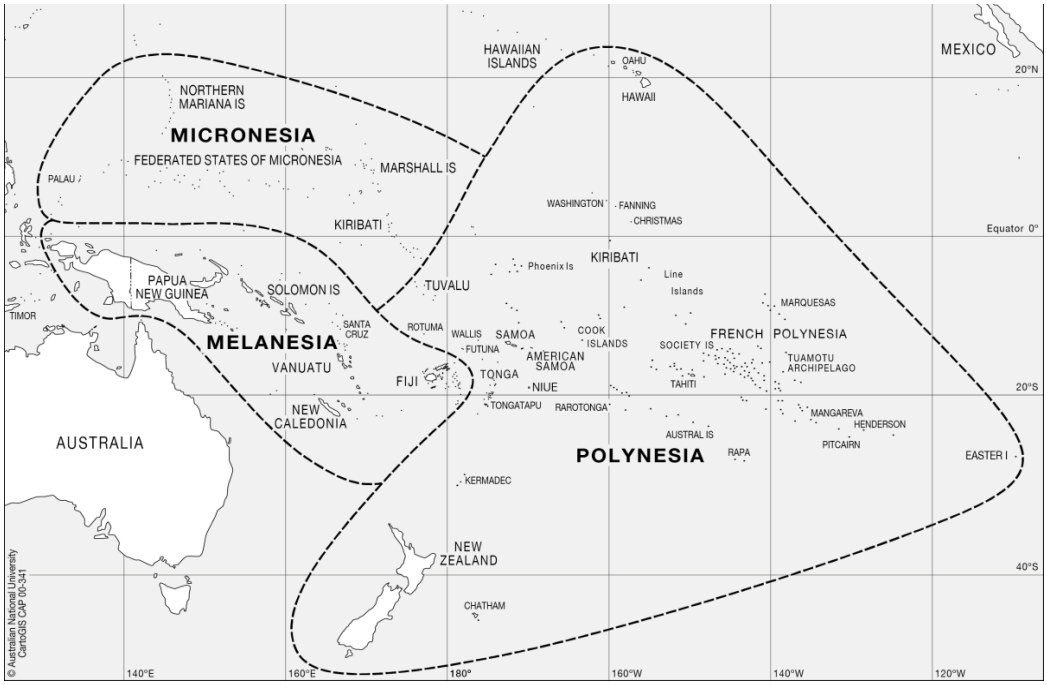

Figure 3. 1 Cultural areas of the Pacific Islands. Map drawn by Max Oulton.

The Pacific island states are experiencing sea level rise and climate change (shifts in rainfall patterns, increasing intensity and frequency of some extreme weather events) and the most exposed areas are coastal locations, coral reefs and low islands

(ADB, 2013; Australian Bureau of Meteorology and CSIRO, 2014; Food and Agricultural Organisation, 2008; Kwa, 2008). Climate change and sea level rise pose serious risks to Pacific Island countries (PICs) because of their remoteness, their relative smallness, the archipelagic character of many of the island states and their geographical location (in the tropics) (Le Cornu et al., 2018; Manley et al., 2016).

The climate change risk profiles in the Pacific region are not uniform (United Nations, 2020). Climate change exposure, sensitivity, vulnerability and adaptation vary among the regions, within each region and within the countries themselves. This is mainly due to communities' activities and responses to climate-related drivers and also because the PICs have economically, culturally and demographically diverse communities in addition to a range of physical geographies (Mimura, 1999; Nurse et al., 2014).

Climatic changes and sea level rise are likely to impact many aspects of life in Pacific communities (Lloyd, 2018; Maclellan and Coates, 2012; Remling and Veitayaki, 2016). Freshwater supplies (which in many places are already limited) are at risk. Adverse impacts may also threaten food security (both agriculture and fisheries). Coastal erosion, flooding and inundation of homes and land with salt water can lead to land scarcity. Furthermore, loss of some marine habitats (mangroves, sea grass and coral reefs) means loss of important nurseries for many marine species. In the Pacific island region these impacts are likely to become more severe and more widespread (ADB, 2013; Australian Bureau of Meteorology and CSIRO, 2014; Food and Agricultural Organisation, 2008; Kwa, 2008). Pacific Island people have not forgotten the intrusion of foreigners into their lives, but now they are facing a new, unknown challenge, climate change, the impacts of which are likely to affect many, mostly those living close to the sea (Kwa, 2008).

3.3 The Physical Impacts of Climate Change in the Pacific

3.3.1 Sea level rise

Sea level rise is mainly due to the thermal expansion of the oceans and melting of glaciers (Church et al., 2013; Mimura, 2013; Richardson et al., 2011; Vardiman, 2007; Wong et al., 2014; Oppenheimer et al., 2019). Sea level rise is likely to intensify inundation of coastal areas, add to the height of storm surges, increase coastal erosion, especially of exposed areas and all of these are likely to affect

coastal communities, resources and ecosystems (Filho, 2015; Mimura, 2013; Pacific Islands Climate Change Assistance Programme (PICCAP) Fiji Islands, 2005; Petersen et al., 2014; Petit and Prudent, 2010; Republic of Fiji, 2014;USEPA, 2011;WHO, 2005).“Some of our islands are only a few metres wide in places. Imagine standing on one of these islands with waves pounding on one side and the lagoon on the other. It’s frightening” (Nakibae Teuatabo, chief climate negotiator for Kiribati, an atoll nation, February 2005 quoted in Dow and Downing, 2006: 63). Table 3.1 summarises the effects of sea level rise.

Table 3. 1 Primary and secondary impacts of sea level rise.

Primary impacts	Secondary impacts
Increased erosion Inundation of coastal wetlands and lowlands. Increased risk of flooding and storm damage. Salinization of surface and ground waters	Reduced livelihoods and impaired human health, such as increases in poverty and vector-borne diseases Disruption of infrastructure and economic activity, such as damage to roads, reduced yields and reduced job opportunities Displacement of exposed populations. Diversion of resources to adaptation responses. Political and institutional instability, social unrest. Threats to particular cultures and ways of life.

Source: Adapted from Harris, 2012: 96.

Rising sea level is likely to have great impacts on human populations, ecosystems and biodiversity (ADB, 2012b; Bindoff et al., 2007; Charan et al., 2017; Connell, 2018; Lloyd, 2018; Ministry for the Environment New Zealand, 2008; Richardson et al., 2011; United Nations, 2019). PICs and their people stand to lose financially, socially and culturally due to the likely impacts of climate change and sea level rise (Johnson and Hunziker, 2017; Kwa, 2008; Nakalevu et al., 2005; Nunn, 2013; Weir and Virani, 2010). Even at present sea levels some coastal roads and villages in Fiji are flooded during high tides (see Figure 3.2). Sea level rise has global effects and once underway, it is difficult to stop (Nordhaus, 2013; Seifert and Lindberg, 2012).

Rising global sea level is fundamentally shaping our present coastal zones (Chapman et al., 2006; Charan et al., 2017; Wong et al., 2014). “I see the change

when the waves tumble over places where rocks once were rocks that I once sat on" (Crystal Kabua, Marshall Islands, Climate Change School Competition Winning Entry, 2009 quoted in Morrell and Scialabba, 2009: 23). While the rising sea level is hard to stop, measures can be taken to reduce the impacts by retreating from, or defending, the coastline.

Figure 3. 2 A house at Lokia village in Rewa province that had to be abandoned because the sea water came right to the doorstep during high tide. Source: Ali, 2009.

3.3.2 Coastal resources and coastal ecosystems

Pacific Island coastlines are diverse, long and rich with resources (Mimura et al., 2007) and are often dominated by complex ecosystems, such as mangrove forests and coral reefs (Hay et al., 2003; Wong et al., 2014). Coastal resources and coastal ecosystems such as mangroves, sea grass and coral reefs are very important and play a vital role for coastal communities for their buildings, farming practices, fisheries and their nutritional intake, not to mention maintaining coastal stability but these resources and ecosystems are particularly susceptible to climate change (Cramer et al., 2014; Daw et al., 2009; Nurse et al., 2014;USAID, 2009; Wong et

al., 2014). The depth of water on reefs is important: if exposed to the air for a prolonged period, the reef organisms are likely to die. On the other hand, if the water is too deep on the reef, the light intensity reaching the reef and its confined organisms is likely to be reduced and the process of photosynthesis may not be possible (Aalbersberg et al., 1993).

Fiji's largest island, Viti Levu, has 750 kilometres of coastline and any increase in sea level may have major impacts on its coastal resources and coastal ecosystems (World Bank, 2000). Changing wind patterns may also change beach plan forms and this change is likely to have a major impact on sea grass, coral flats and algae beds (Pernetta and Hughes, 1990). Climate change is also likely to impact the input of fresh water from tributaries into estuaries and changing winds are likely to affect and alter water circulation, stratification and mixing patterns, thus affecting oxygen and nutrient production rates of the estuaries (Leary et al., 2008a).

The inshore waters and coastal zones are of great importance to local communities. For *iTaukei*, fisheries and marine environments play a crucial economic and social role. Resources collected from coastal areas and traditional fishing grounds (*qoliqoli*) are main sources of protein for coastal communities and any excess harvest is sold for much needed cash (Techera and Troniak, 2009). Increases in sea surface temperatures may cause bleaching and widespread death of corals, which could result in declining sea grass, mangroves, shoreline protection and loss of fisheries habitats (ADB, 2012a; Guinotte et al., 2003; Wong et al., 2014). The coral growth rate is also likely to be reduced because of increasing concentrations of carbon dioxide in the ocean and the coral's ability to naturally adapt to this increased level of CO_2 may be too slow to avoid or avert a decline in the quality and quantity of the coral reefs (Healey, 2003; Republic of Fiji, 2014).

3.3.3 Ocean acidification

Climate variability and change is influenced by the ocean. Oceans are able to absorb heat 1,000 times more effectively than the atmosphere (Bindoff et al., 2007). The oceans are normally slightly alkaline (Australian Bureau of Meteorology and CSIRO, 2011; Juniper, 2007), but when the oceans absorb more carbon dioxide their pH level decreases and acidification increases (Climate Institute, 2008; Meehl et al., 2007; Richardson et al., 2011; Wong et al., 2014). As the acidification increases, the availability of calcium carbonate, needed for the building of shells

and skeletons of corals decreases (Australian Bureau of Meteorology and CSIRO, 2011; Fabry et al., 2008; Republic of Fiji, 2014).

Ocean acidification also affects the foods that humans eat (Ocean Scientists for Informal Policy, 2018; Raunek, 2015). The inability to absorb calcite and aragonite from the surrounding water could make calcifier organisms (clams, oysters, sea urchins etc. which form calcium carbonate to build outer structures and shells) weaker, more prone to diseases and non-calcifying organisms could easily take advantage as far as habitats and food availability are concerned (Fabry et al., 2008; Ocean Scientists for Informal Policy, 2018; Petersen et al., 2014; Republic of Fiji, 2014). For example, lobsters and crabs periodically moult throughout their lives and need calcium carbonate and chitin to harden their shells. Without hard exoskeletons these crustaceans may not be able to protect themselves from predators and diseases. This could have serious consequences for the economies, cultures and wellbeing of many local communities (Harrould-Kolieb et al., 2010; Raunek, 2015; Winner, 2013).

Further, with increasing concentrations of CO_2 and falling pH levels of the oceans most of the corals on tropical and subtropical reefs could die by 2050 (USEPA, 2015). Increases in ocean acidification are likely to have greater negative impacts on subsistence fisheries, and on poorer communities that are dependent on aquaculture and fisheries for their survival (Hilmi et al., 2015; Nurse et al., 2014). By the end of this century, because of the increasing acidity certain fish species may not be able to breathe and decreasing number of fish species would be likely to result in decreasing protein availability from the ocean (Harrould-Kolieb et al., 2010; Wong et al., 2014).

3.3.4 Changes in ENSO and ocean circulation patterns

Initially the term El Niño was associated with a warm-water current that from time to time flowed along the coast of Peru and Ecuador, hindering the local anchovy fishery. It is now known to cause changes in ocean surface temperatures including widespread warming of the Pacific Ocean east of the international dateline. Known as the Southern Oscillation (SO), the atmospheric response to El Niño (normally measured by changes in air pressure) causes differences and annual fluctuations in climate and climatic patterns (IPCC, 2014d; Richardson et al., 2011).The El Niño-Southern Oscillation (ENSO), which typically occurs every 2 to 7 years (Australian Government, 2005) has major impacts on coastal communities in the equatorial

Pacific Ocean, by changing the temperature of the surface waters of the ocean, the direction and strength of winds, movement of ocean currents and ocean nutrients, the number and intensity of storms and by modifying precipitation patterns and atmospheric heating (Burton et al., 2011; Connell, 2018; Gero et al., 2011; Republic of Fiji, 2014; Smith and Baker, 2008; Wratt et al., 2013). ENSO has a strong influence on wave patterns, weather and sea levels in the Pacific Ocean (Flato et al., 2013; Gombos et al., 2014).

The Central Pacific and Northern Polynesia may receive higher rainfall than rest of the Pacific during an El Niño event (Australian Bureau of Meteorology and CSIRO. 2014; World Bank, 2000). Major changes in the Pacific atmospheric and oceanic circulation patterns are caused by El Niño and La Niña (Richardson et al., 2011), which are at the opposite ends of the ENSO cycle (Wratt et al., 2013). In the eastern tropical Pacific, the sea level can be more than 50 cm higher during El Niño years than during La Niña years (Schipper and Burton, 2009). The El Niño-Southern Oscillation can have significant effects on weather conditions and has been linked to disease outbreaks, droughts, floods and even social unrest (Cho, 2016; Latif and Keenlyside, 2008; Morello, 2013). The southwest Pacific island nations during El Niño events experience an increased occurrence of droughts, heat waves, forest fires and tropical cyclones (Howes et al., 2018). More El Niño events have occurred in the last 45 years than before (Powles, 2006) and the effects of these are summarised in Table 3.2 and discussed more in depth in relation to Fiji in Chapter Four (4.10).

3.3.5 Tropical cyclones and flooding

Tropical cyclones are among the most destructive, disruptive and frequent natural hazards occurring in Fiji (Overton and Banks, 1988). Tropical cyclones cause loss of life, damage to resources (particularly crops) and pose a significant threat and risk to coastal infrastructure and communities (Seneviratne et al., 2012). “There are likely to be more intense tropical cyclones and associated intense rainfall in the Pacific...the intensity of tropical cyclones is likely to increase by 3–5 percent per 1°C rise in sea surface temperature” (Manley et al., 2016: 78).

Climate change, with increased intensity of tropical cyclones (Australian Government, 2011; Filho, 2015; Mendelsohn et al., 2012), is causing, and will continue to cause, greater magnitudes of coastal inundation, sand erosion and beach drift events and this may be exacerbated by degraded coral reefs, sea grass and

mangroves (Nicholls et al., 2007). An increase in intensity of extreme events, such as flooding can increase sediment transportation and deposition, which may smother large areas of estuaries, destroying mangroves, with losses of breeding and nursing habitats of fish species, crabs and turtles (Healey, 2003; Republic of Fiji, 2014).

Table 3. 2 The effects of El Niño on coastal communities.

Conditions	**Effects**
Warmer sea temperatures	Production of plankton and fish kills in coastal waters
Lower sea levels	Exposure of underwater, fragile coral reefs
Higher sea levels	Saltwater intrusion into water supplies Coastal erosion and damage to shoreline and property
Flooding/increased rainfall	Contamination of drinking water systems Flooding of wastewater systems Contamination of recreational sites and estuaries Waterborne illnesses, such as diarrhoea
Droughts	Crop failure Increases in disease due to lack of water for sanitation and hygiene Blowing dust Increase in fire Pollution of viable water sources. Decrease in near-shore coastal water quality
Warmer, wetter, more humid weather	Booms in mosquito populations and subsequent increases in malaria and dengue fever Booms in termite populations resulting in damage to buildings and homes.

Source: Adapted from Rose, 2019: n.p. Para 5 from http://www.waterandhealth.org/newsletter/new/summer-1998/elnino.html.

The increased intensity of extreme events, such as tropical cyclones is likely to have negative impacts on the environment and the economies of the PICs and the survival of coastal communities of small and low-lying islands are likely to be threatened (ADB, 2008; Fiji Meteorological Service, 2018). In addition, increased rainfall intensity is likely to cause increased soil erosion resulting in increased

lagoon turbidity, which is likely to adversely affect primary producers from coral reefs, sea grass and macro-algae (Pernetta and Hughes, 1990; Wong et al., 2014).

In many small-islands variations in tropical cyclones are dominated by ENSO (Mimura et al., 2007; Terry, 2007). Tropical cyclones and flood events have major environmental and socioeconomic impacts, yet they are poorly understood. In Fiji in 2011 heavy rainfall in the Western division caused flooding resulting in damages amounting to $7.2 million (Republic of Fiji, 2014). During the period 1970 – 1998, Fiji experienced 37 tropical cyclones (Fiji Metrological Services, 1998) and the South Pacific has an average of 5 to 6 tropical cyclones per year (Gupta, 1998). In the coming century, climate change and its likely impacts on climate are likely to create more intense extreme events, such as flooding, droughts, storms and tropical cyclones (Filho, 2015; Flato et al., 2013).

Major floods are often caused by tropical cyclones, which often cause heavy rain fall (Connell, 2018; Mcgree et al., 2010). As the tropical cyclones approach land, rainfall intensifies, causing extensive flooding, due to rapid runoff, as the already saturated catchment is not able to absorb any more water (World Meteorological Organization, n.d (b)). Warming of oceans and the occurrence of more El Niño like conditions are likely to intensify tropical cyclones in the Pacific (Terry et al., 2004; Stephens and Ramsay, 2014; National Institute of Water and Atmospheric Research (NIWA), 2008). There may be loss of life and damage to residential, commercial and industrial buildings as well as natural resources (Gluckman and Stavish, 2010). The effects of tropical cyclones, drought and flooding inFiji are further discussed in Chapter Four (4.10).

3.4 Socio-economic impacts of climate change

Social, economic and demographic trends and environmental factors are shaping our future. The human dimensions of climate change (see Figure 3.3) focus on the causes and consequences and how people's actions and activities are causing changes to biological and physical systems at different levels.

Many countries in the Pacific suffer from economic hardship and problems, such as slow growth in GDP, escalating poverty, unemployment and environmental degradation (Prasad and Tisdell, 2006; United Nations, 2019). Humans, who have structured their daily activities around past and present climate, tend to be adapted to an expected range of conditions and are likely to be sensitive to any conditions beyond that range including extremes and even changes in means. Climate change

is likely to make poverty and inequality worse, as disadvantaged groups tend to have insufficient means to cope with the risks and impacts of climate change (UNEP, 2013).

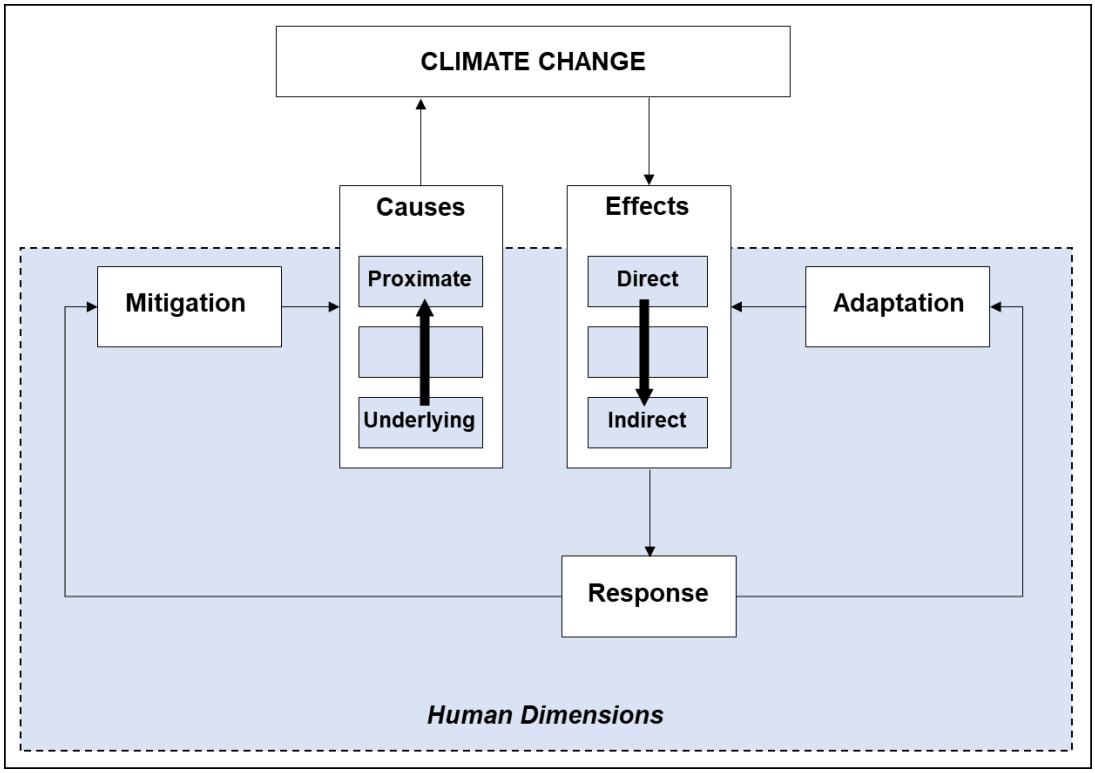

Figure 3. 3 The human dimensions of climate change. Adapted from Campbell, 1997: 260.

Climate change and extreme weather events are likely to affect all development sectors (Weir et al., 2017). Due to high exposure many Pacific Island countries are reallocating their scarce resources away from poverty alleviation and economic development towards the implementation of strategies to better cope with and adapt to the likely impacts of climate change and sea level rise (Mimura et al., 2007; Kwa, 2008). This section examines these issues.

3.4.1 Agriculture

Agriculture and agricultural production are likely to be affected by climate change differently over time and across the region (Bell et al., 2016; Hannah et al., 2010; Hillel and Rosenzweig, 2011; Schipper and Burton, 2009; Taylor et al., 2016). Rising sea level is likely to cause higher storm surges, which could lead to flooding larger areas of cropland with salt water, and heat stress and drought will result in

more crop failures and food shortages (Barnett and Campbell, 2010; ADB, 2012a; Republic of Fiji, 2014). Subsistence and cash crops are very important for island countries and island communities have depended on these for hundreds of years, for local food security and more recently for cash (Campbell, 2006; Mimura et al., 2007; UNESCO, 2017). Small farmers are likely to be affected the most (ADB, 2009) and their families' livelihoods and their incomes, which they normally derive from selling fruits and vegetables are likely to be reduced (Schipper and Burton, 2009). In Fiji in 2009 there were 65,033 farms and over two-fifths (43.9%) of these were less than one hectare in size (Republic of Fiji, 2014).

Hay et al. (2003) note that the agriculture of the PICs is likely to be affected in three different ways by climate change. First, coastal farms may become permanently inundated. Second, extreme weather events, such as tropical cyclones and flooding, may contaminate the freshwater lens, and may also physically destroy crops which could greatly reduce farm yields. Third, during droughts the salinity of rivers is likely to increase, thus increasing neighbouring soils salt levels and concentrations, which would negatively affect plant growth rates (Hay et al., 2003). But I would also like to add one more effect of drought where soil moisture is reduced and crop failure is almost certain. The quality and quantity of yields and production of crops are strongly influenced by changing climate (Leary et al., 2008b; Meybeck et al., 2012). Both subsistence and cash crops are sensitive to climate change and weather fluctuations (Burroughs, 2001; Odebode, 2005).

3.4.2 Fisheries

Fishing is critically important for nutrition and food security of the coastal communities of the South Pacific region (Simon et al., 2015; Valmonte-Santos et al., 2016). The South Pacific people, their seas and marine resources are interrelated (Hanich et al., 2018) and share a long history. In much of the Pacific, the ocean and rivers provide most of the protein for human consumption (Sharp, 2003). As noted, climate change is likely to limit productivity of coastal fisheries (Hanich et al., 2018; Weir and Varani, 2010). Climate change and sea level rise are likely to cause changes in lagoons and coastal environments and these changes are likely to have profound effects on coastal communities that depend upon these ecosystems for their food, health, wellbeing and economic sustainability (Hanich et al., 2018; Le Cornu et al., 2018; Val monte-Santos et al., 2016).

Because of climate change, Viti Levu's commercial fishing could lose between $F0.1 to $1.5 million annually (Hay et al., 2003). Another important thing to note is that coastal fisheries are already under intense human pressure (Vuki et al. 2002). Over-fishing and destructive methods of fishing (e.g. use of poisons and explosives) are damaging or destroying many coral reefs, sea grass beds and mangroves. Climate and related changes are likely to add further stresses to these ecosystems, which means greater adverse impacts on important nursery areas for the associated vertebrates and invertebrates, on which the coastal communities depend for their food and cash (Gillet, 2011; USAID, 2009).

Climate change and sea level rise are likely to cause significant changes in productivity and distribution of fisheries (Republic of Fiji, 2014). In many locations fish species are likely to become extinct while in some locations the productivity of some species may decrease (Bell et al., 2016; Schipper and Burton, 2009). In the Pacific, many communities have experienced significant consequences, such as reductions in size and number of fish caught and to find adequate protein for an increasing population will be a major concern (Sharp, 2003).

3.4.3 Housing and infrastructure

Rising sea level is projected to affect coastal communities and cities and cause significant damage to human habitats and infrastructure (Asian Development Bank, 2013; Republic of Fiji, 2014). Prior to colonisation traditional island settlements were mostly located inland (Barnett and Campbell, 2010; Nunn and Kumar, 2018). Now most infrastructure, settlements and recent developments are found along coastal areas of the Pacific Islands (ADB, 2012b; Nurse et al., 2014). Coastal communities are exposed, and some are vulnerable, to extreme tides, waves, sea level rise and storm surge (Nunn, 2012). Another impact of sea level rise on infrastructure is that roads are often constructed along the coast and these roads are likely to incur severe damage (Mimura, 1999).

Developing countries are already facing difficulties in improving their infrastructure due to lack of technological and financial resources and the impacts of climate change may make matters worse. For example, in some island countries the money that could have been used to renovate or build new hospitals is now used to repair roads that have been damaged by extreme events. Some people are already being forced to relocate to higher grounds due to rising sea levels (Nunn, 2012). One example is from Fiji, where a coastal village, Vunidogoloa, in Macuata

Province in Vanua Levu was relocated one kilometre further inland, because of coastal erosion and regular flooding of the village during high tides (McNamara and Des Combes, 2015). In Fiji there are an additional 34 villages that will be relocated to higher grounds or further inland under a government programme (Ferris et al., 2011). Another example is the village of Solosolo in Samoa. The sea wall (built years ago) is no longer able to stop coastal erosion and is sinking, so villagers have decided to move further inland, though some residents still want to continue living on the coast, near the sea (Allsop et al., 2005; 2007; Müller et al., 2008).

3.4.4 Tourism

Many small island nations rely heavily on tourism to develop and expand their economies (Becken, 2004; Climate and Development Knowledge Network, 2014; Scheyvens and Movono, 2018; Hughes and Scheyvens, 2018). In the Pacific tourists are attracted to clean environments, sandy beaches, favourable weather, crystal clear waters and clear blue skies (Becken, 2004; Scheyvens and Momsen, 2008). A major tourism diver is climate and the industry is climate and weather sensitive and vulnerable to changing climatic conditions (Reddy and Wilkes, 2013; Scheyvens and Momsen, 2008; Simpson et al., 2008). Climate change is already impacting the tourism industry of small island states (Nurse et al., 2014). Increasing intensity of tropical cyclones and flooding is likely to discourage tourists from coming to island countries (Leary et al., 2008a). Important environmental components of holiday destinations, such as beaches, hotels and availability of fresh water can be affected by climate change and this could reduce the attraction of tourist-development economies (Becken, 2004; Mimura et al., 2007; Republic of Fiji, 2014).

By the end of the century tourist arrival numbers and tourism revenue are likely to fall by 27 to 34 percent (ADB, 2013). The weather parameters needed for tourism are constantly being shifted by changing climate. In addition, sea level rise is placing extra pressure on beaches (long-shore drift and erosion) and on associated environments (ecosystems and biodiversity) where tourism activities usually take place (Becken, 2004; Martens and Chang, 2010).

Higher storm surges could also damage beach resorts, threatening foreign exchange earnings (Warrick et al., 1993). The communities that depend upon tourism are likely to feel the economic impacts the most (Reddy and Wilkes, 2013; ADB,

2012a; Republic of Fiji, 2014). In the past 50 years, the tourism industry has undergone dramatic changes in Fiji (Narayan and Prasad, 2013; Taylor,1987). Tourism in Fiji directly and indirectly provides employment to 15 percent (40,000) of the labour force (United Nations Development Programme, n d). and contributes 40.4 percent to the GDP (Howes et al., 2018).

The relationship between tourism and climate change is two-fold. The natural systems in which tourism occurs are affected and altered by changing climate. If tourism needs to be successful in the long run it will need a sustainable socio-economic development path. Tourism also contributes to climate change, such as through fossil fuels required for transportation and air conditioning, resulting in emissions of greenhouse gases (Becken, 2004).

3.4.5 Health

The changing climate is likely to impact the health of people in various ways, both directly and indirectly (ADB, 2012a; Centre for Disease Control and Prevention (CDCP), 2014; Commonwealth Secretariat, 2009Republic of Fiji, 2014; Royal Society Te Apārangi, 2017) (see Table 3.3), and cause social disruption, financial losses and psychosocial impacts (United Nations, 2020). Disease vectors, such as infected mosquitoes and other insects cause communicable diseases like dengue fever, malaria, and filariasis. Diseases such as leptospirosis can spread through urine and/or blood of infected animals or rodents. Their behaviour, ability to survive and reproduce depends upon humidity and availability of stagnant water. Changing climate is likely to increase rainfall and with hot days and warm nights would create ideal conditions for breeding of mosquitoes (Howden-Chapman et al., 2010; Tyler, 1998). Reduced food security tied to climate change is likely to put lives of children and older people at risk (Berman, 2015).

Increased temperature is likely to cause more death and illness, especially among the young, old and poor (Smith et al., 2014). Increases in temperature may also cause increases in salmonella and other food poisoning bacteria, which could lead to more gastrointestinal distresses, such as vomiting, fever and in severe cases even death (Republic of Fiji, 2014; Mclver et al., 2016). Heavy rainfall can cause overflow of sewage systems, which could contaminate water sources and crops with harmful pathogens (United States Environmental Protection Agency. 2015). A World Health Organisation report published in 2002, stated that global warming has caused in excess of 150,000 deaths a year and this figure could double by 2030

(Broecker and Kunzig, 2008). A community's vulnerability depends upon its geographical location (how prone they are to tropical cyclones, floods and droughts), degree of exposure to extreme events, lack of finance and food (malnutrition), and their dependence on terrestrial and marine resources (both of which may be adversely impacted by climate change) (Russell, 2009).

Table 3. 3 Direct and indirect impacts of climate change on health

Direct effects	Extreme events	Any increase in frequency of extreme events such as storms, floods, droughts and cyclones would harm human health through direct loss of life and injury and reduced food security.
	Heat stress	When it is very hot, the risks of heat stress increases. Some people are more at risk of heat stress, including babies, the elderly, and people with some health conditions, such as heart conditions and high blood pressure. Individuals who take diuretics (water pills) may be more sensitive toheat exposure.
Indirect effects	Vector-borne infectious diseases	Higher temperatures, changes in precipitation and climate variability may alter the geographical range and seasonality of transmission of many vector-borne diseases.
	Water-borne infectious diseases	Heavy rainfall events can transport terrestrial microbiological agents into drinking-water sources resulting in outbreaks of water-borne diseases, such as typhoid. Global warming is expected to lead to changes in the marine environment that alter risks of bio-toxin poisoning from human consumption of fish and shellfish. Changes in surface water quality and quantity are likely to affect the incidence of diarrhoeal diseases.
	Food production and supply	Populations in isolated areas with poor access to markets will be particularly vulnerable to local decreases or disruptions of food supply.
	Social and economic disruptions	The impacts of climate change may cause severe social disruptions, local economic decline and population displacement that would affect human health. Population displacement resulting from sea level rise, natural disasters or environmental degradation is likely to lead to substantial health problems, both physical (for example hypertension, asthma and arthritis) and mental (for example anxiety and panic attacks, eating disorders and depression.

Source: Adapted from WHO, 2003: 47-51

Ciguatera fish poisoning (CFP), the most common non-bacterial food-borne illness which one could get by eating fish occurs in tropical regions. Distribution and abundance of dinoflagellates (gambierdiscus), the organisms that produce the toxins that cause ciguatera fish poisoning arecorrelated positively with sea temperature (Nurse et al., 2014). Increased sea-surface temperatures could also mean wider, longer and larger areas (blooms) of harmful algae that produce ciguatoxins (Tester et al., 2010).

3.5 Gender and climate change

Gender equality is not simply about one being male or female, but having the same rights, voices and access to resources. The World Development Report of 2006 defines gender equality as equal access to the "opportunities that allow people to pursue a life of their own choosing and to avoid extreme deprivation in outcomes" (World Bank 2005 quoted in Ruth and Ibarrarán, 2009: 83). Men and women are not equally exposed to hazards, such as floods and tropical cyclones. Often, women are more vulnerable to the impacts of climate change and their security is at stake because the majority of them are poor and disadvantaged when compared to men (Dankelman, 2010; Habtezion, 2016). Environmental degradation resulting from climate change is likely to impose extra burdens (summarised in Table 3.4) on females (Alam et al., 2015; Australian Red Cross, 2014; UNDP, 2016c).

Women's social roles, obligations and traditional duties often make them more vulnerable to the likely impacts of climate change (Alam et al., 2015; Dankelman, 2010; Lothian, 2005-2014; Parikh, n.d.; Ruth and Ibarrarán, 2009; UNPD, 2016c: United Nations, 2020). In many settings their vulnerability to climate related disasters is increased by social and cultural practices (Alam et al., 2015; Ruth and Ibarrarán, 2009; Women's Development and Environmental Organisation, 2018). Women's food and incomes often depend upon traditional food sources (Parikh, n.d.), many of which are likely to be affected by climate change, resulting in reduced food and income for women (United Nations, 2020).

In the Pacific there is often a segregation of gender roles and knowledges (Mimura et al., 2007). For example, men are commonly responsible for deep sea fishing, initial land clearance and terrace building for agriculture, and house and boat construction. Women are generally involved in day-to-day agricultural maintenance (Fischer, 2002). Existing inequalities between women and men are likely to be

exacerbated and magnified by climate change (UNDP, 2016c). Women are likely to face more risks and bear a disproportional brunt of tropical cyclones, floods and drought (Nellemann et al., 2011). For poverty reduction and sustainable development, gender equality is a prerequisite (Dankelman, 2010; United Nations, 2020). Hard water resulting from salinization is likely to make it take longer to cook food, more difficult to wash clothing and it often produces a noticeable deposit of insoluble metals and salts in cooking pots (WHO, 2011).

Table 3. 4 The impacts of environmental degradation on women and girls.

Loss of natural resources	Loss of control and access to natural resources such as land, water, firewood and traditional foods. Work burden may increase significantly-longer walking distances to fetch water, food and firewood. Overuse of marginal resources. More effort required to meet the basic needs. Upslope community relocation is likely to require women to carry water uphill.
Loss of other sources of production	Women's control and loss of access to knowledge, education and housing. Development opportunities may become limited and poverty may increase, due to lack of job availability for women and lack of knowledge in finance management.
Loss of power	Women may also lose decision making powers over things that affect them the most, such as resource usage and management, which is likely to be negatively affected by climate change. Ecological and social insecurity is likely to result in more exposure to unsafe situations and natural disasters. Health, survival and welfare may be adversely affected.

Source: Adapted from Dankelman, 2010: 41-42

Climate change is likely to limit choice and human freedom. Women in underdeveloped countries already often do not have full access to resources, have limited mobility and rights and their voice is often not heard during decision making processes relating to climate change (Kolstad et al., 2014; UNDP, 2010, 2015). Women in general have less access to information and resources that are important and needed in adaptation including disaster preparedness and rehabilitation (Dankelman, 2010; Nellemann et al., 2011; Australian Red Cross, 2014).

When we talk about adaptation to climate change, it is about protecting and enhancing the livelihoods of communities, who are likely to be affected by climate change (Mimura et al., 2007). In many instances, women, more than men, are not

able to make investments in land rehabilitation and improve soil quality as they often have no or very limited access to credit and agricultural extension services due to customary land laws and land rights, government policies and commercial practices (Green Facts, 2015; UNDP, 2010; UNWP, 2012). Often, the school dropout rate is higher amongst girls than boys especially after disasters when household workloads and expenses increase (Australian Red Cross, 2014). Mostly girls are asked to stay home and help and this way the school fees, books and travel expenses are saved, but this could have lasting later repercussions in females' lives (Khalil, 2012; UNDP, 2015d).

Women's roles are deeply rooted in social, economic and cultural factors of the community concerned (Aguilar, 2009; Alam et al., 2015; Odebode, 2005; Oxfam International, 2005). In many societies, women are expected to see that the family's "practical needs" are met (Parikh, n.d.; Haigh and Vallely, 2010). Women, more than men, are responsible for subsistence farming, harvesting, processing food and cooking (Ruth and Ibarrarán, 2009). Women who use indoor wooden stoves are more exposed to smoke and their probability of suffering from emphysema or chronic bronchitis (chronic obstructive pulmonary diseases) are increased by three times more than women who use gas, electricity or other cleaner fuels to cook (WHO, 2006). A 2004 report on the threats from, and responses to, the impacts of global warming on human development stated that climate change policies will be successful if women have equal opportunities to lower their vulnerability, build their capacity, influence decision-making, and diversify their income resources (Jarman, 2007).

Women are likely to be impacted directly (loss of life and injury) and indirectly (deprived of access to education and health services and economic activities) by climate change (Australian Red Cross, 2014). Neveertheless, even with these limitations, it has been found that women are often able to make better decisions than men and are able to find better adaptation strategies to reduce the impacts of climate change (Alam et al., 2015; Dankelman, 2010). Women are often more ready to ask for help and listen and more willing to combine scientific information with their own experiences (Government of Japan, 2013; Urmson et al., 2016). People who listen and take others help are often able to make better and more practical decisions. Women have been found to be more willing to change their adaptation strategies to incorporate new information and to learn from success and failure (Government of Japan, 2013; Ruth and Ibarrarán, 2009).

3.6 The Roles of Regional Organisations.

In the Pacific regional cooperation began after the Second World War and during this period the whole region was virtually made of dependent territories (Hay, 2013). The Council of Regional Organisations in the Pacific (CROP) was established in 1988 to help in achieving sustainable development (through mutual support and cooperation) in the Pacific Island Countries and territories (Pacific Islands Forum Secretariat, 2017b). Later the Pacific Islands Forum endorsed "*ThePacific Plan for Strengthening Regional Cooperation and Integration"* in 2005. The plan provided regional cooperation and integration through shared initiatives in four priority areas, sustainable development, economic growth, security and good governance (Techera and Troniak, 2009). This has now been superseded by the Blue Pacific initiative, and its four principal objectives are the same as "*ThePacific Plan"* but the fourth objective, good governance, is renamed as strengthened systems (Pacific Islands Forum Secretariat, 2017a).

Regional organisations play major roles in disaster responses, but relatively little research has been done on their role in disaster risk management. SOPAC (now part of SPC, see below) in collaboration with other regional organisations has contributed to activities to reduce the likely impacts of climate change (Barnett and Campbell, 2010). The number of regional organisations involved in climate change is growing, expanding their scope and they are becoming increasingly engaged and active in many fields and areas, such as migration and climate change which has been a focus in recent years. The regional organisations are serving, and are becoming important links between, international organisations and national governments (Ferris and Petz, 2013; Gero et al., 2013; Trotsenburg, 2015). Three major regional organisations in the South Pacific in relation to climate change are the Secretariat of the Pacific Community, the Secretariat of the Pacific Regional Environment Programme and the University of the South Pacific.

3.6.1 The Secretariat of the Pacific Community (SPC)

The Secretariat of the Pacific Community, formerly known as the South Pacific Commission, was founded in 1947 (ADB, 2006-2015). It is working in partnership with other regional organisations to assist Pacific Island countries to become more resilient and to be better prepared for the likely impacts of climate change (SPC, 2011a), and implemented the RESCCUE (Restoration of Ecosystem Services and Adaptation to Climate Change)) project, both at local and regional levels, with pilot sites in four countries: Fiji (Kadavu and Ra provinces), Vanuatu, French Polynesia

and New Caledonia. The aim is to make local communities more resilient to the likely impacts of climate change by protecting and planting mangroves, better management of waste and wastewater and by finding least expensive and most effective adaptation strategies (SPC, 2015; SPC, n.d.a).

The programme "Coping with Climate Change in the Pacific Island Region" (CCCPIR) commenced in 2009 and was initially implemented in Fiji, Tonga and Vanuatu and by the end of 2011 expanded to nine other Pacific Island countries. CCCPIR was implemented with the intention of improving communities' abilities to better cope with and adapt to the likely impacts of climate change (SPC, 2011b). SPC and GIZ started in 2011the process of incorporating climate change, its likely impacts, how best to reduce greenhouse gas emissions and disaster risk management into both, the primary and secondary schools' curricula in Fiji. The programme finalised in 2014. The Pacific Centre for environment and Sustainable Development, a division of USP also contributed towards syllabus development and implementation of the programme.

SPC also implemented the Framework for Resilient Development in the Pacific (FRDP) (endorsed by leaders) to enhance resilience to disasters and address vulnerability to climate change across all sectors. Another project carried out by the Pacific Islands Applied Geoscience Commission (SOPAC), now merged with SPC is "The Strategy for Climate and Disaster Resilient Development in the Pacific" (SRDP), with objectives to find ways to reduce the negative impacts of climate change, make communities more resilient, reduce and better manage risks and to encourage sustainable development (Kumar and Krüger, 2013; SPC, 2015). SPC also established theClimate Change and Environmental Sustainability Programme (CCES) to provide leadership training, technical assistance and liaison with international and regional partners to promote, strengthen and streamline its climate change initiatives (SPC, n.d.b). SPC is helping island countries to combine top-down and bottom-up adaptation strategies to climate change. Combining two approaches (community-based and culturally sensitive) is considered to have the best chance of making Pacific communities better able to cope with, and be more resilient to climate change (European Union andGlobal Climate Change Alliance (GCCA), 2012).

3.6.2 The Secretariat of the Pacific Regional Environment Programme (SPREP).

The Secretariat of the Pacific Regional Environment Programme has the goal of bringing about sustainable development and maintenance of Pacific Islands' environments. It also provides financial and technical assistance to its member states to better use and manage their ecosystems, both terrestrial and marine (Barnett and Campbell, 2010; SPREP, 2012b), and is working in partnership with Pacific island governments to make the Pacific communities more resilient to the negative impacts of climate change (SPREP, 2012a, 2014a). The heads of governments of the Pacific Island countries have elected the Secretariat of the Pacific Regional Environment Programme (SPREP) to lead Pacific Island countries and to find the best responses to the challenges of climate change. The Pacific Adaptation to Climate Change Programme (PACC), which began in 2009, under the guidance of SPREP was the first major regional climate change adaptation programme for the Pacific Island countries (SPREP, 2018a; UNDP, 2012b).

The aim of PACC (promoting mainstreaming of adaptation into government activities at all levels, within the countries and regionally and demonstrating best-practice adaptation) is to make Pacific Island communities more resilient, so that the communities can cope better with present and future impacts of climate change. The programme, which is ongoing is being implemented in 14 countries and is focusing on the most sensitive areas of climate variability and change, such as coastal zone management, reduction of poverty by improving food security and food production and improving water supply (SPREP, 2014b, 2018a). The PACC combines both top-down (mainstreaming) and bottom-up (community vulnerability and adaptation assessments) approaches, consistent with both local community and national government programs, plans and methodologies (SPREP, 2018a; 2018b). PACC successfully piloted three varieties of climate resilient cassava, *kumala* (sweet potatoes) and *dalo* in Fiji. "PACC came in and introduced these crops that are resilient to water-logging" (Api Tuwai, PACC Coordinator in Fiji, 2013 quoted in SPREP and UNDP, 2013: 17). Table 3.5 summarises the activities pursued through the PACC programme in South Pacific countries.

SPREP also plays a leading role supporting delegations of Pacific Island countries at international climate change conferences (e.g., Conferences of the Parties to the UNFCCC – see Section 3.8.2) and putting forward their concerns. By doing this it is now in better position to request and leverage more assistance (climate finance)

for members (e.g., from the Green Climate Fund) and help Pacific Island countries to better cope with, adapt and become more resilient to climate change (SPREP, 2016). SPREP in 2017 launched a new 10-year (2017-2026) Strategic Plan, endorsed by member countries in 2016, to better, maintain and improve economic growth, ecosystem and biodiversity protection, pollution and waste minimization and control, improving ocean and terrestrial governance and management and social viability of the Pacific Island communities, so as to become more resilient and to better cope with and adapt to the likely impacts of climate change (Sarika and David, 2017).

Table 3. 5 Summary of the on-the-ground adaptation measures being pursed through the PACC programme.

Countries	Projects pursed
Marshall Islands, Nauru, Niue, PNG, Tokelau, Tonga, Tuvalu.	Capturing and storage of rain and groundwater resources.
Marshall Islands, Niue, Tokelau, Tonga, Tuvalu.	Reducing leakage of reticulated systems and water storage facilities
Niue, Tonga, Tuvalu.	Water saving (e.g. managing demand through education, introducing compost toilets).
Marshall Islands, Nauru	Solar water purifier
Tonga	Groundwater quality monitoring
Nauru	Saltwater reticulation
Fiji, Palau, PNG, Solomon Islands	Development and use of climate-resilient crops that are resilient to waterlogging, pests, saltwater, drought.
Fiji, Palau, Solomon Islands	Using farming techniques facilitating water and soil conservation (e.g. mixed farming, improved drainage, mulching).
Palau, Solomon Islands	Improved food storage and processing techniques
Palau, Vanuatu	Improved aquaculture techniques
Fiji, Samoa, Vanuatu	Protecting coastal structures
Fiji, Samoa, Vanuatu	Planting more coastal vegetation
Cook Islands, Federated States of Micronesia, Vanuatu	Reinforcing existing coastal infrastructure (climate proofing of harbours and roads)
Vanuatu	Relocating coastal infrastructure to less-exposed areas
Samoa	Changes in use of coastal resources (e.g. Reducing or stopping sand-mining, conserving wetlands, forests and reefs as natural protection barrier.

Source: Adapted from SPREP and UNDP, 2013: 7.

3.6.3 The University of the South Pacific (USP)

The USP in partnership with the European Union Global Climate Change Alliance, started a project in 2012, with the aim of introducing new courses at Post Graduate Diploma level, whereby the students could learn more about the socio-economic and cultural impacts of climate change and about building capacity to respond. The USP is offering Degrees, Post-Grade Certificates and Diplomas, Masters and PhD programmes in climate change, whereby the students are taught about the risks posed by climate change and what adaptation strategies may be taken to effectively deal with these risks at regional, national and community levels (Holland, 2014; USP,2014). The university also offers part-time scholarships to help students complete their programmes while still being employed, as shortages of qualified staff make it difficult for employers to release workers to do full-time study (USP, 2017).

The Pacific Centre for Environment and Sustainable Development (PACE-SD) and Institute of Applied Science (IAS), divisions of USP, started the AusAID funded climate change adaptation in rural communities project (CCA), and implemented cost effective adaptation options (phase 1 pilot project, June 2006- June 2010) in the second half of 2006, in six villages, emphasising two major exposure sectors, namely coastal areas and water resource management (USP, 2012). The second phase of the project was from June 2010 to June 2013. The people in the six villages now having a better understanding of the likely impacts of climate change on their coastal environment and water resources. Barnett and Campbell (2010: 130) stated that "The AusAID-funded CCA in the Rural Communities of Fiji is little known compared to other projects, but in many ways it has been the most successful with respect to implementing the kind of material and institutional responses necessary to reduce vulnerability to climate change".

3.7 The roles of International Organisations.

It is unlikely that PICs will, by themselves, be able to deal with the serious risks and climate hazards that are projected and will require international assistance to enhance their coping capabilities and ameliorate the impacts of climate change (Barnett and Campbell, 2010). This is likely to include technical assistance and funding from bilateral partners and international organisations. Assistance can include technical and scientific expertise, policies and strategies for adaptation and actions (strengthened human capacity to assess and monitor social, economic and environmental risks and effects of climate change) at national and regional levels.

Partnership and cooperation with international organisation will play an important role, alongside local expertise and inputs to address the problems brought by climate change. Some examples of International organisations are given below.

The European Union is helping Pacific island countries in drawing up national climate plans to slowly shift businesses to low-carbon climate-resilient economies. It is also carrying out work in the Pacific region on improving water and sanitary services, sustainable rural development and better management and usage of natural resources (European Union, 2016). The European Union in 2016 made available€ 4.5 million from the European Development Fund (EDF) to three Pacific Island countries, Republic of Palau, Republic of the Marshal Islands and the Federated States of Micronesia to build resilience and be better prepared and equipped for future El Niño events. This project was in response to severe impacts and drastic consequences of the 2015- 2016 El Niño, which resulted in severe drought in the three countries. The drought had significant negative impacts on the tourism industry, reduced agricultural yields and many households were without water and food; education and health services were severely disrupted (SPC, 2017).

The World Bank provides technical and financial aid for sustainable fisheries and forest management to its member states and in doing so is helping the states to incorporate climate change policies and planning in their development plan. The World Bank Group, by adopting a new climate change action plan, is helping developing countries to better adapt to the likely impacts of climate change and to meet and achieve their Conference of Parties (COP21, held in Paris) climate commitments (World Bank, 2016a). The World Bank is also helping Pacific Island countries to enhance the resilience of coastal communities and vulnerable road networks, encompassing four pillars: First, risk-based spatial planning (risk-based assessment of hazards and vulnerability); second, fit-for-purpose infrastructure (raising road elevations and strengthening coastal infrastructure); third, stronger enabling environments (capacity and institutional support and raising awareness) and fourth, supporting post disaster recovery (short-and long-term climate change impacts, risks and resilience is integrated in rebuilding plans and efforts) (World Bank, 2015).

The Asian Development Bank, since its operations from 1970, has been providing funds for projects and programmes to develop strategies, so that Pacific communities could become more resilient and better adapted to the likely adverse impacts of climate change. ADB also promotes awareness, shares knowledge and

better understanding of the likely impacts of climate change. Over the last two decades ADB has increasingly demonstrated its strategic engagement and commitment in climate change adaptation and mitigation (ADB, 2014; 2015).

Following Cyclone Winston in 2016, upon the request of the Fijian Government, the World Bank and the Asian Development Bank each gave US$50 million to support and assist the government's effort to: (1) build and improve climate resilience; (2) improve the business and investment climate; and (3) strengthen and maintain medium term fiscal sustainability (World Bank, 2016b). Also, for over 20 years ADB has supported Fiji government to improve living standards and provide an additional 4,500 households with sanitation networks and to ensure that 98 percent of Suva's population have excess to clean and wholesome water supply by the year 2023 (ADB, 2019).

3.8 International climate politics and services

Global efforts to reduce, maintain, and to achieve the required reduction of greenhouse gas emissions require subnational, national and international policy frameworks (Oberthür, 2016). At the international level domestic politics always play major roles influencing and shaping each country's climate agenda in climate negotiations (Sofer, 2016). "Let us be under no illusion. This is a crisis. I urge all parties to work with the spirit of compromise – to take the long view and avoid getting bogged down in minutia" (UN Secretary General Ban Ki-moon, opening remarks at COP 18 quoted in Healey, 2014: 35). One way to speed-up international climate negotiations is for economically powerful countries to act first and to show that economic welfare could be maintained or improved with rapidly decreasing greenhouse gases (Karlsson and Symons, 2015). There are two main international approaches to climate change: scientific and political. The Intergovernmental Panel on Climate Change (IPCC) provides assessment of the state of the art of all aspects of climate change science (defined broadly), providing the knowledge base for international decision making. The major international political arrangement is the United Nations Framework Convention on Climate Change (UNFCCC), which promotes international action to best mitigate, improve understanding, make informed decisions and enable adaptation to present and future climate variability and change (UNFCCC, 2007).

3.8.1 Intergovernmental Panel on Climate Change (IPCC).

The IPCC was established in 1988, jointly sponsored by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO). Today it involves thousands of climate specialists and has 195 member nations. It delivered its first comprehensive assessment of climate change in August 1990, second in 1995 (leading to formation of the Kyoto Protocol), third in 2001, fourth in 2007 and most recent one in 2014 (Moore and Pubantz, 2002). These assessments (which take about two to three years to complete) became very important tools for informed international and intranational negotiations and decision-making processes (Filho, 2015; Moore and Pubantz, 2002). Governments play significant roles by nominating scientific experts to assess the current state of climate change knowledge and prepare the reports. Scientific experts review both, the second order drafts and the summaries for policy makers and they also approve each Working Groups reports. The process for the assessment reports is outlined in Figure 3.4. The chairperson of the IPCC Bureau is also appointed by the governments (Barnett and Campbell, 2010).

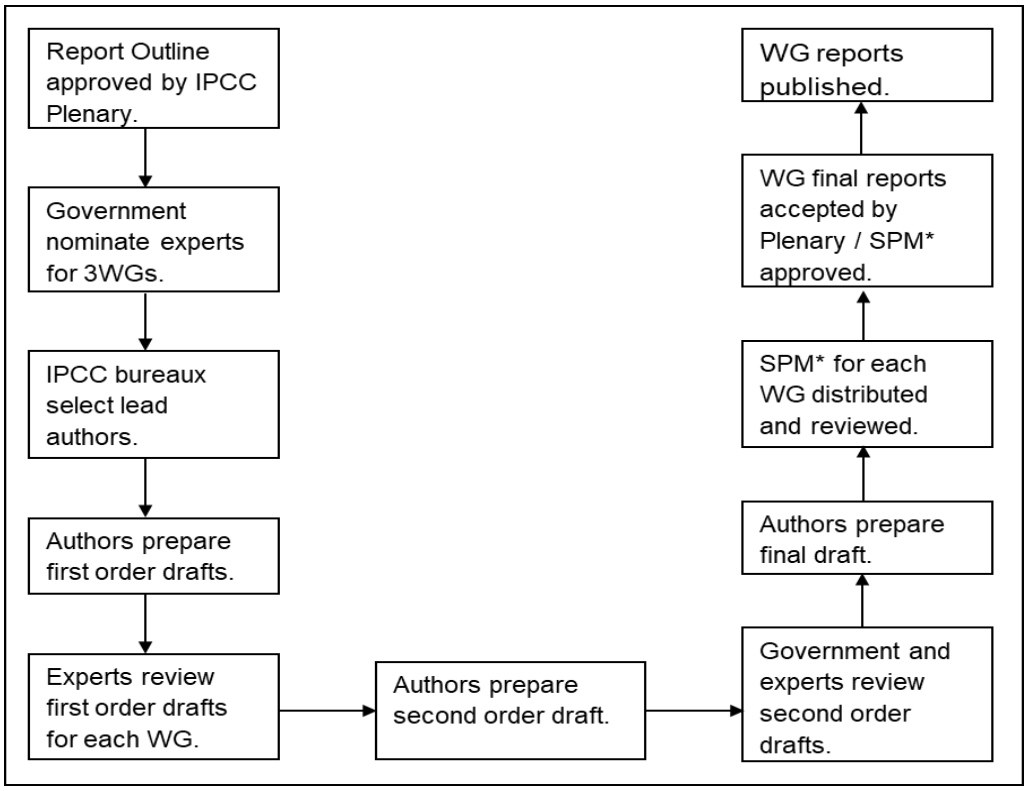

Figure 3. 4 Preparing and adopting the IPCC assessment reports process.SPM* refers to summary for policy makers. Adapted from Barnett and Campbell, 2010: 59.

The IPCC has three working groups. Working Group I (WG I) assesses the contemporary research on the 'Physical Science Basis', including observed changes in land, ocean and air temperatures, rainfall, ice sheets and glaciers, sea level and oceans and modelling scenarios of future changes. Working Group II (WG II) assesses research on the vulnerability of natural and socio-economic systems to climate change, including both its positive and negative consequences, and options for adapting to the likely impacts of these. It also emphasises inter-relationships between adaptation, vulnerability and sustainable development. Working Group III (WG III) assesses options for mitigating climate change through limiting or preventing greenhouse gas emissions and enhancing activities that remove them from the atmosphere. The main economic sectors are taken into account, both in near-term and long-term perspectives.

IPCC is policy relevant and not prescriptive. It can only collect and assess evidence on climate change and its effects, as well as response options, but cannot develop or enforce any policies. Many environmental scientists find this very frustrating as they feel that there is a need for action (laws and enforcement) and outlining its findings alone is not sufficient to bring about political change and achieve required targets for emissions of greenhouse gasses (Reisinger, 2009).

From the very beginning, IPCC's first assessment report, published in August 1990, recognized that most if not all atoll and small island countries are highly exposed, and some are vulnerable to sea level rise and other effects of climate change. IPCC is a major organization which recognizes and is trying its best to address the present and future economic, social and environmental issues of the island countries, by raising awareness and identifying present and future risks of climate change. Its work is, and will continue, to inform strategies, policies and actions to increase both environmental and human resilience to longer term impacts of sea level rise and climate change (Galarraga et al., 2009; Nurse et al., 2014). Keeping this in mind, much of the information in this thesis is from IPCC reports.

3.8.2 The United Nations Framework Convention on Climate Change (UNFCCC)

The countries attending the Earth Summit in June, 1992, held in Rio de Janeiro, Brazil, set up the UNFCCC, the most widely ratified international treaty, to look for ways to address or to reduce the problems associated with global warming and climate change (see Table 3.6). The UNFCC played the most important role in

bringing the issue of climate change to international political prominence and required parties to commit to reduce and review their greenhouse gas emissions (Barker et al., 2007; Barnett and Campbell, 2010; Edenhofer et al., 2014; Galarraga et al., 2009; McDonagh, 2011).

The main aim of UNFCCC is set out in its Article 2 – the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (Saul et al., 2012: 72). The basic principles set out by the UNFCCC enlivened international climate law. The Earth Summit opened a pathway for sustainable development processes, whereby the future of coming generations would not be jeopardised. This pathway, however, has not been easy as negotiations to significantly reduce GHG emissions have proved to be, both politically and logistically, difficult (Saul et al., 2012).

Table 3. 6 Commitments by all parties under the UN Framework Convention on Climate Change.

Develop	National strategies to keep records of the emissions and sinks of greenhouse gases. Programmes to mitigate climate change and to facilate adaptation. Integrated plans for coastal zone management, water resources and agriculture.
Promote	Programmes to control, minimise and to prevent greenhouse gas emissions. Sustainable development to increase sinks and reservoirs of greenhouse gases. Implementation of climate change into social, economic and environmental policies and actions. Scientific research relating to climate change. More training, education, knowledge and public awareness relating to climate change.
Communicate	Communicate and share information of the conference (parties) relating to implementation of mitigation and adaptation strategies to the maximum.

Source: Adapted from UNFCC, Article 4 quoted in Warrick and Ahmad, 1996: 83.

One hundred and ninety-one countries, plus the European Union, agreed in 1992 to meet once a year to monitor and report on the level of production of greenhouse gases in their respective jurisdictions, develop ways to reduce the emissions of greenhouse gases to 1990 levels and to address the likely impacts of climate change. In November 2001, the parties to the UNFCCC recognised that climate

change is having its greatest impacts on the world's poorest countries, and each of the world's 49 least developed countries were asked to come up with a programme, called National Adaptation Programmes of Action (NAPA), to implement and strengthen their ability to become more resilient to the likely impacts of climate change (Jarman, 2007). This programme of NAPAs faced two major hurdles. Firstly, some countries did not have the expertise and were dealing with the impacts of climate change for the first time. Secondly although NAPAs were part of an international climate change programme, the least developed countries were not getting enough funds to implement the much needed and required adaptation.

When we look at the UNFCCC as a whole, it has fallen short in some important areas. For example, it has failed to set long-term goals, such as reduction of greenhouse gasses by 2050, and it failed to get all G-8 countries to agree to meaningful reductions. Some developed countries were making no effort to meet their greenhouse gas emission targets (Bodansky, 2010; Engberg-Pedersen, 2011; Healey, 2014). Despite UNFCCC's many failures and frustrations, parties continue to meet and while there is no agreed schedule for reducing greenhouse gas emissions most individual countries have established national reduction targets (see Section 3.8.6 below), and 192 countries have committed to keeping temperature increases below 2°C and to make all efforts to limit them to no more than 1.5°C above pre-industrial levels (UNFCCC, 2018; Gagnon-Lebrun and Harris, 2016)

Article 4.8 of the United Nations Framework Convention on Climate Change (UNFCCC) refers to "the specific needs and concerns of developing country Parties arising from the adverse effects of climate change... especially on: (a) Small Island countries; (b) Countries with low-lying coastal areas..." (UNFCCC 1992 quoted in Ourbak and Magan, 2018: 2201). Despite this the UNFCCC has contributed relatively little to having adaptation policies implemented in small island developing states. While there is much discussion about impacts on, and vulnerability of, small islands, very little is done to find solutions at community level where most impacts will be felt (Barnett and Campbell, 2010). The big issue is who will pay for adaptation. Recent pledges by developed countries to support risk management approaches, together with catastrophe risk insurance, risk pooling and catastrophe bonds is likely to be technically feasible in the short term in the global climate policy but it is likely that many of these approaches will have little effect at the local level.

3.8.3 Kyoto Protocol

It was soon quite clear that much greater effort than that outlined in the Convention would be needed to control and reduce greenhouse gas emissions. By the third conference of the Parties to the UNFCCC (COP3) efforts began to strengthen international commitments to mitigate climate change. This resulted in the Kyoto Protocol, which was adopted on 11th December 1997 and came into force on 16 February 2005 (UNFCCC, 2008). The Kyoto Protocol was a modest, yet legally binding, initial step to reduce the emission of greenhouse gases (Barnett and Campbell, 2010; Healey, 2014; Victor et al., 2014).

The Protocol set a first target period from 2008 to 2012 in which, the European Community and 37 industrialised countries agreed to reduce their emissions of greenhouse gases by at least five percent compared to 1990 levels (UNFCCC, 2018b). Furthermore, the Protocol included provisions for subsequent commitment periods. It was in the Kyoto Protocol that the means of reducing greenhouse gas emissions were initially agreed upon (Allwood et al., 2014; Barnett and Campbell, 2010; Pittock, 2005; UNFCCC, 2018b). The aim of the Kyoto Protocol was to provide ways and means for industrial countries to meet reduction targets, set down in the protocol for the first commitment period (Korhola, 2014; Renowden, 2007). The European Union's participation in the Kyoto Protocol and achieving a comprehensive binding agreement was highly supported by many of the least developed countries and by many small Island States (Healey, 2014).

However, at COP15 (in Copenhagen, 2009), when the countries were expected to set commitments for the second target period, there was a breakdown in negotiations (World Wildlife Fund, 2018). Most countries had struggled to achieve the relatively small reductions required in the first commitment period and baulked and making further commitments. From this perspective the Kyoto Protocol can be seen as a failure, because it failed to set a much-needed focus to reduce emissions in the second commitment period (World Bank, 2009) and it could not get the world's largest greenhouse gas emitter, the USA, to ratify the protocol for even the first commitment period (Stavins et al., 2014). The USA and Australia undermined the achievements of the Kyoto Protocol by slowing down international progress for a more significant and effective regime (Saul et al., 2012). Australia did not ratify the protocol until December 2007 (Clarke, 2008). While the Protocol included commitments for developed countries to reduce their emissions, there were no binding targets for developing countries (Korhola, 2014) and there were no

consequences for noncompliance (Council on Foreign Relations, 2018). The expectation was much the same as that of the Montreal Protocol which successfully brought about reductions in emissions of ozone depleting substances. First the developed countries needed to show real progress in reducing emission of greenhouse gases (as they were responsible for much of the greenhouses gas emissions up until recently), before developing countries would take similar steps and assume similar obligations (Saul et al., 2012).

3.8.4 Recent developments

The main objective of all COPs is to reduce emissions and stabilise the concentrations of the greenhouse gases in the atmosphere, so that human activities do not dangerously affect the climate system, and to enable sustainable development and allow ample time for ecosystems to adapt naturally (UNEP, 2015; UNFCCC, 2016; 2019b). Many COPs have taken place since the first in Berlin in 1995 with the 25th conference in 2019. For SIDS, including PICs, three recent COPs have been particularly important. COP 19 in Warsaw in 2013 saw the establishment of the Warsaw International Mechanism for Loss and Damage, COP 21 resulted in the Paris Agreement which included a commitment to limit global warming to no more than 1.5°C above pre-industrial levels, and not 2°C and COP 23 held in Bonn, Germany had a strong Pacific theme as Fiji's Prime Minister, Frank Bainimarama was co-chair.

3.8.5 Warsaw: International mechanism on loss and damage

The International Mechanism for Loss and Damage associated with the likely impacts of climate change was established for developing countries which are vulnerable to the likely adverse effects of climate change (Gewirtzman et al., 2018). Loss and damage (L&D) can be defined as the impacts of climate change that are still occurring after adaptation and mitigation measures have already been undertaken (UNFCCC, 2018c; Warner et al., 2013).

The mechanism was a significant victory for Small Island Developing States who promoted the concept in addressing the likely impacts of climate change (UNFCCC, 2018b). The three major functions of the Loss and Damage mechanism are: 1) Identifying potential harms, assessing the costs of losses and damage and enhancing knowledge on risk management approaches; 2) strengthening coordination, dialogue, and synergies among stakeholders; and 3) enhancing

relevant support and action (both technical and financial) (International Institute for Sustainable Development, 2013). The Warsaw International Mechanism for loss and damage was further strengthened at the Paris COP (21), where loss and damage was separated from adaptation (considered a major success for the SIDS). However, an important concern was that Article 8 stated that establishing the level of loss and damage could not be used by parties to claim "liability or compensation" (Ourbak and Magnan, 2018). There will be a need in future UNFCCC talks, negotiations and discussions to consider establishing equitable, permanent, adequate and readily available financial mechanisms to compensate for loss and damage (Gewirtzman et al., 2018).

3.8.6 The Paris climate conference

The Paris Climate Change Agreement was adopted in December 2015 and entered into force before the Marrakech, United Nations Climate Conference in 2016 (COP 22) (UNFCCC, 2016; 2017). The countries that ratified the Agreement are legally bound to abide by its provisions (Gagnon-Lebrun and Harris, 2016). The Paris Agreement has created a fundamental shift or change in the way most of the world prepares, sees and acts on climate change at all levels of business, civil society, investment and government (UNFCCC, 2016). The adoption of the Paris Agreement (COP21) was a major turning point in the climate change debate. All the member countries recognised the significance and importance of mitigation and adaptation actions (UNFCCC, 2019).

The Paris Climate Conference set the aspirational limit of global warming to 1.5°C and not to 2°C (previous threshold). "The Paris Agreement goes well beyond the UNFCCC's earlier 2°C limit and aims to hold warming to well below 2°C and to pursue efforts to limit temperature increase to 1.5°C above pre-industrial levels" (UNDP, 2016a:1). Many small and coastal low-lying islands could be saved from inundation by the likely rising sea levels, if the global warming could be limited to 1.5°C (Climate Action Network Europe, 2013; Pearce, 2016; SPREP, 2015b; IPCC, 2018). Limiting climate change to only a 2^0C increase could have huge impacts on the achievement of human's needs and wants (Pearce, 2016; SPREP, 2015b; IPCC, 2018) (see Table 3.7).

"Limiting warming to 1.5°C would preserve at least ten percent of the world's coral reefs, as opposed to higher levels of warming that would cause their virtual disappearance" (Climate Analytics and UNDP, 2016 cited in Manley et al., 2016:

6). Limiting global warming to 1.5°C will increase safety of both people and environments, and it will also improve global GDP by at least 10 percent by 2015. Also reducing global temperature increase to 1.5°C would decrease heat wave spells for tropical countries by 33.3 percent, which means reducing globally a one-month of extreme heat waves annually. Reduced temperature results in cleaner air, with improved health of citizens (UNDP, 2016a). Limiting global warming to 1.5°C is likely to reduce sea level rise by 100 centimetres, compared to 2°C by 2100 (IPCC, 2018). This would lower exposure to coastal hazards and risks of saltwater intrusion and damage to infrastructure for small island countries and low-lying coastal areas, thus increasing opportunities for adaptation such as infrastructure reinforcement and restoring, and improving management of, natural coastal ecosystems.(IPCC, 2018; 2018; UNDP, 2016b).

Table 3. 7 The possible climate impacts in the global context for 2^0C increase in the mean annual warming.

Water	Potential 20% - 30% decrease in water availability in some vulnerable regions
Food	Sharp decline in crop yield in tropical regions .
Health	Forty to sixty million more people exposed to malaria in Africa. More people exposed to extreme heat waves
Land	Up to 10 million more people affected by coastal flooding each year
Environment	Fifteen to 40% of species face extinction. High risk of extinction of Arctic species, including the polar bear and caribou. More destruction of forests, wetland habitats and tropical coral reefs.
Abrupt and large-scale impacts	Potential for Greenland ice sheet to begin melting irreversibly, accelerating sea-level rise and committing world to eventual 7 metre sea-level rise

Source: Adapted from Römisch, 2008: 9.

In December 2015 at the Paris Agreement, countries committed to submit nationally determined contributions (NDCs), whereby they could set up nationally determined targets to reduce emission of greenhouse gases into the atmosphere and also possibly plan for adaptation to the likely impacts of climate change (Gagnon-Lebrun and Harris, 2016). All the Parties (including the largest gathering of world leaders) that attended the COP 21 assured the Conference of their emission-cutting pledges (World Economic Forum, 2018). COP 21's agreement to address and deal with the environmental risks associated with global warming

washailed by some as success and many supporters are of the view that changing human behaviour, activities and actions may help in reducing the concentration of greenhouses gases in the atmosphere by the end of the 21st century. It was a success in that at least an international agreement with treaty status was reached, which is better than what was achieved at COP-15 (in Copenhagen in 2009)(UNFCCC, 2019a).

3.8.7 The 23rd session of the Conference of the Parties-(COP23)

In his opening remarks at COP23, in Bonn, Voreqe Bainimarama (Prime Minister of Fiji), the co-chair said:

> "I bring a particular perspective to these negotiations on behalf of some of those who are most vulnerable to the effects of climate change…We owe it not to ourselves but to future generations to tackle this issue head on before it is too late" (Bainimarama, 2017 quoted in Johnson and Hunziker, 2017: n.p. para: 8. http://www.atlanticcouncil.org/blogs/new-atlanticist/fiji-s-cop23-presidency-highlights-climate-struggles-of-small-island-nations).

The Bonn Conference was an historical event as Voreqe Bainimarama (entrusted by the global community) became the first person from a Small Island Developing State to preside over the COP. Fiji saw this invaluable opportunity not only for itself but for all Small Island Developing States to bring their grievances and concerns regarding climate change (and efforts to adapt to and combat it) before the world.

> "...I am pleased and proud to report...that we are making a success of the task and will continue to do so. And we are well equipped to lead the climate action struggle all the way to COP24 in Poland and beyond" *(*President Voreqe Bainimarama, 2018 quoted in COP23, 2018: para: 43 and 44. https://cop23.com.fj/well-equipped-lead-climate-action-struggle-way-cop24-beyond-cop23-presidents-ministerial-statement-fijian-parliament/).

As with all COPs, and COP23 being no exception, there were some achievements and some shortfalls. There was some progress made regarding refining rules, which would help in verification of whether parties were actually reducing emissions as required. One major outcome of COP23 was the *talanoa* dialogue, where people floated their ideas on how to minimise present and future likely impacts of climate change. The *talanoa* sessions involved participants from all levels (global to local – cities and regions) in initial stocktaking exercises to monitor and prepare future

NDCs. It is very important to know how climate change is impacting communities at local level, and then only it will be possible to implement appropriate adaptation measures (International Council for Local Environmental Initiatives (ICLEI), 2018). The Least Developed Countries (LDCs) relied on the *talanoa* dialogue to reduce the global temperature to 1.5°C by strengthening NDCs (Abeysinghe, 2017).

Another objective of COP23 was to bring together contributions from various sectors, such as civil society, industry and the science, in coming years. Other major progress was implementation of the rulebook, where countries could measure and report their emissions of greenhouse gases. Another key development was the Nationally Determined Contributions (NDCs) Partnership, where developing countries could draw up and plan national climate action strategies (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, 2017). Nationally Determined Contributions were at the heart of COP23, with the aim of achieving long-term goals, such as outlining, preparing and communicating developing countries post-2020 climate actions (United Nations, 2018).

However, there were some frustrations. PIC leaders were disappointed that developed countries were not compensating island countries being threatened by climate variability and change. There was little progress on how the poorest and the most vulnerable people and countries would cope with losses and damages caused by climate variability and change (Abeysinghe, 2017). Most member countries found it difficult to complete their Rule Book by the end of 2018 because the recording involved small and steady reductions, careful measurement and transparency. Keeping the difficulties in mind, the member countries at COP24 were given an additional three years to complete their Rule Books (International Centre for Climate Change and Development (ICCCAD), 2019).

3.9 From international talks to local action: implications for study area.

GHG emissions are still growing and losses and damage are likely to be significant in Vatukarasa and Sovi Bay. The study sites are situated on coastal areas and are likely to be significantly affected by climate change. The participants stated that in the last sixty or seventy years, the study area has socioeconomically and environmentally changed due to sea level rise, inundation and coastal erosion. How these changes could be minimised or stopped is a major challenge for both the communities.

Adaptation to climate change at my study area will require large costs, and both communities will not be able to do this on their own. External assistance (both financial and technical assistance) is likely to be very much needed. All participants revealed with great sadness that they are not getting any help from regional or international organisations. All the help they are getting, such as repair and maintenance of roads is from the Fiji government.

3.10 Summary

Climate change threatens the survival of Pacific Islands and their people. Most countries in the South Pacific have limited institutional capacity to cope with and to adapt to the likely impacts of climate change. Multilateral and regional cooperation and help is needed to have a wider access to adaptation finance, and technical and scientific knowledge to support local knowledge systems and initiatives. Small island nations' abilities to implement mitigation and adaptation programmes can be significantly strengthened and made more effective, if the polluters could pay for the losses and damage they are causing to small island nations.

The next chapter outlines the likely impacts of climate change in Fiji and what is being done to minimise them. It will explore how traditional and scientific knowledge could be combined to find the least expensive, yet most effective, adaptation strategies to the likely impacts of climate change is exposed. The chapter examines the kinds of land ownership in Fiji, the importance of *vanua(*land and people) to *iTaukei*, how *iTaukei* are trying their best to safeguard their *vanua* and how to preserve their custom and traditional culture. It also focuses upon the descendants of indentured labourersfrom India who were brought to Fiji to work in plantations.

CHAPTER FOUR

Fiji - The land, its people and climate change

"*The Talanoa Dialogue now must give way to the Talanoa Call for Action. Together, we must recognize the gravity of the challenge we face – the need to increase our collective nationally determined contributions fivefold – five times more ambition, five times more action – if we are to achieve the 1.5 degree target...Together, we must commit to continue exchanging ideas and best practices...Together, we can overcome the greatest threat humanity has ever faced – with the entire global community eventually emerging more prosperous and more resilient*" (Voreqe Bainimarama, President of COP23, 2018 quoted in COP 24, Katowice 2018.https://unfccc.int/news/join-the-talanoa-call-for-action)

4.1 Introduction

Fiji is a large archipelago with approximately 320 islands located in the South Pacific, south of the equator, mostly on the western side of the 180th meridian (see Figure 4.1). The islands, with a land area of 18,270 km^2, are scattered over about 1.3 million square kilometres of an exclusive economic zone (EEZ) (Republic of Fiji, 2014). The population of Fiji in 2017 was 884,887 (Fiji Bureau of Statistics, 2018). This chapter outlines the likely impacts of climate change in Fiji and what is being done by the government to minimise them. It examines in detail the importance of the *vanua* to *iTaukei*. Land and village provide an indefinite place of security for *iTaukei*.

The chapter considers *iTaukei*, whose predecessors came to Fiji about three-and-a-half thousand years ago (Murti and Boydell, 2008) and Indo-Fijians who came in the early 20th century. Many *iTaukei koro* (villages) and Indo-Fijian settlements are often close to the sea, which may expose them to sea level rise and other likely impacts of climate change. This sets the platform to address the research question "Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay"? *iTaukei* love their land and are always connected to it. Even when the sea is right at their doorstep, they would be hesitant to relocate and even if they do move, they would be doing this with a "heavy heart" and with great sadness. Land is viewed with respect, loyalty, sacredness and spirituality by *iTaukei* (Ravuvu, 2005).

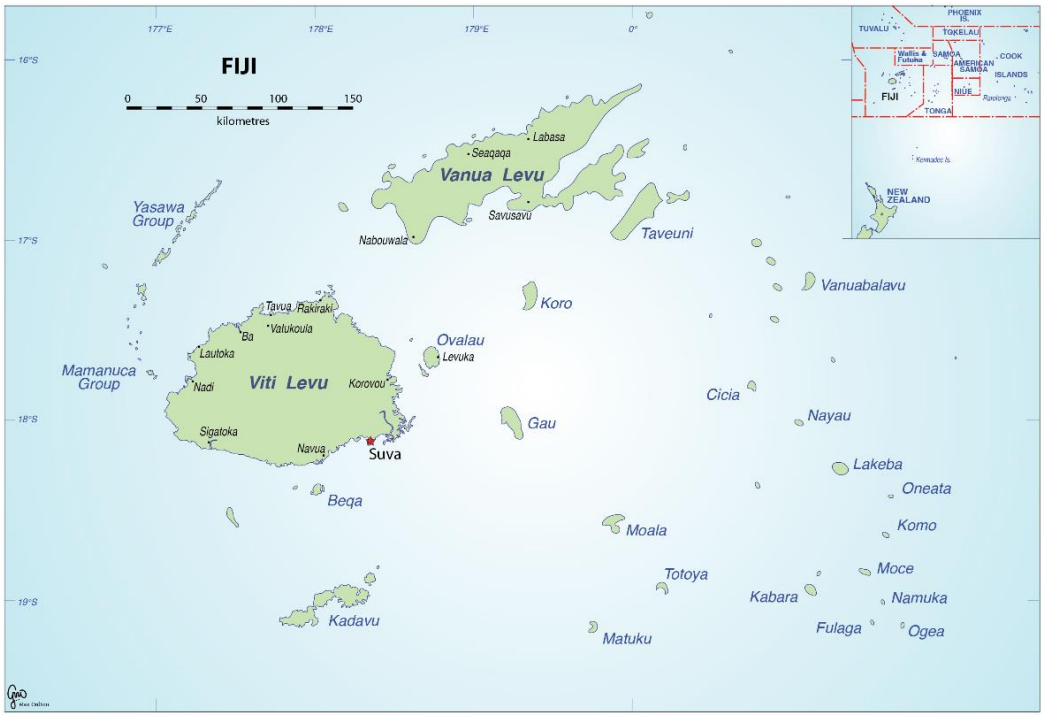

Figure 4. 1 Map of Fiji. Drawn by Max Oulton.

The chapter looks at the kinds of land ownership in Fiji. "In 1885, section II of the Native Lands Transfer Prohibition Ordinance 1875, prohibited the sale by Fijians of their land to non-Fijians, and this prohibition was extended to sales of Fijian land to all persons, except the Crown by Section 4 of the Native Lands Ordinance 1890" (Paterson and Farran, 2013: 13). This Act is making increasing numbers of Indo-Fijians landless, forcing many of them to live in areas which are more prone to the likely impacts of climate change. Indo-Fijians are not able to get loans from the commercial banks, because they do not have any security, such as land to take the loan against. This further intensifies the economic problems of many Indo-Fijians. *iTaukei* are also not able to use land as security to take loans from the commercial banks because the land does not belong to an individual but is held communally and is inalienable. Lt. Col. Sitiveni Rabuka claimed that he carried out the first coup in Fiji in 1987 to safeguard *iTaukei* land and the *iTaukei* way of life (Stanley, 1999). The chapter also seeks to show how *iTaukei* are struggling to safeguard their *vanua* (land and people). It also considers the role of chiefs in *iTaukei* affairs.

The chapter also outlines the arrival of indentured labourers, known as *girmitiyas*, from Bengal and Bihar, India, including their dispatch to different plantations and to different islands, their treatment, their stay in Fiji for over 140 years and why

Indo-Fijians are now leaving Fiji Islands and looking for greener pastures elsewhere.

How present and future impacts of climate change are likely to affect Fiji Islands, and how traditional and scientific knowledge could be combined to find the least expensive, yet most effective, adaptation strategies to respond to the likely impacts of climate change are also considered. The combination of traditional and scientific knowledge is considered to be imperative for Fiji, as increased climate variability is anticipated. The chances of extreme weather events, such as tropical cyclones, storms, and floods becoming more severe are almost certain and there is a possibility that some of these extreme events may become more frequent (Agrawala et al., 2003; National Climate Assessment, 2014).

4.2 National circumstances

The Fiji archipelago is situated on a complicated triangular tectonic plate that is, still not fully understood (Watling, 2005). Approximately three percent of the world's coral reefs are found in Fiji waters which also include the third longest barrier reef in the world, *Cakaulevu* (the great sea reef) (Techera and Troniak, 2009). The coastal areas of Fiji have diverse ecosystems, such as mangroves, and algae and sea-grass beds, which are surrounded by barrier, fringing platform and patch coral reefs (SPREP, 2012a). Two large islands, Viti Levu and Vanua Levu, dominate the land area of Fiji, and account for most of the population.

Administratively, Fiji is divided into four 'divisions': the Northern, Central, Eastern and the Western Divisions. The Western Division, in which my study sites are located, comprises the western half of Viti, the Yasawa islands and Vatulele. Fiji has a large indigenous population, largely living a traditional lifestyle, still adhering to numerous traditional practices and customary laws and spiritually and culturally connected with their *vanua* and *qoliqoli* (coastal lagoon, reefs, nearshore and marine areas). Today, for most *iTaukei* Christianity has become a major aspect of their daily life (Techera and Troniak, 2009).

4.2.1 The physical environment

The 320 islands are located between latitude 15°N and 20°S and between177°E and 178°W. Most larger islands are volcanic (with steep deeply incised terrains cut by perennial streams and rivers) in nature and a few smaller ones are coral islands. The coastal areas are generally flat, and interiors are mountainous. Most islands have

leached volcanic soils although deltas and flood plains are characterised by fertile alluvial soils. Fiji has a hot and wet tropical oceanic climate. The dry period is between May and October, with temperatures ranging from 23°to 25°C and the wet season is from November to April, with temperatures ranging from 26° to 27°C. This wet period is also known as the "hurricane season" as most of the tropical cyclones develop (usually north or north west of Fiji) during this period and in El Niño years they occasionally occur in October and May. On Viti Levu, the mountain ranges and prevailing southeast trade winds influence the rainfall distribution (Kumar et al., 2013). The windward side (east) receives between 3000mm to 5000mm of rainfall and the leeward side (west) ranges from 2000mm to 3000mm. The three large river systems (Rewa, Sigatoka and Ba) drain approximately 70 percent of Viti Levu (Republic of Fiji. 2014).

On the south and east sides of the main islands, the vegetation is tropical forest with dense undergrowth of bushes, creepers and ferns. On the western flanks the vegetation is of thin forest and extensive grassland and degraded soils (known locally as *talasiga*) (Keppel and Tuiwawa, 2007; Spriggs and Scarr, 2014). "Palynological evidence suggests that, before the arrival of people some 3000 years ago, much of the present day *talasig*a grassland on Fiji's largest island, Viti Levu, was covered with forests" (Keppel and Tuiwawa, 2007: 546). The *talasiga* (sun-baked) soils are most likely the result of degradation by fire (human induced) and surface runoff (Cairns, 2015). Some western rain forest remnants are now only found on some of the steepest and most inaccessible slopes that have limited potential for agriculture. The vegetation is determined by the topographical features, climate and how it is impacted by human settlement. There is a wide range of marine and coastal ecosystems, ranging from various coral formations to extensive areas of mangroves. (Agrawala et al., 2003; Berdach, 2005; Derrick, 1951; Republic of Fiji, 2014).

4.2.2 Demographic characteristics

Fiji's population is growing at an annual average rate of 0.6 percent (Reece, 2018). It is relatively young, with more than half the population below the age of 27.5, about 69 percent below the age of 40 (Fiji Bureau of Statistics, 2018). Approximately a third of the population lives below the basic needs poverty line of $6,000-$8,000 annual household income (Republic of Fiji, 2014). Wolfensohn (2003), former President of the World Bank, defines poverty as "living below a minimum level of income... lack of adequate food, shelter, health, education and

influence over decisions that affect one's life" (quoted in Khan et al., 2011: 97). The UNDP and Government of Fiji (1997) poverty report identified three different types of poverty in Fiji, namely food poverty (people not having adequate food for basic sustenance, *iTaukei* 10.4%, IndoFijian 9.2%), basic needs poverty (unable to meet the basic requirements, such as being unable to provide shelter, clothing and education, *iTaukei* 27.7%, Indo-Fijian 31%) and relative poverty (people lacking minimum amount of income to maintain the average standard of living, *iTaukei* 31.3%, Indo-Fijian 34.5%) (Prasad and Tisdell, 2006).

Fiji has more than 180 informal settlements, where approximately 140,000 people (17 percent of the total population) live (Habitat for Humanity Australia, 2014). Eighty percent of the individuals living here have a weekly income of less than $F90.00. Also, these residents do not have access to piped water supply, or electricity. They have pit latrines and no proper method of refuse disposal (Habitat for Humanity Australia, 2018). Nevertheless, overall, life expectancy has improved in Fiji and it is relatively high for both women (71) and men (66) (Government of Fiji, 2016a).

4.2.3 Cultural aspects

The first people, Melanesian ancestors of the *iTaukei* were the "Lapita people", who came to Fiji about three and a half thousand years ago (Clark and Anderson, 2009). Melanesians were renowned gardeners, potters and keepers of pigs. (Thompson, 1938). The indigenous Fijians call themselves *Kai viti* or *iTaukei*, meaning "the people of Viti" and "the owners of the land" respectively (Government of Fiji, 2010; Nabobo-Baba, 2006).

Fiji was 'explored' in the 17th and 18th centuries by Dutch and British sailors respectively. Then in the 19th century followed whalers, sandalwood and bêche-de-mer traders, colonists (including plantation owners), missionaries and then *girmitiyas* from India to plant and harvest sugar cane under the indentured labour system. The Wesleyans were the first missionaries (Rev. William Cross and Rev. David Cargill) to come to Fiji in 1835 from England. They not only preached Christianity but also changed the traditional living style of *iTauke*i (Nabobo-Baba, 2006).

Fiji has a rich diversity of customs, festivals, religious faiths, languages, institutions, forms of entertainment and foods. Under the constitution, freedom of religion is guaranteed, and this is generally respected. *iTaukei* society places huge

importance on the family unit, the village, the district, the province and the *vanua.* They have various regional traditions, such as the firewalkers of Beqa. The *tabua* (whale's tooth) is considered sacred and it is used in both private and public ceremonies. *iTaukei* are mostly Methodist, though there are many Christian denominations. The Indo-Fijians are mainly Hindu, Muslim and Sikh (Nabobo-Baba, 2006).

Fiji became a British Colony (ceded by thirteen Fijian chiefs) in 1874 and was under British rule for 96 years before gaining its independence on 10th October 1970 (Sutton, 2005; Kaplan, 1995). After 17 years at midnight on 7th October 1987 Col. Sitiveni Rabuka staged a coup d'état and declared Fiji to be a republic (Stanley, 1999). He explained his actions in moving to defend the rights of the *iTaukei* and ensuring the Indo-Fijians would live in peace and harmony with *iTaukei*. A coup was the only way in his view to achieve this (Dean and Ritova, 1988; Marg, 1988).

Whatever the reason(s) may be, a series of coups carried out by Sitiveni Rabuka (first on 14th May 1987 and second on 1st October 1987), George Speight (on 29th May 2000) and Voreqe Bainimarama (on 5th December 2006) has affected everyone in Fiji, both *iTaukei* and Indo-Fijians, and particularly the poorer members of both communities (Head, 2000; Lal, 2009; Ramesh, 2004). After the 2006 coup the overall GNP of the country fell by 6.6 percent for the year 2007, whereas the previous year, 2006 showed economic growth of 3.6 percent (Fraenkel et al., 2009). Since then there has been steady annual economic growth at 2.5 percent in 2012 and 2.75 in 2013 (Fiji High Commission to the United Kingdom, 2019).

Many people in Fiji saw coups as the lost years, increasing racial tension and conflicts, bringing economic difficulties, expanding poverty, growing unemployment, increasing the brain drain, creating a lack of confidence and deteriorating law and order (Singh, 2001). However, five years after the most recent coup Voreqe Bainimarama, had a strong approval rating of 66 percent and a majority of the people of Fiji registered that government was doing a good job at listening to people and in delivering major social services such as education, transport and health (Hayward-Jones, 2011). Since the coup there have been two elections in which he has been returned as Prime Minister.

4.3 Types of land in Fiji

As per the Deed of Cession, all the land in Fiji was vested in the Crown, except all that had already become the property of foreigners and *mataqali* (*iTaukei* kinship group or clan) land. The best land (by the seaside and on the riverbanks) in Fiji was obtained by early Europeans (Ewins, 1998). The Native Land Trust Board (NLTB), now known as the *iTaukei* Land Trust Board (TLTB) has authority to lease out land which is not used, occupied or required by indigenous *iTaukei* (Baledrokadroka, 2003; Taylor, 1987; Head, 2000). The British administration determined in 1879 that Fiji *mataqali* (communal) ownership would be the standard land tenure system (Murti and Boydell, 2008).

In Fiji land is divided into three types (see Figure 4.2): freehold land (8 %), State (previously Crown) land (4 %) and *iTaukei* land (88 %) (Tuisabeto, 2018). In Fiji, Indo-Fijians do not own much land and they mostly lease agricultural land from *iTaukei* (Gunnehill 2007: 7) through the TLTB.

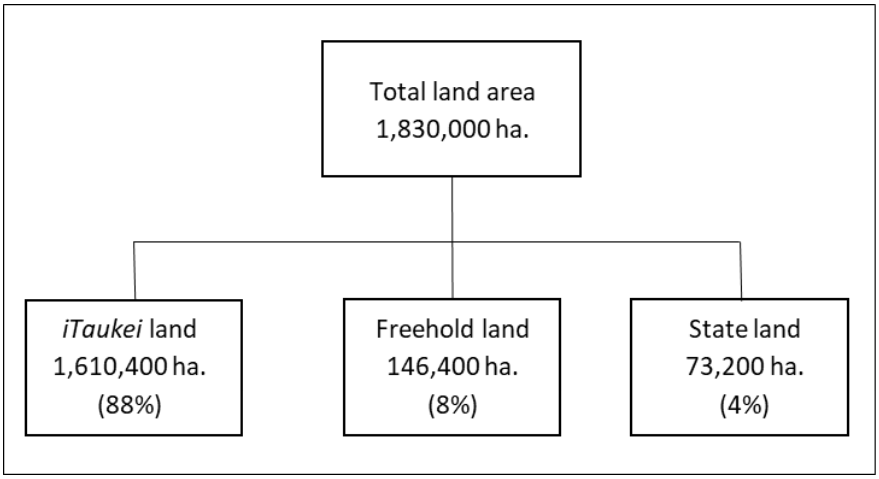

Figure 4. 2 Land tenure by area in Fiji in 2018. Adapted from Tuibeto, 2018: 3

There are five Acts which affect land administration in Fiji:

1. Native Land Act 1905 (now known as *iTaukei* Land Act)
2. Native Land Trust Act 1940 (now known as *iTaukei* Land Trust Act)
3. Crown Lands Act 1946
4. Land Transfer Act 1971

5. Agricultural Landlord and Tenant Act (ALTA) 1966 with major amendments in 1977 (Ushman, 1984).

The two latest amendments to the Native Land Act 1905 and Native Land Trust Act 1940 are the *iTauke*i Lands (Amendment) Decree No. 21 of 2012 and the Native Lands (Amendment) Decree No. 7 of 2011 respectively. The 2011 Act (amendment) also replaced the terms "Indigenous Fijian", "Native" and "Fijian" with *iTaukei* in the legislation (Tuisabeto, 2018).

iTaukei land cannot be sold as freehold land but can be leased out through the *iTaukei* Land Trust Board (TLTB) mostly to Indo-Fijians (Department of Town and Country Planning, 2015; Lal et al., 2001; Overton and Banks, 1988). There are over 40,000 leases (see Table 4.1) of different types such as agricultural, industrial, commercial, residential, logging licences, gravel extraction licences, conservation leases and leases for other aspects of development (Tuisabeto, 2018). All native land is administered by TLTB under the *iTaukei*Land Trust Act (Sutton, 2005).

Table 4. 1 Lease portfolios

Year	Total No of leases	Land area leased (hectares)	Rentals received (F$)
2015	39,823	170,853	32,243,635.97
2016	40,531	167,490	33,741,355.14
2017	42,123	168,214	35,440,603.03

Source: Adapted from Tuisabeto, 2018: 15

There are approximately 8000 *mataqali* (Tuisabeto, 2018). "The official distribution of rent is 25 percent to the TLTB, 5 percent to the head of the *vanua,* 10 percent to the head of the *yavusa* [kinship unit made up of two or more *mataqali*], 15 percent to the head of the *mataqali* and 45 percent to the members of the *mataqali*" (Bolabola, 1978 quoted in Ewins, 1998: 160). Within customary land, there is a particular type of land known as *qele kovu* (reserve land), which is set aside or reserved for use by only the customary landowners or *iTaukei*.

The TLTB, since 1997, has not been very much interested in renewing the leases of Indo-Fijian farmers and even when it does, the rent is calculated on the improved value of the land, which most farmers are unable to afford and they often have no

option but to leave the land (Brear, 2002). All improvements made during the period of lease have to be handed over to the *mataqali* on its expiration, without compensation (Coulter, 1967; Davies and Gallimore, 2000). Some of these farmers have to seek cheaper land rental elsewhere and relocate. This may make Indo-Fijian farmers more exposed and vulnerable to climate change than the *iTaukei* farmers as they may acquire land that is marginal, close to the sea or in flood prone areas.

The freehold lands (mainly concentrated in and around major towns, cities and urban centres) are mostly purchased by non-*iTauke*i. As these lands have a freely transferable title and can be bought outright by anyone, they are very expensive (Ewins, 1998; Ushman, 1984). While Indo-Fijians make up less than 40 percent of the population, the great majority are unable to be owners of the land and the most they can be are the lessees. This may create difficulties. For example, a *mataqali* may say yes to renewal of land leases, but the TLTB can say no, and the lease will not be renewed (Cresetto, 2005).

"As a result, Indo-Fijians are among the largest category of landless people in Fiji. This is a source of anxiety and hardship as they often have no other means of sustenance and feel a real sense of political marginalization" (Naidu et al., 2013: 9). The non-renewed land leases are creating more insecurity and an increasing air of resentment between *iTaukei* and Indo-Fijians (Ewins, 1998; Naidu and Reddy, 2002). "The short term tenure may not be ideal as the owner may be more likely to exploit in the short term as opposed to those on longer or freehold tenure" (Bullard, 2002: 8). Secure land tenure in addition to greater and improved equity in land access supports sustainable development, which in tern can improve household livelihoods and reduce poverty (Naidu and Reddy, 2002; Bullard, 2002). Renewal of leases and longer land tenure security can increase farm productivity due to more incentives for both farmers and lenders (see Figure 4.3).

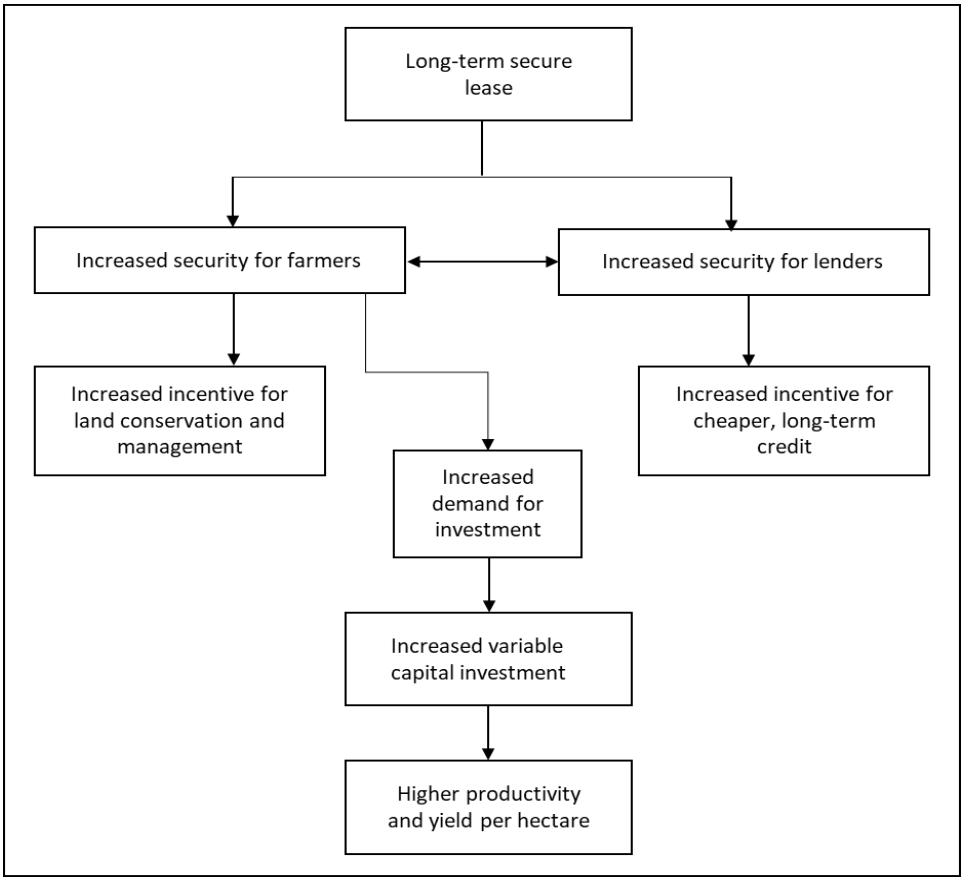

Figure 4. 3 Longer land tenure security can benefit both the lender and farmer. Adapted from Prasad and Tisdell, 2006: 127.

4.4 The importance of the *vanua*

Vanua embodies *iTaukei* beliefs, values, ways of doing things and it also underpins social structure and people's relationships to one another (Ravuvu, 1991). The *vanua* provides the opportunity whereby the adults, traditional leaders and parents teach their children important values, which are needed for a good life and spiritual well-being (Cagivinaka, 2016).“The *vanua*... is an extension of the concept of the self. To most Fijians, the idea of parting with one's *vanua* or land is equivalent to parting with one's life” (Ravuvu, 2005:70). The more an *iTaukei* observes and practices the laws of *vanua*, the more likely he/she will have *sautu* (good health and wealth) (Farrelly and Vudiniabola, 2013).

Vanua is not only how a social group identifies itself to land (*naqo kalou, naqo vanua*; my God and my land), but also how it is connected to the cultural and social aspects of the physical environment (Ravuvu, 1983). To *iTaukei*, *vanua* means one's identity, land, culture and social status. *Vanua* also means a combination of several villages or districts; in other words, *yavusa* comes under *vanua* (Veitayaki, 1998). Land and individuals are not separable as they define each other (Ravuvu,

1987; 1983). Land is the source of *iTaukei* security, pride and identity. Land is tied to *iTaukei* and *iTauke*i are tied to land. There is a spiritual relationship between *iTaukei* and land (Ewins, 1998). For *iTaukei, vanua* is a way of uniting and reinforcing identity (Crosetto, 2005). *Vanua* is blood that flows in veins and for Fijians losing *vanua* is like experiencing a "heart attack" (Tarabe and Naisilisili, 2008). This is one reason why indigenous *iTaukei* are so protective about their land and associated marine resources.

The concept of *vanua* and what it means to *iTaukei* is very well and effectively explained by Ravuvu. "...the concept of *vanua* is an encompassing one; it is the totality of a Fijian community. Used in various contexts, it can refer alternatively to the social and physical environments, or to the supernatural world, or to all the elements which make life occur" (Ravuvu, 1987: 15). To *iTaukei* the *vanua* means everything on the land and in the sea, including all flora and fauna, all marine species, mountains, rivers and valleys (Cagivinaka, 2016). The *vanua* is even entangled in *lotu* (religion). The *vanua* and *lotu* are closely related and have been associated since the start of Christianity (Tuwere, 1987). Each *vanua* has ownership claims and rights to use a particular area, which are summarised in Table 4.2.

Table 4. 2 Ownership claims of a *vanua*

Fijian terms	English translation
Qele ni teitei	Garden lands or farms
Veikau	Forest land or bush land
Yavutu	Founding ancestor's house sites
Qoliqoli	Fishing area

Source: Adapted from Ravuvu, 1983: 76-77.

Land ownership is an extremely sensitive issue and major cause of ethnic tension and conflict in Fiji (Gunnehill, 2007). *iTaukei* are identified by their 'home places', which are summarised in Table 4.3.

Table 4. 3 'Home places' *iTaukei* are identified with.

***iTaukei* terms**	**English translation**
Yavu	Ancestral house foundation
Koro	Village
Koro ni vasu	Mother's village
Baravi	Coastal area
Tikina	District
Yasana	Province
Yanuyanu	Island, or island groups

Source: Adapted from Cattermole, 2009: 158-159.

Ratu Sir Josefa Lalabalavu Sukuna, an early Fijian statesman, established the Native Land Trust Board (NLTB) in 1930, after suggestions from Colonial Administrators (Murti and Boydell, 2008). In a speech to the Council of Chiefs in 1936, Ratu Sukuna said: "It is thoroughly understood that the control of our lands is in our (Fijian) hands, but the owner of property has an important duty to perform...to utilize what they possess for the benefit of all... Should his holding be more than he can utilize, he should lease the surplus to those that can make use of it... it is our duty to use our influence, our power, to open up waste *mataqali* lands for agricultural purposes, whether they be taken up by Europeans, Indians or Fijians" (Quoted in Ushman, 1984: 97-98).

For *iTaukei*, *vanua* and traditional knowledge (locally developed and with potential to effectively contribute towards sustainable environment practices) are interrelated. The concept of sustainability among *iTaukei* is often linked to their way of life and culture (*vanua*) (Cagivinaka, 2016; Nabobo-Baba, 2006). Sustainable natural resource usage and management in a traditional society, as with *iTaukei*, is driven by the behaviours and beliefs of local communities, and their cultures are strengthened by their close and personal connections to the physical environment and resources that sustain them (Cagivinaka, 2016). The significance and advantages of traditional knowledge are further discussed in Section 4.6.

4.5 The *qoliqoli*

Qoliqoli (customary fishing rights areas) are traditional fishing grounds or marine areas, managed and controlled by the *iTaukei* living adjacent to them. "*iTaukei* and the coastal environment are strongly connected" (Minter, 2008: 4). The chiefs, under the Deed of Cession gave Fiji to Queen Victoria without any conditions. After independence, the land (without the issue of *qoliqoli* being solved) was returned to *iTaukei*. The *qoliqoli*are parts of villages, districts and provinces, which can be explored, exploited and utilised by related kinfolkfor their food, most importantly protein (Ravuvu, 1983; Golden et al., 2014). For administration purposes the *qoliqoli* (an extension of the land boundary) is registered by the Provincial Council (Minter, 2008).

There are 410 *qoliqoli* in Fiji, of which 385 are marine and 25 freshwater, and they support approximately one third of the country's population (UNDP, 2012). The definition and ownership of *qoliqoli* differ from one place to another. At one site, the *qoliqoli* may be owned by a province (*yasana*) or by several districts (*tikina*) in a province or by a single or several *yavusa.* Each *mataqali* would have a specific or identified area of the *qoliqoli* to feed from. Certain parts of the *qoliqoli* can be placed under *tabu* (prohibition) for some time to replenish and provide adequate fish for special occasions, such as marriages and farewells (Nainoca, 2011).

There has been a long and difficult struggle by the *iTaukei* to restore *qoloqoli* (near shore marine rights) in order to control and look after their fishing grounds. This has become more important than before because of the need to increase, maintain and monitor the number and the type of fish species as these are likely to be negatively affected by overfishing and climate change (Baba, 2006). To *iTaukei* their *qoliqoli* is their designated fishing ground (Gounder, 2009). A person who is not a community member of the *qoliqoli* and does not have the right to fish can still apply for a fishing license from the Fisheries Department, under the Fisheries Act, Section 13, to fish within a designated area, with the license only being issued when written consent is given by the *qoliqoli* owners (Nainoca, 2011).

A fishing licence can be issued subject to certain conditions, such as protection of *tabu* areas. "A map of the *qoliqoli* including restricted *tabu* areas is included on the back of every licence to ensure that fishermen are aware of the restrictions" (Minter, 2008: 14). Before a fishing licence is given, the *qoliqoli* committee usually imposes a goodwill payment and this amount differs among committees and communities. According to Minter (2008) this payment (which is still practiced) is

unconstitutional and racially based. The Macuata (a province in Vanua Levu) goodwill payment system is summarised in Table 4.4.

Table 4. 4 Macuata goodwill payment

Amount	**For**
$1000	*iTaukei*
$5000	Indo-Fijian
$20,000	Business

Source: Adapted from Minter, 2008: 29.

The Qarase Government of 2000-2006, introduced the *Qoliqoli* Bill to return ownership of *qoliqoli to iTaukei*. It did not proceed however, as it aroused much controversy, especially from coastal resort owners (Paterson and Farran, 2013). Baba (2006) reviews the historical justification for the *Qoliqoli* Bill, and Bryant-Tokalau (2010) has highlighted the significance of the Act for urban dwellers but wider discussion is very much limited (Bryant-Tokalau, 2014).

The proposed restoring of *qoliqoli* in 2006, which would enable *iTaukei* to manage their land and marine resources, was very much appreciated by *iTaukei* (Egli et al., 2010; Fong, 2006). Many *iTaukei* owners living close to the sea have claimed the ownership of coastal areas, such as lagoons, foreshore and reefs in recent years. The *Qoliqoli* Bill would have had some serious consequences, and some are already apparent in Suva, where money is being demanded from coastal squatters by indigenous owners. In some cases, the settlers have been forcefully removed from where they have lived for generations (Bryant-Tokalau, 2010). The passing of the bill would have transferred all traditional fishing areas to *iTaukei*. The *qoliqoli* would have been managed and regulated by a Commission, which would have appointed guardians and would have issued fishing licences (Lal, 2009; Narayan, 2008).

Voreqe Bainimarama, described the *qoliqoli* bill as unconstitutional, racist and damaging to tourism and this was one of the reasons he carried out the 2006 coup. Also, many others (NGOs, the military, a host of *iTaukei* groups and individuals, hotel operators and businesspeople) were against the introduction of the *qoliqoli*

bill. This bill would have affected and imposed many restrictions on Indo-Fijians and all other non-Indigenous residents and citizens over the use or ownership of the sea (travel, trade and resource exploitation) and lands in Fiji (Bryant-Tokalau, 2010).

4.6 Traditional knowledge in Fiji

Traditional Environmental Knowledge (TEK), which is both dynamic and cumulative, with traditional roots, is the knowledge and beliefs including experiences of earlier generations, which is passed on mostly orally from one generation to the next. In this thesis I explore its potential to help communities to adapt to contemporary socioeconomic and technological changes (McNamara and Prasad, 2013; Stevenson, 1996). TEK is composed of three components which are interrelated: First, specific environmental knowledge; second, knowledge of relationships among ecosystems; and third, a code of ethics governing environmental and appropriate human relationships (Stevenson, 1996). Indigenous people across the world are using their traditional knowledge to adapt to changing climate (both slow onset and rapid onset events) (Betzold, 2015; Leonard et al., 2014; Pollard et al., 2015; Theodory, 2016). Traditional Ecological Knowledge is acquired by people living in close contact with, and having a better understanding of, their environment (Society for Ecological Restoration, 2016) and is knowledge which develops and is tested over long time periods (centuries or more). This knowledge is used to adapt to changing environments and is so integral that it has become part of communities' local culture (Gounder, 2009; Theodory, 2016).

Traditional knowledge emphasises factors that are essential for local livelihoods, self-security and well-being (Pollard et al., 2015; Gyampoh et al., 2009). Earlier climate change studies tended to ignore traditional knowledge, but now the scientific community dealing with or focusing on climate change has come to realise that traditional knowledge can be a catalyst to complement scientific climate data and can help to identify adaptation strategies or find solutions to changing climate, which would be culturally and locally appropriate. Use of traditional knowledge can deepen and quicken the process of inventory preparation of the ecosystems and biological and physical resources of an area. Traditional knowledge, when synthesized with local and scientific knowledge, can help in environmental monitoring, project regulations and in drawing up environmental plans (Clarke, 1990; Makondo and Thomas, 2018).

In Fiji people (both *iTauke*i and Indo-Fijians) have developed relevant adaptation measures to reduce the likely impacts of climate change, using traditional knowledge, such as weather forecasting (by observing changes in the moon and stars), increasing food security by planting varieties of crops, by collecting mature food from gardens prior to tropical cyclones and by risk reduction (moving to higher grounds in response to danger of flooding). Traditional knowledge in the Pacific (Fiji being no exception) is passed on through dances, songs, everyday *talanoa* and sharing experiences with one another (McNamara and Prasad, 2013; Meo-Sewabu, 2014).

A survey conducted by McNamara and Prasad in 2013 in three villages in both Fiji and Vanuatu showed that traditional knowledge is an essential component to enhance adaptive capacity of local communities. This is summarised in Table 4.5.

Table 4. 5 How traditional and local knowledge in Fiji and Vanuatu can be utilised to reduce the likely impacts of changing climate

Adaptation to:	**Strategies employed**
Coastal erosion and sea level rise	Planting of trees and grasses along the coastline. Shifting of houses further inland. Shifting of gardens further inland from the sea to minimise the exposure of crops to salt spray. Replanting of vegetation such as mangroves and *vetiver* grass. Piling of huge boulders along the beach.
Droughts	Dry conditions can cause *dalo* suckers to die, so Fijian farmers pull out the 'mother' *dalo* and this way young suckers are saved. Farmers also plant quick maturing crops, such as *kumala* and cassava before the dry season to have better food security. Some inland villagers make provisions for temporary short-stay houses near the coast. When the inland water supply finally runs out then the villagers temporarily move to the coast where the water is collected from the springs along shore and used conservatively for cooking, drinking and washing. Once the inland streams recover, the villagers move back to their inland villages.
Floods	In the farms the villagers dig channels to reduce the damage of floodwaters to their crops. Hornets making their nest well above the ground level (treetop) are a sign of an approaching flood,

	or when hornets bring their nests down to ground level, it is a sign of a tropical cyclone
Tropical cyclones	Division of labour between men and women. Men secure homes (nailing boards on glass windows, concrete blocks and sacks filled with sand placed on roof-tops to secure roofs), moving livestock to leeward side of hills or big community hall and bringing of boats closer to the shore and submerging them in water to reduce the likely damage. Men also prune the crops to reduce surface area exposed to strong winds and collect mature fruits and crops and cook in a *lovo (*an underground oven pit) so it could be preserved for a longer period. Once the cyclone has passed men usually plant crops, such as *kumala* and corn that mature quickly to minimise the problem of food shortage. Women on the other hand take care of children and elderly. All to come to designated buildings such as the village church with their necessary emergency backpacks. The village chief can use a seashell (conch) or the beating of *lali* (modern drum) to inform the villagers about imminent dangers, such as storms or cyclones. The families where the disaster has not happened help the affected members morally and financially where disaster has happened.

Source: Adapted from McNamara and Prasad, 2013: 2/8-6/8.

Traditional ecological and environmental knowledge is highly valued by the older rural *iTaukei* and even Indo-Fijians and many still believe that *talanoa* and oral instructions are the most appropriate and effective methods of passing this knowledge from one generation to the next (Janif et al., 2016). In the past, *iTaukei,* especially the elders, always emphasised "*dou maroroya vinaka nanomudou vanua",* which means the resources and land should be used sustainably, so that future generations could enjoy what the present generation is enjoying now and the tradition and culture could be preserved, which is needed for *sautu* (Cagivinaka, 2016). Traditional environmental knowledge can be an important source of information to improve and better the processes of observation, mitigation of and adaptation to, the likely impacts of climate change (Gyampoh et al., 2009; International Fund for Agricultural Development (IFAD), 2016).

One of the most important components of traditional disaster reduction in Fiji is producing and having food surpluses, which can be used for emergency and

ceremonial purposes. Another important element is food storage and preservation as much of the food is seasonal. Some root crops can be left in the ground and used later-on. Dry *niu* (coconuts) with *qanibulu* (husk) can be kept for months and used as required. Breadfruit and *dalo*, left to ferment in a pit lined with leaves and covered with sand, can be retrieved and used as required. Another way of traditional disaster reduction is by planting a range of different crops, as different crops are affected differently by environmental extremes. *Dalo* is less resilient to high winds compared to yams and on the other hand water logging can have negative effect on yams (Campbell, 1984; 2006; 2015).

In Fiji, both wild (periodic food sources) and farmed crops are consumed, and they complement each other and increase food security. Because of people's skills and traditional knowledge, they are able to survive on wild food sources, such as poisonous giant *dalo* species (Alocasia), which they know how to treat in order to remove toxins, and during droughts people survive by drinking coconut water, sugar cane and vines. Traditional medicinal plants were freely available in *iTaukei* society and were commonly used. For common colds *titi* (Rhizophora sp), *cago* (Zingiber zerumbet), *tavola* (Terminalia catappa), *bati madramadra* (Bidens pilosa) and *cevucevu* (Physalia angulata) were used. For sores and cuts *totodro* (Cantella asiatica), *niu* (Cocos nucifera) and *wa bosucu* (Mikania micrantha) were mostly used to treat wounds and they were very effective (Veitayaki, 2002). Traditional medicine and indigenous healing have great potential. There are cases where indigenous healers had cured sick people after hospital treatment had failed. The medicine men, women and healers were wildly known, utilised and respected in their *koro* and surrounding areas (Katz, 1999).

Traditional experience, wisdom and knowledge are valuable tools and still relevant for Fiji and its people. Traditional ecological and environmental knowledge can be best utilised for the use of traditional resources (for example, to maximize or to restrict harvesting) and the owners of the knowledge need to be recognised, respected and appreciated, as these are the people who have best knowledge about natural resources. These people can be vital source for resource management arrangements, contemporary development strategies and sustainable development planning (Veitayaki, 2002).

4.7 *iTaukei* community

From birth *iTaukei* are obliged and accustomed to share, care and do things collectively as members of a *vanua*, which culturally embodies not just the land but

also the beliefs and values of people of a common locality (Ravuvu, 1987*). iTaukei* are closely bonded and members of a family unit can turn to other members for any traditional or economic help (Hassall, 2005; Ravuvu, 1983). An ideal *iTaukei* should show *loloma* (kindness and love) not only to his people but to all. He/she should offer and provide support and encouragement on his/her own accord, to whoever is facing difficulties or depressed. This sets a strong platform and obligation to share with family members and to contribute towards communal gatherings, functions, causes and events. *iTaukei* live in kin groups, which are generally autonomous and independent, with political and social connections with one another (Hassall, 2005; Ravuvu, 1983; 1987).

4.7.1 Social structure

Indigenous *iTaukei* society is organized around kinship and chiefly hierarchy, tradition and relationship systems (Arno, 1993; Brison, 2001; Cagilaba, 2005). *iTaukei* society is divided into two groups – commoners and chiefs, ascribed by birth and descent in the male line. The word *saka* (sir) or *Ratu* is usually used when talking to someone born in a chiefly family. Another ranking of individuals in *iTaukei* society is based on seniority, age and gender. The most senior male is the head of the household; the men have higher authority than the women; and the same goes for older people over the young (Nayacakalou, 1978). *iTaukei* social structure is varied and like any culture is changing continuously (Nayacakalou, 1978; Ravuvu, 1983).

Senior *iTaukei* have great significance in their society. Senior males are generally present during economic and social activities (discussing and organising) to encourage and inspire the young. In comparison, senior *iTaukei* females spend most of their time at home baby-sitting and mat weaving, keeping the dwelling house occupied as it is important not to leave houses empty (Ravuvu, 1983). But these practices over the years are slowly changing.

In *iTauke*i society, typically communities have several alliances in their hierarchical order. *Matavuvale* is the nuclear family and then comes *i-tokatoka,* which is sub-lineage or extended family or the household of a group of brothers. Next is *mataqali,* made of several *i-tokatoka* or family units in each village. In turn, *mataqali* make up *yavusa*, which are larger tribes and then several *yavusa* make up a *vanua.* Several *vanua* combine to form a larger alliance, known as *matanitu* (Cagilaba, 2005; Hassall, 2005; Nation, 1978).

iTaukei communities are typically self-reliant and self-sufficient, based on communalism (Baker-Jones et al., 2013). The society's hierarchical order and traditional social structure is still respected and is intact despite colonisation, arrival of indentured labours from India, modernisation and globalisation (Biturogoiwasa and Walker, 2001; Rajotte and Bigay, 1981). The *iTaukei* social structure has survived for so long mainly due to *veiwasei* (sharing), *veikauwaitaku* (caring), *dua vata* (togetherness), *veilomani* (loving and being friendly) and *doka* (respect) for one another's property. *iTaukei* are actively devoted to reinforcing, developing and promoting social relationships (Becker, 1995). An *iTaukei* male may not be able to separate himself from his village and his people (Ravuvu, 1987). Christianity and church also play a very significant role in contemporary *iTaukei* life (Biturogoiwasa and Walker, 2001; Ratuva, 2006; Ravuvu, 1988; Toren, 1999).

iTaukei identity is built around and based upon *vanua*, *lotu* (the Church-Christianity) and *matanitu* (the government). These three pillars are closely interrelated and if one is affected then the whole is affected (Walsh, 2006). To have a smooth and continued functional interrelationship among these three components, the most important requirement and ingredient is co-operation, mutual respect and trust (Tuwere, 1987). Trust is not only important at the level of government and non-government organisation but also at individual, *itokatoka*, *mataqali*, *yavusa* and *vanua* level. "A frequently used term to describe a person of integrity who can be trusted is *tamata dina*" (Gounder, 2009: 108).

4.7.2 iTaukei administration

The British Colonial government, after 1874, established a system of indirect rule over the *iTauke*i people. A separate Fijian administration was created by Sir Arthur Gordon, with a "protectionist policy" for the *iTaukei* people (Appana, 2012; Fraenkel and Firth, 2007; Sienkiewicz, 2000). The administration was a form of local government which had jurisdiction over all *iTaukei*. The duty of the administration was appointment of "native" officials and setting responsibilities forgoverning and smooth running of the affairs ofvarious provinces (Roth, 1951). Indirect rule was a "government within a government" (Appana, 2012: 54). This was a customary system of government, which emphasised the principles of *iTaukei* holding and preserving their land rights (Ravuvu, 1983). Many of the regulations and ordinances of the Native Regulation Board set up by Sir Arthur Gordon are still retained in the current *iTaukei* Affairs system, with only slight modification (Appana, 2012). The Fijian administration was "...a system empowered by law to

organize some of the activities of the Fijian people for their own social, economic and political development, as well as for the preservation of their traditional way of life" (Nayacakalou, 1975: 85)

iTaukei have a special ministry in the government, which looks after the welfare of the indigenous Fijians; the Ministry for *iTaukei* Affairs, formerly known as The Ministry of Fijian Affairs (Figure 4.4). The Ministry's aim is also to provide tertiary education for indigenous *iTaukei* and to have a system to maintain effective communication with *iTaukei* at all levels of society (Ministery for *iTaukei* Affairs, 2010).

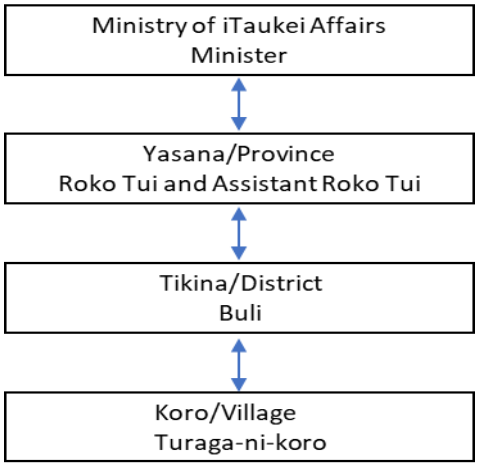

Figure 4. 4 *iTaukei* administration structure. The top of each box gives the name of the administrative unit and the lower entry is the title of the senior officer. Adapted from Nainoca, 2011: 63.

As Indo-Fijians do not fall under the Provincial Act, they are governed under the National and Local Government Act. *iTaukei*, too, are governed by the National and Local Government Act, but they also have fourteen provincial councils, overseen by the *iTaukei* Affairs Board (Republic of Fiji, 2018). The Republic of Fiji (for administration purposes) is divided into four divisions and a commissioner, appointed by the national government heads each division (United Nations, 2004).

4.7.3 Roles of chiefs and turaga-ni-koro

The chiefliness, tradition and identity of *iTaukei* go hand-in hand and they are not separate from one another. The chiefs and the *iTaukei* cannot exist without the other, they are one. The chiefs provide leadership in the *vanua*, *yavusa*, *tikina* and *koro* (Ewins, 1998; Ravuvu, 1991; Rich et al., 2006). The chiefs in Fiji have

considerable power and influence and if chiefs' powers are threatened, every precaution and all steps would be taken to restore or safeguard the chiefly systems.

The chiefs are the symbols of *iTaukei* tradition and at the political level their influence was embodied in the *Bose Levu Vakaturaga* or Great Council of Chiefs.Whenever the *Bose Levu Vakaturaga*made any decisions on important matters, such as land and fishing rights, which affected *iTaukei*, the decisions they took become the collective voice of all *iTaukei* (Sherlock, 1997; White and Lindstrom, 1997). The coups of 1987 and 2000 were executed to ensure Fijian paramountcy, protection of land and to "save" Fiji from the "diabolical design" (alleged land reform to create division among chiefs and commoners) of Fiji's first ever elected Indo-Fijian Prime Minister, Mahendra Chaudhry (Alley, 2001; Fraenkel et al., 2009; Lal, 2012). On the other hand, the 2006 coup was carried out ostensibly to save Fiji from "one sided" government (in favour of *iTaukei*), alleged widespread corruption, lack of accountability and proposals to pardon the 2000 coup perpetrators (Fraenkel et al., 2009; Woods, 2008). Commodore Bainimarama's administration since 2006, has made several efforts to solve the issue of land by making changes to the*iTaukei* Land Trust Board (TLTB), such as reducing administration fees from 25 percent to 10 percent. It also made provisions, whereby *mataqali* members (both chiefs and commoners) could equally share the economic gains and leasees could also benefit (Dodd, 2012). Furthermore, after seizing power in 2006, Commodore Voreqe Bainimarama refused to allow the *Bose Levu Vakaturaqa* to meet and in the early morning of March 14th 2012, in a national broadcast abolished it (Field, 2012).

Village communities still mostly live within a strict hierarchical system, whereby the village chief and *turaga-ni koro* receive the respect of all the villagers. Chiefs have a special position in *iTaukei* society. They are given authority, precedence, privilege, respect and loyalty (Nayacakalou, 1975). The position of a chief is important to *iTaukei* societies. *iTaukei* chiefs do not receive any formal training, but they are born into chiefly families and receive their understanding of chiefly behaviour and knowledge from their parents or by watching other chiefs (Biturogoiwasa and Walker, 2001).

The village *turaga-ni-koro* are typically elected by their community and have a different role from that of the chiefs. They prepare work programmes (to encourage community responsibility, uphold law and order, maintain personal hygiene, sanitation and environmental standards, etc.) for the villagers and are in

charge of the implementation of village, provincial and government activities and at each monthly meeting of the *tikina* council, the *turaga-ni-koro,* presents a report on the affairs of his *koro*, including the welfare of the villagers (Ravuvu, 1988). *Turaga-ni-koro* and village chiefs are for villagers and villagers are for them. "There is a misconception that the chiefs form a club and think as group ... The chiefs are the chiefs of a group of people. They think more in line with the groups of which they are chiefs rather than their own class" (Ratu Sir Kamisese Mara, interview with Matt Wilson quoted in Fiji Times, 6 Mar.1972: 2).

4.7.4 iTaukei economic activities

The economic growth of Fiji has been negatively affected by the political instability over the last few decades. The most important foreign earner is tourism and it plays a significant role in employment creation. Fiji's economic growth has also been affected by reductions in prices and access to main overseas markets, such as the European Union, for commodities like sugar and textiles (SPC, 2008). When we look at *iTaukei* economic activities, villagers mostly depend upon the resources from land and sea. They mostly engage in subsistence cultivation, growing *tavioka* (cassava), *dalo* (taro), *uvi* (yams) and *kumala* (sweet potato). The most important staple green vegetables grown are *bele* (*Abelmoschus manihot*) and *rourou* (*dalo* leaves). *Yaqona* (kava) is the most important cash crop since the decline of the copra market.

After the first coup in 1987, *iTaukei* were promoted in the public service to substitute for Indo-Fijians who left the country. Some Indo-Fijians were harassed and forced to take early retirement (Leckie, 2015; Singh, 2001). Senior Indo-Fijian civil servants were ordered to resign so that *iTaukei* could take over their positions. Many junior *iTaukei* staff were promoted to senior positions (Singh, 2001). The government gave more scholarships to *iTaukei,* to prepare them for government work and to teach them more about business (Crocombe, 2008; Singh, 2001). During the coups of 1987, 2000 and 2006, it was repeatedly emphasised that *iTaukei* should play a more significant and important part in commerce and business development in Fiji (Farrelly andVudiniabola, 2013).

4.8 Indo-Fijian community

4.8.1 The arrival of Girmitiyas

In 1878 arrangements were made with the colonial Indian Government for Indian labourers to come and work in Fiji (under the Fiji Colonial Government's directive) for a period of five years. If they chose to return to India after five years, they could do so at their own expense and if they elected to work for another five years (ten years in total) then their return passages including those of wives and children would be paid by the Fiji Government (Coulter, 1967; Donnelly et al., 1994). Most Indo-Fijians saw Fiji as a destination to escape from poverty and hunger (Ravuvu, 1991). Mayer (1963:4) also agrees with Ravuvu: "The push from India must have been in most cases greater than any pull from Fiji. Poverty and disputes with the police are said to be the main incentives which overcome the distaste for emigration." In reality Indo-Fijians found out that plantation life was much harder than life in India, with human rights abuses and diseases (Ali, 2004; Baladrokadroka, 2003; Naidu, n.d.; Neal, 2012). Sixty-eight women and twenty-eight men were murdered between 1885 and 1920 (Lal, 1985). The *girmitiyas* were 80 percent Hindu, 14 percent Muslim with the remainder Sikh and Christian (Fiji Guide, 2018; Starnes and Luckham, 2009). Most of the girmitiyas came from Nagpur plateau and Bihar, North India and from the Madras area (Batsha, 2017).

The first batch of 498 Indian labourers came to Fiji on the *Leonidas* on 14th of May 1879 (Ravuvu, 1991) and for every hundred men, forty women were also sent (Donnelly et al., 1994). In 21 years by 1900, the number of Indians in Fiji was 15,000 (Ravuvu, 1991). The European plantation owners needed a labour force and this labour force was recruited through misrepresentation, trickery and sometimes coercion. Many of the indentured labourers (about 2000 arrived in Fiji per year) had little knowledge about their destination, the kind of work they would do and their terms and conditions (Singh, 2001; Starness and Luckham, 2009). The increasing number of Indians coming to Fiji created some discomfort amongst the indigenous population (Mayer, 1963). The *iTaukei* were frightened that their land may be taken away by the Indians. This fear was the initial cause of conflict and mistrust between Indo-Fijians and *iTaukei* (Coulter, 1967; Degei, 2007; Geddes, 1945).

This fear and mistrust did not allow meaningful dialogue between *iTaukei* and Indo Fijians which helped the Colonial Administration to keep the two communities apart and separate (McCarthy, 2011; Singh, 2001; Spickard et al., 2016). "As more

Indo-Fijian leaders pushed for a greater economic and political share, the colonial government took counter measures and pushed harder to vilify and stereotype the Indian community. The best way to do this was to strengthen its ties with *iTaukei* chiefs" (Ramesh, 2004: 1).

Upon completion of their indenture period, approximately 60 percent of Indian labourers chose to remain in Fiji (Gillion, 1958) and many of them brought their families from India to join them (Starness and Luckham, 2009). Since the political turmoil in Fiji, which began in 1987, there has been a constant decline in the Indo-Fijian population. Since the 1987 coup, more than 120,000 Indo-Fijians have left the country to settle overseas. Before the coup of 1987, the Indo-Fijian population was greater than *iTaukei* (World Directory of Minorities and Indigenous Peoples, 2005). Table 4.6 summarises how the Indo-Fijian population has declined over the period from 1996 to 2007.

Table 4. 6 Fiji Census population demographics

Ethnicity	**1986**	**1996**	**2007**
iTaukei	334080 (46.7 %)	393,575 (50.8 %)	475,739 (56.8 %)
Indo-Fijian	354111 (49.5 %)	338,818 (43.7 %)	313,798 (37.5 %)
Other	27185 (3.8 %)	42,648 (5.5 %)	47,734 (5.7 %)
Total	715376	775,041	837,271

Source: Adapted from Donnelly, 1994: 111 (1986) and Fiji Bureau of Statistics, 2008: 1(1996 and 2007).

4.8.2 Contemporary Indo-Fijian social structures

Since arrival of the *girmitiyas* in Fiji their descendants' cultural, religious and social practices and networks have undergone constant changes (Voigt-Grant, 2008). "The new life fostered a sense of companionship and togetherness that cut across barriers of religion, caste and place of origin" (Brij Lal 1983 quoted in Lata, 2009: 2).

Jaat (the caste system) which was initially strong eventually demised (Munro and Corbett, 2017). Arranged marriage remains quite common in rural areas though not so much in towns and cities. In arranged marriages, the match is usually arranged

by a “middleman”, in most cases a relative. Marriage is the most expensive ceremony in Indo-Fijian culture, which could cost a parent one year’s income (Tiwari, 1980). In Indo-Fijian society when a woman is married, she becomes part of the husband’s community. Indo-Fijians tend to live more of an individual (one) family life. The Indo-Fijian festivals, such as *Eid* (celebrated by Muslims after the fasting month of Ramadan), *Diwali* (festival of light, celebrated by Hindus) and Christmas (celebrated by Christians) provide opportunities to meet one another and renew ties (Singh, 2001). Indo-Fijians, like *iTaukei* visit their parents, villages, settlements, hometowns, families and friends with some regularity, mostly during school breaks, *eid*, *diwali*, New Year and Christmas.

4.8.3 Indo-Fijian economic activities

The celebration of the anniversary of the arrival of *girmitiyas* in Fiji is a day of both happiness and sorrow, the latter in the sense that it reminded people of their ancestors’ suffering, forced labour, ill-treatment, humiliation, alienation and degradation. Also, Rabuka’s statement “that the Indians had no role in Fiji, for Chinese immigrants from Hong Kong could easily replace Indian Farmers” (Singh, 2001: 135), did not encourage Indo-Fijians. But there was also a sense of happiness, that Indo-Fijians have made a huge contribution in making Fiji a progressive and prosperous nation (Trnka et al., 2013).

As Indo-Fijians were prohibited from buying *iTaukei* land, many moved into small businesses and some acquired long-term leases and became independent sugar cane farmers (Starness and Luckham, 2009). Indo-Fijians on the western side of Fiji are mostly cane farmers and some are working at the three sugar mills (Donnelly et al., 1994). For Indo-Fijians the key to prosperity and security is through education and this is one reason why Indo-Fijians are trying their best to educate their children. For Indo-Fijians education is the pathway to overcome poverty and a passport to migrate (Singh, 2001). For over more than a century (approximately 140 years), Indo-Fijians have contributed towards not only to Fiji’s social and economic development, but also to the Pacific as a whole (Kumar, 2005).

4.9 Relationships between *iTaukei* and Indo-Fijians

The *girmitiyas* descendants, today’s Indo-Fijian population, regard Fiji as their home, but *iTaukei* regard them as *vulagi* (foreigners). Mostly the rural Indo-Fijians have adapted well to *iTaukei* culture and customs (often speaking their local dialect) even though they are culturally different in beliefs, values and aspirations

(Ravuvu, 1991). Most rural Indo-Fijians are not worried about political power. They just want to live their life. They are often accepted into *iTaukei* family and *koro*. They drink grog (*yaqona*) and eat together harmoniously. The real conflict is in the parliament (Ewins, 1998). Sharing is a major part of indigenous Fijians' way of life. The more a person shares, the wealthier the person is. By sharing *iTaukei* are able to create and maintain long term healthy relationships, which bring peace and prosperity (Cagivinaka, 2016).

"Historically, Fiji's economic and political development has created inequalities and deep-rooted divisions between its diverse ethnic groups. The country has experienced four military coups and a military mutiny since 1987, mainly as a result of tension between the majority indigenous Fijian population and an economically powerful Indian minority" (Naidu et al., 2013: 4). *iTaukei* law dictated that Indo-Fijians could not live in *koro*. This law segregated the Fijians and Indo-Fijians, leaving Indo-Fijians no option but to create their own communities or move to rural sugar cane farms (where farmers had to lease *iTaukei* land, subject to stipulated conditions regarding land use rights) or to the coastal towns, which later became centres of commerce and trade providing the economic growth and prosperity of the Indo-Fijians, leading to the emergence of a stronger an Indo-Fijian professional and business class, filling the higher echelons of the civil service (Voigt-Graf, 2008).

While initially Indo-Fijians were the dominating commercial and economic actors and the indigenous Fijians on the other hand (initially and even now) were and are over-represented in the army and police force. The socio-economic divisions and segregation from the colonial times did not help to improve race relationshisp between *iTaukei* and Indo-Fijians (Voigt-Graf, 2008; Walker, 2005). "While it is true that some Indo-Fijians are successful businesspeople, the majority of Indo-Fijians are economically not better off than indigenous Fijians. The myth of their economic success nevertheless lives on and remains responsible for indigenous Fijian hostility towards them" (Voigt-Graf, 2008: 5).

The major point of disagreement between *iTaukei* and Indo-Fijians is caused by land (Cagivinaka, 2016; Head, 2000; Kurer, 2001; Lal et al., 2001; Naidu et al., 2013; Prasad and Tisdell, 2006; Ravuvu, 1991). Land tenure disputes and access to natural resources have become the main sources of social tensions between *iTaukei* and Indo-Fijians in the last thirty years (Murti and Boydell, 2008; Dodd, 2012). The conflict is mostly regarding leases and high land rents (Rapaport, 2013). For Indo-

Fijians leasing land was and is a difficult task, requiring a great deal of effort and expense. “Broadly speaking, periodic lease renewals were politically determined, but individual leaseholders were required to make ‘goodwill’ payments for renewal of their individual leases to land-owning *mataqali* heads. Some goodwill payment demands could be large and cause long-term indebtedness” (Naidu et al., 2013: 14). Furthermore, the short length of lease periods has led to much frustration and uncertainty (Prasad and Tisdell, 2006; Singh, 2001).

The British authorities made assurances to both major races in Fiji: To *iTaukei* they promised that all their rights would be protected and on the other hand they promised Indo-Fijians that their status in Fiji would be the same as that of any other race (Crocombe, 2008). The *iTaukei* were under the impression that after independence the government would be in the hands of the indigenous Fijians and the Indo-Fijians, in particular Mr. A. D. Patel, the founder of the National Federation Party (party representing most Indo-Fijians) in 1968 was under the impression that the Indo-Fijians would have equal rights in the running of the government. (Crocombe, 2008; Singh, 2001; Ewins, 1998).

Colonial rule also kept *iTaukei* and Indo-Fijians separate geographically and in other aspects (Ewins, 1998; McCarthy, 2011Ravuvu, 1991; Singh, 2001; Starness and Luckham, 2009). This separation has bred, mostly among urban *iTaukei* and Indo-Fijians, dislike, fear, mistrust and even hatred between the two groups (Ewins, 1998; Singh 2001; Sherlock, 1997). Their focus on different activities, such as the economy (Indo-Fijians) and politics (*iTaukei)*, further reinforced the divisions, with each group having different views about the other, which have eventually turned into stereotypes (Gunnehill, 2007). Some politicians advocate and encourage racial division for their own benefit (to win votes and secure power). They also use exclusionary terms such as “you are *iTaukei*”, “you are Indian”, “you are Rotuman” and “you are other race” (Singh, 2001; Ewins, 1998).

Another point of disagreement between *iTaukei* and Indo-Fijians has been caused by the election system (Ravuvu, 1991). The Indo-Fijians were of the opinion that there should be one common voting system and a voter should be able to vote for any candidate, regardless of race. With this *iTaukei* felt insecure because a common roll would have given Indo-Fijians more seats in parliament, as prior to the coups their population was greater than *iTaukei* and other electors. By 1946, the Indo-Fijian population was greater than *iTaukei* (Donnelly et al., 1994).

For *iTaukei* and Indo-Fijians, 14 May 1987 was a turning point in their relationship. The two military take-overs of the government in May and September of 1987, received huge support from most *iTaukei* (Ravuvu, 1991) and most Indo-Fijians saw this as the "death" of democracy (Prasad, 2010). In previous generations (for example that of my grandfather), especially in rural areas, the relationships between the Indo-Fijians and *iTaukeis* were cordial. There used to be trust and understanding, which is no longer there. Community members used to "share and care" about one another, including fishing and farming together. For example, the *iTaukei* used to give their land to Indo-Fijians to plant and farm produce was shared. The relationship has declined, particularly since the first coup in 1987 (Ravuvu, 1991) and these current tensions may affect the relative capacities of these two communities to adapt to the changing climate.

4.10 Impacts of climate change in Fiji

Fiji is likely to experience increases in climate change risks and climate variability (Andrade et al., 2010; UNESCO, 2017). On the global scale Fiji is a minor emitter of greenhouse gases, both in absolute and per capita terms, but being surrounded by ocean, like other countries of the South Pacific, it is likely to be impacted the most by the negative effects of changing climate (Pacific Islands Climate Change Assistance Programme (PICCAP) and Fiji Country Team, 2005; White, 2014). "It is estimated that almost F$9.3 billion (equal to almost 100 percent of GDP) in investments is required over the next 10 years to strengthen Fiji's resilience to climate change and natural hazards for decades to come" (Government of Fiji et al., 2017:27).

The land and sea-surface temperatures are projected to increase during the 21st century (Mataki et al., 2006). These temperatures are strongly influenced by ENSO which is a major source of climate variability for Fiji. In the future *El Niño*and La Niña will continue to occur, but there is little consensus on whether theseevents will change in frequency or intensity. The temperatures of extremely cool and hot days are projected to increase. In the south-east Pacific Ocean basin (0-40°S, 170°E-130°W), the number of tropical cyclones is projected to reduce but the intensity is likely to increase during the 21st century (Australian Bureau of Meteorology and CSIRO, 2011; 2014).

During the 21st century drought is projected to decrease slightly, and little change is projected in total annual rainfall. Rainfall is projected to increase during the wet season (November to April) and to decrease during the dry season (May to

October). The intensity and frequency of extreme rainfall events occurring are projected to increase. During the 21st century the mean sea level is projected to continue to rise and this will be mainly due to thermal expansion of water and melting of icecaps and glaciers. Wave height is likely to increase (lightly) in the dry season and to decrease in the wet season. Ocean acidification will continue to increase during the 21st century. Coral bleaching, fishing pressure, storm damage and other human impacts are further likely to impact the health of reef ecosystems in addition to warming waters and acidification. The risk of coral bleaching will increase in the future (Australian Bureau of Meteorology and CSIRO, 2011; 2014).

Fiji has a narrow cash economic base, which is mostly dependent upon the sugar and tourism sectors, both of which are likely to be impacted by changing climate (Republic of Fiji, 2014). Most of Fiji's population, major towns, hotels and industrial lots are located in coastal areas, which are exposed to extreme weather events and sea level rise (Tompkins et al., 2005). Coastal communities are exposed to present and future impacts of climate change due to increased usage of coastal resources (such as mangroves, see Figure 4.5), extension of urban development, increases in poverty, deforestation of watershed areas and increased quantity of untreated sewerage being pumped into the sea (Pacific Islands Climate Change Assistance Programme (PICCAP) & Fiji Country Team. 2005; Republic of Fiji, 2014).

Figure 4. 5 Mangroves cut down and left to dry to be used as firewood.

The government of Fiji is very concerned about climate change and rising sea levels which was shown when it became the first country, out of 195, to sign the Paris climate agreement in December 2015. A few months later the island nation was battered by 'monster' Cyclone Winston (Pacific Media Centre, 2016). The cyclone brought torrential rain, causing flooding across the islands, wind velocities exceeded 306 km/h, destroying infrastructure and up-rooting trees and with wave heights exceeding 12 metres, destroying coastal vegetation, causing coastal erosion and heavy rains resulted in serious inland flooding (Government of Fiji, 2016b).

Tropical Cyclone Winston caused destruction and damages equivalent to 20 percent of Fiji's GDP, approximately F$2 billion (Government of Fiji et al., 2017). Extreme climate events are likely to impact and adversely affect unemployment, living standards, budget deficits, balance of payments, gross domestic product, and foreign debt. The impacts of extreme events on coastal areas are likely to be exacerbated due to sea level rise, greater incidence of erosion and inundation and by reduced reef protection (Australian Bureau of Meteorology and CSIRO, 2014; 2011). Tropical cyclones are becoming more intense in the South Pacific and this may be due to increasing temperature (Terry et al., 2004**).** Many communities and the resources that these communities depend upon are likely to be affected by the changing climate (Powles, 2006).

There are several significant and immediate impacts of changing climate in Fiji. The mean air temperature has warmed by 0.52°C (0.01°C/year or 0.1°C/decade) over the last half century and the maximum temperatures have warmed at a faster rate than the minimum air temperatures over Fiji. Additionally, a periodic (2 to 5 years) cycle of warming and cooling has been observed. The mean monthly sea levels observed at the Lautoka Tidal Gauge show an increasing trend (after accounting for the precise levelling and inverted barometric pressure effect), at a rate of 60mm/decade, over the 1993 to 2012 period (Republic of Fiji, 2014). Fiji's National Climate Change Policy document (Government of the Republic of Fiji, National Climate Change Country Team, national and divisional stakeholders, 2012) stated that the sea-level had been increasing by 4.6 mm per decade since 1993, but satellite observations indicated a further 1.4 mm rise, meaning a 6 mm of rise per decade for the same period (Atkin, 2014).

The rising sea level in Fiji has put some villages at the risk of being forced to relocate to higher grounds and in doing so leave behind their ancestral lands, the value of which cannot be measured in economic terms (McNamara and Combes,

2015). In Prime Minister Bainimarama's opening address to the Pacific Islands Development Forum, June 2014, speaking to the wealthy major emitting nations of the world, he said,

> "History will judge you harshly if you abandon us to our apparent fate of sinking below the waves because you don't want to make the necessary adjustment to your domestic policies." (Bainimarama, 2014 quoted in Narayan, 2014. n. p para 1 from http://fijivillage.com/news/History-will-judge-you-harshly---Bainimarama-r529sk/)

Major meteorological droughts in Fiji have been associated with El Niño events. During moderate to strong events, the annual rainfall is reduced by as much as 20% to 50% over most parts of the country as experienced during 1982/83, 1986/87, 1992/93 and 1997/98. The El Niño event of 1997/1998 brought about one of the worst droughts in Fiji history. Weak El Niño events do not have much influence on the country's total annual rainfall (Republic of Fiji, 2014). The impacts of ENSO are further summarised in Table 4.7.

Table 4. 7 Impacts of *El Niño* and La Niña at Suva (Eastern side) and Nadi Airport (Western side).

	Suva (Eastern side	**Nadi Airport (Western side)**
El Niño	The dry season is drier and cooler than normal. ENSO's influence is stronger on temperature than on rainfall.	The dry seasons are cooler and drier than normal. Rainfall during the wet season is reduced by approximately 50 percent.
La Niña	The dry season is wetter and hotter than normal. La Nina's influence is stronger on rainfall than on temperature.	The dry season is hotter and wetter than normal. The rainfall during wet season is increased. The days are cooler.

Adapted from Australian Bureau of Meteorology and CSIRO, 2011: 80.

Flooding in Fiji is a common hydrological event. Large scale flooding is usually associated with prolonged, intense rainfall especially during the passage of tropical cyclones or tropical depressions. Increased rainfall and localised flash flooding, in the wet season, is very common during La Niña events (Australian Bureau of Meteorology and CSIRO, 2011). Rainfall data for the last half century (52 years)

show no significant long-term change. Coastal flooding is usually associated with the passage of tropical cyclones close to the coast. However, heavy swells, generated by deep depressions and/or intense low-pressure systems some distance away from Fiji have also caused flooding to low-lying coastal areas. At times heavy swells coincide with king tides to cause flooding and damage to coastal areas. In Fiji, between 1970 and 2016 about 3.3 million people were affected by disaster events, with an estimated 475 fatalities (see Table 4.8).

Table 4. 8 Direct impact of major disasters, 1970–2016

Type of disaster	Number of events	Number of peopleaffected	Fatalities
Drought	6	840,860	0
Tropical cyclone	66	1,888,490	355
Flood	44	563,310	103
Severe local storm	2	8,370	17
Total	118	3,301,030	475

Adapted from Government of Fiji et al., 2017:48

Fiji's populations living along the coast, especially in low-lying coastal communities, is most exposed to the likely impacts of climate change, such as increased intensity of storms, rising sea level, tidal inundation, intrusion of saltwater, salt spray and coastal erosion (UNESCO, 2017). The growing density of populated coastal areas is increasing the exposure of economic, cultural and social activities and the physical environment to disasters, placing more stress on resources needed for development and poverty alleviation (Ruth and Ibarrarán, 2009; Nunn et al., 2014).

4.11Government responses

Fiji signed the UN Framework Convention on Climate Change in February 1993. Articles 4 and 12 of the Convention require the signatories to develop a national inventory to record sources of greenhouse gas emissions, methods of removal (sinks) and sectors which are more vulnerable to the impacts of the changing climate, and to think of ways to improve socio-economic status through sustainable development, without increasing the emissions of greenhouse gases (Pacific Islands Climate Change Assistance Programme (PICCAP) & Fiji Country Team, 2005; White, 2014). Even though Fiji is a minor emitter of greenhouse (GHG) gases, it is

significantly important to take all necessary measures to reduce the emissions of GHG gases (White, 2014). “The goal of the adaptation objective of Fiji’s National Climate Change Policy is to reduce the vulnerability and enhance the resilience of Fiji’s communities to the impacts of climate change and disasters” (Manley et al., 2016: 95).

The Fiji government planned, and made commitments, to improve disaster risk reduction through its implementation of the National Disaster Management Plan and the National Disaster Management Act in 1995 and 1998 respectively and its endorsement of the Sendai Framework for Disaster Risk Reduction (2015-2030) and the Hyogo Framework for Action (2005-2015) (Government of Fiji et al., 2017). Fiji recognizes the importance of sustainable use of natural resources and management of the environment to ensure economic prosperity and social harmony for present and future generations. The Fiji Government signed a new National Climate Change Policy in March 2012, setting objectives and developing strategies to mainstream climate change policies into relevant sectors, such as human health and welfare, agriculture, forestry, marine and fisheries, transport, communication, water resources, energy and energy infrastructure, urban development and housing and tourism. The key elements of the Fiji National Climate Change Policy, 2012 are summarised in Table 4.9. Fiji, working with the Green Climate Fund, the Global Environment Facility and with several United Nations agencies, has implemented and is pursuing a “Green Growth Plan” to promote sustainable development and is trying its best to transition to renewable energy by 2030 (Republic of Fiji, 2014; White, 2014).

The Fiji Government prepared its first ever Climate Vulnerability Assessment (CVA) in 2017 and in 2013 there was a report prepared by the government (Auditor-General) on the Joint Climate Change Adaptation and Disaster Risk Management National Action Plan (JNAP) (World Bank, 2017). This assessment was prepared with the help of expertise from various government sectors and there were several recommendations made to enhance Fiji’s coping capability and resilience to climate-related and geophysical hazards. Since 2013, Fiji Government’s annual spending on better understanding of, coping with, and adaptation to, the likely impacts of climate change has increased from F$89 million to F$359 million (Government of Fiji et al., 2017; Republic of Fiji, 2014). Also, the Fiji government has already amended (to include climate change) the primary and secondary school curricula. It is also encouraging radio talk-back shows on climate change in Hindi, Fijian and English and has held a Climate Change Summit, at

national level, every year since 2012 to educate and create awareness of climate change (Government of the Republic of Fiji, 2014). Another action of the Fiji government is establishing a climate change officer to facilitate and coordinate climate change issues for the government (UNDP, 2012a).

The Fiji government has identified 676 villages that are at risk from climate change. With financial and technological help from the government some villages, such as Vunidogoloa in Macuata, Vanua Levu have been relocated further inland from the coast (McNamara and Des Combes, 2015; White, 2014). The Fiji Government, in addition to its domestic policies and actions, is also offering assistance to other Pacific island countries.

"Fiji's commitment to international cooperation on climate change has perhaps been most clearly symbolised by Fiji's promise to aid Kiribati islanders in case climate change sea-level rise forces citizens of Kiribati to request international relocation" (White, 2014: n.p. para 14 from http://nationalclimatejustice.org/national-reports/fiji/. At COP 23 held in Bonn, Germany, Voreqe Bainimarama was co-chair and there was a strong Pacific theme, as discussed in Chapter Three (3.8.7).

Table 4. 9 The key elements of the Fiji National Climate Change Policy, 2012.

Long-term sustainability	Initiatives and programmes should deliver long-term, positive, ecological, economic and social impacts.
An integrated approach	Ensure multi-sectoral, multi-level and inter-disciplinary approaches to achieve national development goals.
Community ownership	Ensure local community involvement and put in place effective feed-back mechanisms.
Strategic partnerships	Ensure government coordination with relevant and potential development partners, CROP agencies, NGOs, community-based organisations (CBOs), faith-based organisations, academic institutions and the private sector for effective delivery of initiatives.
Scientifically sound and appropriate information	Planning, policy formulation and decision making are to be based on scientifically and technically sound data and information, while recognising the value of traditional knowledge.
Reporting and feedback mechanisms	Ensure systematic reporting and feedback of climate change initiatives, programmes and projects through the National Climate Change Focal Point and the National Climate Change Country Team.
Monitoring and evaluation	All climate change initiatives, programmes and projects to feed into the national climate change monitoring and

	evaluation mechanism coordinated by the Climate Change Unit.
Equity and fairness	Initiatives, programmes and projects should ensure the equitable accessibility and distribution of all benefits, information and support to marginal and disadvantaged groups, recognising their differing vulnerabilities to climate change.
Practical, affordable and appropriate solutions	Adaptation options and technologies are locally appropriate and affordable.
Gender considerations	In recognising that men and women face different social, economic, and environment situations, gender issues are to be considered in all planning and implementation processes. A better understanding of the vulnerabilities and capacities of different gender groups to deal with climate change is to be promoted.
Incorporating lessons learned	National planning and policy processes should consider findings and lessons learned from climate change related programmes and projects.
International collaboration	Continue to foster international partnerships to address climate change on a regional and global level while acknowledging national responsibilities.

Source: Government of the Republic of Fiji, National Climate Change Country Team, national and divisional stakeholders, 2012: 20.

4.12 Summary

The Colonial Administration made assurances to *iTaukei* and Indo-Fijians that all rights would be protected and both groups would have equal rights. This promise created division and mistrust amongst *iTaukei* and Indo-Fijians, which surfaced after the first coup in 1987. Now whenever these two communities sit together to solve any issue, whether it is land tenure or fishing rights, trust is very limited. The *iTaukei* have at the back of their mind "can Indo-Fijians be trusted" and on the other hand Indo-Fijians would always be thinking "when will the land be taken back or what will be the next year's land rental".

iTaukei society is very communal, traditional culture is highly valued and people are firmly attached to the family unit, the village (*koro*) and the *vanua.* From an Indo-Fijian perspective longer land leases could be formulated, whereby both the landowners and the tenants would benefit. A longer lease would mean more investment and better care of the land, better drainage systems, contour ploughing and crop rotation and these are likely to increase land's resilience to the likely impacts of climate change.

Fiji's location makes it exposed to the likely impacts of climate change, so there is a need for the combination of traditional and scientific knowledges to improve the resilience of the communities as the patterns of extreme weather events are likely to change. Fiji's main concerns are rising sea level, coastal erosion, intrusion of salt water and increasing number of extreme weather events. Fiji is trying to minimise these impacts by following the adaptation strategies stipulated in "The Republic of Fiji National Climate Change Policy", 2012. Climate change is the problem of present and future generations. There is a need for building community awareness on how to identify present impacts and how to anticipate future struggles. Good development work, learning and listening to people, how they see their needs, may help to build up adaptive capacity of a community. If the human needs of a community are not addressed, the end result can be both failed adaptation and mitigation projects.

The next chapter looks at my study sites, Vatukarasa and Sovi Bay, both with a sea frontage and situated on narrow flats along the coasts and just a few metres above the high-water mark.

CHAPTER FIVE

The Study Area.

"*Vatukarasa means hot rock. The village got its name because the initial location of the village was in the interior near a big black rock. Sovi in Nadroga dialect is pronounced as "hovi", meaning a net or collecting something in your hand. May have got its name due to shape of the bay*" (Apinisa-Chairman *komiti ni koro*, 2019).

5.1 Introduction

The study location is in the Nadroga Navosa province on the south-western coast of Viti Levu, in an area commonly referred to as the 'Coral Coast'. The Coral Coast (longest chain of fringing reef in the Republic of Fiji) is 80 kilometres in length, situated in the southern part of Viti Levu, stretching from Pacific Harbour in the east to Natadola Beach in the west.

My study sites, Vatukarasa and Sovi Bay, both with a sea frontage, fall under the provincial boundary of *Baravi* in the *Tikina* of *Cokavata*.The study area is approximately 15 kilometres east of Sigatoka Town on the way to the capital city, Suva. Several taxis, minibuses and buses run through Vatukarasa *koro* and Sovi Bay settlement in both directions (Suva to Sigatoka and Sigatoka to Suva) on a daily basis.

Vatukarasa and Sovi Bay (see Figure 5.1) are on land that rises gently from the highway towards the centre of the Island. The vegetation is *talasiga* grassland (typically associated with degraded soils), with trees here and there, but becoming denser inland. The *iTaukei* people of Vatukarasa and Sovi Bay (under Vatukarasa *mataqali*) have customary ownership of large areas of land and the marine environment.

Vatukarasa and Sovi Bay (see Figure 5.2) have dynamic ecosystems and they are continuously changing as part of a changing environment. Human disturbances are affecting both terrestrial and marine ecosystems. On the land the changing seasons play a very important part in the type of crop that is grown, when and how it is grown, how it is managed and the manner in which the produce is used. Vatukarasa *koro* and Sovi Bay settlement are situated on narrow flats along the coasts and are just a few metres above the high-water mark.

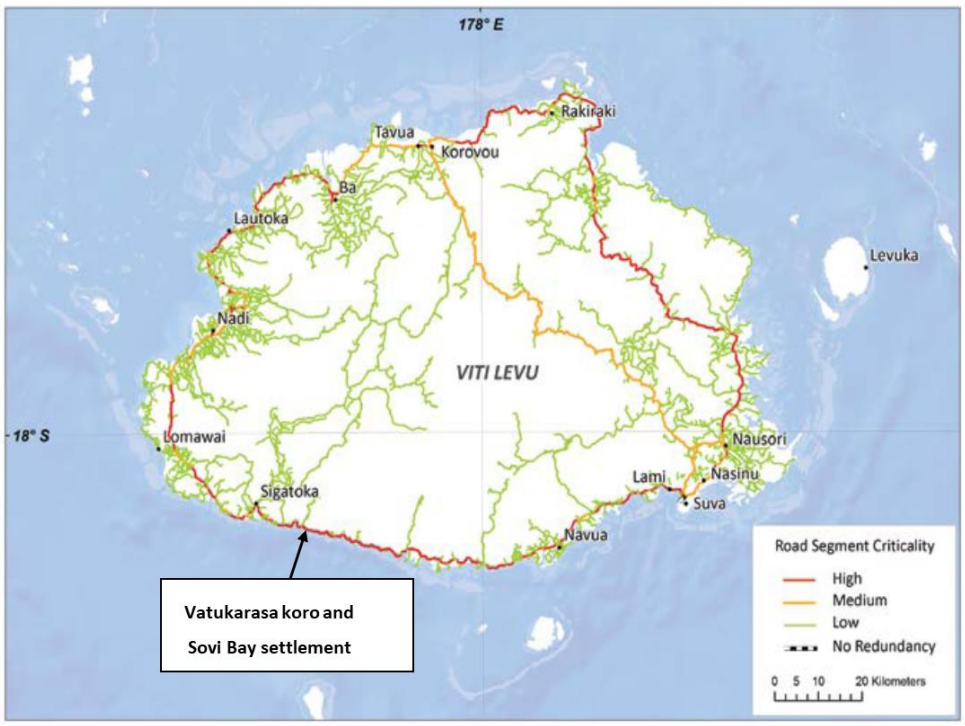

Figure 5. 1 Map of Viti Levu showing location of Vatukarasa and Sovi Bay. (Map by Government of Fiji et al., 2017: 26).

The coastal waters, including the large fringing reefs (Oria and Navoto, both having shallow inshore lagoons) with a variety of coral species, sea grass beds and *veidogo* (Bruguiera) and *veitiri* (Rhizophora), and mangroves provide shelter, habitat, nursery and breeding grounds for various types of marine species. The lagoons and coral reefs used to harbour many species of fish, but now there are only a few. On the Suva side of the Vatukarasa *koro* (village) are *veidogo* and *veitiri*, with some stands of coconut trees and on the Sigatoka Town side there is a sandy beach (see Figure 5.3), strand vegetation, and some *veidogo* and *veitiri* at the mouth of Sovi River.

According to the 2017 census the population of the study area was 725 with over half (418) in Vatukarasa (see Table 5.1) (Fiji Bureau of Statistics, 2018). Sovi Bay had a population of 179 and the Indo-Fijian settlement at Vatukarasa (128). All the households, both *iTaukei* and Indo-Fijians have free piped water supply (connected to springs) and access to metred electricity (Fiji Electricity Authority).

Figure 5. 2 Google Earth Image showing the two study areas.

Figure 5. 3 Sandy beach of Sovi Bay.

Table 5. 1 The population of Vatukarasa and Sovi Bay in 2017

	Vatukarasa Village			Vatukarasa Settlement			Sovi Bay Settlement		
	M	F	Total	M	F	Total	M	F	Total
0-14	75	67	142	20	15	35	32	24	56
15-24	42	27	69	14	12	26	19	15	34
25-64	98	98	196	31	31	62	38	40	78
65+	5	6	11	3	2	5	5	6	11
Total	220	198	418	68	60	128	94	85	179

Source: Fiji Bureau of Statistics, 2018.

There are more *iTaukei* than Indo-Fijian households at Vatukarasa and that is why I have included nearby Sovi Bay, which is Indo-Fijian dominated to balance the number of households. This study will provide me with a unique opportunity to assess and compare the impacts of climate change on two major ethnic communities in Fiji Islands.

5.2 Settlement patterns of *iTaukei* and Indo-Fijian at Vatukarasa and Sovi Bay

At Vatukarasa *koro* (*mataqali- Nabili*) there is a community of positive spirit and everyone seems to know, respect and understand one another. *iTaukei* are born into a cultural and social system, at the heart of which is the *mataqali* the whole *koro* is

an extended family, all youngsters are children and all the elders are uncles, fathers or grandfathers. The Vatukarasa *koro* is a locus of rural economic activity, staying together and a centre of local *iTaukei* politically organised society. "Village structure has an important bearing on the structure of Fijian descent groups...The village is the primary unit of local organization in Fijian society" (Nayacakalou, 1975: 14). This description applies well to Vatukarasa.

Vatukarasa *koro* (see Figure 5.4) lies beside the Tamanua River which empties into Tamanua Bay at the eastern end of Oria reef. The river (like the nearby Sovi River) is narrow, salty and sluggish and the water is not fit for drinking, but it provides *ika* (fish), *gari* (crabs) and *ura* (prawns) for local consumption, sand and stone for construction and a place for bathing and washing during droughts. The initial location of the Vatukarasa *koro* was on the Suva side of Tamanua Bridge (approximately 400 metres from the present site) on the hill side near a large black rock. Most *iTaukei* participants stated that traditionally most villages were situated inland for better protection from enemies. They feared that they could be attacked from the sea and if they had lived near the sea their escape would have been very much reduced. By living inland, the arrival of enemies from sea could be noticed by someone and appropriate defensive actions could be planned. In Vatukarasa's case the new location was chosen because of lack of space for extension of the inland *koro*. The new *koro* site was also selected for its accessibility to the river and sea (transportation and fishing), proximity to fertile land and fresh water (springs). At the *bili ni koro* (the outskirts of the *koro*) are the food gardens where vegetables, root crops and fruits that form the bulk of the diet are grown.

The houses at Vatukarasa *koro* used to be traditional *vale vaka viti* (known commonly as *bure*), made of wood, bamboo, dried leaves and reeds with a stone-faced *yavu* (raised foundations which are sacred property of the family), approximately three-quarters of a metre above the ground (see Figure 5.5). Immediately upon completion a *bure* was traditionally thoroughly smoked to prevent insects destroying the walls and the roof. Once the *bure* was properly smoked, the insect infestation became virtually nil or very much reduced, thus increasing the life expectancy of the building. The timber used to construct the *bure* was generally cut from the nearby forest. The timber was normally tied in a bundle and left in saltwater for about six weeks to treat it, so that it could last longer. The floor of traditional *bure* used to be made of flattened interlaced bamboo which lay on the *yavu* and then covered with an *ibe* (mat made from *voivoi*-Pandanus thurstonii).

Figure 5. 4 Google Earth Image of Vatukarasa *Koro*.

Figure 5. 5 *Yavu*-raised foundations, sacred property of the family.

In the past the size and shape of the dwelling houses used to be relatively uniform but now they vary in both and are built and constructed without the aid and help of *iTaukei* social groups. In colonial times, anyone owning a dwelling house with a tin roof had a certain amount of social prestige and pride. The people who were well off could afford large houses and there were prolonged feasts during construction and opening of such houses. Nowadays, the desire to have a *vale tudei* ('modern' dwelling house) is quite evident and visible at both Vatukarasa and Sovi Bay (see Figure 5.6). In fact, the desire to have *vale tudei* is increasing the need to find paid employment, so needed building materials could be bought. Remittances from overseas relatives and those living in towns and cities, with paid employment, are particularly valued. The importance of remittances is further discussed in Chapter Eight (8.9).

The houses are built in a unique pattern, being in two rows with open ground/space between them (see Figure 5.4 and Figure 5.7). "The Fijian nucleated village, a cluster of houses about an open space, is a distinctive settlement form, contrasting sharply with the dispersed pattern of Indo-Fijian rural settlement" (Crocombe and Meleisea, 1994: 134). The open space between the two rows of houses is called *rara*, which could be translated as "village green" and is usually kept clear of tall grasses (Roth, 1953).

Figure 5. 6 *Vale tudei* (durable or permanent dwelling house) are quite evident and visible at both Vatukarasa and Sovi Bay. However, flat roofs, overhanging eaves and louver windows make them liable to damage from strong winds such as those experienced in tropical cyclones.

Figure 5. 7 Two rows of houses with *rara* between them.

The traditional *bure* or *vale* or the "house" constructed with *gasau* (reed) well sealed walls, deeply embedded and spiked hardwood posts, using sennit to fasten and bind connections, mostly had well sealed roofs, which are high and steep-pitched to allow efficient and quick flow of rainwater and to make it more resilient to tropical cyclones (Campbell, 2006). The high roofs with three doors on three sides, one *katuba levu* (main big door) and two *katuba lailai* (small side doors)

allow good cross and through ventilation, which is required in warm and humid climates. “The *bure* is singled out for special mention because of its status as the traditional dwelling of indigenous Fiji...it is a cultural masterpiece, its decorative lashings works of art ... its spaciousness an arena for meetings and welcoming guests, and its layers of soft mats comfortable to sleep upon” (Walsh, 2006: 153). To maintain and improve the living conditions of a *koro*, each one has a communal work plan managed by the *turaga-ni-koro.*

The *vale ni kuro* (house for the pots or kitchen) and *vale ni sili* (bathroom) *and vale lailai* or *vale ni po* (sanitary accommodations) are usually detached from the *bure.* The kitchens are also frequently used as dining rooms. Any root crops brought from the gardens are usually left near the fireplace, except *tavioka* (cassava which when pulled out and exposed to light at night and sunshine during the day goes bad). It is a common belief among *iTauke*i that *buka* (fire) keeps evil spirits away; even today most villagers still light a *cina* (lamp-lantern) for the whole night to protect themselves from evil spirits. Any vegetable brought from the farm in the evening is kept outside at night to maintain its freshness and appearance.

Vatukarasa *koro* life is based on co-operative and communal principles and it can be difficult for those who wish to establish more individualistic economic practices. For *iTaukei*, the *koro* (a complete unit in itself) of Vatukarasa is a major part of their life. *iTaukei* of Vatukarasa and Sovi Bay have great *varokorokotaku* (respect) for *na itovo vavisi* (*iTaukei custom*) and for their *turaga-ni-koro*, who sees that the instructions from the Provincial Council or higher authorities are implemented and that requests of the villagers are forwarded to the Provincial Council and to the higher authorities.

Traditionally all *iTaukei* lived in the *koro*, but now some families have made their home on the Sigatoka Town side of the Sovi River (see Figure 5.9). Some *iTaukei* families are setting up their homes on their own lands and are separating themselves from their village life so that they could enjoy the fruits of their toil. Historically *iTaukei* hardly thought of leaving and moving away from their *koro*, but now the newest force, the urge to achieve a higher material standard of living is impelling some Fijians to leave their traditional *koro* (Naidu et al., 2013; Overton, 1993; Taylor, 1987). Nevertheless, *iTaukei* who are living away from their *koro* (see Figure 5.8), are still very much emotionally attached to their *koro*. In traditional times, when a villager left his *koro* to reside elsewhere, he was termed a *yasa*

(outcast/derogatorily), who was not willing to take responsibilities and obligations of the *vanua* and relatives (Ravuvu, 1988).

Figure 5. 8 Some *iTaukei* families who were living in Vatukarasa *koro* have constructed their houses on the Sigatoka town side of the Sovi River.

In any Fijian *koro*, and Vatukarasa is no exception, *kerekere*, the custom of giving willingly and not expecting that the borrowed item would be returned or any repayment for the item plays an important part in family relationships (Nayacakalou, 1995). Respect in the *koro* is very important, so before entering an *iTaukei koro* one must present a *sevusevu* (gift of *yaqona*) to the *turaga-ni-koro. Sevusevu* stresses the way *iTaukei* are embedded in communities and practice and follow the hierarchical structure of the society through kava drinking order (Brison, 2001). If chiefs are present their authority is quite visible at kava sessions, they are served first and then commoners.

For *iTaukei* the kava ceremonial preparation is performed with the utmost gravity and is the most honoured traditional feature in the formal life of *iTaukei* (Ravuvu, 1983; Stanley, 1999). "Traditional ceremonies continue to exist as a model of life for Fijians. They reflect their world view, and define the social and political structures, religious beliefs, values and practices inherent in Fijian communities" (Ravuvu, 1987: vii). When one visits an *iTaukei koro*, he/she may be asked *"E dua na bilo"* (Try a cup). Most social contracts and business deals are consummated around a kava bowl. *Yaqona* is regarded as men's goods and is referred to as *ka vakaturaga* (chiefly things) (Ravuvu, 1987). If an *iTaukei* loses his/her custom and culture, then he/she is lost, finished and will become "*vakatai ira na vavalagi kei na*

Idia-e sege tu na nodrai tovo" (just like Europeans and Indian people without customs) (Nayacakalou, 1975: 5).

The spatial layout of Sovi Bay settlement is quite different from Vatukarasa (see Figure 5.9). Some Indo-Fijian houses at Sovi Bay tend to be located near their farms, so that they could have easy excess to their crops and discourage or minimise stealing. Most Indo-Fijians stated that when they live near their farms, their work becomes very easy. If the farms are far away from home, the farmers usually find it difficult to travel that distance in the morning. To them work on the farm is not difficult but reaching the farm and starting the work is a problem for some. Once the work commences, everything starts falling into place. The dwelling houses are normally built with timber, concrete and corrugated iron. The kitchens and sanitary accommodations are usually attached to the dwelling houses.

The headmen of the Indo-Fijian settlements are not as influential or as highly respected as chiefs or *turaga-ni-koro* in Fijian villages. In Indo-Fijian society normally it is the eldest male of the household who holds the greatest respect and he is the one who makes most of the decisions. The most senior female's duty mostly involves the supervision of all other females and disciplining the children of the household. The Indo-Fijian communities of Vatukarasa and Sovi Bay do not believe in leaving things for tomorrow. To them *waqt paisa hai* (time is money) and any time wasted doing nothing or waiting for someone who is not on time *hai paisi ke barbadi* (is money lost).

The Indo-Fijian community at Sovi Bay and Vatukarasa tends to be categorised and differentiated on the basis of religious groups. In this community the majority follow Islam, together with a few Hindus, who are Arya Samaj or Sanatan Dharma. In the Indo-Fijian community sons are preferred to daughters and sons inherit most of the parents' properties, but in Islamic society sons are entitled to two thirds and daughters are entitled to one third of the parents' properties (Khalil, 2012).

Figure 5. 9 Google Earth image of Sovi bay. Note the scattered distribution of houses, a number of which are located adjacent to farms.

5.3 *iTaukei* and Indo-Fijian economic activities at Vatukarasa village and Sovi Bay.

The everyday economies of Vatukarasa and Sovi Bay are based on local resources from the sea, land, labour and opportunity. The coastal communities at Vatukarasa and Sovi Bay are mostly subsistence farmers and fishers and as the effects of climate change are likely to affect agricultural and fisheries yields, the already existing problems of these coastal communities may be magnified. Reduced earning

potential of the present generation means fewer children will be able to attend schools, there may be increases in child labour and these are likely to negatively affect future generations.

The *iTaukei* of Vatukarasa and Sovi Bay use the land and sea to the maximum, initially for subsistence purposes and using any surplus production for sale. Like every village in Fiji, at Vatukarasa the *mataqali* owns their land which they take care of and use to grow food crops for their daily needs. The land is worked by the whole *mataqali.* The workers are not united by rewards, but primarily by common allegiance and loyalties, mostly guided and supervised by chiefs or other senior members of the *mataqali*.

In Vatukarasa, as for most rural *iTaukei*, life depends on, and revolves mostly around, the *koro* and the land. The land use is determined by the needs of the *vuwere* (household) and the size, location and the physical characteristics of the land. The majority of *iTaukei* of Vatukarasa and Sovi Bay are still villagers, attached to their ancestral land, but nowadays some are living in urban centres, engaged in wage employment. In contemporary *iTaukei koros*, such as Vatukarasa, most wants and needs are now realised with money and wage payments. Until the early 1960s, the production of farm produce for sale was restricted due to lack of roads leading to the main river valleys and coastal areas of Viti Levu (Taylor, 1987). The increasing markets for food crops in urban centres and construction of new roads led to changes in rural agricultural systems, and the use and allocation of village land and labour.

At Vatukarasa (as in many *koro* in Fiji) usually when the sun rises the villagers go to their *teitei* (garden) to *werewere* (weed) and *tei* (plant). *iTaukei* males always try to have large *teitei* and have plenty of crops, rich in food (*vutunikakana).* In *iTaukei* society size plays an important part, such as large gatherings of people, large exchanges of gifts, building a big boat, holding big rugby tournament, catching an *ika levu* (big fish) or hunting a *vuaka levu* (big pig) is always the main topic during *talanoa*. *iTaukei* of Vatukarasa and Sovi Bay are also very experienced and gifted fishermen. They catch *ika, ura, uraua* (lobsters) and *qari* and sell them to Indo-Fijian communities nearby (including Sovi Bay). This may be one reason why the Indo-Fijians (with exception of one or two) are not allowed to use fishing nets and boats. The Indo-Fijians can only fish from the shore using fishing lines.

Farmers (heads of households normally choose plots for cultivation) plant *dalo* (taro), *tavioka* (cassava), *kumala* (sweet potato), *jaina* (banana) and *yaqona* (kava).

Good gardening areas of Vatukarasa and Sovi Bay are concentrated on hill slopes and flats along the Sovi and Tamanua Rivers. The farming, except of *yaqona* is mainly done for subsistence use, which provides an important source of nutritional benefits and any surplus is sold at the roadside or at the Sigatoka market. For *iTaukei* villagers, the most common type of agriculture is shifting cultivation, where crops for subsistence use are grown. Clearing of garden land by burning is declining at Vatukarasa and Sovi Bay because anyone found setting fire to bush, grassland and forest islikely to be charged and may be fined.

iTaukei grow many types of green vegetables and they get their protein mostly from the sea. Their cash expenditure on food is confined to *falawa* (flour), *masima* (salt), tea leaves, *suka* (sugar) and at times meat (both canned and fresh). The types of crops grown differ from one location to another. This depends upon soil fertility, precipitation, access to the site, rivers and the sea, protection from extreme events and on terrain. The secondary forest and forest borders of lower hills are the most intensively used land for agricultural purposes because lower areas are more easily accessible and colluvial soil tends to be more fertile than further up slope.

iTaukei also make use of seasonal fruits and vegetables such as guava, oranges and mandarins, watermelons, *tikau* (*dioscorea alata*), *kawai* (*dioscorea aculeuta*), *baigani* (egg plants) etc., which are collected or grown and mostly sold at the roadside where they also sell green coconuts for F$1.50 or F$2.00. The pandanus (*pandanus thurstoni*) is the most common non-food plant that is utilised. *Voivoi* (*pandanus leaves*) are used to make mats (a common commodity in most *iTaukei* homes) and stems are used in house construction. The dried leaves of *pandanus* are also used by senior citizens: *Itaba gase* (senior *iTaukei* citizens) use *pandanus* leaves to *itibi tavako* (roll cigarettes) and *Buzuruk* (senior Indo-Fijian citizens) use *koila ke pati* (dried pandanus leaves) to wrap their *suki* (Fiji tobacco).

The *iTaukei* also keep livestock such as *bulumakau* (cattle), *me* (goats), *vuaka* (pigs) and *toa* (chickens) and these at times are sold for much needed cash or used for feasts. The diet of the traditional *iTaukei* was different as they depended more on their farm produce and sea food from the reef and lagoon. Some *iTaukei* and Indo-Fijians still forage in nearby forest and bush land for *rauva* (wild yams), which at times supplement root crops from their farms. The increasing desire of having factory goods is evident. Due to increasing western education and increasing exposure to the market economy, locals are losing some of their traditional culture and obligations. Nowadays, supermarkets (in Sigatoka and other main centres) are

important sources of food and everyday living items and this lifestyle is diminishing their ability and desire to grow their own food crops.

Today, the *iTaukei* at Vatukarasa and Sovi Bay mostly eat *mandrai* (bread) (originally *mandrai* also referred to fermented taro etc. that was stored in pits and used after disasters) and *bisikiti* (biscuit-breakfast crackers) for *katalau* (breakfast) usually eaten at 8 to 8.30 a.m. by people who are staying home. The recent acquired taste for supermarket goods and the thinking that only people with money can afford such food items is making these goods more prestigious (Ravuvu, 1983). Children have their breakfast at about 7am, before leaving for their schools. For *iTaukei* going to their farms or fishing, breakfast is either early in the morning before leaving or later when they return. Rice is replacing *dalo*, *tavioka* and *uto* (breadfruit, artocarpus altilis) at *I vakasigalevu* (lunch) usually taken between 12 and 1.30 pm and *I vakayakavi* (dinner) is usually taken between 6 and 7 pm. Dinner may include some *kaikoso* (shellfish) marinated in *lolo* (coconut cream) and *wai ni moli* (lemon juice) for a few hours, *ota* (athyriuna esculentum), *karisi* (water cress) and *rourou* (boiled *dalo* leaves in *lolo*) may also be served. It is the females that do most of the cooking for the family. As outlined in Chapter Seven, production of a number of these important elements of the *iTaukei* diet may be adversely affected by climate change.

In most villages in Fiji, including Vatukarasa, much of the *iTaukei* cooking in former times used to be *tatavu* (roasting) on an open fire or baking in a *lovo* (earth oven with hot stones, in which large pieces of meat or a whole carcass and whole yams and *dalo* are placed directly on the hot stones and other smaller parcels of food, such as *palusami*, made from coconut milk, *dalo* leaves and tinned meat, and fish on top of these), but now most starchy foods such as *uto*, *tavioka*, *uvi* and *dalo* are boiled. *iTaukei* do not *kanakana lo* (eat in the quiet, behind closed doors). This would make a family appear mean hearted. *iTaukei* will invite all in the vicinity, *mai kana* (come and eat) or *sa vakarau tu na kakana* (the food is ready). In *iTaukei* society, the senior males are normally served first and they usually occupy the upper end of the *ibe ni kana* (eating mat) (Ravuvu, 1983). At Vatukarasa (as in all *koro* in Fiji), *iTaukei rere vaka na kalou* (do fear God) (Arno, 1993) and at every meal the household head says grace (beseeching God to bless the food).

Today the Indo-Fijians of Sovi Bay and Vatukarasa remain mostly as farmers, although a few have taxi businesses and mechanical garages. The farmers now plant seasonal crops such as *kheera* (cucumber), *papita* (pawpaw), *painap* (pineapple),

tamatar (tomatoes), *makai* (corn) and *tarbuaj* (watermelons) instead of sugar cane and these crops are mostly grown for cash. The Indo-Fijian farmers also grow subsistence crops such as *mircha* (chillies), *kasera* (cassava) and *saak bhaji* (vegetables).

The cash crops are mostly sold at the *raaste ke kinare* (roadside), near the Sovi Bridge in small tin sheds or to middlemen. The corn is usually boiled (see Figure 5.10) and is sold to bus passengers. Typically, vendors (both *iTaukei* and Indo-Fijians) will board a bus which is going towards Suva from Sovi Bay and they will sell the boiled corns to the passengers and after 3 or 4 villages they will get off and will get into a bus which is going back towards Sigatoka Town and will get off at Sovi Bay. This way they are able to make approximately $30 to $40 every day during the corn season.

Figure 5. 10 Corn being boiled to be sold to the bus passengers.

5.4 Gender roles at Vatukarasa and Sovi Bay

In 2008 FAO stated that women in the Pacific are main producers of staple crops. The case at Vatukarasa and Sovi Bay,where women mostly cultivate for family use,is no different,. Women are mainly responsible for food security, inputting their energy and expertise in securing food, health and energy for the family. Women

carry most of the burden of the household, such as cooking, collecting fire wood, planting of vegetables, taking care of domestic animals and caring for the elderly, children and sick. Some females said that they have to prepare certain food for certain family members in certain ways (to their taste). An Indo-Fijian participant (IT-3-R) states:

> My husband still wants his *savere ke chai* (morning tea) to be cooked on the wooden stove because he really loves his tea to have that wooden smoke smell.

At Vatukarasa village, the females were seen fishing using quite a different range of traditional methods and in different zones and ecosystems of the coast as compared to men. Women were seen reef gleaning in the intertidal zones. Most *iTaukei* females noted that their grandmothers and mothers collected invertebrates from inshore areas and lagoons, and even today their fishing practices have not changed much. They also take their children with them, so that the children could help and at the same time learn from them, while men were seen fishing beyond the reefs. Men of Vatukarasa and Sovi Bay usually undertake what are considered to be more demanding and dangerous tasks, such as deep-sea fishing. Vatukarasa and Sovi Bay tend to be male-dominated areas where females have very little chance for their views to be heard and their suggestions such asto reduce the likely impacts of climate changeto be taken or implemented.

Women of Vatukarasa and Sovi Bay are less likely to have been trained at the tertiary level, they own fewer businesses, earn less and have less access to loans and credit. Also at Vatukarasa and Sovi Bay, because of their easier mobility, it is men who have more opportunities and access to paid employment. Most female participants, both *iTaukei* and Indo-Fijians, are of the view, that their work (doing household chores) is more demanding, tiring and time consuming than males' paid employment. Both *iTaukei* and Indo-Fijian female participants, stated that if given the chance females can be equally good as males in paid employment. It is the culture of their society that is suppressing females by requiring them to keep the house and stay at home.

It was also observed and mentioned by participants that especially *iTaukei* females of Vatukarasa and Sovi Bay deal with different species of marine organisms and trees than the males and these are utilised in many different ways. Many species of finfish are caught for subsistence use or for sale and a wide range of species of mollusc and other invertebrates are also harvested by women for family

consumption and some for sale. Women use trees of different species for many purposes. They cut mangroves for firewood, make ropes out of vines and lianas, baskets from coconut leaves and mats from *voivoi* leaves. They also collect fruits, leaves, barks and roots of many species of trees and herbs to make *dranu* (traditional medicines) either for subsistence use or to be sold in the market. *iTaukei* females use many of the marine species such as the small gastropod shells to make *taube* (necklaces), *qato* (bangles) and many other forms of *civicivi* (handicrafts), which are sold to tourists who visit Vatukarasa village.

The gender roles of *iTaukei* and Indo-Fijian women are not the same at Vatukarasa and Sovi Bay. It was revealed and observed that more *iTaukei* women than men are involved in selling of goods from the road side, whereas in Indo-Fijian society it was men who were seen selling boiled corn, water melons and other farm produce from the road side. The different tasks performed by *iTaukei* and Indo-Fijian females are summarised in Table 5.2.

Table 5. 2 Typical daily activities of *iTaukei* and Indo-Fijian women at Vatukarasa and Sovi Bay.

iTaukei	**Indo-Fijian**
A Fijian female's (mother) day at Vatukarasa village normally begins *qena qwata* (in the morning) with a prayer, then boiling the kettle and preparation of breakfast. After breakfast they ready their children for school. Also lunch parcel are prepared for all those leaving for school and work. Then they wash, sweep and tidy their home. Then laundry is done, some houses are using washing machines and at some houses laundry is still hand-washed in wash tubs.	The day starts with a prayer (*pooja* for hindus and *fajar* for muslims). Then breakfast is prepared, usually *roti*, flatbread made from imported flour, round in shape, made using a *chauki* (wooden rolling board) and *balna* (wooden rolling pin) and cooked on a *tawa* (hot plate). Vegetable curry or any left-over rice and curry from last night and tea (usually black) is served for breakfast to the whole family. Also lunch parcels (usually two or more *rotis* with dry curry) are prepared for all leaving for school and work. Then chickens are fed, their water containers cleaned and refilled with fresh water and eggs are collected.

Then back to the kitchen to peel and cook dalo and/or cassava for lunch and dinner.	It is common for Indo-Fijian women to have their breakfast after completing all their morning chores.
Osi na vahigalevu (after lunch) they usually go out fishing (depending upon tides). At Vatukarasa village women mostly work in groups (especially when fishing).	The next hour or so is spent sweeping the whole house. Then laundry is done, some houses are using washing machines and at some houses laundry is still hand-washed in wash-tubs outside.
The days not fishing are spent in the family garden, gathering firewood and weaving.	Lunch is prepared, normally *dhal* (split peas soup) is cooked and families at home usually have this with all left-over from breakfast, and all left-over dhal is used for dinner. While *dhal* is being cooked, usually on wooden stoves outside, the females normally sweep and clean their outside compound and water their flower gardens.
They usually come back from fishing and/or gardens before their children come back from their school. Usually some bread and/or biscuit is ready for them.	
Collection of edible vegetables, such as *bele* and *dalo* leaves for *lolo* (cooked in coconut milk).	After their lunch, Indo-Fijian women spend the next hour or so in their back-yard gardens (weeding and planting) and bringing some vegetable for dinner (served with *dhal*) and some for next morning's breakfast.
Selling of fruits, vegetables, fish, crabs and handicrafts.	
Flower arranging.	
Na siga tabu (Sunday) is the day for prayer and rest. Sunday's breakfast and lunch is special and normally eaten with the whole family.	Dinner is usually dhal, rice, some vegetable and meat or fish, it is usually eaten gathered around a television set, watching very famous hindi programme "Saab bhi khabi bhahu thi" (mother-in law was a daughter-in law once).

Source: Field notes, 2013

It was observed that women of Vatukarasa village and Sovi Bay settlement are more actively engaged in their daily activities than men. Even when men go fishing it is a woman who is responsible for mending nets and preparation baits, spears and fishing lines. Unfortunately, most women have fewer education opportunities than men, thus limiting their access to information pertaining to disaster warning mechanisms, rights to resources and to have their voices heard in decision making processes. The gender roles at Vatukarasa and Sovi Bay are well defined. Because

of the social, cultural, religious and political influences, which are quite strong, changes to gender roles in the near future are not likely to happen.

5.5 Annual activities of *iTaukei* and Indo-Fijians of Vatukarasa and Sovi Bay

It was observed by the Vatukarasa villagers and the people of Sovi Bay that their daily activities still mostly depend upon weather and season. The participants also stressed that nowadays some years are quite favourable for planting and fishing and some years are quite the opposite, bringing hardship and suffering. It was revealed by both *iTaukei* and Indo-Fijians, especially the younger males, that they would prefer to forgo cash and subsistence farming for wage employment. The reason given is that wage employment means a regular fixed income. On the other hand, it was revealed by senior participants of both communities that they would prefer to live in their *koro* and settlement respectively, because they do not have to pay rent and water bills. The only thing they have to pay is for electricity. They also stated that easy-going village and settlement life is more relaxed, social and with less stress and tension.

As explained by the participants the activities carried out, and natural resources available during the year, are as follows. From November to April the local weather conditions are usually very humid with both plentiful rain and available sunshine. As this is the hurricane season, the deeper oceans become very unfavourable for many fish because of cyclones, and fish tend to migrate to enclosed coastal areas and the villagers are able to catch large numbers. As far as terrestrial resources are concerned, during the hurricane season, there is availability of vegetables and fruits such as *dawa* (Pometia pinnata), *ivi* (Inocarpus fagiferus), *quwawa* (Psidium guajava) and *moli* (C. reticulata). *Uvi* become fleshier and are harvested around March. In January the villagers usually plant root crops such as ginger, *dalo* and *kumala* (sweet potato, Ipomoea batatas). They also plant banana and green vegetables for commercial purposes. In February the guava fruit are at their peak.

From May to August there is a turnover in the types of marine and terrestrial resources and also in the people's activities. Many of the fish migrate back to the open ocean. Other fish like *salala* (Rastrelliger brachysoma), *kawakawa* (Epinephelus spp) and *kuita* also known as *sulua* (Octopus spp) which were in the ocean, would usually come into coastal waters. June is usually the month of the season when Fijians and Indo-Fijians would start weeding, clearing and ploughing the land. This is normally the time of less rain and villagers experience dry climate.

The land is especially prepared for *uvi, kumala,* corn and peanuts and planting is carried out whole year around, crops are harvested as they mature and are replanted.

It was revealed by both *iTaukei* and Indo-Fijian participants that the month of October is the breeding season for many marine species. It is also the month of *balolo* (sea worms, Palolo spp); which come near the coastal areas to lay eggs. This is also the period when people may get fish poisoning (ciguatera) though it is not common in the study area. Many crops are also in their growth state and people keep up with weeding. The *iTaukei* participants also told me that this is the season for *uto* which matures after flowering from May until the fruit slowly grows and reaches good size in October. *Borososo,* as called in *iTaukei* (Indo-Fijians call it *junglee mircha* (small jungle chilli, Capsicum annuum) and *cagolaya* (Zingiberaceae), similar to ginger and used for medical purposes, are also available. During this period the wind is quite strong. The mangrove ecosystem species, such as mangrove mud lobster, locally known as *mana* (Thalassina anomala), *lairo* or *tubā* (hunted in season and found in well drained brackish sites- Cardisoma carnifex) and black mangrove crab, locally known as *kukaloa* (Metopograptus messor) are easy to catch, because they find food and shelter in mangroves, as the conditions elsewhere are less favourable.

5.6 Backyard and bush gardening

At both the sites there are two types of gardens: backyard gardens which tend to be in or close to the *koro* and settlement, and bush gardens. The method of backyard gardening is the same for both the communities, whereas the bush gardening is quite different. The *iTaukei* communities have a specific area for their bush gardens, and they maintain that area, whereas Indo-Fijian communities regard bush gardening as something that provides food by chance. So, I will refer to Indo-Fijian bush gardens as *moka* gardens (chance or opportunity gardens).

5.6.1 Backyard gardening

An *iTaukei* participant during Fijian focus group discussion one, participant "B" (FFG-1-B) stated:

> FFG-1-B: The ladies of my house do food farming. I do cash farming such as yaqona and banana. Banana takes a long time to mature and yagona even takes longer, so it is family food farming that is really feeding my family.

An Indo-Fijian participant during Indo-Fijian focus group discussion two, participant “L” (IFG-2-L) stated:

> IFG-2-L. Planting of vegetables near our house is very important and this is mostly done by the ladies and this is from where we mostly get our vegetables for curry.

It was stated by all the participants, and also observed, that it is women who do most of the planting for family use and any surplus for sale forcash. At Vatukarasa and Sovi Bay it was observed that *iTaukei* men and women spent approximately equal numbers of hours in farms. On the other hand Indo-Fijian men spent more hours in commercial farming than the females. It is mostly the Indo-Fijian women who do backyard gardening. Women at Vatukarasa village and Sovi Bay (especially *iTaukei*) were seen as providers of the most basic needs, such as food, much of which directly came from the natural environment and these activities are likely to be negatively affected by sea level rise and climate change.

Most of the female participants, both *iTaukei* and Indo-Fijian, mentioned that in their backyard gardens, they mostly plant local crops, such as chillies (Fijian *rokete*, Hindi *mircha*), *rourou, dalo* leaves, *bele*, tomatoes (Fijian *tomata*, Hindi *tamatar*), carrots (Fijian *kereti*, Hindi *keret*) and eggplant (Fijian *baigani*, Hindi *baigan*). Older Indo-Fijian participants, both males and females, stated that they do not plant chillies close to their house, especially at the front and rear doors. They believe that if they do then the couple will always argue and fight. As one approaches respective backyard gardens, Indo-Fijians usually have curry leaves (*tej patti*, meaning bright or intelligent leaves, which add favour to curry), then chillies. *iTaukei* on the other hand have *bele* (a leaf that could be boiled in water or coconut milk and eaten likespinach), *rourou* (usually cooked in coconut milk) and chillies. For both *iTaukei* and Indo-Fijians the things that they use the most are planted closest to home for easy access.

Both *iTaukei* and Indo-Fijians mentioned that there are so many benefits to having their own backyard gardens. First, it is a great form of exercise and keeps you fit. Second, vegetables and fruits from your own gardens are healthier (no pesticides used) and taste better (fruit of your own labour). Third, it could be the best way to teach younger people how to plant their own fruits, vegetables, and some root crops, such as *tavioka* and *kumala*, and save time and money.

5.6.2 Bush gardening

All the *iTaukei* participants stressed that bush gardens are an insurance or backup garden. The bush garden is an important source of food security during droughts and tropical cyclones, as nearby trees provide much needed cover and wind protection, thus reducing temperature and moisture loss, which enable the food crops, such as wild yams, some leafy crops (*bele*) and fruits to survive. What I have observed is that the older participants are more engaged with bush gardens. It was also revealed that older participants, their parents and grandparents, strongly believed in diversity in gardening systems, which provided or maintained food security throughout the year and especially after extreme events.

I have called Indo-Fijian bush gardens *moka* gardens because Indo-Fijians do not have any fixed area as their garden. With the exception of a few, they usually collect or dig whatever they can from their area of the bush. If they see a jackfruit tree and they see a jackfruit (Fijian, *uto ni kaindia*; Hindi, *khatar*) that could be used for curry, they bring it home or if they see matured wild yams, they dig them and do the same. For Indo-Fijians too, the produce, such as mandarin, guava, passionfruit, mangoes, coconut, yams, jackfruit and breadfruit from *moka* gardens, do become a major part of Indo-Fijian diet. The Indo-Fijian participants recalled that plants and trees found in *moka* gardens are usually not planted by the present generation, but were planted by their great grand-parents, grand-parents and parents.

Older *iTaukei* participants explained that they have a special habit of planting crops as the previous one is harvested, and they stated that younger generations have got into the habit of putting things off to later dates. The older *iTaukei* participants recalled their parents planting yams, keeping in mind their children's *vakamou* (marriage time), so they would have enough yams for the marriage function. Yams have always been an important food for the *iTaukei* communities. The older *iTaukei* participants indicated that they visit their bush gardens at least four times per week (except on Sundays) and spend long hours in their gardens. Some time they take their lunch from home and at other times they pull out root crops and make a *lovo* (earth oven) for lunch. Their lunch is usually *lovo*, lemon (usually *moli ni karo*), salt and *rokete* (chilli). The older *iTaukei* participants also indicated that females usually help in bush gardening during planting and harvesting or whenever requested.

Focus group discussions, *talanoa* sessions and participant observations indicated that backyard gardening and bush gardening are mostly based upon gender and age. Older *iTaukei* and Indo-Fijian males prefer *teitei* and *moka* bush gardens respectively. *iTaukei* and Indo-Fijian females and younger people usually prefer backyard gardening. When asked about the reason for this, they said it is just a norm and practice. Foods (nuts and fruits) from trees and the forest are really of immense value for both, *iTaukei* and Indo-Fijians.

5.7 The differences between *iTaukei* and Indo-Fijian agriculture.

Land, its tenure and importance to both *iTaukei* and Indo-Fijians was discussed widely during the research and outlined in Chapter Four (4.3 and 4.4). For *iTaukei*, protection and keeping the land within the family is paramount and to Indo-Fijians, getting the most (cash income) from the land is essential. "Land tenure and environmental conditions are closely related: land tenure can promote land use practices that harm the environment, or it can serve to enhance the environment" (Food and Agricultural Organisation of the United Nations. 2002: 23). It was revealed by Indo-Fijian farmers, that they only concentrate on crops that take a shorter period to mature, thus giving a quick turnover. The Indo-Fijians fear of losing their land and crops is not something new; it has been there from their great grand-parents time (Derrick, 1951). At Vatukarasa and Sovi Bay land tenure (a major political issue) is a significant factor influencing vulnerability to climate change impacts, as secure access to land is seen as one of the key elements that increase people's adaptive capacity. Secure land tenure is a critical asset in the fight against climate change, risk reduction, planning, monitoring, and mitigation and also in influencing a farmer's decision whether to adopt and implement improved adaptation tools or not (Kukkonen and Pott, 2019).

An Indo-Fijian participant during Indo-Fijian *talanoa* session one stated:

> IT-1-D Now days, we are planting crops, that could mature quickly or could mature in less time, who knows, this land tomorrow may be mine or not.

The *iTaukei* fallow areas are mostly on rolling hill soils and in secondary and primary forest. Here some tree crops are growing naturally, and others are planted in lines, so these trees could be used as fence posts where beef and dairy cattle could be kept. One could say that the Indo-Fijian farming system is a high-input permanently cultivated system and Fijian farming system is low-input shifting agriculture. The low-input shifting agriculture is more sustainable and the high-

input permanently cultivated system is mostly focused on income generation. The Indo-Fijian farmers of Vatukarasa and Sovi Bay are mostly focused on increasing their agricultural productivity by intensive use of fertilizers *juste kar ke nimak masala* (mostly chemical), herbicides and farm machinery. Coulter noted even in 1967 that "[t]he Indians are commercial...farmers, while the Fijians still practice their time-honoured method of shifting cultivation" (Coulter, 1967: 22-23). This practice is rapidly changing at Vatukarasa and Sovi Bay as most *iTauke*i farmers are now producing more than is required for subsistence use and any surplus is sold.

iTaukei farmers, especially in their *tavioka* (now the main staple food) plantations (bush and backyard) normally employ raised beds of soil, grass and other organic materials. It was observed that the materials needed to form raised beds are usually scraped from near-by and surrounding areas. This makes the surrounding areas much lower in elevation and this helps to provide drainage in swampy, low-lying and flood prone areas. Most *iTaukei* participants stated that they are lagging behind in agriculture because of the unavailability of loans. Most Indo-Fijian farmers use farm machinery and those who do not have tractors, hire them from others, to prepare their farms for planting (Figure 5.11). On the other hand, *iTauke*i farmers mostly use simple technology and manual labour to clear, plant and weed their plantations and gardens.

Figure 5. 11 Shameen Buksh preparing land to plant cassava.

5.8 Summary

Both the study sites are close to the sea. The “Coral Coast” where Vatukarasa and Sovi Bay are situated is a dynamic place. Since the initial occupation of Vatukarasa and Sovi Bay, these coastal communities have witnessed changes to their environments and ecosystems. These changes provide a backdrop to understanding how climate change and sea level rise might affect them. Chapters Seven and Eight seek to outline these effects and possible ways in which they may be addressed.

The next chapter outlines the qualitative research methodology (focus group discussions, *talanoa* sessions and participant observation, which are often more flexible and less formal) used to gather the data for the thesis.

CHAPTER SIX

Methodology

> *"There are many reasons for choosing to do qualitative research, but perhaps the most important is the desire to step beyond the known and enter into the world of participants, to see the world from their perspective and in doing so make discoveries that will contribute to the development of empirical knowledge"* (Corbin and Strauss, 2008: 16).

6.1 Introduction

This chapter outlines the research methodology used to obtain the data for this thesis. I have employed a qualitative research methodology, including focus group discussions, *talanoa* sessions and participant observation. These three methods are not superior to one another, but each provides different things (Davies and Hughes, 2014). Qualitative research is not simply collection of data to assess predetermined theories, but it is research where concepts are developed to understand the patterns in the data (Taylor and Bogdan, 1998). Mason (2002: 1) states that qualitative research "...is a highly rewarding activity because it engages us with things that matter, in ways that matter".

I have used qualitative research because this helped me to understand the respondents' social interactions, thoughts and feelings and enabled me to know an individual's definitions, descriptions, meanings of events, and socio-cultural activities. In using qualitative research, I identified codes, categories, themes and theories as the research progressed (Burns, 1997; Crossman, 2013; Ezzy, 2003). "Qualitative research can make visible and unpick the mechanisms which link particular variables, by looking at the explanations, or accounts, provided by those involved" (Barbour, 2008: 11). The objective of qualitative research is to explore and attain an in-depth scenario or understanding of participants' personal feelings and experiences (Davies and Hughes, 2014;Yin, 2011; Corbin and Strauss, 2008).

Typically, qualitative research is the collecting and analysing of information regarding people in their everyday settings and environments (Arksey and Knight, 1999; Polit and Hungler, 1995). This research gave me a broader picture of the ways people interacted with one another, their patterns of behaviour, values, what they actually did, their reactions, perceptions, opinions, quality of life and sharing

of experiences in a social group (Hancock, et al., 2007; Yates, 2004). With qualitative research methods I attempted to find, see and capture the underlying meanings of events performed by the people (Burns, 1997; Silverman, 2007; Yin, 2011). Ethically advantageous and a more open-ended type of data collection, qualitative research provides a stronger voice and say for participants on how research should be carried out and how data should be collected (David and Sutton, 2011).

6.2 Qualitative research

"Qualitative research thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things" (Berg and Lune, 2012: 3). It involves mostly the task of making meaning of how the social world operates. With qualitative research I focused on studying people's social lives in their own natural environment or setting and this method enabled me to investigate issues and topics relevant to my thesis.

According to Mack et al. (2005) qualitative methods are more flexible and less formal, creating environments where participants' responses are elaborated in greater detail, and thus providing better correlations between data collected and data analysed. Qualitative research is a process of exploring and understanding human problems by building a holistic picture from the information received from participants, while still being in their natural setting (Cresswell, 2007; Franklin, 2013; Leung, 2015; Yin, 2011). The major advantage of qualitative research is that it uses both open-ended questions and probes, which provide greater opportunities for participants to answer the questions in their own styles and words, rather than just following a fixed pattern. Mack et al. (2005) go on to explain further advantages of open-ended questions which are more meaningful and culturally appropriate to the participants, provide responses that are not even thought of by the researcher and responses that are more detailed, rich and explanatory in nature.

Hancock (1998) is also of the opinion that qualitative research involves understanding social phenomena, such as why people behave in certain ways, why their opinions and attitudes differ from others, how they are affected by their environment and why do we have different social groups. Flick et al. (2004) state that qualitative research is used to describe the actual world of the participants 'from inside out' and this provides processes, patterns and features to better understand the social realities of the participants. Qualitative research allowed me to use various methods for acquiring knowledge, which in the end complemented

one another. This approach is concerned with understanding participants' experiences from their points of view. The participants' responses, behaviours, actions and voices are the main elements of my study.

6.3 Obtaining informed consent.

Sieber and Tolich (2013) and Franklin (2013) reported that informed consent is a way of telling and informing the participants about their roles, rights, risks and the benefits of participating in the research. "Informed consent must be tailored to the specific population in terms of language as well as capabilities" (Carey and Asbury, 2012: 57). Participants' privacy should be the foremost concern of the researcher. The participants' confidentiality must also be protected and their anonymity preserved if they so desire. All the participants were well informed about my research and the University of Waikato Human Research Ethics Committee Procedures and General Principles. The participants were given my chief supervisor's and my contact details to contact either of us, should they have any queries or needed any further information about the research.

On the15th of December, 2012, I approached the *turaga-ni-koro* of Vatukarasa, explained the purpose of my visit, presented him with *yaqona*, which he accepted (see Figure 6.1), as a traditional *sevusevu* (gift of respect) and gave his blessing. Traditional ceremonies are key elements of the *iTaukei* way of life, many of which have not changed, even since coming in contact with other cultures, such as Europeans and Indo-Fijians. Traditional ceremonies are very important components of social and political structures of contemporary *iTaukei* (Ravuvu, 1983).

The same afternoon the *turaga-ni-koro* called the villagers to the community hall and the purpose of my visit to the village was described to one and all. On the days of data collection, the *turaga-ni-koro* assigned a villager to be my guide and host while I was in the village. Once permission was given by the *turaga-ni-koro*, I was not required to obtain informed consent from each household. If I had done that, it would be seen as if I was trying to undermine the *turaga-ni-koro's* authority, which would not have been tolerated and then I would be asked to leave the village immediately. The *turaga-ni-koro* was given a copy of the information sheet and consent form. He did not sign any form but gave his verbal consent. In the Indian settlement the overall procedure was similar. I received the permission from the headman of each family who was given a copy of the information sheet and consent form, which he signed. Some of the heads of the Indo-Fijian families did not sign the consent forms but gave their verbal consent. As an Indo-Fijian I understand the

culture and customs of the community very well and as most of the residents of Sovi Bay settlement are related to me, obtaining consent to carry out the research was very easy but I clearly explained to them that they were under no obligation to participate because of this. Trust and rapport, collective field knowledge, protection of data and positive engagement are important for updating, maintaining and sustaining family and known participants in social research.

Figure 6. 1 The *turanga-ni-koro* of 2012 (Joseveci) of Vatukarasa village accepting *yaqona* thus giving his permission to carry out the research.Source: Photo by Rizu, 2012. Note in2019 the *turanga-ni-koro* of the village wasMeli Tawake.

6.4 Recruitment of participants.

For the data collection, I selected people who had some knowledge of climate change but also who were free at the right time and who were willing to come and attend the research sessions.

Keeping the above in mind the following criteria were used:

1. People who were born at Vatukarasa and Sovi Bay.
2. People who are still living at the study sites.
3. Adults - at least eighteen years of age. Initially I thought that I would have people who were at least twenty-five years old, but when I went to do my research, I saw most of the activities, such as fishing, farming, and hunting were carried out by people from eighteen years of age upwards, and I thought best to include them too. Only adults were chosen because they are likely to have more relevant observations and they are also likely to have more experience of climate changes.
4. Equal number of males and females (I wanted to have an equal number of males and females), but in some cases females were not able to come and sent their husbands in their places, so I had slightly more males than females.
5. People who lived close to the sea and/or river.
6. People who have their farms nearer to the sea and/or river.

Another very important thing that was taken into consideration when recruiting the participants was that they were never coerced to take part in the research. The participants were also not recruited well in advance because they may forget the actual day and time of the sessions. Accordingly, I recruited the participants four days before their sessions and a day before reminded them of the day and time of their participation. All the participants were voluntary, free to take part and free to leave. They were all thanked for their generous contribution of knowledge, patience, understanding and time. I advised the participants that I would return to share my research results with them with the intention of making some meaningful contribution to the communities. The participants were fully informed about their rights. As pointed out by Mack et al. (2005), what each participant was told is summarised in Table 6.1.

Table 6. 1 What each participant was told:

Aim	The main reason and why the research was carried out were explained
Roles	What would be participants roles were outlined
Risks	Possible psychological and social risks were explained
Voluntary participation	All participation was voluntary, and anyone could withdraw without any repercussion within two weeks of participation
Confidentiality	How their information would be kept confidential and not be revealed to anyone were explained, unless they wanted their names and photos used in the thesis.
Contact of Chief Supervisor	Contact information of the Chief Supervisor was given for any further questions and / or information on participants' rights.

Source: Adapted from Mack et al., 2005: 10.

The focus group discussions, *talanoa* sessions and participant observations were carried out on different days, so that I had ample time to complete my data summarisation. All the focus group discussions and *talanoa* sessions were scheduled in the evenings, so it became easier for the participants to be present. The participant observations took place as the activities such as fishing and farming were carried out by the participants at their own time and pace. Another factor that actually worked in my favour was that the data collection was carried out during the seven weeks school holiday period, so daily activities of households were shared, and both the parents and children were able to attend the focus group discussions and *talanoa* sessions. Also, there was a function in the village, where they were collecting money for a student nurse's travel fare and pocket allowance. I attended the function, drank *yaqona* with them and it further enriched the data collection and improved relationships between myself and the villagers. Establishing good and warm relationships with participants is an important basis for information gathering and ethical conduct.

I used two note-takers. In the village, I used Rizu, my brother in-law, who lives at Sovi Bay settlement. He is very much liked by the villagers and has a very good relationship with them. They often *veiwali* (joked) and exchanged chitchat with him and this helped to create a friendly and comfortable environment. In the settlement, my wife Nazra, who is a teacher, was my note-taker which helped me in two ways. Firstly, she is very good and fast in taking notes and secondly, as she was with me,

the wives of my younger cousins, were not hesitant to come and take part in the research. Nazra was extremely polite, humble, thoughtful, attentive, considerate, understanding, smiling, warm and comfortable with the participants. Both my note-takers, Mr. Rizu and Nazra have good hearing and understand both Hindi and *iTaukei* languages, customs and cultures well. Both the note-takers were well briefed before the research and they understood the research objectives well and knew, as Burges (1982) and Rabiee (2004) point out, "what to take and what to ditch"

As Hancock, et al. (2007) and Gibbs (1997) recommend I had six to eight participants in each focus group, with similar cultural and social backgrounds. This number was just right to spark energy and creativity and a bigger number could have become unwieldy and voices may have got lost. Larger groups may also lose momentum and could become difficult to control or manage. Angrosino (2007) postulates that participants who are shy may hide in a large group, while other participants who are willing to say things or give their opinions may not get the chance and may lose interest. Invitations were extended to nine people to allow for no-shows. All the participants were visited personally and each was extended a personal invitation.

I informed all of the participants that they had two weeks to withdraw their participation if they wished and they were informed that should they feel uncomfortable at any time during the participation they all had the right to withdraw and simply walk away. Also the participants were told that all data collected would remain confidential and names and photographs would only be used with permission in publications, all recorded data, notes and transcripts would be kept under lock and key and all information stored on a computer would only be accessible through a password (changed regularly) known to the researcher. I advised them that they all have the right to remain silent or refuse to answer any question or simply ask that the question be removed from the schedule.

6.5 Pre-test

On the 13th December 2012 a pre-test of the research methodology, which involved two *iTaukei* and two Indo-Fijians was carried out. Rizu and Nazra were also present. The two *iTaukei* were from a Coral Coast (the same region as the study site) village; one was a degree student at the University of the South Pacific and the other a farmer. The two Indo-Fijians were from a Coral Coast settlement; one was a shop keeper and other a social worker. The four respondents were told that the pre-

test was a practice run. As Barribeau et al. (1994-2012) state, the respondents were asked to critically analyse question form, meaning, task difficulty, participants' interest and attention, language, wording, order, flow, overall participants well-being and whether or not the participants would be able to understand the questions correctly.

The discussion took about forty minutes. They found the questions and their order easy to understand and likely to provide information and opinions that would help me in fulfilling my objectives. But they advised me to include few more icebreaker questions, especially with Fijian participants, which I included. They also advised me about audio recording of the discussions in rural settings: they stated that it may stifle conversations and make them more formal, become a distraction, and the participants may feel that the information given may be used out of context, and also feel that whatever they say, once recorded, could be used against them later on. They also felt that their exact words would be captured, or they could be easily identified. Upon hearing these comments, I thought it best not to audio record the data collections (Meo-Sewabu, 2014). As Bell (2010: 170) points out I always kept the following in mind: "People who agree to be interviewed deserve some consideration and so you will need to fit in with their plans, however inconvenient they may be for you".

6.6 Participant observation

Bell (2010: 15) states that "[p]articipant observation enables researchers, as far as possible, to share the same experience as the subjects, to understand better why they act in the way they do". Participant observation is an ethnographic approach to data collection (Davies and Hughes, 2014; Kawulich, 2005; Olsen, 2012) and as suggested by Jorgensen (1989) it provides opportunities to study most aspects of human existence, such as what, when, why, with whom and how people are carrying out certain activities. Participant observation provides opportunities to observe, record and analyse non-verbal communication, such as body language (Moriarty, 2011).

Following the approach used by Mason (2002) for the participant observation I became a member of the community during the study, "simultaneously becoming part of and transforming the dynamics within them" (Mason, 2002: 88) and this provided me insight into the participants' behaviour. This way I became an active participant during the research and as identified by Bell (2010) by using participant

observation I was able to interact with, and share the lives, functions and activities of, other people in their own environment over a period of time.

As Burges (1982) and Hancock, et al. (2007) point out, by means of participant observation I was able to see, observe and feel the behaviour and activities of people, the cultural and physical characteristics of the participants and what it felt like to be part of the group when participants were engaged in their normal day to day activities and gaining first-hand experiences. In other words, I became embedded and immersed in the action and context of the social settings of Vatukarasa village, Sovi Bay and Vatukarasa Settlement to gain more understanding and knowledge of the likely impacts of climate change on people at these two locations. As suggested by Mason (2002: 90) I prepared myself "quite carefully in both an intellectual and practical sense before... observation". Following the approach used by Mack et al., (2005: 17-18), my responsibilities as a participant observer are summarised in Box 6.1.

Box 6. 1 Responsibilities of a participant observer

- Not to disturb people as they engage in their daily activities. Observe them as if you are not there.
- Engage in some activities (see Plates 6. 2 and 6. 3) to better understand the local perspective and not to draw attention to oneself.
- Mingle with people outside the period of observation for better rapport and for more substantive discussion pertaining research topic.
- Identify key informants and develop relationships with them.

Source: Adapted from Mack et al., 2005: 17-18.

Glesne (2006) points out that participant observation differs from everyday observation and interaction with people. In participant observation, the researcher carefully, systematically and in detail, observes and records the various activities of the participants, and analyses the data constantly to give meaning to the social world of the participants. I participated in the daily life of the participants (see Figures 6.2 and 6.3), to gather data. In fact, as a participant observer, as suggested by Fox (1998), I had two roles, one being an observer and the other as a participant. Participant observation can be either open or in some disguised role. I opted for open participant observation, where the participants knew that they were being observed in their natural environment, engaging in their daily routines. In other words, I announced and formally made my presence, purpose and intentions known

to the parties being studied. I observed the participants' daily activities, what they did (farming, fishing, selling produce from the roadside and attending social gatherings), how and when they did it, why and with whom they did it, thus connecting me to the most basic of human experiences.

Figure 6. 2 The researcher helping the participants boiling corn for sale from the roadside. Source: Photo by Rizu, 2012.

Figure 6. 3 The researcher tethering the goats. Source: Photo by Rizu, 2012.

As I knew most of the people at Sovi Bay Settlement and some at Vatukarasa village I was easily able to gain enough trust and acceptance and this enabled the participants to carry on with their daily activities, as if I was not present there. Knowing people also helped me to have a sufficient range of experiences, conversations, views, opinions and unstructured interviews for my research. Knowing the people and environment made it quite easy for me to conduct my participant observation at these two sites. Who, where and what to observe became

easy and clear to us (self and note-takers), as we knew and understood the research questions well and knew where to go or which venue to go where the activities were actually occurring or were being carried out.

I used note-takers to share my workload and to help or to improve overall recall of observations. We wrote and transcribed what we saw, heard or felt during the observation period. As Denscombe (2007) points out participant observation provided a unique way of data collection; it is more direct and provides first-hand information, rather than what people say or think.

Upon reaching the venues, my note taker introduced me and her/himself, explained our purpose and what we would be doing. Participation observation is not simply gaining access to the field or building rapport. Equally important is recording and describing what was seen, observed and heard. Initially what we did was to appear at venues, "hang out" with the participants and just ask casual questions. We made broad descriptive observations of the things or activities that were done in front of us (Angrosino, 2007). Then having written, recorded and analysed the initial data, I was able to narrow the data and we were able to make more focused observations. As suggested by Gallicano (2013) more analysis and repeated observations were carried out and then these repeated observations were further narrowed so selective observations could be made.

6.6.1 The strengths of the participant observations

Burns (1997) and Woods (2006) are also of the opinion that participant observation provides information on behaviour, daily routines, interactions, actions and reactions of the participants. It allowed me to fit in well with the participants and even things such as asking questions, note-taking and photography were ignored. "Participation is a strategy for gaining access to otherwise inaccessible dimensions of human life and experience" (Jorgensen, 1989: 23).

Participant observation gave me another opportunity to be a part of the community under study and this helped me to develop a closer relationship with the people under study. As suggested by Jorgensen (1989) during participation observation I become directly involved as a participant in participants' daily lives. We also learn more by participation or doing things by ourselves. As Rich (2012) points out, if you see, you may remember for a while and you would forget, but if you actually do things, you will learn and remember. Additional advantages of participant observation as pointed out by Denscombe (2007) are summarised in Table 6.2.

Participant observation reflects the details, focuses more on depth rather than the breadth of data and provides a better relationship between the researcher and the social life of the people under study (Denscombe, 2007). In participant observation, I recorded what I saw and heard, and this self-reporting enabled me to get necessary data and a better understanding of the participants' activities and behaviours. Another thing is that when anything was done in front of me or I was a member of the group when certain things were done, it was much easier for me to recall, than things I was told. Thus, participant observation also allowed me to see, observe and experience how setting, environment and participants' activities and behavioural interactions influenced my understanding of the likely impacts of climate change at Vatukarasa village and the two settlements.

Table 6. 2 Advantages of participant observation

Requires basic equipment	Researcher uses 'self' as main instrument of research, with very little technical support.
It is non-interfering	The researcher is able to carry out the research, still maintaining and retaining the naturalness of the setting.
Provides insights	Provides rich insights into social processes and enables one to deal with complex realities of the society.
Holistic	Provides a complete and a better picture by incorporating the relationship between various factors.

Source: Adapted from Denscombe, 2007: 224

6.6.2 Some limitations of the participant observations

I found participant observation to be more time-consuming than the other research methods. I had to be in the field for long periods of time and it was difficult to know in advance how long it may take to complete the data collection. Participant observation findings are restricted, as the relatively small number of observations makes it difficult, or at times even impossible, for the findings to be generalised to other settings.

At times it also became difficult to compare the results with the findings of the other research methods. Inability to compare the results may also limit the value of the data and may leave the results open to challenges. If you make your role clear to the participants their interactions and other observable behaviour may change and you may not get the true picture. As Hankcock (2007) points out, there is always a

risk that the researcher may have missed certain things or may have focused on one event and may have missed things which were equally or more important.

6.7 Focus groups

As suggested by Curtis and Curtis (2011) and Yates (2004) focus group discussions helped me to explore, examine and understand what participants were thinking, how and why they were thinking in that manner and what were issues of importance to them. Focus groups explore the participants' different points of views and stimulate discussions (Reed and Payton, 1997;Yin, 2011). A focus group is a group activity, where a moderator or facilitator starts a conversation, which leads to group discussion and interaction among several participants (presenting their experiences and views and they listen to, engage with, and reflect on what others are saying, taking their standpoint further) and producing shared meanings about a defined topic (Glesne, 2016; Greener, 2011; Ritchie et al., 2014; Yin, 2011). "The focus group is led by a trained moderator, who is expected to cover a series of questions on a pre-established discussion guide ... and the participants are encouraged to freely discuss their opinions and feelings on these and other topics" (Ward et al., 1991 quoted in Bailey, 1994: 192).

In the focus group discussions, I used a less structured approach as this allowed me greater flexibility and more interaction amongst the participants and even those who had very little to say or had limited societal voice. With a less structured approach I was able to encourage respondents to discuss matters informally and share views among themselves rather than just answering questions. This also allowed the respondents to see their own realities and helped in providing more accurate and relevant data (Morgan, 1997). As focus group discussions progressed among the participants their responses were refined and sharpened, and their discussions moved to a deeper level. Following the approach used by Glesne (2016), Hancock et al. (2007), Ritchie et al. (2014) and Silverman (2007), I found self-contained qualitative focus group discussions very useful to express and explore "how" and "why" and to find more about the research questions. "Situations such as focus group interviews provide access to both actual and existentially meaningful or relevant interactional experiences" (Denzin, 1998 quoted in Berg and Lune, 2012: 173). I prepared a schedule of prompts for focus group discussions that I used as a guide and I allowed and encouraged the participants to shape the discussions in a more informal and spontaneous way.

The focus group discussions were held at a participant's residence. One participant's resident was chosen from each group, with which most agreed. This enabled them to be in their own natural settings, feel more comfortable, be at ease and open which in turn provided a more enjoyable environment for them to share and discuss their views and opinions (Arksey and Knight, 1999). For the focus group discussions, I and my note-takers were always present thirty minutes before the start of each session. We all sat on pandanus mats which is customary practice for both communities. The seating arrangements were done in such a way that it formed a "U" shape, so all the participants and the researcher (none of the participants were at my back) could easily see one another and have maximum eye contact with each other. This created interactive discussions and a more open and friendly environment. I welcomed the participants and thanked them. I introduced myself and my note-taker to the participants, explained my role and my note-taker's role. "This helps to establish rapport and trust" (Carey and Asbury, 2012: 60). We (myself and note takers) dressed appropriately, to create a positive impression, with particular emphasis on body language, behaviour and manner of speaking.

The ground rules were explained to the participants, who were told that there is no right or wrong answer, but only different points of view. All participants were called by their first name and they were informed their names would not be used in the thesis, so they would feel free to express their points of view with no repercussions, nobody would know who said what because codes will be used. Only one person was to speak at a time, "which prevents overlapping comments" (Carey and Asbury, 2012: 61). I also informed the participants that they do not necessarily have to agree with others but please respect others' views, talk to one other and please do not hesitate to give alternative comments as they are also very important for the research.

I conducted six focus groups. There were three for the *iTaukei* and three for the Indo-Fijians. The reason, I had no more than three focus group discussions for each community was that I was not getting anything new in my third sets of discussions, the information being pretty much a repetition of what had already been given in first and second discussions. Czarniawska (2014: 145) states that "When there is no doubt that the material has become repetitive; it is time to stop and move on". Focus group discussions for Fijians and Indo-Fijians are summarised in Tables 6.3 and 6.4 respectively.

Table 6. 3 *iTaukei* focus groups

Focus group	Number attended				Duration (minutes)	Number unable to attend
	Male	Ages	Female	Ages		
One	2	27/32	4	21/22/24/36	103	3
Two	2	32/41	4	19/20/31/43	93	3
Three	3	19/34/41	3	21/25/32	85	3

Source: Field notes, 2012.

Table 6. 4 Indo-Fijian focus groups

Focus group	Number attended				Duration (minutes)	Number unable to attend
	Male	Ages	Female	Ages		
One	3	23/37/69	3	34/39/69	103	4
Two	7	18/20/27/34/37/41/56	1	33	88	3
Three	6	24/27/31/34/43/58	1	67	75	4

Source: Field notes, 2012

I started each discussion with few icebreakers, such as “Do you like living here?” And “For how long you have been living here?” Then I moved from general to more specific questions. I also made sure that every participant was heard. I requested that the participants gave answers in full, by asking them for further information such as “can you shed some more light on it” or “can you elaborate some more on that” or “can you give some examples please”. I drew out quieter participants and provided them opportunities to give their views and opinions. I asked open-ended questions to generate discussions and avoided questions which would have given me “yes” or “no” answers. As suggested by Berg and Lune (2012: 151-152) I applied the ‘Ten Commandments’ which are summarised below, to my focus groups.

- Establish a warm and comfortable rapport. Never begin a meeting cold.
- Always keep the subjects on track, always work with an interview schedule and always remember your purpose.

- Be relaxed, affirmative, and as natural as you can. Present a natural front.
- Do not present yourself as uninterested or unaware. Demonstrate awareness and listening.
- Always remember to think about how you look to other people. Think about appearance.
- The subjects should always feel comfortable. Conduct discussions in a comfortable place.
- Avoid “yes and no” answers, as these answers will not offer much information during analysis. Don’t be satisfied with monosyllabic answers.
- Participants should always feel that they are an integral part of the research. Always be respectful.
- Always remember “practice makes perfect”. Practice, practice and practice more.
- Do not forget you are a research emissary. Always thank the participants when you finish and answer all their questions. Always be cordial and appreciative.

I quickly summarised what I thought I heard and asked if the group agreed. I also rephrased the questions in different ways and focused on participants who did not contribute initially regarding each question. This way I was able to get their views and opinions. I made sure that I remained neutral and unbiased towards participants and their views. I fully engaged myself in all discussions, at times intervened, but did not interfere. Before the end of each discussion, I asked the group if anyone had any other comments to make. This helped me to hear the views or opinions which were not heard before. It is important to stimulate discussions and debate and permit differing opinions and views to be heard, contested, agreed and accepted.

6.7.1 The strengths of the focus group discussions

The focus group discussions allowed the participants to be more involved in the research topics (Gibbs, 1997; Glense, 2016; Ritchie et al., 2014) have more in-depth discussions, share social and cultural experiences and this enabled me to explore, clarify and to better understand issues raised in greater detail as interaction was among a small number of people (6-8). These focus group discussions allowed

me to hear the participants' different forms of their day-to-day interactions and to enter their world, to know their feelings, perceptions, impressions, beliefs, attitudes and to see their way of living. In other words focus group discussions provided in-depth information and brought me closer to the participants' thoughts and feelings.

Focus group discussions also provided me an opportunity to learn how the *iTaukei* and Indo-Fijians reacted to common issues or how they shared the expectations of the likely impacts of climate change. What I found with the focus group discussions is that I was able to cover more than six people at a time; group members were also able to naturally interact with each other, thus stimulating new thoughts, opinions and views, which may not have occurred otherwise. Focus group discussions allowed me to have direct interactions with the participants, which gave me more chance of clarification and enabled me to ask rephrased and probing questions. Focus group discussions also allowed me, as suggested by Greener (2011: 78) to "have the maximum space for shared meanings to emerge."

I have also found out that focus group discussions can be venues for social issues, questions, problem solving and carrying out community projects. For example, when we were discussing the impacts of mangroves on coastal fishing, one group suggested that there should be a committee formed in the village that could look after the planting of mangroves, as mangroves minimise coastal erosion and provide nurseries for juvenile fish, crabs and other marine species. The focus group discussions also provided me and the participants much safer and comfortable environments and this helped them to express their honest and genuine views, thoughts and opinions, without fear of attack, disrespect, insult and condemnation.

The participants found it much easier to freely express their views when they were in their own cultural and age group with the researcher. Example, I had some participants, mostly Muslim, who stated that sea level rise was God's punishment and this world will be under the sea in time to come. The focus group discussions also provided me an opportunity to ask probing questions. Knowing how and when to follow up, probing questions, or simply probes, provide researchers with ways to draw out more complete stories and good-quality data from subjects. Following the approach used by Berg and Lune (2012) the participants were asked to elaborate on what they have already answered in response to a given question – for example, "Could you tell me more about that?" "How long did you have that?" "What happened next?" or simply, "How come" (Berg and Lune, 2012: 121).

6.7.2 Some limitations of the focus group discussions

Like any other research methods focus group discussions also had some limitations. For example, they generated a huge amount of data, I also had some participants who did not actively take part in the group discussions and a few who were not very vocal. Some topics were too personal, such as the question: "What was the number of people from your family who had diarrhoea in the last three years". Here the participants were hesitant or were reluctant to discuss the issue in front of other participants. Another topic that the Fijian participants were hesitant to discuss was the issue of extraction of coral from the sea. As permission had been given by someone higher in authority, the participants did not feel very comfortable in discussing the topic.

At times I felt that I had less control over the proceeding of focus group discussions than I might have had with individual interviews. The other thing I noticed was that if a participant started saying positive things about a topic, then the other participants would say very little negative about it. It seemed that at times participants significantly felt obliged to say things that others were saying and it may have silenced some participants whose ideas and views are different from the majority of the group. I also had some "self-appointed experts" or participants, who had the idea that they knew everything and wanted to show this to the other participants.

6.8 *Talanoa* sessions

Talanoa is a word that is very frequently used by both the Indo-Fijians and *iTaukei*. *Talanoa* can be purely imaginary, fiction, non-fiction, formal or informal. The term *talanoa* as used in Fiji, Tonga and other Polynesian countries, is similar to the *Bislama* term *storian* (Warrick, 2011), where two or more people (all my *talanoa* sessions (four for *iTaukei* and four for Indo-Fijians) had more than three but less than seven participants) can talk freely and openly about incidents, activities, their obligations and responsibilities, not only through their mind but also from their heart. The Tongan academic, Timote Vaioleti has broken the word into two parts, *tala,* which means to convey, talk, tell, discuss, relate and inform, and *noa* which means, talking for the sake of it and not focusing on anything in particular (Vaioleti, 2006). To have an effective *talanoa* three major components are required, such as a story, the act of telling that story and an occasion for conversation (Havea, 2010). "The Fijians, the indigenous people of Fiji, do not generally communicate in

writing. They listen, observe and communicate verbally among themselves" (Ravuvu, 1991: ix).

Talanoa is a very important component or aspect of Fijian culture, because day to day activities are mostly based on *talanoa* (Otsuka, 2006). "Oral tradition dominates over electronic communications" (Rich et al., 2006: 4). What people do, when, how and with whom they do it, is mostly discussed with one another as they live and practice a communal way of living, in which there is more "sharing", "caring" and "helping" within the communities (Meo-Sewabu, 2014). "*E veitalanoa ga na vuravura. Kevaka ko kila a vosa, e sega sara na ka ko na ta' rawata kina"* (The world is just talk. If you know how to talk, there is nothing at all you cannot get from it) (Tui, a residentof Yanuyanu, quoted in Arno, 1993: 1).

Talanoa is also common among Indo-Fijians, but they seldom discuss their day to day activities with non-family members and their way of life is more strongly individualistic. Knowing the protocols of both the cultures, Indo-Fijians and *iTaukei*, such as what are some of the things that are culturally appropriate, ways of approaching people, when to approach them and when not to approach them, helped me in achieving favourable outcomes from my *talanoa* sessions. *Talanoa* "... helps build better understanding and cooperation within and across our human relationships. It advances knowledge about our social identities, extended families, our village, our ethnic and tribal communities, our religious beliefs and our moral, economic, and political interests" (Halapua, 2000: 1). *Talanoa* is a cultural synthesis of the stories, information, theories and emotions that can produce knowledge to address Pacific issues (Vaioleti, 2006).

I employed a conversational approach with participants, talking with them, actively listening to what they were saying and responding to the story being told (see Figure 6.4), by using positive body language, such as maintaining eye contact. Eye contact is important not only when you are speaking but also when the participants are speaking. By maintaining good eye contact I was able to establish a bond between the participants and myself. It also gave the impression to the participants that I was sincere and interested in what they were saying. "...more flexibility in following the questions and more openness of the questions can allow unanticipated data to be elicited" (Carey and Asbury, 2012: 61).

Figure 6. 4 *Talanoa* session with *Taukei*villagers while they were selling boiled corn from the roadside. Source: Photo by Rizu, 2012.

I also did not interrupt the participants. I always allowed the participants to finish what they were saying and then gave my side of the story. Interruption could swiftly destroy the rapport that was established and interfere with the participants' "trains of thought". The participants may have been in the process of making an important point and may lose their concentration if they are interrupted. Whenever the participants were saying anything, I always leaned slightly forward to show the participants that I was interested in whatever they were saying and was appreciating it. I also nodded my head, showed appreciation and agreed with the participant's story, but not too much as this may have discouraged others, who were of different views. To get the participants' interest, I used humour and did not act "like an expert". I tried to engage with them as equals and this made them more relaxed and comfortable. In other words, I made the participants feel valued and important.

6.8.1 The strengths of the talanoa sessions

As suggested by Otsuka (2006) I found *talanoa* sessions to be a very useful method to collect qualitative data. I also found them to be most culturally appropriate to establish and to maintain good coordination, interpersonal relationships and rapport with *iTaukei* and Indo-Fijian participants, thus providing more reliable, valued, accurate and valid data to address the climate change issues. They are flexible which provided me opportunities to obtain insights, to uncover and explore unanticipated issues and important information as they arose during the sessions.

Another very important thing that I learned is that *talanoa* sessions provided me the opportunity to bridge the gap between the participants and myself, providing a more comfortable, easy, open and free environment, where we (self and participants) were even able to share our emotions. The informal face to face *talanoa* sessions not only provided information on impacts of climate change, but also understanding, tolerance and insight into the needs of the participants.

I found *talanoa* sessions to be more open and relaxed and participants found them very comfortable. As participants were often related and knew one another they did not hesitate to freely engage in the conversations and reflexively brought themselves into the story, the likely impacts of climate change. In *talanoa* sessions some participants were more dominating than others and I also found data analysis to be difficult and more time consuming.

6.9 Differences between *talanoa* and focus group discussions

6.9.1 Focus group discussions

Focus group discussions require careful planning. They are mostly developed and constructed around a number of predetermined questions which have to be identified. First a topic is introduced. A time schedule is prepared, to help provide a rough guide on how much time to be spent on each topic. Each group member needs to be managed fairly and each member of the group needs to be encouraged to participate.

One needs to have more than one focus group discussion to have a useful result. In focus group discussions participants do not have to agree or disagree with one another, but they have to discuss the topic, put forward their opinions and respond to the comments of other group members. This way participants are able to understand, or to get insight to, an issue. The participants were also required to stay on the specific topic and not to wander off the issue. Focus group discussions do not involve one individual participant, but are conducted with a group of participants, where in depth interviewing takes place to gain rich, full and detailed insights of participants' perceptions and understandings of a topic within a selected group of people (Walter, 2013).

Focus group discussions can produce a lot of information in a relatively short time. As the name implies, it is a group activity, with normally six to eight people, where an individual's point of view or opinion is not focused upon, but more or less all the

emphasis is placed upon inter-and intra- personnel conversations and engagement of all the group members.

6.9.2 Talanoa sessions

Talanoa is casual sharing of opinions, stories or points of view. *Talanoa* sessions are not structured around predetermined questions and conversations are freer flowing than focus group discussions. A *talanoa* session can be a one to one conversation or a group session. *Talanoa* is frank expression of an individual's inner feelings and experiences that he/she wants to share with other members of the community (Halapua. 2002). To me *talanoa* is a process of sharing sorrow, pain, despair, emotions and happiness. This way one is able to off-load, whatever one has got in his/her heart and share his/her burden, wrong doings, guilt, sufferings and good deeds with his/her trusted friends and family members.

One major outcome of COP23 was the *talanoa* dialogue, where people floated their ideas and shared their experiences on how to minimise present and future likely impacts of climate change. The *talanoa* sessions involved people from all levels and ranged from initial stocktaking exercises to monitor and prepare future Nationally Determined Contributions (NDCs).

Talanoa can be formal or informal discussions or conversations, where ideas and thoughts can be exchanged. *Talanoa* is also discussed in Chapter Three 3.8.7. *Talanoa* brings the researcher and the participants closer and they are able to easily relate with one another (Vaioleti, 2006). *Talanoa* sessions can also be a process of bringing different political, religious and ethnic groups together to address and find solutions for issues, topics and conflicts. So, when one compares focus group discussions with *talanoa* sessions, focus group discussions are more beneficial to the researcher, whereas *talanoa* sessions can be more beneficial to the participants. If not, they can equally benefit both, the researcher and the participants. "The process of talanoa is fundamentally concerned with strengthening relationships that not only connect us, but also enable us to respect and learn from each other" Halapua, 2000: 1-2).

What I have noticed and learned is that focus group discussions are a relatively quick way of obtaining information on a specific topic, with predetermined questions, whereas *talanoa* requires more time, you see yourself in participants, you become part of them, at times sharing their emotions and feelings. Also probes or follow-up questions are more easily and more effectively used in *talanoa* sessions,

than in focus group discussions. The probes used in *talanoa* sessions provide information, which is closer to the participants and which may they have not revealed during other methods of data collection. Additional *talanoa* sessions were carried out in 2019.

6.10 Data analysis

"Qualitative data analysis is an interpretive task. Interpretations are not found-rather they are made, actively constructed through social processes" (Ezzy, 2003: 73). Analysis is the most important component of the research because it helps to understand the experiences of people and enables the researcher to communicate the results, whenever needed (Bryman, 2012; Carey and Asbury, 2012; Hardy and Bryman et al., 2004). Glesne (2006), Corbin and Strauss, 2008 and Denzin and Lincoln (2013) note that qualitative data analysis is making sense of what things were observed, seen, understood and learned. As suggested by Denscombe (2007) advantages of qualitative data analysis are summarised in Table 6.5.

Table 6. 5 Advantages of qualitative analysis.

Both the data and the analysis are "grounded"	The data and the analysis are "grounded in reality" and have their roots in the social structure of the respondents.
The data provided are rich and more detailed.	It provides thick description of even complex social situations and is able to provide justice even to the subtleties of social life.
Contradictions and ambiguity are tolerated	The analysis of the data is not reflected as being weak, but reflects the social reality being studied.
There is always chance for alternative explanations.	As the analysis of the data depends upon the skills of the researcher, it provides opportunity that another explanation could also be valid and different conclusions can be reached using the same methods.

Source: Adapted from Denscombe, 2007: 312.

In qualitative research, the data is analysed as it is collected. Data collection is not separate from data analysis (Tracy, 2013). They are done simultaneously, which "enable you to focus and shape the study as it proceeds" (Glesne, 2006: 148). The analysis of qualitative research is to capture raw data and categorise it into respective categories, which would provide useful and meaningful information (Neuman, 2006). "Analysis involves the process of breaking data down into smaller units to reveal their characteristic elements and structure" (Dey 1993 quoted in Gray, 2014: 607).

There are certain things that a researcher should do while preparing qualitative data for analysis. First make a copy of all original materials and store them safely. Second, when recording data, have a wide margin on the right-hand side of the page, so it becomes easy to add memos or notes to the relevant text. Third all 'raw data' should be given a serial number, so it becomes easy to go back and forth through the data and to retrieve significant data from the lot (Denscombe, 2007). The techniques for managing qualitative data are summarised in Table 6.6. Data management systems should not be rigid and complex and should be designed soon after data collection or even better before data collection (Hardy and Bryman, 2004).

Table 6. 6 Techniques for managing data

Coding	The data are put into groups to simplify and standardize the data for analytic purposes. Coding has its own logic, structure and purpose.
Annotating	Notes and comments are added to written materials to refine and progress the ideas further
Selection	Significant, relevant, interesting and representative items are picked from the lot to further reinforce the arguments.
Summary	Here the reduced version of the larger body of data is obtained (keeping in mind the original data collected) to generate something unique or typical about the research.

Source: Adapted from Blaxter et al., 2006: 203.

In qualitative data analysis there are five main stages. First, is data preparation; the text is transcribed and catalogued. Second, is initial exploration of the data; reoccurring themes are looked for, notes are added to the data and memoranda are written to capture ideas. Third, is analysis of the data; data are coded and the codes are placed into respective categories or themes. Fourth, is representation and display of the data; interpretation and writing of the findings, figures and tables are used to illustrate points. Fifth, is cleansing of data (making it correct and useful) and triangulation of data (see Section 6.11) (after Creswell, 2007). "Qualitative data analysis usually involves a process of labelling, organising and interpreting data with reference to a set of 'codes', 'categories' or 'themes' (Ritchie et al., 2014: 272).

In qualitative studies there is no fixed or simple formula for developing concepts and identifying themes, but Taylor and Bogdan have suggested some steps, summarised in Table 6.7, which I found to be quite useful.

Table 6. 7 The steps to develop concepts and to identify themes in qualitative studies

Read and reread the data	Read the field notes, documents and transcripts several times so as to know the data inside and out. It is also useful to have someone else to read the data, as the researcher may have missed certain things
Keep track of hunches, interpretations, and ideas.	Keep recording important things and ideas as you read through the data and also make notations in the margins.
Look for emerging themes.	Identify tentative themes and look for deeper meanings in the data.
Construction of typologies.	Typologies can be used as a tool to identify themes and to develop concepts and theory by linking even seemingly different phenomena.
Develop theoretical propositions and concepts.	Generalise ideas from observations, focus group interviews and *talanoa.* Look for themes, compare statements, look for concepts that unite them and look for similarities between them.

Source: Adapted from Taylor and Bogdan, 1998: 142 – 145.

6.10.1 Participant observation

So as not to forget anything, all that was observed and heard was quickly and briefly noted down in the field notebook. At the end of the day the full field notes were written up and expanded as fully as possible, giving the locations, all those who were present, all those who were involved, what happened, and date and time of the day. The field notes not only contained what occurred and was observed in the setting but also the observer's own interpretation of such happenings or activities and what further could be done in future. All notes were clearly written. First the full story of what I observed was written and then the interpretations or what I thought I observed was written down.

6.10.2 Focus group discussions

I carefully analysed the focus group discussions to make visible the likely climate change issues important to the participants. Before I go any further, I would like to

state five important rules of thumb for analysing focus group data, which are summarised in Table 6.8.

Table 6. 8 Five important rules of thumb for analysing focus group data

1. Avoid quantifying results or offering magnitudes.
2. Provide quotations to support your assessment of what the various trends and patterns of discussion are.
3. Offer relevant characteristics of each group member prior to offering their quoted response in order to provide a sense of three-dimensionality to group members.
4. Make a point, state or demonstrate a specific pattern.
5. Use quotes to illustrate, not prove. It does matter that everyone in your group prefers the yellow box over the green one, but it does not prove anything.

Source: Adapted from Berg and Lune, 2012: 188.

For data analysis I wanted to use thematic analysis for participant observation and grounded theory for focus group discussions. The terms used in thematic analysis and grounded theory are interchangeable as these two processes are very similar to one another. Both are key tools of analytical induction and in some textbooks, both are treated as same thing (Curtis and Curtis, 2011). Accordingly, I used grounded theory analysis to analyse the information collected (participant observations and focus group discussions), because it provided a deeper appreciation of the data (after Boyatzis, 1998).

6.10.3 Grounded theory

Grounded theory is most often based on qualitative data (Birks and Mills, 2011; Walker and Myrick, 2006). It explains how and why people interact or behave differently when they encounter certain events, situations or problems in their life (Ezzy, 2003; Smoekh and Lewin, 2011) and the data is constantly compared to look for commonalities and differences. As stated by Greener (2011), in grounded theory a researcher takes an inductive approach to compare the collected data with their emergent ideas to come up with theories. Grounded theory, which builds categories and concepts from the bottom up, makes it easier to combine existing theoretical ideas with new theories, also providing an opportunity to know more about areas and participants, where very little has been done previously. Grounded theory

generates theories with the aim of explaining social actions, processes or experiences of people through analysis of data (Corbin and Strauss, 2008).

Each of the focus group discussions and participant observations were summarised immediately, in one sitting to avoid memory lapses. I thought it best to summarise each discussion immediately, because it was fresh in my mind and it was very easy to recall. All the data were summarised together with the note-takers and we shared observations (both verbal and non-verbal) and discussed participants' behaviours, reactions and responses to key questions.

The first step of the analysis was open coding which is the process of condensing the bulk of data into categories and their properties. "Open coding works through a process of making constant comparison" (Gray, 2014: 612). As suggested by Strauss and Corbin (1998) in open coding, through close examination of the data collected, naming and categorising of the phenomena are carried out. Data are coded to proceed from recording of data to identifying categories thus providing a new picture of the data (Richards, 2009). "In qualitative research, coding is a way of developing, refining and interpretations of the data" (Taylor and Bogdan, 1998: 150). In grounded theory coding involves concepts and categories, which are used to describe, analyse and generate theories (Blaike, 2010; Punch, 2001; Walker and Myrick, 2006).

The information collected was transcribed into text and a margin was provided to identify individual pieces of data. In qualitative analysis the field data is transformed into a textual state by transcription. The data was read initially to find out major issues and to make connections. As Curtis and Curtis (2011), Walter (2006), and Yates (2004) point out, the data was read closely, line by line to examine words, phrases and paragraphs, to identify any new information that may have been embedded in the information collected. "Grounded theory works by the researcher examining the text (or possibly recorded words) of research participants, as well as their own notes, and coming up with codes that capture and summarise the data" (Greener, 2011: 96). Then an overall feature of the research was described and was sorted into categories (Burges, 1982; Packer, 2011; Walter, 2013). Following the approach used by Jorgensen (1989) the categories were developed keeping in mind the following:

1. How many times something was said?
2. How many people said that?
3. What were the levels of emotions created by the subject or issue?

After this, theoretical values or the nature of each category, were developed or found out by comparing the coded data with previously coded materials.

The second phase, axial coding, involved trawling back through the data (after Walter, 2006). The categories were further developed by identifying each category and subcategory, forming them into themes. As identified by Greener (2011) each theme was taken separately; information from the data was placed into respective themes and the final form of each theme was constructed. The axial coding refines and differentiates already available concepts, so as to transform them into theoretical core categories. “Typically, axial coding is used particularly in the middle and later stages of an analysis” (Flick et al., 2004:271- 272).

Selective coding is the third phase of data analysis. As Curtis and Curtis (2011) point out themes were selected and identified from axial coding, and then were related systematically to other themes (Strauss and Corbin, 1998). Then a single story line was developed around each theme. “The emergent theory is then tested against the data, most likely resulting in further definition of the basic conceptual categories, as well as the linkage and relationships among them” (Jorgensen, 1989: 113-114). Selective coding is like a catalyst that drives the story forward (integrating and refining categories until relationship and categories are saturated, meaning no new data could be added to the developing theory) and further refines the story (Richards, 2009).

As I had two note-takers, one for the village and one for the settlement, the note-taker who was not directly involved in the data collection was given the chance to review the results independently. Then we all (two note-takers and I) got together to compare our interpretations. One of the major advantages of grounded theory is that it avoids ‘forcing the data’ to examine predefined theoretical models (Walter, 2013). Denscombe (2007) postulates further advantages of the grounded approach which are summarised in Table 6.9.

Table 6. 9 Advantages of grounded theory approach

Recognized rationale for qualitative research	Grounded theory provides a structure that fends off likely criticism which could be directed towards a small-scale qualitative research project.
Fairly adaptable	Can be used with a variety of qualitative research approaches (interviews, observations etc) to analyse data.
Focuses on practice	Deals well with human interactions and can be used to improve interpersonal relationships.
Provides a systematic way to analyse qualitative data	Can provide help and show easy ways to newcomers how to code, develop concepts and to reach ultimate theories.
Easy to analyse on computer software	Computer can be used to help in analysing qualitative data
Provides the means for developing theoretical propositions	Can help to increase confidence of the researchers by encouraging them to achieve at least modest theories from the data collected.
Explanations are grounded in reality	Concepts and theories are built on sound foundation of evidence, thus keeping in touch with reality
Well suited to the exploration of new topics and new ideas	Provides a certain degree of flexibility in what to include and what to exclude in the analysis of the data.

Source: Adapted from Denscombe, 2007: 104.

6.10.4 Talanoa sessions

For *talanoa* sessions, I used narrative analysis, because narrative analysis places emphasis on the story told, shows how an event unfolded in one's life or how people construct meaning from those experiences and particular events (Walter, 2013). Narrative analysis focuses on the stories told by the participants, how these stories are told, the intention of the teller, the meaning of the plot, "how these stories link to a broader social or structural context" (Walter, 2013: 324) and how a researcher accentuates a sense of "being there". The objective of narrative analysis was to attain whole lived experiences of the participants and their interactions with their internal and external worlds. Narrative analyses focus on various elements, such as how stories about the participants and their world are sequenced and chronologically told. The elements reveal 'scripts', that are used to interpret events and stories told by the narrators, which are mostly drawn from their biographical

experiences, such as “culture, complexities and contradictions in organisations” (Gray, 2014: 166).

The captured lived experiences and stories of the participants were viewed in the gestalt (human behaviours or experiences as a whole and not a collection of parts of individual behaviours or experiences), “making distinctions between text that constitutes narrative passages and other forms of text” (Gray, 2014: 621). Narrative analysis revolves around stories, events, accounts or experiences of poverty, inequality, sexism, climate change etc., and the reactions and feelings expressed by individuals, groups or societies. Narrative analysis came into existence in the 1960’s because the traditional social sciences lacked human stories (Chase, 2005). “The purpose of narrative analysis is to unfold the ways individuals make sense of their lived experience and how its telling enables them to interpret the social world and their agency within it” (Smoekh and Lewin, 2011: 160).

As described above, I used *talanoa* sessions, as my method of obtaining narrative data. Firstly, I created and organised files (notes) from the data collected, creating a plot, which formed the central structure of the story. Then I prepared a list of important or significant statements obtained from the participants to their understanding of the likely impacts of the climate change. Then each statement was placed into a relevant group, which provided information called “meaning units” or themes. Following the approach used by Cresswell (2007) the participants’ experiences and the likely impacts of climate change were then described and written down, called “textual description” (Cresswell 2008; Carey and Asbury, 2012).

6.11 Triangulation (mixed methods approach).

“The key to triangulation is to see the same thing from different perspectives and thus to be able to confirm or challenge the findings of one method with those of another” (Laws 2003 quoted in Bell, 2010: 118). Triangulating my two note takers’ notes and observations, provided a much fuller, comprehensive and clearer record of my data collection. As Descombe (2007) points out that triangulation has three characteristic features that distinguish it from other strategies for social research which are summarised in Box 6.2.

Box 6. 2 Three major characteristics of triangulation.

- Both qualitative and quantitative approaches can be used within a single research project.
- Explains why alternative approaches are beneficial and explicitly focuses on the link between approaches. It shows that results obtained by several research methods can agree with one another, or even if they do not agree they do not contradict each other.
- It is pragmatic; it looks for the practical answers and solutions to research problems. It also helps to bring together research methods that could be regarded as incompatible.

Source: Adapted from Descombe, 2007: 108 – 109.

"In social research the term 'triangulation' is used to refer to the observation of the research issue from at least two different points" (Flick et al., 2004: 177). Triangulation is used to make qualitative findings more credible and involves using data from several sources (different types of samples and methods of data collection), for double, triple or more "cross checking" of the results, thus increasing the credibility, reliability and strength of the findings, enriching the interpretation and producing more in-depth answers to research questions (Cohen and Crabtree, 2008; Kennedy, 2009). Further advantages of mixed methods approach (triangulation) are summarised in Table 6.10.

I triangulated multiple methods such as talanoa sessions, focus group discussions and participant observation to address the research questions. Triangulation helped me to improve validity (by using different sources of information) and breadth of research (by having different dimensions of the same phenomenon) and findings (by analysing the research questions from multiple perspectives).

Table 6. 10 Advantages of mixed methods approach

Improves accuracy	Provides opportunity to compare and check the findings obtained through different research methodologies. Getting the same data from different approaches increases the confidence of the searchers that their findings are rigorous. The researchers can also discover which method of data collection is more suited for what type of research.

The end picture can be more complete	Using more than one method of data collection will enhance the findings; the data can also be complementary and can provide opportunities to see the same thing from different perspectives (compare and contrast). The findings are also likely to answer more questions and in greater depth regarding the 5 W's and 1 H (who, when, what, where, why and how).
Compensating strengths and weaknesses	Different methods have their strengths and weaknesses, so mixing methods will offset any inherent (strengths and weaknesses) and they can compensate one another.
A more practical and problem-driven approach to research	When mixed methods are used the approach is more problem-driven than theory driven. The mixed methods approach allows researchers to evaluate and find solutions for the practical problems of the participants.

Source: Adapted from Descombe, 2007: 110 – 118.

6.12 Researcher as an "insider", "outsider" and somewhere "in-between."

"Unlike the role of outside observer that is defined by the researcher and imposed by the setting, insider roles are provided by the setting" (Jorgensen, 1989: 60). I was an "insider" in two ways. First, I am a member of the Indo-Fijian community (which includes some of my relatives) and as such I have been a frequent visitor at Sovi Bay Settlement and secondly by becoming an accepted member for both the communities. Insider research plays a vital role in data collection (Davies and Hughes, 2014). In reality, in the *iTaukei* community I was not an "insider", but somewhere in-between an "insider' and an "outsider". Being an "insider" and somewhere in-between an "insider' and an "outsider" provided me with some advantages, such as having knowledge of the area and people, and participants felt comfortable and were able to talk freely with me. This helped me to acquire richer, deeper and honest information.

By being an "insider" and somewhere in-between an "insider' and an "outsider" it made it much easier for me to have easy access to people, how best to approach them (even people with authority, such as *turanga-ni-koro* and settlement headman) and obtain information which enhanced my knowledge about the research objectives. "Research in a particular place or institution in which you already work or attend may seem ideal as a method of recruitment as you are already known and

trusted" (Farrimond, 2013: 67). When one is from the area of study, like me, we have more knowledge (than an outsider) about the sites and being an insider provided a unique opportunity to acquire more in-depth knowledge of the said area. "Not only do you have your own insider knowledge, but you have easy access to people and information that can further enhance that knowledge" (Costly et al., 2010: 3).

There are, nevertheless, some disadvantages and problems associated with being an "insider" and somewhere in-between an "insider' and an "outsider". As in my situation (being an "insider" and somewhere in-between an "insider' and an "outsider") one is bound to be more familiar with the study sites and may lose objectivity. I may also have overlooked things that may be taken for granted. To the best of my ability I tried not to predetermine or assume anything and only noted what I was told, what I saw and heard. This research has taught me that research itself is a true lesson in patience and fieldwork will "go on" at its own pace and it could not be forced or pushed any faster than it usually wants to go.

6.13 Limitations of my research

As a male researcher I found it difficult to have access to women in the communities and I was not able to have an all female focus group discussion or *talanoa* session for both the communities, even though Nazra (my wife and note taker) was with me. Also in Indo-Fijian focus group discussions, women were strongly outnumbered (5 to 16), despite my efforts to have equal numbers. However, the *talanoa* sessions (with greater female numbers) gave me some opportunity to get a better gauge on women's perceptions of the issues.

Also as I was an 'insider' and being somewhere in-between an "insider' and an "outsider", and being known to participants, it may have made it difficult for people to say no to participating, as I was asking them directly. In conducting some of the qualitative research, it became difficult to keep the information confidential. In one to one interviews, the researcher has a higher degree of control over the information shared. However, this is more difficult to achieve in focus groups and *talanoa.* Even though the participants were asked to keep all the information confidential, it would have been extremely difficult for me to enforce this. Here the participants knew one another, and they knew who said what, so it became quite easy to reveal information or opinions that the participants would have wanted to keep private.

The best I could do was to strongly request that all the participants left everything that had been said and discussed within the four walls. In group interviews, participants are usually asked to agree to keep information confidential. “However, it is difficult, if not impossible, for any researcher to enforce confidentiality” (Perecman and Curran, 2006: 111).

In participant observation I found social gathering venues were quite complex socially and physically and it was very difficult to get consent from everybody. This was particularly a problem at Sovi Bay Settlement (Indo-Fijians), but at Vatukarasa village, as I had already obtained the consent from the *turanga-ni-koro* it was not such a problem. At Sovi Bay Settlement I obtained the consent from those participants who were initially present, but as other people joined the group, it was disruptive and disrespectful to seek their consent, as they were being seen by participants already there. Accordingly, I thought it was best to interact and observe them, but at the same time to conduct the observation ethically and respectfully so as to protect the rights of those being observed.

6.14 Ethical issues

“An effective system of ethical review of research involving human subjects is vital to the protection of research participants” (World Health Organization, 2009 quoted in Sieber and Tolich, 2013: 1). The research was approved by the Human Research Ethics Committee of the Faculty of Arts and Social Sciences, University of Waikato. The nature of research was explained to all the participants, they were informed that their participation was voluntary and that they can refuse to answer any specific question or could with-draw within two weeks from the date of participation. I promised to all participants that their personal information and their identity (except for those who willingly wanted their photographs and/or names to be used in the thesis) would be kept under lock and key and never be revealed to anyone. The participants’ time was not wasted. I and my note-takers were always early and prepared. All the participants were treated with dignity, trust and their time and efforts were highly appreciated.

“Ethical research is concerned with ensuring that ethical principles and values (summarised in Table 6.11) always govern research involving humans” (Walter, 2013: 73).

Table 6. 11 The ethical principles

Avoid harm to participants	Participants not to be embarrassed, no mental stress, belittlement or anxiety and no negative emotional reactions.
Obtain informed consent of participants	Ample, sufficient and accessible information to be provided to the participants, so that they can, on their own freewill, decide whether to participate or not in the research. Participants to be informed using short, simple language and theoretical language and jargon should be avoided. Participants were also encouraged to use their own language, *iTaukei* and Hindi.
Confidentiality	All collected data must be stored in such a way that no third party is able to have access to it. Issues of anonymity and confidentiality should be paramount
No deception	In order to elicit natural responses, the researcher should be fully candid with participants

Source: Adapted from Gray: 2014: 73-80.

6.15 Summary

Qualitative research emphasises mostly individual's activities, experiences and understanding, but it does not stop there, as it formalises and generalises each participant's views or what they are telling the researcher. It demanded my active engagement; I was integrally bound up with the methods of data collection and analysis of the data. I have found that there are five major components in qualitative research processes, namely designing the study, using various methods of data collection (triangulation), analysing data using different methods, interpretation of data and finally informing all relevant parties. In qualitative research all collection, analysis and interpretation of data are done simultaneously. Qualitative research, by elaborating and developing theories, has helped me to better understand the impacts of climate change on two communities, namely *iTaukei* and Indo-Fijian, at Vatukarasa and Sovi Bay.

The analyses of the qualitative data mostly depended upon two processes. Firstly, managing the data collected (reducing its "size") and secondly analysing that data (identifying that which is important) so that an adequate, relevant, significant and useful report can be prepared. The qualitative research also provided me with the opportunity to have an efficient and effective way to have access to and to gain insights into the social process of people at Vatukarasa village and Sovi Bay settlement, as this was very important in order to find out the relationships between

the social processes and the likely impacts of climate change. The whole purpose of qualitative research and analyses was to make ‘meaning’ from full, detailed and rich data collected by focus group discussions, *talanoa* sessions and participation observations.

The data collected is brought together in Chapters Seven and Eight which synthesises it in addition to information from the literature review and discusses their relevance to research questions.To discuss the results or what each participant has said I have used a key, which is explained in Table 6.12. By using the key I was able to keep the identity of the respondents or participants confidential.

Table 6. 12 Use of key to explain what each participant has stated

FFG-1-D	*iTaukei*focus group - 1 - participant D
IFG-2-E	Indo-Fijian focus group - 2 - respondent E
FT-2-I	*iTaukeitalanoa,* session - 2 - participant I.
IT-1-C	Indo-Fijian *talanoa*, session - 1 - participant C.

The next chapter discusses the challenges facing the coastal communities of Vatukarasa and Sovi Bay to enable them to continue to live with a changing climate and rising sea-level. For low-lying coastal areas, sea level rise is one of the greatest climate change threats. They are also confronted with impacts on their food security and health and the likelihood of increased exposure to extreme events.

CHAPTER SEVEN

Climate change impacts

> *Climate change impacts...generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system* (IPCC, 2014b: 5).

7.1 Introduction

In this chapter, I bring together the data gathered, synthesise information from the literature review and discuss their relevance to the first two research questions.

1. Are the *iTaukei* and Indo-Fijian communities of Vatukarasa and Sovi Bay vulnerable to the impacts of climate change, and if so why?
2. Are the *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay?

The chapter is structured to reflect the emphases that participants and respondents placed upon their perceptions and understandings of the impacts of climate change. The reporting of focus group discussions and *talanoa* sessions refers to views generally held by both communities (*iTaukei* and Indo-Fijian), unless specifically stated otherwise. When participants talked about climate change, the first thing that they mentioned was sea level rise. I begin by discussing the coastal impacts of climate change and sea level rise, and their consequences for the two coastal communities.

The chapter also discusses how the two different communities are impacted differently reflecting their locations, social organisation, livelihoods and social and cultural obligations. One point to note here is that the most exposed systems are not necessarily the most sensitive. Vulnerability to climate depends upon a community's socio-economic conditions and adaptive capacity.

7.2 Climate change impacts

I asked participants for their opinions regarding climate change. Most held similar views stating that climate change is the change in climate from their grandparents' and parents' times to what is experienced now. They also added that temperatures

are getting hotter, bad weather is now occurring more frequently and the weather also seems to be more changeable and less predictable. One moment it will be dry and the next raining. The months that used to be dry are flooding and the months that used to have floods are experiencing drought.

The participants were asked if climate change is a present or future problem. During discussions it became clear that extreme weather events and changing climatic conditions are of great concern to both *iTaukei* and Indo-Fijians. Most participants during focus group discussions and *talanoa* sessions explained that climatic conditions were not that much of a problem in the past, but they have become a problem now and they will be a bigger problem in the future.

As indicated in Chapter Three, a useful approach to understanding the human dimensions of climate change impacts, is to first distingish direct impacts and then the indirect effects that ensue (see Figure 3.3). In some cases several orders of effects (direct, intermediate amd indirect) can be detected, as shown in Figure 7.1, enabling strategies to be developed to adapt to climate change by focussing on different orders of effects and identifying approriate points of intervention (Chapter Eight addresses the issue of adaptation). In this chapter the first order or direct impacts of climate change are organised into three main groups: coastal effects, extreme events and increasing temperatures. This is done to enable discussion of complex issues: in reality many of the higher order imapcts are cummulative and can trace back to more than one initial direct impact. For example, sea level rise and on going coastal erosion are likely to increase the impacts of storm surges during tropical cyclones. In turn, the storm surges may further increase rates of coastal erosion and salinisation of soils. Heat stress, salinisation and reduced soil moisture can reduce crop productivity and consequently reduce livelihoods and increaase food insecurity. However, the broad categorisation has been adopted to facilitate analysis of complex and interrelated processes.

7.3 Direct coastal effects

There are three main direct effects of climate change on coastal areas including sea level rise, increasing sea surface temperatures (SSTs) and acidification. As Figure 7.2 indicates these three first order effects give rise to a number of indirect effects, several of which are interrelated. The one which most participants were aware of and mentioned was sea level rise.

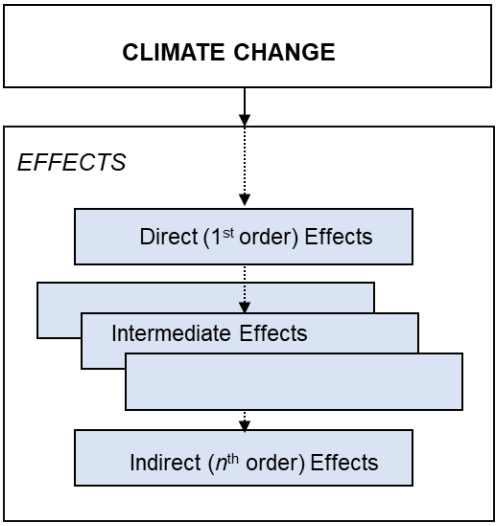

Figure 7. 1 The orders of climate change effects.

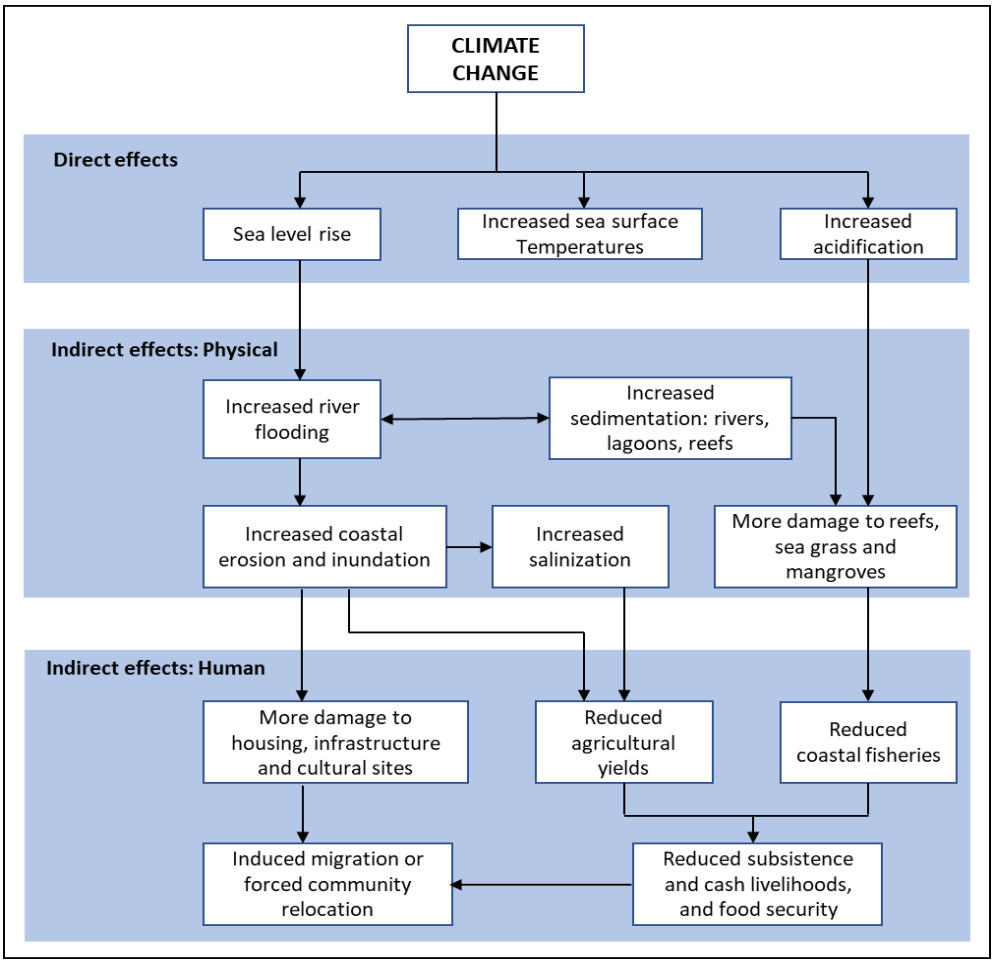

Figure7. 2 Some of the direct and indirect effects of climate change at Vatukarasa and Sovi Bay.

As noted by McLeod et al. (2010 cited in Wong et al., 2014: 381), "[t]he major impacts of sea level rise are changes in coastal wetlands, increased coastal flooding, increased coastal erosion, and saltwater intrusion into estuaries and deltas, which

are exacerbated by increased human-induced drivers". For low-lying coastal areas like Vatukarasa and Sovi Bay, sea level rise is one of the greatest climate change threats. Exposure to sea level rise is determined by the topography of the coastal areas, which is flat and low-lying with lagoon and reef morphology. Moreover, Vatukarasa village is quite close to the high-water mark.

Most participants considered that sea level is rising because of climate change. Vatukarasa and Sovi Bay are historically exposed to multiple-hazards, and their populations are quite familiar with the impacts of king tides, coastal inundation and erosion, saline intrusion, salt spray and storm surges during tropical cyclones and floods. With sea level rise, people are experiencing more frequent coastal flooding. The participants during *talanoa* sessions stated that they have to empty their septic tanks more frequently now as the absorption and percolation rates of the soil have reduced and water tables have risen. Climate change and sea level rise are likely to make the coastal communities of Vatukarasa and Sovi Bay more exposed to the impacts of shoreline change and coastal flooding.

Sea level rise, discussed in Chapter Three (3.3.1) is quite evident at Vatukarasa and Sovi Bay. It was observed by *iTaukei* participants that, especially during gale force winds and spring tides, sea water enters Vatukarasa village, particularly the low-lying areas. Rising sea level inundates land and less land is available for human habitation. The focus group discussions and *talanoa* sessions revealed that this was not the case about 50 years ago.

One *iTaukei* paricipant stated:

> FFG-3-M: My village is my beautiful beach, the place I am sitting I can see a huge wave, its mouth wide open approaching me, will it swallow my village or me with it.

One thing noticed at Vatukarasa village is that the reefs that were once acting as barriers are no longer as effective and increasingly larger waves are now reaching the beaches and coastal areas. Reefs play a major role in limiting foreshore erosion by supplying sediment to shore and by causing waves to break or shoal reducing the amount of wave energy reaching the coast (Nurse et al., 2014). Most participants, both *iTaukei* and Indo-Fijians, identified that now, even when the tide is at its lowest, the reefs are not as exposed as they used to be when they were young. Many waves are no longer breaking on the reefs but are now breaking on the beach.

> FFG-1-A: The reefs are mostly under water now; more waves are pounding beaches, causing more beach and land erosion, also destroying wildlife and fish breeding places.
>
> I FG-2-L: Now even when the tide is low, water is on the reef, not like before when the reefs were exposed during the low tide. The big waves also damage mangroves and uproot corals. When the tide is full, big waves now smash on beaches and sand is washed away.

I asked the participants how could we tell that sea level is rising and they replied:

> FT-I-B: My house is now very much closer to the sea than it was twenty years ago. Twenty years ago, the sea was very far off; I had to climb a coconut palm to see a boat returning from a fishing trip but now the sea is at my doorstep.
>
> IT-1-C: Before when we used to let our cattle out of the paddocks, the cattle used to go right near the sea to graze, but now they tend to graze further inland, because they are now able to get enough salt there, yet horses still graze near the sea, as they need more salt than cattle.

Both the *iTaukei* and Indo-Fijian participants recalled that if horses do not have enough salt, they will not drink, will not eat much grass and eventually will become weak. Horses getting enough salt will be healthier. Sea level is rising, and with the help of the wind, sea salt is sprayed further inland and some horses are now observed not having to graze near the sea.

Sea level rise is considered by the participants to be associated with many climate-related impacts at Vatukarasa and Sovi Bay. As the sea level is rising, so are the effects of tropical cyclones and storm surges, causing damage to the highway, coastal defences and houses, flooding inland areas, causing coastal erosion, and destroying cultural and medicinal trees and plants (IPCC, 2014b). It was stated that tropical cyclones and storm surges have overturned and damaged much of the coral near the shore. The communities of Vatukarasa and Sovi Bay have a history of tropical cyclones, heavy rainfall and associated river and lowland flooding, as shown in Chapter Three (Section 3.3.5). Participants indicated that they consider these events are now happening more frequently and/or with greater intensity.

Sea level rise is having both direct and indirect effects, as shown in Figure 7.2. The three major direct impacts of rising sea level on the coastal ecosysytems and communities are coastal erosion, inundation and increased salinity of ground (including soils) and river water (USEPA, 2011; Mimura, 2013; Neumann et al., 2015;Nunn, 2013). These are experienced at Vatukarasa and Sovi Bay where

people have observed poor drainage, reduced percolation rates, and increasing waterlogging of the coastal areas, which are reducing farm productivity (increasing the risk of subsistence food insecurity with both *iTaukei* and Indo-Fijians needing more money to buy food) and increasing vegetation death.

Increasing sea surface temperatures and acidification have not been observed by the participants, partly because they are relatively imperceptible and also because they have less awareness of these aspects of climate change. Despite this the particpants have observed many of the indirect effects of these changes such as reef, mangrove and sea grass degradation and declining availability of coastal fish. The participants are also aware that human activities have also contributed to the degradation of these marine resources. These, together with the indirect effects of sea level rise are discussed in the sections that follow

7.4 Indirect coastal effects

As figure 7.2 indicates there is a number and wide range of indirect effects resulting from sea level rise, increasing sea surface temperatures and ocean acidification. This section addresses the indirect physical effects including coastal erosion and inundation, salinisation, degradation of reefs, mangroves and sea grass beds and declining coastal fisheries resources.

7.4.1 Coastal erosion and inundation.

One of the major effects of sea level rise, especially at Vatukarasa, is coastal erosion. Both the communities are noticing changes to the Vatukarasa and Sovi Bay coastalines. Most participants believed that more intense tropical cyclones and storms are likely to make the problem worse, causing damage to coastal protection works and coastal areas. Beach erosion was also noted by Prerna Bhariti Chand (2010: 75) who observed that it "is prominent in the Vatukarasa Village area". Large sections of the coastal areas of Vatukarasa and Sovi Bay are being rapidly eroded (see Figures 7.3, 7.4, 7.5 and 7.6).

Sea level rise is not the only reason for coastal erosion in the study area. Human activities, (such as cutting and clearing of mangroves for land reclamation and fuel wood), have also contributed to much of this erosion. Beach sand has also been removed for use as decoration of tombs (Chand, 2010). In turn the erosion has further impacts such as increasing coastal inundation, increasing exposure of beaches to wave action, intensifying the speed of mangrove retreat, increasing flood

susceptibility and exacerbating the intrusion of saltwater into soils on agricultural land, thereby reducing the amount of arable land. These effects on the coastal communities of Vatukarasa and Sovi Bay have degraded their coastal habitats.

Figure 7. 3 Coastal erosion damaging *pandanus* trees, approximately 50 metres, south west of Vatukarasa village. Source: Nur Ali, 2012

The inundation of coastal areas by rising sea level is having social, cultural, and economic consequences for coastal communities as was suggested by both *iTaukei* and Indo-Fijian participants during focus group discussions and *talanoa* sessions. As outlined in Chapter Four *iTaukei*, more than Indo-Fijians, are deeply attached to their local environment. It was noted by most *iTaukei* participants that any destruction, disruption and degradation of their local environment (both terrestrial and marine) causes distress, anxiety, stress and depression. To *iTaukei* the *vanua* is part and parcel of themselves. One older *iTaukei* participant (TF-2-I) stated:

> How can I be happy when even my finger is cut and it is hurting?

The participant is referring to a small part of his body (finger), indicating that the environment is part of him and he is part of it. Even a small change in the environment is likely to upset him.

Rising sea level and past coral extraction are affecting the reefs' abilities to reduce the tidal and wave energy reaching the coastline. Some participants emphasised that past coral harvesting also contributed to sand erosion and disrupted sediment movements in estuaries and along the beaches.

> FFG-1-A: Live rock mining at Vatukarasa took place from 1992 to 2004 from two reefs - Navoto and Oria. Live rock mining has left our reefs destroyed and it will take decades for the reefs to recover. It may not be possible during my lifetime. Of all the rock mined about one third was rejected because of poor quality.

Other *iTaukei* participants agreed with FFG-1-A and indicated that people used to mine large amounts of live corals for sale. After selection only about one third of the rocks were sold and the rest were just left on the beach. Participants also agreed that the reefs of Vatukarasa were mined to the extent that the reefs started producing inferior quality rock that was no longer wanted by the buyers.

The daily functions and productivity of coastal communities like Vatukarasa and Sovi Bay depend upon healthy coral reefs. "Reefs play a significant role in supplying sediment to island shores and in dissipating wave energy, thus reducing the potential foreshore erosion" (Nurse et al., 2014:1621). Another common occurrence nowadays, as observed and revealed by the *iTaukei* participants is that during high tides and tropical cyclones, the waves bring debris and saltwater right into the village. The participants recalled this was not the case 50 years ago. I have also observed sites, where erosion has removed trees (see Figure 7.3), brush and coastal vegetation, which were previously barriers to reduce or minimise coastal erosion and flood inundation.

All the participantsalso stated that sea level rise is causing reductions of coastal land, flora (such as the hardwood *nokonoko* (casuarina), pandanus trees, bamboo and palms) and fauna (fruit bats, wild ducks, *ugavule* (coconut crabs), hawks and orange doves). Now both the communities have to travel further inland for the flora and they are not able to enjoy the traditional fauna.

> FFG-1-F: We are losing our coastal land, our wild (jungle) fruits and animals, because their homes are being destroyed by rising sea water. We are experiencing now more and stronger storm surges, more floods, making our lands not good for planting. It is hard now days to find wood for handicrafts.

> IFG-1-E: As sea level is rising, our land, vegetation, birds and animals are becoming fewer. Even now it is very difficult to have sufficient firewood.

All *iTaukei* participants mentioned that beach erosion is a major problem. A building (under construction) had to be abandoned, because the beach had been eroded and the foundation of the building was washed away (see Figure 7.4).

Figure7. 4 Mr. Ifereimi showing the building, the construction of which has been abandoned because the footing is being washed away by the sea.

The building in Figure 7.4 was being constructed (about 800 metres from the village on the narrow strip of land on the Suva side of the Vatukarasa *koro*) about 12 metres away from the sea (high water mark). In a short period, of about five years, the sea had eroded this buffer of coastal land. The building was to be a cafe, where people (mostly tourists) could have had their refreshments and snacks and the profit would have been used for village development. Coastal erosion is not only a danger to structures and properties but also to human life. Some *iTaukei* participants indicated that due to coastal erosion, the nearshore areas close to the beach are getting deeper and deeper and the currents have become swifter, making it dangerous, especially for children, to swim.

The volleyball court which was about 20 metres away from the sea is just 10 metres from it now. The rising sea level and increase in storm intensity is causing beach erosion and retreat of the coast. The wave and erosion forces are controlling the shape of the coastline. Most *iTaukei* participants agreed that they are very fortunate to have beach rock (see Figure 7.5), in front of their village, which is dissipating some of the wave energy and the erosion on that part of the beach is much less than other areas.

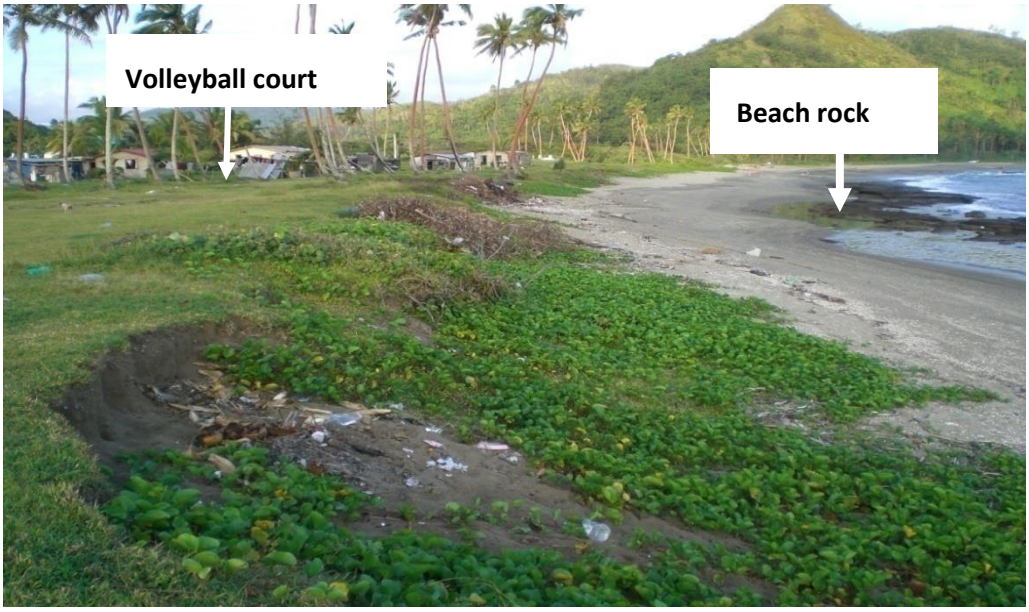

Figure7. 5 Beach rock in front of the Vatukarasa village is breaking the wave energy thus reducing beach erosion.

Another major impact of large waves smashing on beaches and causing sand erosion is the loss of protective strips of land between infrastructure and the sea. Figure 7.6 shows a part of Queen's road near Vatukarasa (about 400 metres on the Suva side of the Tamanua Bridge) that has become very exposed to the ocean. As sand is eroded from the beach, the important buffer zone (which is provided by sand absorbing wave energy) is very much reduced, together with the protection of the abutting land. Most *iTaukei* participants, contend that coastal and beach erosion at Vatukarasa village and surrounding areas is mostly due to the following: first, increased wave attack and increased wave energy (especially during storms), and second, extraction of coral and removal of mangroves and other coastal vegetation (for building construction and firewood).

Figure7. 6 The sea is just few metres away from the road. In a few years the road is considered by the local people to be likely to be washed away by the encroaching sea. The participants recalled that about 40 years ago the road was about 15 metres away from the sea, now it just a few metres (at places less than 2 metres) away.

The stress and impacts of extreme weather events are causing significant damage to the roads, which are now requiring more frequent maintenance, repairs and rebuilding, but these works are disrupted more nowadays and are becoming more costly as the bigger and stronger waves are washing away the earth and culverts that are needed to repair and maintain the road in good condition.

7.4.2 Salinization

Salinization is increasing concentration of salt in the soils and freshwater due to intrusion of seawater, seepage of brackish groundwater or loss of moisture as a result of sea level rise and drought. Soil salinity limits plants' water uptake from the soil by imposing ion toxicity, oxidative stress, nutrient deficiency and osmotic stress (Shrivastava and Kumar, 2015). Every aspect of plant development, such as germination rate and chances of survival, vegetative growth and reproductive rate is affected by salinization. Accordingly, most crops are sensitive to salinity (Chen and Mueller, 2018). Strong sunlight and heat also deplete groundwater resources, further increasing salinity of the soil. Climate change causes ocean temperatures to

rise, warmer water occupies more space, pushing salty water along coastlines, enabling more dissolved salt to leach into coastal areas.

The participants noted that these days crops, such as *bele*, when grown near the two rivers (Sovi and Tamanua), are no longer as healthy as they were before, when the edible leaves were large and dark green in colour. Now the leaves are small, have reduced plant biomass and are light yellowish. The participants revealed that they think this may be due to increased intrusion of saltwater in the soil near the two rivers, which is causing plant stress.

Indo-Fijian farmers recalled that nowadays they are less able to grow rice (like their parents and grandparents used to do), mainly due to intrusion of saltwater in their farms. Their grand-parents used to harvest about 60 sacks of *dhaan* (padi-rice) per hectare, but this gradually dropped to 30-35sacks per hectare (parent's time) and finally now they were only able to get 20-25 sacks per hectare. The farm yield has greatly reduced, and it is more economical now to buy rice than to grow it.

7.4.3 Coral reefs, sea grass beds and mangroves

Most participants stated that inland activities such as logging, deforestation, sedimentation, unplanned developments, farming near the two rivers, mangrove cutting, littering and use of weedicides, herbicides and pesticides were causing environmental degradation that impacted not only the land but also marine ecosystems. Sediments and toxins discharged from the rivers into the two bays adversely affected mangroves, sea grass beds and coral reefs. Both the communities have altered and are continuing to alter the natural character of the coastal areas of Vatukarasa and Sovi Bay through their exploitation and managed usage of their natural resources. Some of these changes have had a significant impact on the degree of exposure, vulnerability and resilience of the coastal areas to climate change and rising sea level.

The fragmentation and degradation of mangroves, sea grass beds and coral reefs is likely to reduce the survival rates of fish and invertebrates that depend upon these ecosystems for their food and shelter (Wetlands International, 2014; Wildlife Conservation Society, 2016). Coastal ecosystems and fisheries are over harvested; destructive fishing methods and extreme events, such as tropical cyclones and flooding are putting additional pressure on already depleting coastal and marine resources. The composition of coral reefs, sea grass beds and mangroves is changing and this is likely to continue in the future because of rising sea level and

sea surface temperatures, and increasing acidification of ocean waters. Without any adaptation, cliffs, beaches and sand dunes will continue to erode under rising sea level.

As noted earlier, significant reef damage was caused by coral extraction in the past. The participants emphasised that as the reefs were destroyed, the habitats for small fish were degraded and large fish like barracuda, locally known as *oqo* (Sphyraena barracuda) and trevally, locally called *saqa* (Caranx spp), are no longer attracted to the reefs and the people are no longer able to catch them like their parents and grandparents used to do. Habitat destruction is reducing the productivity of the area (fish and other marine species), which is further impacting on the daily lives of the communities of Vatukarasa and Sovi Bay.

7.4.4 Coastal fisheries

Marine resources are the main sources of protein and are also socially, culturally and economically important, but they are easily impacted, damaged and in some cases destroyed by the changing climate. Most of the fish consumed by both the communities originate in, and are obtained from, coastal fisheries. Fish and invertebrates are significant parts of *iTaukei* diets and an important source of income. Both men and women of Vatukarasa and Sovi Bay, especially *iTaukei*, fish from Monday to Saturday. All the participants, from the focus group discussions and *talanoa* sessions, indicated that the coastal fisheries are declining. Most participants stated that they are not able to catch enough fish for family consumption and/or to sell to sustain family cash incomes.

The fishermen of Vatukarasa village told me that before they used to count the number of waves hitting the reefs and the eighth one would be the smallest just after the seventh one which is the biggest. So just after the biggest one they would normally cross the passage in their canoes and boats. Today this theory no longer works, as any wave can be the biggest or the smallest. Crossing the passage has become very dangerous and difficult and even when they do cross the breakers, a good catch is not guaranteed. One *iTaukei* fisherman (FT-2-G) recalled that:

> When I was a young boy I used to go fishing with my grandfather and my grandfather used to catch big fish from the beach (near the mouth of Tamanua River). Now days we are not even able to catch small fish from the same spot. When my grandfather used to fish in a boat, he used to bring home so many big fish.

Because of the stronger sea currents, the fishermen are also having difficulty in catching fish that live near the sea floor with their fishing lines. Because of the strong currents they are unable to hold their lines at the bottom of the sea. Thus, they are only able to catch the "ground fish" when the tide is fully out or when the tide is fully in when the sea current is at its lowest. As a result, fishing times are now somewhat restricted, and because of this the catch is less than it was about 30 years ago. The participants emphasised that it is not only the number of fish that are caught that has fallen, but also the number of species of fish caught has also reduced. This is affecting both the communities, as the participants indicated that some species are good to cook in *lolo* (coconut milk), some to boil in plain water with onion and chilli, some to curry and fry and others to *lovo* (earth oven). Accordingly, dietary variety has been reduced.

One Indo-Fijian participant (IT-2-G), remembered that his grandfather used to tell his grandmother to prepare the ingredients (spices), he is going fishing and that he is going to bring *damu* (mangrove red snapper) for her to cook *machari ke surwa* (fish curry). It is no longer possible to be so confident.

An *iTaukei* participant (FFG-3-M) also noted that:

> In olden times people regarded the sea as a fridge, as if fish is there to bring. All they needed was, to know what time to go (tide) and what type of bait to use. My grandfather used to tell my father, start preparing the *lovo*, I am going to get a big *oqo* or *saqa*. Before he would go out to fish, he would go to the river mouth to catch some *kanace* (mullet) and he would keep them alive in a bucket to be used as live bait.

People can no longer be so sure about what type of fish they will catch. All participants indicated that because of rising sea level, more intense tropical cyclones, larger waves, and more destruction of sea grass and mangroves (habitat destruction), they are not able to take advantage of the marine resources that their grandparents and their great grandparents had enjoyed. Participants also recalled that their parents and grand-parents used to catch so many different species of fish (summarised in Table 7.1), but now they are not able to do so. Fish at Vatukarasa and Sovi Bay have reduced in size, range of species and numbers.

In addition, most *iTaukei* and Indo-Fijian participants stated that they are no longer able to stay out fishing in the sea for long periods because of the strong sun and excessive heat. They easily get heat exhaustion and dehydration. They also stated

that because of strong sunlight and heat they usually have sore eyes and headaches during and after fishing.

Participants also remarked that nowadays Vatukarasa villagers are only able to catch two types of crabs, both from the mangroves, commonly known as *qari* (Scylla serrata) and *kuka* (Metopograpsus messor), which are mainly for family use with any surplus being sold. In the past the villagers used to catch basketfuls of these crabs, but now, the maximum they can catch is about a dozen.

All the participants also suggested that increased demand and the use of overly efficient, illegal,destructive and banned fishing methods, such as the use of *duva* (Lasianthera Vitiensis (Lascineae)), the roots of which are crushed into a fibrous mass, shaken in water by the coral reefs, stupifying the fish so they become easy to be hand-picked or speared with certainity, had reduced fish stocks. They also revealed that today *duva* has been replaced by paraquat, cyanide and other pesticides, which are non-selective (having the potential to kill all those fish exposed to it) and thus have much greater and more farreaching impacts on the fisheries than the traditional vegetable poison. These pesticides are readily available and once used they not only kill the target species, but also non target species and coral polyps which are reef building organisms. The participants also explained that the traditional vegetable poison has no or very little effect on human consumers, because it is degraded at higher temperature and cooking makes the fish safe to eat. In comparison, cooking does not destroy chemical pesticides.

Another destructive method is breaking coral to remove clams, shell fish and other marine organisms destroying fish habitats, thus reducing coastal fisheries. Growth in population size is also placing additional pressure on already depleting coastal ecosystems and resources. Participants also indicated that the river water not only near the village but even further upstream is now more salty than it used to be about 20 to 25 years ago. This they said is due to the fact that sea level is rising and salt water is pushed further upstream. It was also revealed by the participants that fish, such as *damu*, that they used to catch near the mouth of the rivers, can now be caught further up the rivers as the fish migrate with the increasing salinity.

Table 7. 1 Species caught by parents and grandparents, current availability

Name			Availability of species today	Image
iTaukei	Common Name	Taxonomic Name		
Saqa	Bluefin Travally	Caranx melampygus	Only at times	
Sabutu	Orange-stripped Emperor	Lethrinus obsoletus	Few only	
Dabutu	Red-lipped Emperor	Lethrinus obsoletus	Hardly any	
Sevaseva	Many-spotted Sweetlips	Plectorhinchus chae to donoides	Few only	
Kaikai	Ponyfish	Leiognathus equulus	Few only	
Kake	Blackspot Snapper	Lutjanus ehrenbergii	Able to catch some	
Damu	Mangrove Red Snapper	Lutjanus argentimaculatus	Only at times further up the rivers	
Ta	Bluespine Unicornfish	Naso unicornis	Few only	
Kabatia	Thumbprint Emperor	Lethrinus harak	Able to catch some	
Ulavi	Bleeker's Parrotfish	Chlorurus bleekeri	Able to catch some	
Kawakawa	Groupers (rock cods)	Serranidae	Banned from catching	Image not available
Silasila	Bigeye Barracuda	Sphyraena forsteni	Few only, have to go to deeper waters	
Oqo	Great Barracuda	Sphyraena barracuda	Few only, have to go to deeper waters	
Nuqa	Spine foot	Siganus spp.	Few only	
Hose	Goatfish	Mulloidichthys vanicolensis	Able to catch some	
Dorodoro	Sabre Squirrelfish	Sargocentron spiniferum	Able to catch some in moonlight	

Photographs by author.

7.5 Direct effects of extreme climatic events

Another important group of direct effects falls under the category of extreme events. “A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of weather and climate extremes, and can result in unprecedented extremes” (IPCC, 2012b: 109). Extreme weather events affect social, cultural and economic aspects of all human activities and assets but with varying degrees of impact (Wairiu et al., 2012). Extreme events in the study area include tropical cyclones, floods and droughts. They cause significant disruption to subsistence and cash livelihoods, threaten food security, damage settlements, houses and infrastructure and from time-to-time cause injury and even fatalities.

7.5.1 Tropical cyclones

Among the extreme events experienced in the study area, the people of Vatukarasa and Sovi Bay fear tropical cyclones the most. All the participants stated that the greatest rates of coastal erosion occur during tropical cyclones and the majority of them associated tropical cyclones with destructive winds, strong seas, heavy rainfall and storm surge. According to the participants, tropical cyclones are the most disruptive, destructive and frequent natural hazard affecting both the communities. For older participants, Cyclone Bebe in 1972 is still imprinted in their minds. They did not state that Cyclone Bebe was the most devastating event and they do agree with the younger participants that recent cyclones have caused more damage and destruction, but they enjoyed talking and sharing their experiences of Cyclone Bebe with younger participants. They narrated that the height of flood water, effects on food security and destruction caused to social, economic and physical environments was quite severe. Many trees were uprooted, especially the ones with shallow root systems. The older participants revealed that the several months following Cyclone Bebe were particularly problematic. Children stayed back from school, as most school buildings were damaged or destroyed, and to help their family to clean-up and to gather food. Most participants revealed that it is not only the tropical cyclone winds that cause most damage and destruction but also the associated storm surge, extreme rainfall and flooding. One *iTaukei* participant (FFG-3-M) stated that Cyclone Bebe came like a butterfly, stung like a bee and left a trail of destruction. The participant made this statement (made famous by the boxer Muhammad Ali) because *Bebe* in Fijian means a butterfly.

Most participants agreed that both the intensity and frequency of tropical cyclones are increasing and now is becoming a major social disruption and economic hardship.

> FFG-3-M stated: Tropical cyclones with destructive winds destroy and damage our farms, forest, our reefs, rip and blow roofs of our houses and destroying some entirely, leaving us homeless. Not only this, the whole preparation and ensuring that our houses are safe, always end-up in increasing cost and loans.

> IT-3-R stated: When I was a small girl, we hardly used to hear about tropical cyclones. Before my marriage, I can only recall having two cyclones. As I became a mother and grandmother, the number of tropical cyclones and their wind force is increasing.

Many participants felt that the social disruption and economic hardship not only affect those directly affected by the cyclones, but also future generations. Contemporary economic losses, for example, lower the chances of children attending schools (as money is needed for recovery and earning potential is severely cut), thus reducing their chances of getting better and well-paid jobs in the future. Moreover, these younger people are likely to face increasing costs of disaster damage in the future. Most *iTauke*i and Indo-Fijian participants, noted that during and immediately after tropical cyclones it becomes very difficult to transport food, clothing and other necessities (given free) to other villagers and relatives (who may be more badly affected than themselves), as tropical cyclones and associated flooding, landslides and mudslides damage and destroy bridges and roads. Some of the impacts (as recalled by the participants) of each tropical cyclone are summarised in Table 7.2.

7.5.2 Flooding

The Government of the Republic of Fiji (2014) noted that a common hydrological event is flooding, which is often associated with the passage of tropical cyclones or tropical depressions. Climate change may affect the incidence and/or magnitude of flood events (IPCC, 2012b; Climate Institute, 2007 – 2010b). The participants explained that in the past 50 years, the magnitude of floods have been variable. In some years they have increased and in others have been less severe and the same could be said for the frequency of the flooding. In some years they have two to three floods and then they do not have any for the next six to seven years.

In coastal areas like Vatukarasa and Sovi Bay flooding is both a hydrological and oceanic process. Major coastal flooding and damage result when heavy rains occur in addition to large swells coinciding with king tides. Heavy rains and storm surge are both likely occurrences during tropical cyclones. It was observed by participants that prolonged heavy rain with a combination of factors including high tide and heavy seas blocked mouths of both rivers resulting in extensive flooding, damaging water, electricity and telephone connections. The combination of a higher sea level and more intense cyclones is likely to lead to higher storm surges (with increased run up), which may result in more crop damage and destruction, damage to farm equipment, longer working hours on farms, lower crop production and reduced crop yields.

During floods water runs over the land surface, carrying away loose materials, such as soil particles and rocks, into the streams. As the flooded water goes down the stream the velocity and momentum increase, causing further soil and riverbank erosion (see Figure 7.7). Increases in sediment supply, and changes in rainfall and temperature are likely to have significant implications for the present and future responses of the coastal areas and coastal ecosystems to sea level rise. Continuous soil erosion and intrusion of saltwater (contamination of groundwater) in farms are causing farm soils to become infertile, requiring more chemical fertilizers to improve and attain sufficient farm yields. In turn, increased soil erosion and use of chemical fertilizers are suffocating sea grass and coral reefs, reducing aquatic life and marine food resources on which *iTaukei* (heavily) and to a lesser extent Indo-Fijians depend.

Figure 7. 7 Mr. Fazal showing where the fence was before the flood on 29th March 2012.

Table 7. 2 Tropical cyclones experienced in Vatukarasa and Sovi Bay, 2009-2019

Tropical cyclone	Date	Some of the impacts at study sites
Keni	10/04/2018	Cyclone came about a week after Josie, thus making the impacts (see below) of Josie worse. Participants also revealed that they were in the initial stage of recovery when they were hit by another tropical cyclone. Most participants stated that those most affected by the tropical cyclones were socio-economically disadvantaged members of both communities.
Josie	2/04/2018	Most losses were caused by flooding including damage to both farm (such as cabbage, watermelon and chilli) and tree crops (such as coconut palms and citrus trees). Flooding was worst during high tides and the waters receded slowly. Water pipes were damaged.
Gita	12/02/2018	Participants recalled that Gita was not a major problem, but heavy rain resulted in some flooding.
Winston	19/02/2016	Some houses damaged. Winds and flooding caused most economic and social disruption. Flooding in coastal low-lying areas increased soil erosion and soil salinity, affecting future land productivity. Crops (both tree and farm), mangrove and coral reefs damaged. Some fishing boats, including motors, and fishing gear were also lost. Nearby primary and secondary schools were damaged, and children had to stay home for several weeks.
Lusi	12/03/2014	Minor disturbance.
Ian	11/01/2014	Heavy rain caused some flooding and minor damage to farm crops.
Evan	17/12/2012	Tree and farm crops damaged by strong winds and flooding. Some structural and power lines damage. Some damage to buildings caused by flying debris. Coral broken off nearby reefs and deposited on beach. Storm surge, strong winds and high waves altered the shoreline.
Yasi	30/01/2011	Heavy rain caused some flooding, resulting in crop loss. Wind was not much a problem.
Tomas	16/03/2010	Destructive winds and heavy rain caused flooding, crop damage and damage to some structures.
Mick	15/12/2009	Strong winds and flooding damaged power lines, crops, building structures, mangrove, coral reefs and forests. *iTaukei* participants stated that damage to nearby reefs, fishing grounds and forests impacted them the most as they depend upon these two resources for their livelihoods.

Source: Collected from participants during field work. Note: More than one date was stated for each tropical cyclone and I took the date which was most emphasized by the participants, because they related the date with something special or major in their life, for example birth of a child, buying a car, etc. I only emphasized tropical cyclones which occurred in last ten years because these were easy for the participants to recall.

At Vatukarasa and Sovi Bay some years have experienced wetter weather, benefitting farmers from increased water availability, but at the same time, this increased water availability has caused waterlogging of soils and on occasion major damage from flooding. *iTaukei* and Indo-Fijian farmers agreed that too much rain and waterlogging during the planting period could damage seedlings, which often results in weak or stunted plants, which are more likely to be affected by pests and diseases, which will lead to decreased yields.Farming, crop types and cropping patterns are closely linked with rainfall patterns. Most participants stressed that flooding usually accompanies tropical cyclones, resulting in crops being damaged (uprooted and swept away) and animals being killed.

> FFG-1-C: The last flooding (29th March 2012) was very bad. The water level was very high. This was the worst flooding I have seen in my life. My cassava and pawpaw farm was all destroyed. The whole farm was under water. I had my goat fence near the river, all my goats and the fence were washed away to sea.

> IFG-2-H. When I woke up in the morning, I saw that Sovi Bay Bridge was under water. My whole farm was under water. All my corn and pawpaw was washed away. My one male goat and two female goats were also washed away. This was the biggest flood (on 29th March 2012) of my life.

The participants also stated that construction of the highway, which is more elevated than the previous road is creating a basin like structure on the landward side of the road, holding back more surface-run off, resulting in increasing extreme flooding. All the participants recalled that the flooding (29th March, 2012)was not due to a tropical cyclone but a tropical depression. The participants' views were also supported by Lee (2012), who stated that the flooding in the western district (29th to 31st March 2012) was caused by a tropical depression, which was located west-southwest of Viti Levu.

7.5.3 Droughts

While flooding is a significant hazard, so too is its opposite, drought. Increasingly unreliable patterns of rainfall are directly and indirectly affecting the livelihoods of the people of Vatukarasa and Sovi Bay, with significant impacts on food security and development. As the people of Vatukarasa and Sovi Bay mostly depend upon farming and grazing, changes in water balance are causing them greater hardship. Compared to tropical cyclones and flooding, drought is relatively more pervasive and quite slow to manifest itself. Sufficient rainfall is very important for

agriculture. Without it, the crops are not going to grow (Nawrotzki and Kadatska, 2010). However, it is not only having sufficient rainfall, the timing of its occurrence is also very important.

> FFG-2-G: Before we had rain every time but now we are not sure when it is going to rain again so it becomes very difficult to plant. The plantation seasons come and go but we are not able to plant the crops that we want to grow because we do not receive rain at the right time.

> IFG-1-B: We cannot trust the weather now, when it is going to rain and when it is not going to rain. When we want rain it does not rain, but when we do not want rain it floods. This is really bad and affects our crops.

Droughts in Fiji are often associated with El Niño events and the effects of climate change on ENSO are not yet well understood (Australian Bureau of Meteorology and CSIRO, 2014). One older participant (IFG-1- A) recalled that the drought of 1998 (which was during a major El Niño event) was the worst so far.

7.6 Indirect effects on people, their assets and their livelihoods

There is a large number andwide range of consequences of the direct and indirect physical changes brought by climate change for the people of Vatukarasa and Sovi Bay. Often their causes or pathways are complex and intertwined. For ease of analysis the indirect human consequences of climate change are divided into three groups. These include impacts on settlements, livelihoods, and health. In this section I also examine the current, and likely future, gendered nature of climate change impacts.

7.6.1 Settlements and housing.

Rising sea level, coastal erosion, more intense tropical cyclones and storms expose and create risks to coastal settlements of Vatukarasa and Sovi Bay. Coastal areas are sensitive to rising sea level, warmer ocean temperatures, more intense storms and increases in rainfall. The threats at Vatukarasa and Sovi Bay are significantly increased because both the sites are located in low-lying coastal areas. Most of the damage to settlements and infrastructure are caused by high winds and flooding associated with tropical cyclones. The most common damage caused is to house roofs and overhead utilities. Participants stated that further destruction and damage to houses are caused by windblown corrugated iron sheets, tree branches and other debris, such as unsecured drums, sheet metal and timber. As mentioned earlier, the

construction of the highway has restricted and obstructed the natural drainage pathway, resulting in more intense flash flooding and causing greater impacts on settlements.

7.6.2 Livelihoods.

The most important contributors to livelihoods in Vatukarasa and Sovi Bay are agriculture and harvesting of marine resources which underpin food security and provide opportunities for relatively modest cash earnings from the sale of produce. As indicated in the previous sections these two sectors have high levels of exposure and sensitivity to the effects of climate change. Figures 7.8 and 7.9 illustrate some of the pathways through which climate change affects livelihoods and food security in the study area.

Extreme events such as tropical cyclones and droughts can have major impacts on livelihoods from time to time, although recovery is possible after a period of time. In cases where the extreme events are of greater magnitude or occur with greater frequency, recovery can take longer and periods of 'normal' productivity between events become shorter. All the participants stated that after extreme events the price of farm produce is likely to double or increase by even more. A heap of cassava normally costing F$2.50 is likely to cost F$5-$6. Participants also stated that unfavourable and dangerous weather conditions make it very difficult to go to sea, leading to decreased fish catches and increasing (at times doubling) prices. At times this may be good for fishers (if they are able to take to sea) and farmers whose crops are not badly damaged, but often at these times this is not the case and people do not have enough money to buy food. It was also recalled by the participants that some employers stop paying their workers during the periods when businesses are not operating because of extreme events. All the participants stated that large increases in the prices of building materials, following tropical cyclones and flooding severely hampers rebuilding processes in both communities.

At the same time, more gradual changes in mean conditions such as sea level, sea surface temperatures, ocean acidification, air temperature and salinization of land resources slowly reduce production, reduce food security and restrict opportunities for earning cash from sales of produce. Climate change and variability also affect growth of crops in a number of indirect ways, such as causing increases in some pests and plant diseases.

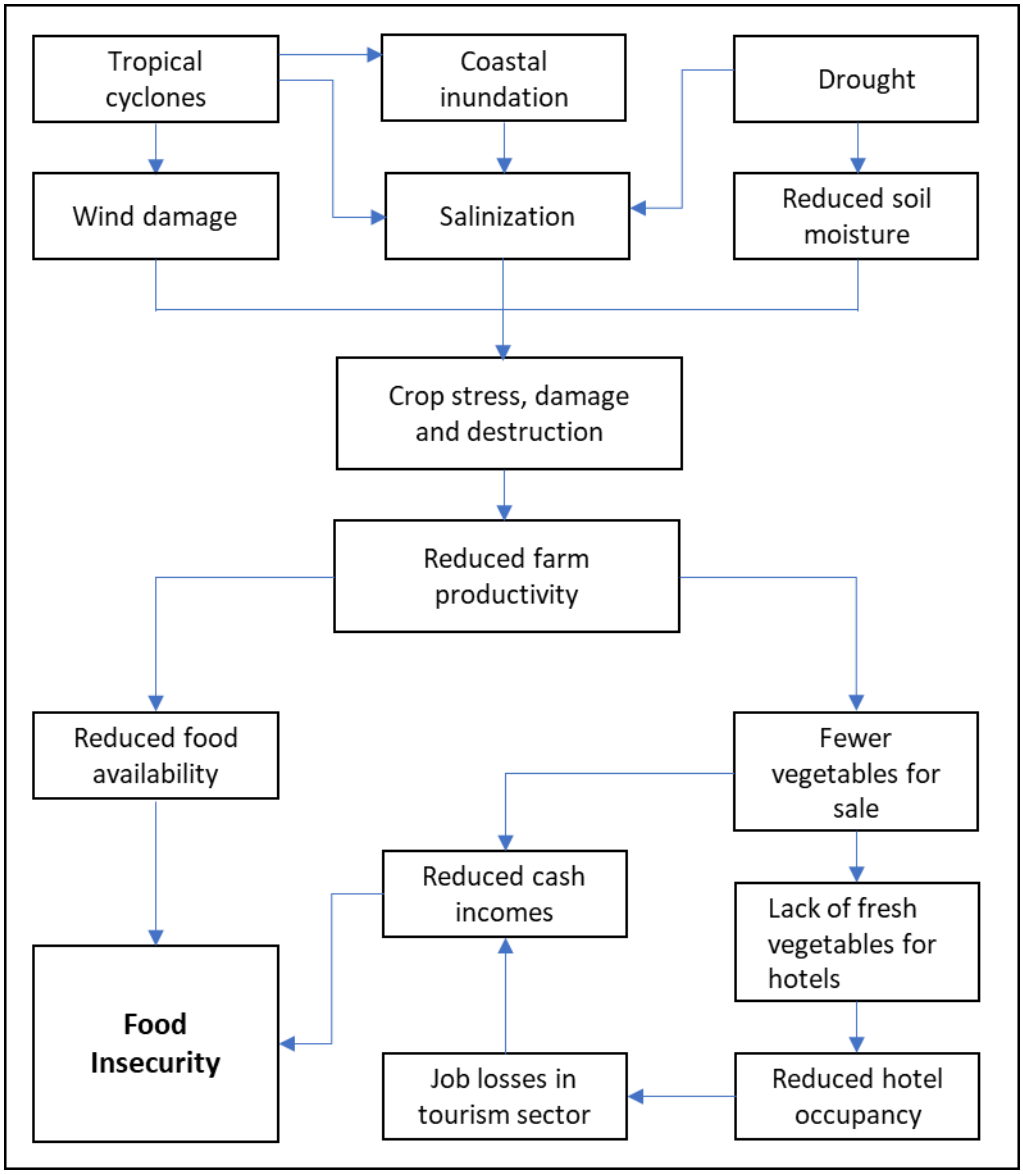

Figure 7. 8 Some effects of climate change on agriculture, livelihoods and food security at Sovi Bay and Vatukarasa Village.

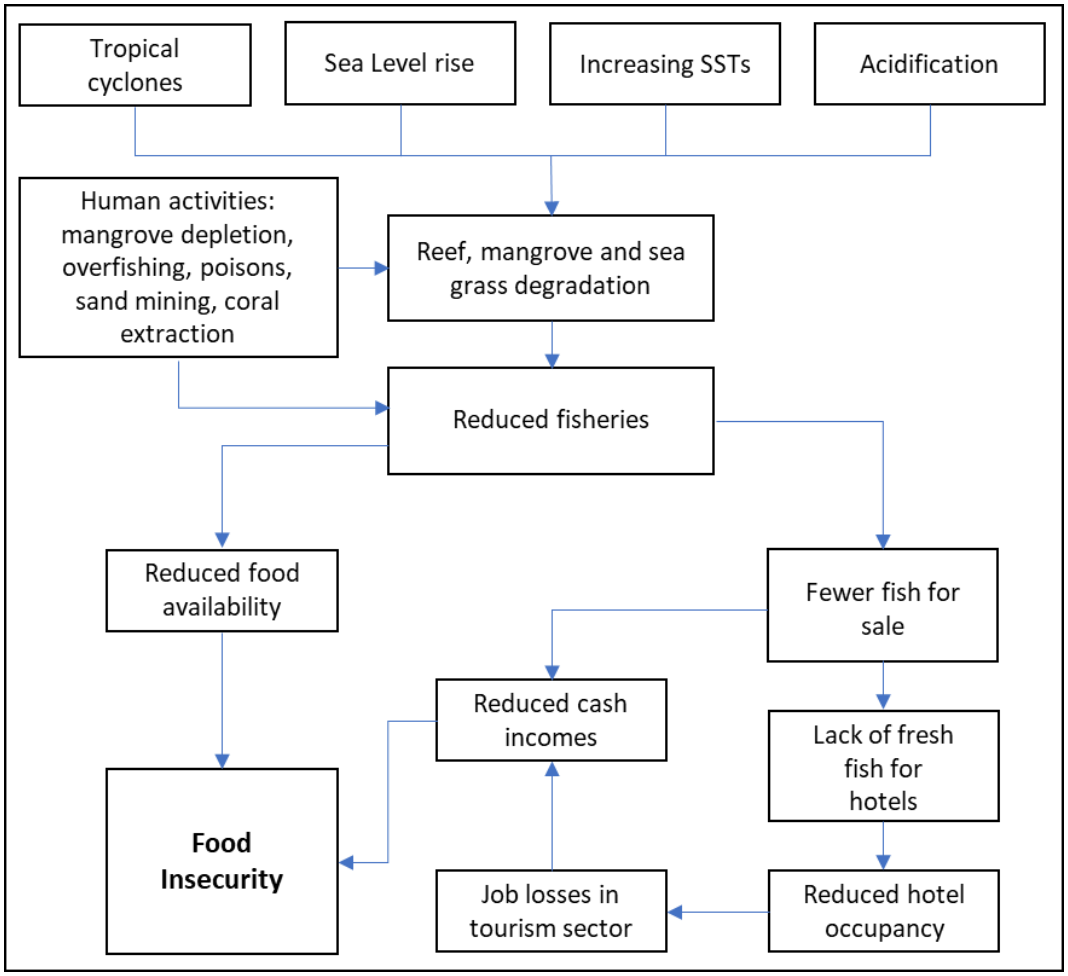

Figure 7. 9 Some effects of climate change (and human activities) on marine ecosystems, livelihoods and food security.

It was also noted by the Vatukarasa villagers and the people of Sovi Bay that during their grandparents' and parents' times, the local weather conditions and the period of the year were very important in their day-to-day activities. The participants agreed that these days less defined weather patterns, such as increased rainfall or prolonged severe droughts are the main causes of diminishing agricultural yields, reduced food security, decreasing cash incomes and increasing migration to urban centres. Most farmers stated that unlike their parents and grandparents (who had a fixed weather pattern), they have to wait for wet weather to plant their crops such as *dalo* and *yaqona*.

Participants stated that people in olden times took advantage of the available resources (as they were plentiful) in a particular season. Fruits, vegetables, roots crops, fish or other marine organisms, all had a particular season in which they were abundant. The season also had an impact on the type of activities that were

carried out. Farmers are no longer able to predict when it will rain and when it will be dry, as their parents and grandparents used to do and this has hampered their capacity to make best use of the growing seasons of respective crops.

All the participants stated that the farm yields have decreased and this is mainly due to soil becoming less fertile and also because of extreme events such as tropical cyclones, flooding and drought. Participant (IFG-2-G) stated:

> When we have tropical cyclones, flooding and droughts our whole farming area is affected, and there is no safe place where crops could survive.

They also revealed that some crops are easily destroyed by extreme events and some are more resilient. Crops like banana, cabbage, *bele* and lettuce are easily destroyed by high winds and floods during cyclones. The participants noted that whatever is salvaged, the strong sunlight and extreme heat that usually follows tropical cyclones and associated flooding, destroys most crops that remain.

At Vatukarasa and Sovi Bay droughts have significant economic impacts (farmers have fewer crops to sell or for family use and they have to buy most food items), environment impacts (wind erosion of soils, resulting in poor soil quality) and health impacts (low and poor quality water supply is leading to more health problems). Drought is also reducing crop growing land areas and crop yields due to reduced soil moisture and less or no water for crop growth. During intensified droughts, seeds sown may not germinate, plant growth may be stunted, and fruits are likely to drop off trees before maturing. Dry conditions induce more stress on growing crops and may result in reduced production and food insecurity.

7.6.3 Health

Human health may be affected directly and indirectly by climate change. Quantifying the impacts of climate change on human health is complex as there are many economic, social, climatic and environmental factors that cause diseases among a group of people (IPCC, 2014b). “Extreme weather and climate events such as tropical cyclones, storm surges, flooding, and drought can have both short and long-term effects on human health, including drowning, injuries, increased disease transmission, and health problems associated with deterioration of water quality and quantity” (Nurse et al., 2014: 1624). This is also the case in the study area where the most obvious and easy connections between human health and climate change at Vatukarasa and Sovi Bay are associated with extreme events including tropical

cyclones, flooding, droughts and high temperatures.For example, some participants, when talking about Cyclone Josie, stated that the number of communicable diseases, such as diarrhoea and dengue fever cases usually increase after cyclones as the areas of standing water increased the number of potential breeding grounds.In addition, more intense storms, flooding and droughts can diminish and compromise the standards of hygiene and sanitation. As the climate is changing so are the risks of health impacts. Stresses, risks and impacts of climate change on human health depend on the exposure of people, their sensitivity, susceptibility and vulnerability to hazards, and their capacity and ability to cope, absorb, accommodate, recover and adapt. "Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development" (United Nations, 2020: 23).

All the participants agreed that climate is getting warmer nowadays, even during rainy seasons. FFG-3-P recalled that:

> I am not able to sleep well because of hot nights. Before the nights were much cooler and I used to have two blankets on, but now I hardly use any.

Many participants stressed that parasitic infections and bacterial water-borne diseases are increasing with the increasing periods of both drought and flooding. "Higher temperatures create conditions that allow pathogens to proliferate while water supply and safety, as well as sanitation and hygiene are compromised during periods of droughts and floods" (Republic of Fiji, 2014: 79). Most participants cited that changes in lifestyle, abandoning local foods, lack of physical activities (people spending more time drinking kava, playing cards, watching TV and sleeping till mid-day) and consuming imported foods, such as white rice, butter, tinned meat, white bread and flour, which are high in carbohydrates, sugar and cholesterol are the main causes for increasing numbers of hypertension and diabetes cases.

At Vatukarasa and Sovi Bay, I asked about the types of diseases in the last two years, who got sick, whether they were male or female and their mode of treatment. This gave an indication as to whether there was a gendered dimension to illness in the previous two years, the type of sickness and whether it could be related to changing climate and sea level rise. I only asked about the past two years because this was relatively easy for the participants to recall.

Also, all the participants stated that it is usually after tropical cyclones and flooding that the water gets contaminated and there are greater chances of being affected by

water borne diseases. Extreme weather disasters, such as tropical cyclones, floods and droughts at Vatukarasa and Sovi Bay produce both direct and indirect threats to human health which are summarised in Table 7.3.

Table 7. 3 The impacts of extreme weather events on human health at Vatukarasa and Sovi Bay.

Source	**Effects**
Direct injuries	Injuries caused by flying objects during tropical cyclones and storms, drownings may occur during floods and storm surges
Vector- borne	Dengue fever spread by *Aedes aegypti*. Tropical cyclones and flooding provide more potential breeding grounds.
Water-borne	Diarrhoeal diseases caused by drinking contaminated water, this happens usually after flooding and when there is a period of low water supply
Food-borne	Diarrhoeal diseases caused when food is not covered and exposed to flies. Fly population can increase through overflow of latrines (flooding), more flies mean more chance of food being contaminated.
Malnutrition	Food shortages following extreme events may lead to malnutrition.
Ciguatera	No cases in the last 4-5 years.
Respiratory	Asthma and bronchitis, when exposed to dust (prolonged drought) and smoke (wooden stove).
Heat related	Heat stress and dehydration (prolonged drought and hot days and nights) especially children and elderly.
Psychological effects	Only a few participants associated tropical cyclones with psychological impacts, such as distress, worry, loss of sleep, shock, fear and disappointment. There was some anxiety among Indo-Fijians of losing their homes and farmland (due to tropical cyclones and flooding). They were also worried about reduced farm yields, and reductions in income making it difficult to pay their land lease.

Source: Collected from participants during field work (*talanoa* sessions and focus group discussions).

Increased flooding, saltwater contamination of soil and contamination of freshwater reservoirs, as outlined in previous sections are all likely to affect the people's health in the study area. Climate change is likely to result in reduced labour productivity and lost work capacity, maycontribute to further reductions in food production

(caused by the physical impacts of climate change on agriculture and fisheries) which can in turn result in undernutrition or malnutrition. Increased intensity of storms and high temperatures may lead to increased risk of water-borne, food and vector-borne diseases. Rainfall, flooding and changes in temperature can affect the geographical distribution, incidence, vector survival, breeding sites, incubation period, replication and transmission of pathogens. The two most common diseases at Vatukarasa and Sovi Bay are diarrhoea and dengue fever.

7.6.3.1 Diarrhoea. Diarrhoea can be caused by an infection, food poisoning, some medications and/or eating food which one's digestive system is not used to. "Variation in rainfall and temperature can also influence the incidence of water-related diseases such as diarrhoea..." (Singh et al., 2001 cited in Barnett and Campbell, 2010: 31). Water sources and water contaminated during floods with human faeces are likely to cause diarrhoea, which can result in severe dehydration, fever and weakness.

> FFG-2-H: After every tropical cyclone and flooding we have more diarrhoea cases. Our water supply is not treated; it is coming from a spring, so when we have heavy rainfall more rubbish enters our water supply, so there are more diarrhoea cases.
>
> IFG-2-H: Stomachache and diarrhoea are mostly common after tropical cyclones and flooding. This is the time when water is mostly dirty and more germs are present in the water.

Participants observed that the number of cases of communicable diseases, such as diarrhoea, has been steadily increasing in the last 50 years because of the increase in the intensity of tropical cyclones, bringing heavy rainfall and causing flooding, which is contaminating the water supply (both ground and surface water resources) and disrupting lavatory facilities. Also, warmer temperatures and high humidity help in proliferation of water-borne pathogens, bacteria and viruses.

It is also possible that there may be emergence of new diseases and re-emergence of those that were once dormant. It was noted by some participants, that there are now cases of diarrhoea during the dry season. Typically, during dry seasons water supply can become affected as the amount of water decreases and it becomes more prone to pollution. Here the vectors are flies. What I have seen at both the sites is that the small children do not always use the toilet. The density and activities of flies increase during drier months and this could be the catalyst for the increased transmission of diarrheal cases at Vatukarasa and Sovi Bay at these times.

7.6.3.2 Dengue fever. Dengue fever is spread by *AedesAegypti*mosquitoes, a common mosquito that lives and breeds in and around houses. It cannot spread directly from one infected person to another healthy person; it has to be transmitted by the bite of an *Aedes Aegypti* infected with the dengue virus. At Vatukarasa and Sovi Bay there were many potential breeding grounds seen near, in and around houses, such as coconut shells, used tins, blocked drains, guttering and down pipes, tree holes and flowerpots. Both the *iTaukei* and Indo-Fijian participants noted that the number of dengue fever cases is increasing. The warm and wet climate favours the vectors accelerating their biting rate and speeding up the maturation process of the parasites that the mosquitoes carry, and the mosquitoes are able to multiply at a faster rate increasing the incidence of diseases such as dengue fever.

> FFG-2-H: There are too many mosquitoes now, before the mosquitoes bite during afternoon and morning, but now they are biting all the time. We have more dengue fever cases now.

> IFG-1-F: The mosquito population has increased, and the cases of dengue fever have also increased.

Climate change is likely to cause more extreme rainfall events, increasing the potential breeding ground for *Aedes Aegypti* mosquitoes. More breeding grounds mean more mosquitoes. Dengue fever begins as a flu-like illness and can develop into a deadly fever (dengue haemorrhagic fever), but the participants, cannot recall anyone having dengue haemorrhagic fever or dying from the disease at Vatukarasa and Sovi Bay.

7.6.3.3 Ciguatera fish poisoning (CFP). Ciguatera fish poisoning (CFP) is caused by toxins mainly produced by dinoflagellates of the genus Gambierdiscus. This is the most common non-bacterial food-borne illness in Fiji and is associated with consumption of fish with toxins. There are reports that correlate CFP positively with increasing sea temperatures (Nurse et al., 2014). I asked about CFP because fish is the most important source of protein for both the coastal communities. However, no person could recall anyone having CFP in last four to five years. But some older participants stated that they had CFP when they were young. One older *iTaukei* participant (FT-2-G) stated:

> When I was a young boy my whole family had fish poisoning twice. Once by eating a yellow tail *oqo* (barracuda) and another time by eating *saqa loaloa* (black giant travelly).

This participant recalled that they all had severe vomiting, headaches and joint pain and had shocking sensations when they touched water. They all got better by drinking concentrated coconut milk.

One older Indo-Fijian participant (IFG-1-F) recalled that:

> My parents and grandparents used to check if fish is poisonous by inserting a copper coin in the flesh and if the coin turns black in five minutes, that's an indication that the fish is poisonous. Another way of testing was to simply leave the fish in the open and if no flies sit on the fish for long (flies immediately fly away just after setting), it means the fish is poisonous.

Most of the participants are of the view that they do not have CFP because they are not able to catch big fish nowadays. They are saying that the poison (toxin) has to be in fish's system for long periods to be able to affect consumers. Nowadays they are only able to catch small fish, so they are not getting CFP.

7.7 Gender and climate change

"The degree to which people are affected by climate change impacts is partly a function of their social status, gender, poverty, power and access to and control over resources" (United Nations Development Programme, 2013: 1). Men and women are socialised differently in the South Pacific to take on different responsibilities and roles determined by custom, tradition, and religion (Mimura et al., 2007). Gender roles (of *iTaukei* and Indo-Fijians) given by societal expectations and kinship obligations often lead women and men to have different expectations and experiences in life, as discussed in Chapter Three (Section 3.5).

Relative to men, women tend to have less control over, access to, and ownership of, land and other productive assets. Typically, it is the husband who manages the family property. Women's economic empowerment is hindered by many social norms such as girls' choice of subjects in the education system, what professional development pathways should they follow, the burden of unpaid work and pay disparity. Mostly all land and other fixed assets are under men's name and nothing is under women's name which could be put as security to obtain loan from commercial banks. No security means no loan from banks. In both the communities the cash is handled and is under men's control. Also because women's labor force participation is lower and even when women are working they tend to earn less than men; it is harder for women to accumulate savings with less earning. These affect the way they see the world and the way they make decisions (political, economic

and social spheres) in their homes, communities and at work (Aguilar, 2009). "Providing women and girls with equal access to education, health care, decent work, and representation in political and economic decision-making processes will fuel sustainable economies and benefit societies and humanity at large"(United Nations, 2020: 31). .

Most older participants, both *iTaukei* and Indo-Fijians, stated that usually after natural disasters, such as tropical cyclones and flooding, men (as heads of the family) are under stress and they are more likely to perpetrate violence and take out their anger and frustration against women (view shared by Schrader and Delaney, 2000). Also, the International Women's Development Agency (2018) noted that "violence against women increases because of climate change and natural disaster" (Paragraph 8. Retrieved from https://iwda.org.au/heres-what-climate-change-looks-like-in-the-pacific). Some younger participants did not agree with the older participants and some other younger participants were silent regarding the topic.

Women (especially *iTaukei*) are likely to be more affected than men because of degradation and fragmentation of mangroves, sea grass beds and coral reefs, as they are more engaged in lagoon fishing and reef gleaning. Degradation and fragmentation of these ecosystems means women must spend more time at sea in order to catch enough fish and invertebrates for the family. Men also revealed that now they have to work harder to catch pelagic fish, such as tuna, *walu* (Spanish mackerel), *saqa* and *oqo*, because they are now moving further away from reef edges that are no longer as attractive in terms of food for pelagic fish.

It was emphasised, mostly by *iTaukei* females, that these days they have to go further inland to collect fruits, wild yams and wild vegetables. Women, more than men, are responsible for obtaining natural resources that are significantly at risk from the impacts of climate change and other disasters (UNDP, 2016c; Australian Red Cross, 2014). Women are heavily dependent on climate-sensitive sectors to fulfil their expected responsibilities of caring for the livelihoods and well-being of their household. Women still disproportionately bear the primary responsibility of unpaid care and domestic work. They now also have to plant larger areas to get sufficient food for their family and they have to spend more time to catch enough fish than previously. All these are placing additional burdens on woman and they are not able to allocate enough time to non-agricultural income generating activities such as weaving and making pickles with available seasonal fruits and vegetables. At Vatukarasa and Sovi Bay women are more associated with family sustenance

and men with cash income generation. In both communities a woman's role is considered to be that of a good and caring mother, a homemaker and an "obedient wife".

Any profound negative impact on the environment has direct and/or indirect negative impacts on women (UNDP, 2016c; Australian Red Cross, 2014). In rural communities of Vatukarasa and Sovi Bay it is a cultural practice (seen at most places) that women usually eat after men have eaten. This affects woman disproportionately as following a natural disaster, people usually have shortages of food and when it becomes their turn to eat there may be little left.

It was revealed by both *iTaukei* and Indo-Fijian participants that when there is any tropical cyclone warning, it is the women (mostly *iTaukei*) who gather food, secure animals by moving them to higher ground and secure a safe place for children. On the other hand, men usually secure buildings by tying down the roofs, and secure boats by bringing them inland and tying them to mangroves. Extreme weather events impact the education of children, especially of girls, as they are often taken out of school to assist in housework and to help take care of younger siblings after tropical cyclones and flooding (Australian Red Cross, 2014). . The situation at Vatukarasa and Sovi Bay is similar to what UNICEF stated: the impacts of climate change "...can limit the ability of parents to afford to educate their children or require them (especially girl children, whose access to education is typically prioritized less than that of boy children) to work to meet basic needs" (UNICEF, 2009 quoted in Cardona et al., 2012: 82).

Women of both study sites mostly do the cooking and most participants, recognised that females have higher incidence of chronic respiratory disorders than men. In 2006, WHO stated that women are more prone to chronic respiratory disorders in developing countries. At Sovi Bay and Vatukarasa, I observed females being closer to wood burning stoves, blowing through pieces of pipe (hindi-*phukanee*), trying their best to start the fire. I observed, and it was also revealed by the participants, that there are more cases of coughing in females, because they are more exposed to indoor and outdoor pollution from wood fuel. This coughing can easily develop, trigger and exacerbate asthma (Belanger and Triche, 2008; Perez-Padilla et al., 2010).

Fresh water is becoming increasingly hard as the rivers are becoming more saline and as a result the water takes longer to boil and to cook food. This way women have to be near the stoves for longer, which is likely to expose them to smoke for

longer periods, thus making them more vulnerable to respiratory diseases. "Cooking with firewood...is by many accounts among the most urgent problems in the developing world today...The resulting indoor smoke pollution causes serious health problems, especially for women and children who have the most frequent exposure" (Khandelwal et al., 2016: 1).

Women, both *iTaukei* and Indo-Fijians, usually look after children, the sick and the elderly. As indicated in Section 7.6.3 the incidence of health problems is increasing as a result of climate change. Most participants stated that the increasing number of community and family members getting sick, means increasing workloads (caregiving) for women, resulting in girls and women having less time and opportunity for education, income earning and decision making processes to reduce impacts of climate change, make themselves more resilient and contribute to disaster risk reduction. All the participants mentioned that their families become more concerned when males get sick (females are also taken care of), especially secondary school boys. When the boys get sick towards the end of the week, they may not be able to help their parents in the farm during weekends.

7.8 Discussion

The study has found that changing climate and sea level rise are negatively affecting the people of Vatukarasa and Sovi Bay in a number of ways as summarised in Box 7.1.

Furthermore, what I have observed and what the participants emphasised during focus group discussions and talanoa sessions is that 'non-climatic' stresses are directly increasing the impacts of, and vulnerability to, climate events. The 'non-climate' stresses are impacting the daily lives of both the communities and this stress is the catalyst which reduces the ability of both the communities to meet and fulfil their needs and wants and to cope with problems brought by climate change.

My observations and focus group discussions and talanoa sessions indicate that, when we rank impacts on resources at Vatukarasa and Sovi Bay, the most affected is coastal resources, followed by agriculture, then water and finally forest resources. The importance of each resource for the two respective communities, and the likelihood and severity of impacts are summarised in Table 7.4.

Box 7. 1 Impacts of climate change and sea level rise at study sites

- Loss of land due to inundation and erosion.
- Stronger storm surges leading to increased flooding.
- Changes in currents (stronger).
- Reduced production of beach sediments from degrading coral reefs.
- Intrusion of salt water, further up the rivers, also into aquifers, wetlands, estuaries and farm land.
- More salt spray – causing more vegetation death and rusting of roofs and louvre blades.
- Increased sediments introduced to coastal ecosystems by the rivers damaging reefs and seagrasses
- More overflow and blocking of drains. Higher sea level is causing more "backwater effects".
- Reduced crop production.
- Agricultural produce becoming expensive.
- Offshore fishing becoming dangerous and risky.
- More bad weather – reducing fishing days.
- Reduced fish catches.
- Damages to *koro*, settlements and housing.
- Damages to infrastructure, such as the highway.
- More hot days / extreme weather events – reduces productive days for men and women.
- Increase in both food and water-borne diseases.
- Increase in vector-borne diseases.

Source: Own elaboration from field notes, Nur Ali, 2013.

Table 7. 4 The importance of resources at Vatukarasa and Sovi Bay, their certainty and severity of impacts.

Resource ranking	**Importance of resources**		**Likelihood of impacts**	**Severity of impacts**
	iTaukei	**Indo-Fijian**		
Coastal and marine resources	High	Medium	High	High
Agriculture	Medium	High	Medium	Medium
Water resources	High	High	Medium	Medium
Forest resources	High	Medium	Medium	Medium

Source: Field notes, 2013.

Table 7.5 compares the two communities in terms of the different effects of climate change. While the communities have similar levels of exposure, different

vulnerabilities are reflected in different impacts. For example, both communities are affected by increasing salinity but in different ways and with different outcomes for their agricultural activities. *iTaukei* now struggle with *dalo* cultivation in areas with high salinity while the Indo-Fijians have difficulties in producing rice. One area where there is an important difference is in the case where relocation may become necessary. Both communities would be disrupted by such a necessity but the *iTaukei* community has options to move within their own customary lands while the Indo-Fijian community does not. They may have to find new land to lease which is likely to be difficult. While both groups exploit marine resources, they play a greater role in *iTaukei* nutrition. While a number of adaptations will be in common for the two communities, these differences will also need to be accounted for in developing adaptation strategies for the study area.

Climate change is affecting the coastal communities of Vatukarasa and Sovi Bay in various ways, such as coastal erosion, damage to houses and other koro and settlement assets, damaging and disrupting the transportation system, reducing terrestrial and marine habitats, threatening human health, lives and safety, intrusion of salt water (having a major impacts on plants that are not able to adapt or tolerate increased salinity), increasing surface run-off and flooding, drought (including raised salinity in estuaries because less fresh water input into tidal rivers) and more intense tropical cyclones and storms.

The growing demand and pressure on already depleting resources (both human and climate impacted), development along coasts and extraction of corals are making the situation even worse. In other words climate change along with some human induced change is holding iTaukei and Indo-Fijian communities back, by having major impacts on the social, physical, cultural and economic aspects of their lives. Climate change and sea level rise are becoming major hurdles and barriers to sustainable development, poverty reduction and food security.

Table 7. 5 The effects of climate change on *iTaukei* and Indo-Fijians at Vatukarasa and Sovi Bay

iTaukei	**Indo-Fijians**
Living closer to the sea-thus greater impacts from rising sea level. Rising sea level and king tides coinciding with heavy swells (mostly associated with tropical cyclones) increases sea flooding and damage to low-lying coastal areas (such as more erosion and intrusion of saltwater in coastal farmlands), thus increasing the need for more protection for coastal areas. Rising sea level and destruction of coral reefs is making the currents stronger (stated by most participants), making it difficult for fisherman to catch ground fish. More exposure of *iTaukei* assets, such as buildings, other facilities and coastal crops to salt sprays, negatively impacting socio-economic well-being of *iTaukei*. More time and labour that could have been utilised in economic activities are used in recovering from the impacts. More exposure of *iTaukei* assets and coastal crops to salt sprays. More erosion and intrusion of saltwater in coastal farmlands. Bleaching of coral reefs and acidification of the ocean is having greater impacts on iTaukei as they rely more for their livelihoods on coral reefs, sea grass and mangroves. Some *iTaukei* graves are near the sea, some had been relocated and other in future may need relocation further inland. iTaukei farmers are no longer able to grow *dalo* and other root crops near the river mouth, which their parents, grand and great grandparents used to do.	Increasing sea level is likely to force some Indo-Fijians to relocate. The further inland does not belong to Indo-Fijians, but to *mataqali.* Indo-Fijians may in future have to leave Sovi Bay and Vatukarasa and migrate elsewhere. Drought reduces backyard gardening. Wilting of foliage, curry-leaves, chilli, coriander, etc. (major ingredients of Indo-Fijians curry). Because of intrusion of saltwater in river, Indo-Fijians are taking their trucks further up the river to wash. Intrusion of saltwater in water supply increases the cooking time. What makes the matters worse is Indo-Fijians add salt while cooking, making water harder (on the other iTaukei add salt after cooking), increasing exposure to smoke for women using wooden stoves. Damages to fence during flooding (Indo-Fijians mostly fence their farms). River mussels (*nakai*- an Indian delicacy), due to intrusion of saltwater, have reduced in number and size. Fish such as *damu* which they were able to catch at the river mouth has migrated further up the rivers. Indo-Fijians are no longer able to grow rice (padi) which their parents, grand and great grandparents used to do.

Increase in frequency and intensity of tropical cyclones are destroying forest, on which most *iTaukei* depend upon for their livelihood. *iTaukei* farmers are no longer able to grow dalo and other root crops near the river mouth, which their parents, grand and great grandparents used to do. Even further inland climate change is disrupting the growth of *iTaukei's* staple crops such as *tavioka* and *dalo*. Increase in frequency and intensity of tropical cyclones is destroying forest (such as coconut palms and citrus trees), on which most *iTaukei* depend upon for their livelihood. *iTaukei* participants stated that strong winds and flooding are destroying their cultural totems. They identify themselves with certain plants, animals and fish. Plants used in preparation of traditional medicine are increasingly difficult to find.	

Without adaptation the lives of *iTaukei* and Indo-Fijians at Vatukarasa and Sovi Bay will become more difficult. Community-based adaptation (CBA), which is more of a bottom-up approach, where local communities identify their own vulnerabilities and implement urgent and best adaptation strategies, keeping in mind the interests of all community menbers is likely to be the most appropriate adaptation approach. The best for the people of Vatukarasa and Sovi Bay would be to implement CBA, using both scientific and traditional knowledge to guide adaptation and to use local resources to achieve the best strategies with least expenses involved.

The next chapter addresses measures that can be taken to reduce the impacts faced by the two communities and enable them to have sustainable futures in the context of climate change. Adaptation can be short or long term and is not only determined by the climatic conditions but also depends upon local capacities, access to funds and government initiatives.

CHAPTER EIGHT

Adaptation to climate change

> *"Adaptation needs arise when the anticipated risks or experienced impacts of climate change require action to ensure the safety of populations and the security of assets, including ecosystems and their services... But more recently, the focus has been on tackling the underlying causes of vulnerability such as informational, capacity, financial, institutional, and technological needs*" (Noble et al., 2014: 836).

8.1 Introduction

The previous chapter has outlined the impacts faced by the two communities at Vatukarasa and Sovi Bay. This chapter discusses the coping strategies that the people in the communities may employ to enable them to continue to live with a changing climate and rising sea-level. This will draw from past experiences and contemporary responses and explore future possibilities and evaluate the challenges they face in implementing these. The section throws light on the third key research question: what adaptation options have been implemented and what further could be done to reduce the impacts of the climate change on both the *iTaukei* and the Indo-Fijian communities at Vatukarasa and Sovi Bay?

The chapter also investigates how and why traditional knowledge is an important resource to reduce the impacts of climate change (e.g.Gyampoh et al., 2009; Maclellan and Coates, 2012; Nakashima et al., 2012; Nyong et al., 2007; Theodory, 2016), to enable communities to better adapt to, and ameliorate the consequences of, climate change (IFAD, 2016) and for the people to achieve *sautu* (good life and wellbeing) (Cagivinaka, 2016). The adaptation options in this chapter follow mostly the same order as the impacts discussed in Chapter Seven.

8.2 An overview of adaptation

The most consistent effect of climate change at Vatukarasa village is rising sea level, which is causing coastal erosion and intrusion of saltwater into agricultural land and freshwater aquifers. In this chapter I will outline a range of adaptation options, and criteria to evaluate them. Keeping in mind such issues as their effectiveness (will they significantly reduce impacts), sustainability (will they last,

will they need long term maintenance), ecological soundness (will they have negative impacts on other parts of the environment), financial feasibility (how expensive are they to implement and what would be the cost of maintenance), technical feasibility (would external technology and expertise be required and at what cost), cultural appropriateness (including land and other cultural elements), and gender implications.

One younger educated *iTaukei* participant (FT-2-I) emphasised that:

> Climate change is the wrong doing of developed and rich countries. They are slowly killing us, it is their resposibility to help us. The time of talking and making false promises has gone, it is time for some constructive action on the ground.

Adaptation measures need to be identified at the local level, and proposals shared and discussed at district, provincial and national levels, so that climate change adaptation measures could be mainstreamed into national policies and planning. Sharing of adaptation information can assist all players in every sector to find the most effective climate change and disaster risk reduction measures. Without any adaptation, climate change and sea level rise are not only likely to have present day socioeconomic and ecological impacts, but they are also likely to threaten and undermine future economic activities, environmental conditions (upon which the communities depend), and health.

Variation in the magnitude of impacts of changing climate to a large degree reflects inequalities among social groups, and individuals within a community as well as among different communities. This is also the case with the ability to adapt which Adger et al. (2007) refer to as adaptive capacity, which is context specific. Adaptation can be short or long term and is not only determined by the climatic conditions but also depends upon local capacities, access to funds and government initiatives. On the one hand a discussion of adaptation requires consideration of the various actions that need to be implemented. On the other hand, it requires an understanding of the social and cultural factors that influence the levels of resilience and capacity to adapt within communities.

For adaptation to be successful both of these elements need to be taken into account. There is also a need for an integrated and combined approach between local communities and local authorities, such as Nadroga/Navosa Provincial Council, Nadroga/Navosa Local Authority and other government agencies (Lands and Fisheries Department etc). Adaptation needs to be a joint and shared

responsibility and better understanding and partnerships are important and critical. Decisions and actions taken now will determine and affect present and future vulnerabilities, coping abilities and resilience. Delaying adaptation will increase costs of future actions and will increase exposure and vulnerability of coastal communities to coastal hazards. "... immediate adaptation actions will...enhance future options and preparedness" (IPCC, 2014F: 79).

For adaptation both the communities will need serious financial support and technical assistance. For any adaptation to be successful it is important to first understand the factors or the processes that are likely to cause vulnerability. Adaptation reduces vulnerability and in turn vulnerability reduction enhances adaptation to climate change (Barnett and Campbell, 2010; Bryant-Tokalau, 2018; Campbell. 2014; Schipper and Burton, 2009). Adaptation also incorporates better resource management, buttressing food security, strengthening institutional, social and human capacities, and increasing resilience. It includes actions and activities undertaken at national or community levels, which are culturally and socially acceptable and reduce the negative impacts and seek benefits from the effects of climate change (Bryant-Tokalau, 2018; IPCC, 2014f; Schipper and Burton, 2009; Noble et al., 2014).

For the rural communities of Vatukarasa and Sovi Bay, adaptation should provide an acceptable level of security from exposure, and vulnerability, to risks and climate change impacts. The best option can be working, not against but, with nature such as using a natural system (coast) to buffer and protect coastal communities from coastal erosion, coastal flooding and inundation (Wong et al., 2014). "...lessons learned from adaptation... must be exercised to ensure that the transfer of such experiences is appropriate to local biophysical, social, economic, political, and cultural circumstances" (Nurse et al., 2014: 1642). Effective coping capabilities, adaptation and management of coastal threats posed by climate change are immediate needs of both the communities. Equally important is the communities' acceptance and cooperation for implementation and maintenance of adaptation projects.

In Chapter Seven (Figure7.1) different levels of impact were identified from direct effects through to indirect and n^{th} order impacts on human activities and assets. A key for successful adaptation is to identify at what stage adaptive intervention is likely to be most effective. In some cases adaptation will require tackling the direct effects of climate change while in others actions may focus on the indirect effects.

Figure 8.1 illustrates how different adaptive options may be applied to respond to problems of water supply quality and quantity that may arise from increased frequency and magnitude of droughts and/or salinization of water supplies.

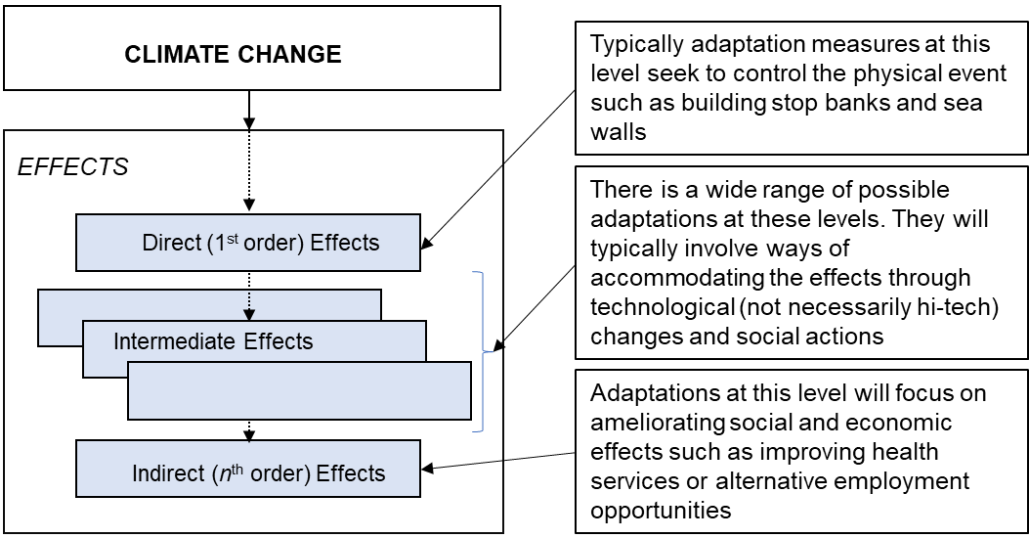

Figure 8. 1 Points of adaptation intervention at different orders of climate change effects (see also Figure 7.1).

8.3 Sea level rise, coastal erosion and inundation

Without adaptation measures, sea level rise is likely to result in increased frequency, duration and intensity of flood events at Vatukarasa and Sovi Bay. Sea level is also likely to amplify exposure and vulnerability to storm surge, increase inundation risk, threaten water supply, storm water and wastewater utilities. If no adaptation measures are taken, then sea level rise is likely to exacerbate existing, or introduce new, risks at both locations. One heart-breaking example is at Vatukarasa, where rising sea level, storms and coastal erosion are damaging the ancient graves and relatives have been forced to relocate the graves further inland (see Figure 8.2).

Figure 8. 2 Mr. Ifereimi showing the grave that had to be relocated to the landward side of the road.

My survey revealed that most of the participants, both *iTaukei* and Indo-Fijians, are of the opinion that enhancing adaptive capacity and coping capability will be important steps towards developing effective measures to lower the likely coastal impacts of climate change, a view also supported by Nurse at al. (2014). A common classification of coastal adaptation strategies includes three options: protect, retreat and/or accommodate. Protection is the first response to guard infrastructure, property and people from sea level rise, by such measures as 'hard' defensive structures such as sea walls constructed along the beach or coastline and/or 'soft' measures such as beach nourishment and planting of mangroves and other species that help reduce erosion (Oppenheimer et al., 2019: Wong et al., 2014). Accommodation allows people to continue occupying the coastal areas, while making changes to human behaviour, activities and /or infrastructure to make them more resilient to the impacts of sea level rise. Retreat is a decision to abandon, withdraw or relocate public or private assets that are at risk from sea level rise and/or other associated coastal hazards.

All the participants agreed that protection could include construction of hard structures, such as sea-walls, soft structures, such as dune and beach nourishment, enhancing beach vegetation and indigenous options, such as construction of sea walls with stones to stave off and reduce the likely impact of the encroaching rising sea. Hard protection in the short-term can reduce beach erosion, but in the long-term it is likely to interfere with longshore sediment drift (the transportation of pebbles and sand along the coast) as waves bounce off the breakwater, resulting in increased beach erosion (Brown et al., 2016; Gombos et al., 2014). Where the littoral drift is blocked erosional stress on adjacent unprotected beaches or coastlines can also result (Climate

Technology Centre and Network (CTCN), 2010; Dolphin et al., 2012; Mohanty et al., 2015). Hard protection can cause significant coastal environmental losses in front and back of the seawall, such as loss of estuary intertidal areas, beaches and salt marshes (Brown et al., 2016;Gombos et al., 2014).

Another disadvantage of hard protection is that it could create a barrier between communities and their coasts. Hard protection is also likely to damage coastal ecosystems, which can result in reduction of fish stocks, as most fish species at some time in their life (especially when juvenile) spend time feeding and hiding in mangroves and sea grass, which are likely to be damaged by construction of hard protection works. Seawalls may provide protection for a few decades, but in the long term are likely to become ineffective with continued sea level rise and/or if tropical cyclones become more intense and frequent (Wong et al., 2014). Sea walls are often expensive and require ongoing maintenance and repair: they are not one-off investments. Moreover, like most engineering works, seawalls are built to specific design levels. If conditions exceed this level the protection fails. But in many cases "protection" gives people a sense of security and they invest more in developing the "protected" area (which in this case would be Vatukarasa) so that when the works fail the losses are even greater than would otherwise have been the case. If not built correctly, seawalls can collapse during tropical cyclones with larger waves and expose assets, such as buildings and ecosystems behind the seawalls to damage.

Accommodation is a more flexible approach and includes changes to human behaviour, activities and assets (Oppenheimer et al., 2019). Some examples are flood-resistant agriculture, comprehensive risk insurance and adjustments to land use planning, early hazard warning systems, and modifying structures such as raising low-lying buildings and bridges to make them more resistant to sea level rise (Wong et al., 2014). For accommodation, a reliable early evacuation system is important. It could also include new building codes, such as all buildings to be constructed on raised posts. For accommodation to be successful there would need to be agreement among community members about measures to be adopted. Alternatively, government rules and regulations, such as all houses being required to be constructed on raised posts to minimise the structural damage from floods, and not located too close to the coast or rivers (zoning could be introduced). In Vatukarasa, the Ministry of *iTauke*i Affairs could enforce village by-laws, as Local Authority's laws do not apply in villages. The Nadroga Rural Local Authority could

approve all building plans outside village boundaries (including the Indo-Fijian settlements), subject to similar conditions.

Retreat includes establishing set-back zones, where all development takes place at a specified distance from high-water mark and all threatened buildings are relocated further inland (Oppenheimer et al., 2019; Wong et al., 2014). It would require giving up exposed and threatened *vanua* and preventing damages to future development. Early retreat would be better than staying and suffering losses if other adaptation measures are inadequate. Retreat needs to be considered by the communities, along with the other options in developing a comprehensive and proactive adaptation plan. Retreat in the long run may prove to the most effective and least expensive approach. However, it may also cause considerable cultural disruption, especially if it involves separating people from their *vanua.* For the Indo-Fijian community it may involve having to find new land on which to resettle.

The three approaches (protection, accommodation and retreat) can be jointly implemented at Vatukarasa and Sovi Bay. The participants emphasised that they would need government's financial, policy, institutional and technology assistance. They stated that an integrated adaptation programme such as this would be too big to implement on their own because of the likely high cost of materials and skilled labour requirements.

The participants during focus group discussion and *talanoa* sessions also stated, and agreed with one another, that more vegetation, such as *vetiver* grass (Chrysopogon zizanioides) should be planted near the coast. *Vetiver* grass (a native of South India) is a tough grass, which forms clumps with mat like root systems that are 600 – 900 mm wide and grows up to one metre in height. It is a sterile clone that will not become a weed and that can reduce soil erosion by 95 percent and conserve as much as 70 percent of surface run off (GreenWeb Ltd, 2015).

The *vetiver* grass already planted, the participants stated, is very helpful in reducing soil erosion and making the area more stable. *Vetiver* grass has a deep root system that could reach up to three metres below the surface, so it is not easily uprooted by flooding and tropical cyclones. Even when it is burnt, the grass can re-grow from the nodes and can grow well in dry conditions as well as in alkaline and high salinity areas. It usually forms a porous barrier, which would slow down water flow and trap more sediment (GreenWeb Ltd, 2015; Meredith, 2015; Oshunsanya and Aliku, 2017). Shoreline vegetation can help to buffer impacts to reduce flooding and erosion and contribute to making the coast more stable (Mamanuca

Environment Society, 2013). Forming a barrier between the coast and the sea with rocks, coconut palms, concrete slabs and coral (dead coral already washed on the shore) can also help reduce coastal erosion.

Some young *iTaukei* participants also raised the idea of creating artificial reefs to enhance coastal protection and increase marine species habitats. Artificial reefs are usually made from wrecks and construction debris, to promote marine life of a section of the sea. They usually have hard surfaces, to which barnacles, oysters and coral polyps are able to attach themselves. This in turn attracts juvenile fish, followed by bigger fish, which prey on smaller fish. Thus, artificial reefs help to reduce the pressure of overfishing on near-by natural reefs, by providing new fishing locations for both *iTauke*i and Indo-Fijian fishers. Artificial reefs can also help to increase both the number of fish and the number of species in certain areas and can support diving trades (tourist attraction) and generate extra income especially for *iTaukei*. The potential increase in economic opportunities could be a catalyst for protecting the coastal areas and the sea. They can force waves to break further away from the coast. This can help in settling of sediments in shallow areas and reduce beach erosion. They can also help by diverting heavy visitation away from natural reefs, while still allowing divers, fishers and snorkelers to enjoy diverse marine life.

One thing to be kept in mind when building artificial reefs is that materials (concrete, steel, stones) used should be able to provide opportunity for invertebrates to attach themselves. Materials such as tires and old fridges (which while corroding release toxins in the sea) should not be used as these can do more harm than benefit. Artificial reefs should have enough weight so that they are not dislodged by ocean's powerful forces (waves and tropical cyclones) and in doing so may damage near-by natural reefs.

Artificial reefs should be designed in such a way that they cause least harm (benefits should outweigh costs). Also, they should not be used as a dumping site for all manner of waste and if not carefully planned and constructed can damage surrounding natural habitats and can become a spawning source and habitat for invasive species, such as crown-of-thorns starfish (Acanthaster planci), which prey on coral polyps (Scleractinia). Invasive species can pose serious threats to both coastal and marine resources on which the *iTaukei* community, in particular, depends. Artificial reefs are likely to attract large numbers of fish and this could

easily lead to overfishing. As with all adaptation initiatives, it is important to ensure that projects do not become maladaptive.

Most of the participants during focus group discussions and *talanoa* sessions stated that the existing damaged natural reefs can be brought back to their past healthy levels. *iTaukei* of Vatukarasa and Sovi Bay are doing this by placing a ban on all activities on Navoto Reef. The ban was placed in 2015 and may be lifted in 2020, but I was informed this depends upon the *komitini wai* (see Figure 8.12). The ban can help in restoration of coral reefs to original state that has been damaged by natural disasters, such as storms, tropical cyclones, flooding (smoothing of reefs with sediments), El Niño events and human activities close to or on the fragile reef environments. Participants tended to agree that a much better option for Vatukarasa and Sovi Bay would be to combine both artificial reef creation and coral transplantation. This will protect and enhance natural habitats, fisheries and other marine resources.

I have a good personal experience of artificial reefs. My first posting (1977) after my graduation (as an Environmental Health Officer) was to Rotuma Island. There, Doctor Raj (medical officer of Rotuma, 1977) and I went fishing at the edge of the reef, we caught plenty of fish and to mark the spot, we plugged a two-metre steel rod in the reef. Over the years, due to accumulation of turf algae (which attract algae grazers), barnacles, oysters and coral, the rod has now become a big rock and a very good fishing spot, known as *fa'a Indiya* point (Indian man point).

8.4 Coral reefs, sea grass beds and mangroves

Most participants stated during the focus group discussions and *talanoa* sessions that there is a need to plant mangroves. Mangrove forests are very important for them and the marine environment and it was widely felt among participants that anyone found cutting down mangrove forest should be heavily fined. When asked what the fine should be, they all were hesitant to state an amount, but agreed that mangrove forests are breeding grounds for most marine species. Clearing and overharvesting of mangrove forest is not sustainable and is likely to threaten the future of this important coastal forest. The coral reefs and sea grass beds of Vatukarasa and Sovi Bay can be better protected by constructing artificial reefs (discussed in 8.3), prohibiting destructive fishing methods and imposing *tabu* (discussed in 8.5) useful, win-win adaptation actions include replanting native mangroves species, especially in places where they historically grew, leaving ample landward space for mangroves to adapt naturally to rising sea level, and increasing

awareness about benefits and importance of mangroves and how best to use and manage them.

8.5 Coastal fisheries

The people of Vatukarasa and Sovi Bay rely heavily on subsistence fishing. The participants mostly identified the prohibition or restriction of ecologically damaging activities as key elements ofa fisheries related adaptation programme. These included the use of some types of nets, overfishing, and the use of damaging methods such as poisons.

It was stressed by participants from both communities that the use of beach seines should be restricted as this is likely to trap and kill all sizes and species of marine organisms. For example, the use of beach seines could be permitted for one month in a year. Beach seines should only be of a certain length, for example no more than 12 metres long and 1.5 metres high. Joining of such two or more nets should be prohibited as should using a net within 75 metres of the mouths of both the rivers. In addition, there should be limits on the net leaving period, for example no net shall be left for a period more than one tide.

They also stated that, if possible and through education, it should also be advised and implemented that the size and number of fish caught per person be limited. This could be made possible by involving the *turanga-ni-koro* and the village elders. The recently established *komiti ni wai* could also be involved in setting fishing limits. Once this was implemented, the Indo-Fijian fishers would have no option but to abide by this. This is likely to improve and increase the coastal catch. “Local communities and landowners... must be given the tools and incentives to protect all important ecosystems and plants and animals so that they will be available for use by future generations of landowners” (Thaman, 2000:21-22).

Another idea that was put forward by participants was that catching species during their breeding season should be prohibited, as the females during this time will become vigorous feeders and are bound to be caught easily. Once they are caught their chances of laying eggs are gone and this is likely to reduce the number of that particular species in future. They considered that there was a need to increase awareness of fish and marine invertebrates, such as their spawning sites, life cycles, maturity and how best to sustainably use them (traditional knowledge could play an important role in this). Protecting spawning sites increases the productivity of species of fish and invertebrates. “The Fiji Government has banned the fishing, sale

and export of all species of grouper (*kawaka*) and coral trout (*donu*) during their peak spawning months, from the 6th of June through to the 30th of September, 2018, to help revive these rapidly declining fish species" (Ministry of Fisheries, Fiji Government, 2018:1). One older *iTaukei* participant (FT-2-G) stated:

> Spawning grounds could be protected by *tabu.*

The creation of *tabu* (where a fishing ground is set aside as a no-take area) empowers coastal communities to manage their own fishing grounds. *Tabu* is a crucial local form of fishing conservation. Traditionally *tabu* were imposed for 100 days after the death of a high chief, but now days *tabu* are jointly set up by the chief and its people. One could say that marine protected areas (MPAs) are modern versions of *tabu.* For *iTaukei tabu*are a way of maintaining harmonious relationships with the marine environment." No fishing areas help animal reproduce" (Lui Manuel, 2019. Conservation Officer Nadroga/Navosa Provincial Council-Personal communication).

There was not unanimity, however, over the issue of *tabu* which according to some participants is not helping the situation. Many of the younger participants are of the view that *tabu* may force local fishers to travel longer distances and spend more time in finding new fishing grounds. The new fishing grounds may lead to congestion resulting in fewer numbers and species of fish in those areas. Increased fishing pressure and not meeting their daily needs is likely to create conflict amongst the fishers. Impacts of *tabu* on family diet are summarised in Figure 8.3. Some older *iTaukei* participants recalled that in olden times it was much easier to impose *tabu*, because *tamata sa rere* (people were scared) that disrespecting *tabu* would anger spirit gods and people would face and suffer certain retribution by spirit gods.

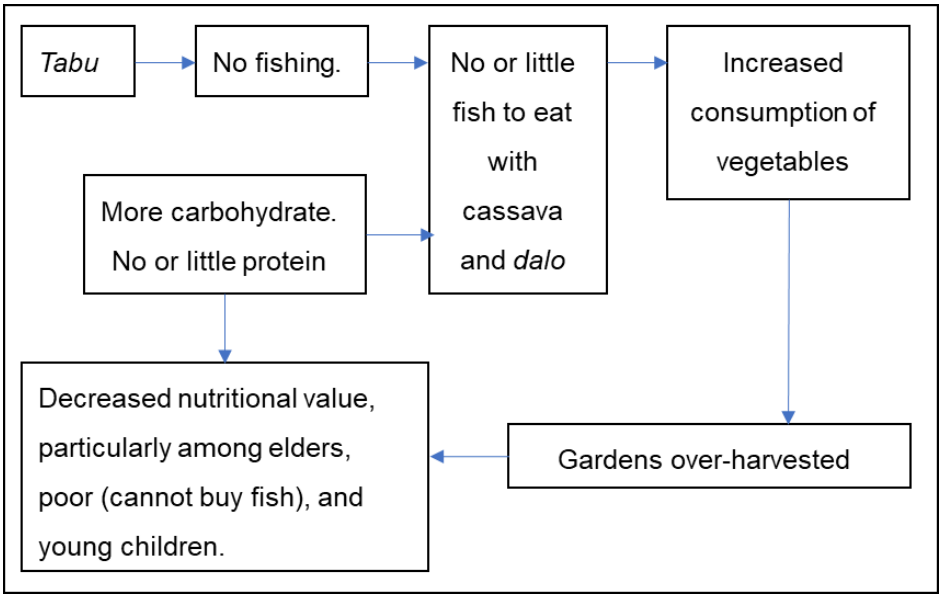

Figure 8. 3 Diagrammatical representation of *tabu* on family diet.

Participants also considered that destructive fishing methods should be banned because they can extensively damage and ravage productive fishing grounds and coral reefs that have taken centuries and decades to grow. No participant stated that dynamite and cyanide are used to catch fish at Vatukarasa and Sovi Bay. Only a handful of participants added that there may be a few isolated cases where traditional plant poison, such as *duva* and physical destructive practices, such as manual breakage of coral reefs may be employed to catch fish. People are very hesitant to talk about destructive fishing methods because they know that these practices are illegal.

8.6 Extreme events

Tropical cyclones, floods and drought have been recurrent phenomena at Vatukarasa and Sovi Bay and their co-existence poses risks and threats, which are impossible to eradicate but can only be managed by limiting exposure levels and reducing vulnerability.

8.6.1 Tropical Cyclones

Participants revealed that tropical cyclones are the most feared and destructive of the natural disasters faced by both the communities at Vatukarasa and Sovi Bay, followed by flooding and then drought, where the impact is slowonset and not immediate, is least feared.

As described by the participants in Table 8.1, steps taken in the emergency phase (from warning until the extreme event subsides) are important, but more important are long-term measures that build resilience in the first place and make some of the measures stated in Table 8.1 less important or even unnecessary. The villagers are no longer building traditional bure and concrete, timber and corrugated iron houses have become the norm. I will focus on how these houses could be made more resilient to extreme weather events.

It is important for houses to be constructed so as to be resilient, especially in the face of high winds during tropical cyclones, and to flooding (IPCC, 2014b). While the traditional *bure* had many features that enhanced their resilience it is important that contemporary structures are also resilient. This can be achieved through education and training for village-based home construction. Legal approaches could also be considered. For Vatukarasa *koro*, the Ministry of *iTaukei* Affairs and the Nadroga/Navosa Provincial Council could include in village by-laws (Local Authority laws does not apply in villages) a range of designs (such as external roof tie-down systems), published by the Fiji Building Standard Committee (FBSC) in 1985 to upgrade and to build more stronger and more wind-resistant houses. The implementation of guidelines in the FBSC is costly and may be inaccessible to most villagers. Here the government could help the villagers, technically and financially to build stronger and safer houses.

For the Indo-Fijian settlements, all building plans are approved by the Nadroga/ Navosa Local Authority. The problem here is that only double storey buildings are certified by structural engineers and all single storey buildings are approved by building surveyors, usually health inspectors, who mostly focus on health aspects of the building, such as "cross and through" ventilation, minimum floor area for habitable rooms and bathrooms. The health inspectors are not trained and qualified to do any calculation as far as buildings structural strengths are concerned. Getting single storey buildings certified by structural engineers is costly and inaccessible to most. The government could employ a structural engineer at every Local Authority Office and the engineer could do the work free of charge for the applicants. This will increase buildings resilience and durability.

Most participants stated that Fiji Government is helping tropical cyclone affected victims in rebuilding their houses. The government has directed Fiji National

Provident Fund (FNPF) to help members to withdraw and use their shares up to FJD 5,000 to repair their houses. The problem at Vatukarasa and Sovi Bay is that most people are not full-time workers and some who are working do not have adequate funds to withdraw to carry out some required repairs. The government has also made provisions, whereby individuals can apply for bank loans, but this must be paid back with interest. Participants also collectively stated that it would be of great help, especially after devastating effects of extreme events, if the loans could be given interest free and more time could be given for repayment. Some participants floated the idea that insurance against climate-related hazards would be the best option to overcome the situation effectively. But most participants revealed that they do not have sufficient regular income to pay the insurance premiums, which are quite high.

Both groups of participants spent a great deal of time, outlining the step-by-step responses (most were similar) to prepare themselves before, during and after tropical cyclones. From the discussions two main categories of protection (personal protection practices and property and crop protection actions) emerged. The village and settlement could be protected from strong winds by planting hardy trees, such as *nokonoko* (casuarina) which could act as a wind break and can also help in reducing salt spray. But care should be taken that these trees are planted away from houses and other buildings**,** so they do not fall on them. The actions taken by both the communities are summarised in Table 8.1.

8.6.2 Flooding

Flooding at Vatukarasa and Sovi Bay is usually associated with tropical cyclones (both river flooding and storm surge) and heavy rainfall associated with tropical depressions that do not necessarily reach the intensity of tropical cyclones. During heavy rains (and high intensity rainfall events are likely to increase as a result of climate change) surface runoff carries debris and sediments into the rivers which increase the likelihood of overbank flooding (Republic of Fiji, 2014; Handmer et al., 2012). The participants revealed that siltation of both rivers, with associated destruction and degradation of coral reefs and mangrove is increasing along with the intrusion of saltwater into coastal aquifers and exposure to storm surges. Most participants emphasised that overbank flooding could be reduced by dredging, which can help to clear "choked up" rivers, enabling them to hold more water, thus reducing the risks of overbank flooding. But I was informed by *iTaukei* of Vatukarasa and Sovi Bay that they do not believe in clearing the choked river mouths. They believe that when the rivers are choked, it

means that a snake with seven-heads is in the water. The river should be left to clear itself and the snake will then find its way out. *iTaukei* believe that clearing choked river mouths could bring bad luck.

After every destructive flood both communities demand, mostly from government agencies, that both rivers should be dredged. Dredging can be very expensive, yet effective way of controlling flood, and the participants from both communities stated that they would not be able to do dredging on their own; they will need government's help. Minimising the impacts of flooding at Vatukarasa and Sovi Bay will be a difficult task, as both sites are at the foot of the hill and inland activities (such as logging) are discharging high sediment loads into both rivers.

The participants recalled that flooding usually damages the water pipes (from reservoirs to the *koro* and settlements). The damage could be reduced by burying the pipe underground. Flooding also damages food supplies (farm produce) and other properties (Republic of Fiji, 2014; Handmer et al., 2012; Nawrotzki and Kadatska, 2010). The participants, whose houses are near the two rivers, stated that they move to family members' houses, which are on higher ground. In the case of Vatukarasa, the village is on flat low-lying ground, so they are forced to evacuate further away from Tamanua River and the coast or move to the church, which is on raised ground. In some cases, they move to the other side of the highway and stay with Indo-Fijian families, whose houses are on higher ground at the foot of the nearby hill. Early flood warning systems, such as river gauges and simple rain gauges could be installed and alarms could be raised by assigned personnel, when water-level reaches dangerous (critical) level (Handmer et al., 2012; Nawrotzki and Kadatska, 2010) .

Table 8. 1 Summary of actions taken before, during and after a tropical cyclone by communities of Vatukarasa and Sovi Bay.

Personal protection practices	Property and crop protection actions
Before	
Children, women and elderly are evacuated to church (considered to be the strongest-cyclone-proof building. Indo-Fijians prefer to stay in their own houses.	For iron roof protection-sacks filled with sand and heavy concrete, bricks are secured onto roof tops.
Matured fruits and crops are collected and cooked so that they could be kept for a week or so.	Tree branches (tenuous) near houses are cut and removed.
Glass windows shuttered to protect from flying debris and high winds.	Fishing boats are brought into rivers, filled with water and tied to mangroves.
Motor vehicles parked under solid shelter, with hand brake on and in park (gear).	Crops such as cassava and *bele* are pruned to reduce leaves surface area, making them less exposed to strong winds.
A working radio with spare batteries and torch to be kept ready as power may be out for some time.	
Dry foods, such as sugar, biscuits, rice flour and tinned foods, as well as gallons and drums of drinking water to be stocked. First aid kit to be well stocked.	
Mobile phones fully charged and only used when necessary. All loose items tied down or filled with water or sand.	
Family briefed of cyclone procedures and duties delegated.	
During	
If possible, use a map (supplied by government) to keep track of the cyclone.	Do not think about saving any property or crops and just think about saving yourself and your family.
Stay inside (well clear of doors and windows) and do not try to save anything.	
Switch off main electricity (meter-box).	
Protect yourself with blankets, mattresses and rugs and move under a strong bed or table when house starts breaking. Don't assume that the cyclone is over, it is the eye which is calm, damaging and destructive wind will resume from any direction soon.	
After	
Don't use any wet electric appliances, until all clear is given	Salvaging food crops and kava that are possible and planting quick maturing crops, such as *kumala* and white cassava, while rebuilding the gardens
Don't go sightseeing.	
Don't enter floodwater to collect floating coconuts, breadfruits, etc. Stack all loose materials together.	

Source: Collected from participants during field work (talanoa sessions and focus group discussions).

8.6.3 Drought

Long- lasting droughts can lead to social disruption, degradation of plant and animal habitats and soils. Wholesome and ample water supply is essential for healthy living and for healthy ecosystems. Drought hardens the soils, reducing moisture absorption rates, increasing surface run-off and degrading the soil properties. While changing climatic conditions cannot be directly modified by the people of Vatukarasa and Sovi Bay (that would require major reductions in global greenhouse gas emissions) there is a large number of possible adaptive options that can be employed to help the communities reduce the hardships brought by droughts and other impacts on water supply such as salinisation. The effects of climate change on water supply and possible adaptations at different levels are summarised in Figure 8.4 and discussed below.

One way of improving water supply can be construction or installation of water tanks with foul tanks (known as first-flush diverters in New Zealand). Foul tanks are attached to the main tank. Water collected from roof catchments can be contaminated with dust, corrosion, ash, lead flashing, leaves, dead animals, vermin and bird droppings, which can cause serious sickness and ill-health, such as vomiting, dysentery and diarrhoea. Foul tanks can be the main instrument in removing these contaminants as they collect the first rain from roofs. This way the roof surface is washed, and contaminated water is collected in the foul tank. A floater closes the entrance of the foul tank, once it is full and water is then directed to the main tank. A debris screen can also be installed at the joint of down-pipe and guttering. Overhanging branches should be trimmed, and roof guttering should be cleared and cleaned regularly to prevent leaves, debris, cats and rodents waste being accumulated. After each fill of the main tank, the foul tanks should be drained out and made-ready for the next roof wash.

Another way of improving water-supply during droughts can be by zoning of rivers. Water quality in rivers is changed by human land use activities. The rivers could be zoned for example so that the first 50 metres (from the source-side) can be for drinking and cooking, the second 50 metres for bathing and washing and the next 50 metres can be utilised for animal drinking and bathing. Zoning determines, prohibits and/or restricts certain uses of certain portions of rivers and is a primary planning tool that can significantly improve quality of water. But it needs a bottom-up approach and communities' cooperation and understanding for effective conservation, management, planning and usage of water. The quality of river water can be improved by increasing

the oxidation level of the water. Before the first 50 metres (drinking and cooking zone) the obstacles, such as fallen trees and other debris in the river should be cleared to increase the flow of the river. This would allow more oxygen to be mixed with water, increasing oxidation levels (reducing contaminants and other decaying materials) and reducing eutrophication (nutrient enrichment) of the water.

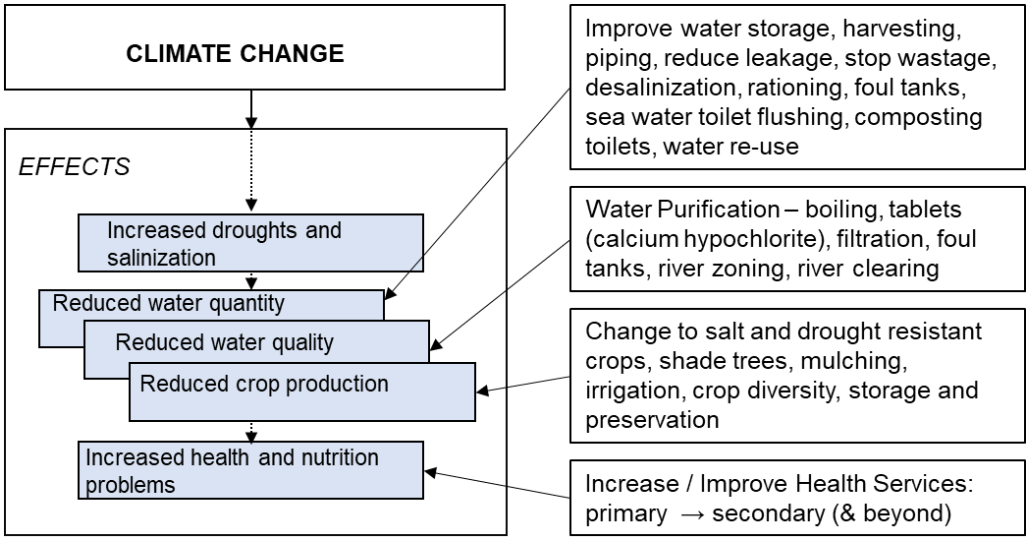

Figure 8. 4 The effects of climate change on water supply and possible adaptations at different levels. Source: Field notes, 2013.

The above two methods (construction of foul tanks and zoning of rivers) are more water quality improvement methods. They would also reduce the time women spend boiling the water, reducing the quantity of water lost through evaporation, and importantly reducing exposure of women to indoor and outdoor pollution from wood fuel. The time spent boiling the water could also be used in some income generating activities, especially during droughts when, farm yields are reduced and any extra income for the family would be of great help. "...[M]oney entering a household through a woman brings more benefits to the family as a whole" (Muhammed Yunus, Noble Peace Laureate and Founder of the Grameen Bank, 2008 quoted in Alam et al., 2015: 18). Water scarcity especially for women and young girls can compromise their personal hygiene, particularly during menstruation and pregnancy.

Both the communities can use sea water to flush toilets and even for bathing (although people will need to rinse their bodies with fresh water in the end). A key element in reducing water insecurity is to ensure that all leaks from pipes, containers, drums and of tanks holding water are repaired with minimum delay. Most leaks can be easily

detected and repaired. Droughts are likely to become more frequent in Fiji and loss of water from leaking pipes in Fiji is more than potential water loss due to climate change (World Bank, 2000).

People can also employ reuse water strategy. Water from washing of pots (kitchen sinks), bathing (bathrooms) and washing of clothes (wash-tubs) can be used to irrigate backyard gardens. Methods of water conservation should be part of the communities' daily lives, to preserve this much needed and essential resource. Working with nature, learning about and better understanding of drought and the environment (which reveals so many clues about drought) can help people to reduce the likely risks and impacts of drought.

Farmers of Vatukarasa and Sovi Bay plant crops (*kumala*, *uvi*, *chikau*-a type of yam), that grow throughout the year and are able to survive with low or no rainfall. They are also planting vegetables under taller trees to provide shade to low-lying plants and to prevent them from dying. I have also seen farmers making temporary shelter using coconut leaves over vegetable gardens to protect vegetables from drying and dying. Another important method of protecting crops, such as egg-plant and chillies, is mulching to reduce the loss of soil moisture and erosion. Also planting crops (such as *tavioka* and *kumala*) that need less water can keep a field productive and increase erosion protection.

8.6.4 The importance of religion

It is also important to consider the role of religion in people's attitudes towards, and responses to, extreme natural events. Most older participants, from both communities, are of the view that more intense tropical cyclones and rising sea level are God's punishment for increasing sins. *iTaukei* and Indo-Fijians of Vatukarasa and Sovi Bay are very religious people and they believe that everything is happening because it is God's will and if they have faith in God and pray, then they will be saved. Most participants are of the view that many plants and animals will become extinct, reducing the beauty of God's creation. For people's sins, others will suffer. One older Indo-Fijian participant (IT-1-F) indicated that:

> All the mountains will turn into cotton and will be blown off. The land will be flat and the whole world will be covered with water. The only solution is to pray to God and ask for forgiveness. God is going to punish us all. The weather is going to change suddenly. One moment it will rain and flood, the next will be dry and dusty. The

> days are not far away, when you will be ploughing and one bullock will get wet from the rain and the other will be dry.

One *iTaukei* participant (FT-1-F) believed that:

> God is giving us plenty to have, preserve, store and be ready before approaching hazards. It is us; we are not able to get the correct message and prepare ourselves before approaching danger.

One Indo-Fijian participant (IT-2-K) also stated:

> God is always giving us signs and indications, but we are not able to notice and recognise them.

These two latter statements suggest that the application of traditional ecological knowledge could play an important role in reducing disaster losses. For some of the participants prayer may be seen as a significant adaptation option. However, others may see this as a barrier to other forms of adaptation being supported or implemented.

8.7 Health impacts

"Sound and reliable information is the foundation of decision-making across all health system building blocks, and is essential for health system policy development and implementation, governance and regulation, health research, human resources development, health education and training, service delivery and financing" (WHO quoted in Government of Fiji. 2016a: 1). Sustainable resource management is likely to enhance the long-term availability and productivity of local ecosystems, which in turn is likely to increase food security, nutrition and livelihoods. Managing and reducing environmental threats, such as reducing water contamination are likely to prevent or reduce the number of cases of communicable diseases. The two most common diseases at Vatukarasa and Sovi Bay are diarrhoea and dengue fever.

8.7.1 Diarrhoea

"Loss of access to safe water supplies accentuates the incidence of diarrhoea, where rates are positively correlated with temperature, and negatively with water availability" (Connell 2013 quoted in Connell, 2018: 162). The number of diarrhoeal cases could be reduced by improving water-supply (WHO, 2012), as summarised in Table 8.2 (see also Figure 8.4).

Table 8. 2 Fresh and clean water, its threats, contributing factors and management actions.

Resource	Threats	Contributing factors	Management actions
Wholesome drinking water, clean and healthy rivers.	Pig pens close to and over the river.	Easy to clean pig pens (easy access to water)	Pig pens to be built away from river banks.
	Dumping rubbish and waste in rivers.	No proper place to dispose rubbish.	Install communal rubbish pits.
	Unsustainable farming and riverbank logging.	Farming in water catchment area.	Water-catchment area to be fenced and farming and/or cattle raising to be prohibited.
		Need (timber) for housing materials.	Plant trees on near-by hills to reduce land run-off.
		Lack of awareness.	Increase public awareness why the above are necessary.
		Lack of money.	Fund raising, government assistance

Source: Field notes 2013 (observation, *talanoa* sessions and focus group discussions).

To treat diarrhoea the most important response is home therapy where, the mothers and other family members are trained to recognise symptoms, assess the degree of seriousness and provide early treatment. It was revealed by both the *iTaukei* and Indo-Fijian mothers during focus group discussions and *talanoa* sessions that they prefer their own home-made oral rehydration salts solution (ORS) over the ones provided by the district nurse. They boil a litre of water; add three tablespoons of sugar and a teaspoon of salt to replace salt, sugar and minerals lost during diarrhoea. Mothers also stated that they give plenty of fluids to their children, to replace water lost during diarrhoea. It was revealed that a small portion of cooked white rice mixed with vinegar

(1 teaspoon), honey and ginger, drinking coconut water, aloe Vera juice, and avoiding milk and dairy products may help in controlling diarrhoea.

Some participants also stated that they cut small pieces of cassava and boil them in prepared ORS and feed their children. They found this to be more effective than only giving ORS provided by district nurses. It was also indicated that to treat adult diarrheal cases, those affected usually eat boiled and raw cassava, or just dry breakfast crackers (biscuits), or they chew and eat young guava leaves. They told me that these things are very effective in treating diarrhoeal cases, if taken as soon as diarrhoea starts and their own homemade method of treatment, is mostly very effective. On the other hand, participants also agreed that if diarrhoea becomes severe, it is best to seek medical advice (see a doctor). Now, the Ministry of Health has stationed a doctor and a nurse at Vatukarasa *koro*.

8.7.2 Dengue fever

Aedes aegypti mosquitoes, the dengue vector, are most active during early morning hours before daybreak and in the late afternoon before dark, but some participants (both *iTaukei* and Indo-Fijian) stated that mosquitoes are now biting all the time, although they may all not be *Aedes aegypti*. One way to reduce exposure is for people to limit their movements when the mosquitoes are biting at dawn and, although this is not always possible in village and rural life, such as in Vatukarasa village and Sovi Bay. People usually go to their farms early in the morning and they normally gather in the afternoon for *talanoa* and grog (*yaqona* drinking) sessions. Also, there is belief in villages and in rural settlements (revealed by participants) that if you are sick and you only lay in your bed, you are bound to become moresick, so people move around and in this way they are likely to spread or increase the number of dengue fever cases.

Researchers are yet to find any vaccine for dengue fever, so the best and only option is to avoid being bitten by the *Aedes* mosquitoes infected with dengue virus. which can be achieved by reducing the number and density of the mosquitoes. The participants, during focus group discussions and *talanoa* sessions revealed that the best way to do this is through environmental control (this was very much seen during participant observation), such as clearing and cleaning drains, guttering and downpipes, cutting long grasses, changing the water and cleaning the bases of flower pots every two to three days, burying discarded tins, keeping discarded tires under cover, filling tree holes with soil or sand, using coconut shells as firewood,

and by having a buffer zone between dwelling houses and plantations or any overgrowth.

The participants stated that the number of dengue fever cases could be reduced by using mosquito repellents, wearing protective clothing, such as long-sleeved shirts, long pants, socks and shoes, although, this is not usually favoured. Accordingly, the control and prevention of dengue fever depends very much on the control of the local *Aedes aegypti* population. The best way to achieve this is reduction and destruction of potential breeding grounds. The village elders revealed that during their parents' and grandparents' times the district officer and *Roko* (head of the Province) used to make an annual visit to Vatukarasa village to talk to villagers (to find out if they are having any problems) and to inspect the hygiene, cleanliness and housing of the village. This practice is no longer continued.

While I was working as an Environmental Officer in Fiji, I carried out various "Outreach Programmes" at Nausori, where *the turanga-ni-koro* and settlement headmen were given money (donated by prominent citizens and business proprietors), to reward children who were asked to collect all tins, cans and coconut shells (F$3.00 for each bag). The children were asked to put all coconut shells in a separate bag. The tins and cans were buried, and a bag of coconut shells were sold for F$3.00 to families, to be used as firewood. This way the potential mosquito breeding grounds were destroyed and fewer trees were cut down for firewood.

The human impacts of climate change at Vatukarasa and Sovi Bay can be reduced by improving health facilities and services, better and quicker disaster management, such as improved sanitation and access to safe water supply, controlling infectious diseases, effective warning and informing systems and by reducing poverty. Improvement in economic growth and social welfare will improve living conditions, which is likely to reduce the prevalence of both diarrhoeal and dengue fever cases (Walker and Mason, 2005).

To reduce the climate change impacts on human health, the policy makers and health planners (working in close collaboration and consultation with the community) need to establish the linkage among health effects, actions, vulnerability and environment (WHO, 2007). This effort must involve a wide range of stakeholders and should be multi-faceted. Reducing impacts of climate change on human health will require incremental to more fundamental and transformational changes.

8.8 Agriculture and climate change

All the participants emphasised that every stage of agriculture is influenced or impacted by climate change. For example, climate change is likely to affect whether crops or livestock grow well, deteriorate, survive, flourish or die. As indicated in Chapter Seven (see Figure 7.8), farming is the main source of food and income for both communities. Climate change with more intense tropical cyclones, more devastating floods, prolonged droughts and increasing temperatures is magnifying the hardship of farmers in Vatukarasa and Sovi Bay. Its impacts on farmers and their families are also influenced by their access to land, cropping practices, use of fertilizers, tools and machinery, and other inputs such as secure access to capital (loans).

Extreme rainfall (frequent waterlogging of soils and flooding of gardens), salinization of soils, increasing temperature, and prolonged drought conditions alter soil structure and accelerate nutrient loss (Nawrotki and Kadatska, 2020). What I have observed and heard from the participants is that social and cultural disempowerment are the major hurdles and obstacles to adaptation in the agricultural sector and achieving sustainable agricultural development at Vatukarasa and Sovi Bay. When we talked about "how to minimise the impacts of climate change on agriculture", we were talking about the adaptation of agriculture to climate change. This includes actions to minimise or reduce the risks to agricultural crops and to maximise crop production or yields.

Most participants, during *talanoa* sessions and focus group discussions, noted that climate change is negatively impacting crop yields, increasing both men's and women's workloads, as they have to replant the same crops more often to achieve the required crop yields. Older participants stated that some ancient and traditional practices, such as use of ashes to control insect infestation, sighting of the moon (no planting during full moon) had been eroded. It was revealed by both the *iTaukei* and Indo-Fijian older participants that the crops that are planted during full moons are more likely to be infested by fruit flies and white flies. Accordingly, all planting is to be done during dark-nights (new moon and waning phases) and this improves production of the locally grown crops and fruits. Both the *iTaukei* and Indo-Fijian older participants also stated that when planting if the plants are sprayed (using a sprayer) with ashes the infestations of fruit flies and white flies are very much reduced. Counting the number of halos or rings around the moon, to know when it will rain (helps in land preparation, buying of seeds, fertilisers and sowing) all could help in agricultural practices and most likely increase yields.

Most participants also revealed that damage to *tavioka* (cassava) can be minimised or prevented by pruning (cutting off foliage) before floods or approaching cyclones. Even when the *tavioka* plant is destroyed, tubers underground can be preserved for a week or two provided the ground is not wet. Once out of the ground, it will only last for a short time. Crops like *kumala* and *uvi* (yams) need dry conditions to thrive but will die and decay when the ground is wet. *Kumala* and *uvi* tend to survive wind damage even if foliage above ground is badly damaged and they can be salvaged and stored for long periods in a dry place. On the other hand, *dalo* will thrive in wet conditions, but will die during a drought (Fijian *dausiga/ dravusiga*, Hindi *jhuura*). Most participants revealed that when *tavioka* and *dalo* plants are destroyed by tropical cyclones, *dalo* tubers in wet conditions will last longer than *tavioka* tubers in dry conditions when left underground.

Most *iTaukei* and Indo-Fijian farmers stated that crops like corn (Fijian *sila*, Hindi *makai*) and peanuts (Fijian *pinati*, Hindi *mung fale*) can survive flooding to some extent, as the plants normally bend with the force of flood water and can straighten up again when flood water recedes (see Figure 8.5). These variations in the ways crops respond to different extremes point to the importance of agricultural diversity as an adaptation strategy. This reflects traditional practices throughout the Pacific region (Campbell, 1984, 1990, 2006).

Figure 8. 5 Mr. Fazal showing his *makai* (corn) plantation that was affected by flooding. The plants bent with the force of the flood water but survived. Source: Nur Ali, 2015

The communities of Vatukarasa and Sovi Bay are already employing a number of strategies to minimise the impacts of climate change that they have observed. Some participants revealed that they have a specific planting calendar indicating which crops should be grown in which month. They plant more than what is required by the family (to create a surplus) and they plant many different kinds of vegetables and fruits, increasing the possibility of some surviving extreme events. I have noticed that both communities are now rearing "*English murgi* (English chicken)" which take only about eight weeks to mature unlike the traditional "*Junglee murgi*", which takes more than a year. Women are more involved in poultry farming and men on the other hand are more likely to participate in goat, pig and cattle farming.

The farmers are nowadays planting faster maturing crops, such as corn, white cassava (*iTaukei-tavioka telai*, Hindi-*ujaar kasera*) as compared with yellow cassava, pawpaw and peanut. This way it is more likely that they will be able to harvest their crops before the next extreme weather conditions occur. Some farmers stated that they are now constructing elevated seedbeds to reduce the likely impacts of flooding and planting boundary trees to minimise and prevent soil erosion.

Examples of potential sustainable development strategies at the study sites include contour ploughing and crop rotation. These practices would reduce surface runoff, soil erosion and help to maintain soil fertility, thus increasing food security and decreasing dependence on imported foods. Changes such as these may also initiate interest in other sustainable agricultural practices, revitalise interest in farming, and further increase food security and use of climate-resilient crops. Additionally, fewer chemical fertilizers and pesticides would be needed, and thus fewer chemicals and pesticides would be washed from the catchment areas, into the rivers, and then into the lagoons and onto the reefs, resulting in fewer impacts on coral photosynthesis and less marine pollution.

Some *iTaukei* participants also revealed that their fallow periods have shortened dramatically in recent times. Their parents' and grandparents' fallow periods were at least ten years, but now it is only a year or not at all. The short fallow does not provide enough time for secondary bush to grow back again and for land to rest and regain its nutrients. So, these farmers have come up with the idea of crop rotation. Different crops are alternatively grown to help replenish soil nutrients. "Agriculture is crucial to food and nutritional security...and supports livelihoods through the sale of agricultural products on the domestic...market" (Simpson et al., 2009: 196).

8.9 Induced migration and forced relocation

Two forms of mobility have been associated with climate change (Campbell, 2014). The first is induced migration where individuals (and their families) migrate to reduce the population pressure resulting from reduced productivity and food and income stress from degrading environments. At the same time they can offset the declines in food and income through sending remittances from their new locations. The second form of mobility is forced community relocation where the original site (*koro* or settlement and agricultural lands and fishing grounds) is no longer able to sustain the community as a whole. In this case the entire community is required to move to a new site. It is likely in Fiji that relocation will result from the coastal effects of climate change (in fact some relocations have already occurred, see below).

Relocation is a challenging, difficult and complex decision for households and in some cases for an entire community to leave their place of birth and move to a new environment to sustain their livelihoods in the long-term. Decisions regarding relocation should be given ample time and consideration and options should be carefully identified. Campbell explains relocation as: "Permanent (or long-term) movement of a community (or a significant part of it) from one location to another, in which important characteristics of the original community, including its social structure, legal and political systems, cultural characteristics and worldviews are retained: the community stays together at the destination in a social form that is similar to the community of origin" (2010: 58-59). Relocation is likely to be least disruptive if it is within the community's own *vanua* (Campbell, 2019).

In the study area it is possible that rising sea level and associated flooding will force the coastal communities of Vatukarasa and Sovi Bay to move further inland to more marginal hilly and steep areas. In such a scenario, further land degradation, would be likely with adverse effects on food production and increased siltation of rivers and coastal areas, if not properly planned. For *iTaukei* of Vatukarasa and Sovi Bay moving inland will not raise issues about the *vanua*, because the areas belong to their *mataqali*. They would still be living close to their old *koro* and could visit it regularly. For some, relocation may give people a stronger sense of safety, as they no longer would be fearful of high tides during storms and cyclones. On the other hand, other issues may arise including access to fresh water which may have to be carried or pumped up hill, provision of infrastructure such as electricity and transport access would need to be provided. For the Indo-Fijian population

relocation may be much more difficult as they may have to find new land that they could lease. It is possible that communities may disperse under circumstances where no suitable site for a community can be found.

Some participants foresee a future where relocation will become necessary.

> FT-1-F: In years to come we may have to move our village further inland because sea level rise and frequent flooding will make it impossible for us and our children to live here.

According to Crate and Nuttall (2009) the survival of *iTaukei* and their *vanua* depends upon their relationship with their environment. Their survey further revealed that more Indo-Fijians than *iTaukei* are willing to leave their present area and migrate to urban centres and for many more, preferably to overseas to join their close relatives. This perhaps reinforces the respective attachments to place of the two communities.

> IFG-2-M: If I get the chance now I will leave everything and I will like to join my family in New Zealand.

The older participants during both focus group discussions and *talanoa* sessions noted that relocation is not just people moving from one place to another, but also what people have lost through physical movement (such as sacred sites, being further away from good fishing grounds and fertile agricultural land) and how these needs could be recovered. It is not only the recovery in a material sense, but how one could re-knit the fabric of his/her life and make his/her life whole again. "Displaced people are often distanced from their sources of livelihood, whether land, common property (water, forests, etc.), or urban markets and clientele" (Koenig, 2009 cited in Cardona et al., 2012: 80)

> FFG-3-M: I was born in this house. I want to stay here, and I want my funeral to go from this house. This house is not just tin and timber, it is my father's sweatand hard work and my mother's love and affection. This is the house of my ancestors. How can I leave this house?

Relocation, for some *iTaukei* will mean moving closer to their bush gardens but away from coastal fishing areas. The likely impacts of relocation are outlined in Figure 8.6.

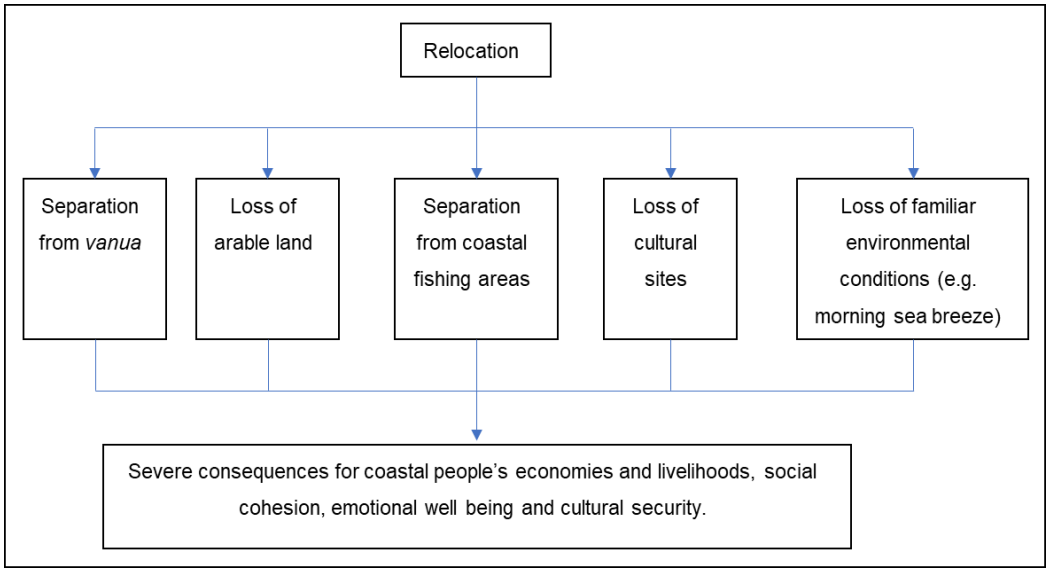

Figure 8. 6 Likely impacts of relocation on the people of Vatukarasa and Sovi Bay.

The *iTaukei* community is more exposed and vulnerable to increased flooding risks because their sacred sites and valued infrastructure are on erosion-prone coastal low-lying areas. For example, a grave in the narrow strip of land between the coast and the road on the Suva side of the bridge (about 200 metres from the Tamanua Bridge) was damaged by the rising sea level and waves, see Figure 8.7.

Figure 8. 7 Mr. Ifereimi showing the location of the grave that had to be relocated.

"Death, according to traditional belief, is a process of entering into the spirit world. Only those who have carried out their traditional responsibilities in the earthly

world satisfactorily will be admitted to the supernatural realm. Others will be destroyed on the way" (Ravuvu, 1987: 339). The above statement clearly explains the importance of traditional responsibilities in *iTaukei* society. It is not only important in the earthly world, but also in the hereafter. Death for *iTaukei* has important cultural, religious and social significance to the living. Death brings everybody together, reaffirring and strenghtening existing political and social links. It is time to forgive, forget past differences and reconcile, transcending disagrrements and social barriers.

At Vatukarasa village the dead are buried on their own land because in Fijian culture, land is regarded as an extension of oneself. The chiefs, by custom are at times buried in the village precincts (Roth, 1953). *iTaukei* families also want to keep the dead very close to themselves and this is one reason why we see some graves in villages next to family *bure*, see Figure 8.8.

Figure 8. 8 A grave in the village next to family *bure*. Note the bure has many features that foster resilience to high winds including a relatively steep, hipped roof, limited overhanging eves and no windows (if the doors are shut air pressure does not build up inside the structure).

In some cases, the dwelling house is threatened by the rising sea level, but the ancenstors graves are not threatened and in such cases the villagers are very relectant to relocate to a new site, which would be further away from their ancestors' graves. *iTaukei* of Vatukarasa village stated that they do not want to relocate to a new location or relocate their ancestors' graves to new sites, until and

unless it is really required or unavoidable. All potential relocation should be organised and the views of those affected to be paramount in the (relocation) decision making process and social and cultural networks would need to be preserved and maintained.

In some cases *iTaukei* (especially the older citizens) are prepared to face problems and hardship, but they would not like to be away from their ancestor's graves.

> FFG-1-D: In our Fijian society there is great social interaction among the villagers and families. Even when there is a death in the village, *reguregu* [Every *iTaukei* funeral starts with a traditional ceremony, called *reguregu* where friends and family members come to offer their last respects] is performed and some burial takes place in the village boundary.

The relationship of people with their ancestors is important in sustaining *iTaukei* culture giving the people mutual respect for each other, better understanding among people, personal satifaction, and harmony and ability to care for others. All of these can not be measured in monetary terms, but it can only be felt and experienced . These people do not want to leave their home, and they do not want to lose their culture, heritage and identity, even though their low-lying coastal areas are becoming uninhabitable. A few participants stated that they do not want to leave their land, because if they do, they are likely to lose it forever. They only own the land as long as they use and occupy it – if the land is abandoned the critical link with the *vanua* will be broken.

As earlier stated, the inland area (where the *koro* could be relocated) belongs to Vatukarasa *mataqali.* A village, Vunidogoloa in Vanua Levu, relocated two kilometres inland (on their own *mataqali* land) in 2014 is now doing quite well. The Fiji government, at a cost of $879,000, constructed 30 houses, with few fishponds and some farms (*iTaukei* Affairs Board-Provincial Councils-Ministry of *iTaukei* Affairs, 2015). It is imperative to see that when relocation is undertaken, the government and other stakeholders should see that relocation improve the lives and livelihoods (reducing exposure and vulnerability) of all those relocated. Relocation can enhance the adaptive capacity, if it is more participatory, properly planned and well managed (Campbell and Warrick, 2014; Charan et al., 2017).

The two communities already have a number of members who have migrated for a variety of reasons including education, employment and other economic opportunities. Many of the migrants have moved to urban areas in Fiji, but some

have gone further afield to places like New Zealand. Migrants play an important role in responding to environmental change, especially extreme events. When people are impacted or affected by natural disasters, such as tropical cyclones, floods and droughts, relatives who are living in Australia, New Zealand and USA often send money back home to help their affected kinfolk . Most participants recalled that remittances sent back home are noticeably increasing and these remittances often represent an important source of income during and after disasters (Backer, 2015; Campbell and Warrick, 2014; Harper and Zubida, 2016). It was revealed that remittances at Vatukarasa and Sovi Bay are mainly for everyday consumption and only two Indo-Fijian participants stated that they have used remittances for investment purposes (operating small businesses such as carrier vans). Further, some participants stated with great sadness that they are no longer receiving any remittances as migrants who were close kin have died and they get smaller amounts at times from second and third generation migrants upon request. Remittances are very important for rural communities like Vautukarasa and Sovi Bay and play an imperative role in 'hard times' (disaster recovery), in plugging the holes 'in family' needs and wants and enabling families to adapt to natural disasters and climate change.

8.10 Gender and adaptation

As outlined in Chapter Seven, the impacts of climate change are culture and gender specific, depending upon traditions, local customs and gender roles. Both, men and women can take some adaptation measures to minimise the impacts of climate change by working off the farm (as permanent full time employees or as daily labourers). It was observed and revealed during *talanoa* sessions and focus group discussions, that is is women whose roles are less flexible (resulting in fewer job opportunities) than those of men who are more easily able to find employment off-farm in case of reduced crop yields. At Vatukarasa and Sovi Bay participants indicated that women have limited access to education and their reproductive, household and family obligations are reducing their chances of employment outside of the home**.**

Most female participants also stated that as men are departing to look for employment off-farm, the females' workloads are increasing at home as they have to make up for the loss of labour and help which was provided by departed household male relatives. This is further worsened by climate change effects such as reduced agricultural productivity requires greater imputs of labour into the degrading land, which is likely to increase in the future.On the other hand male

migration may be seen as empowering women to decide what crops to plant and what actions to take regarding land rights. This empowerment may not last last for long and authority, regarding planting and land rights, may be reverted back to men upon their return to the *koro* or settlement. It was also stated that men's social ties are stronger and more extensive than women in and beyond both the *koro* and settlements. Accordingly men can rely upon more extensive networks for help and assistance during and after extreme events. Men and women often take different steps and strategies and make different choices regarding climate change, which has gender-differentiated impacts. Because of climate change women's burdens are becoming significantly heavier, as they have to spend more time and travel further addressing the resources scarcities.

The intrusion of salt water into fresh water aquifers, makes fresh water harder and it takes longer for hard water to boil, thus more wood is needed to cook (see Figure 8.9), which means more cutting down of trees, more and more exposure to domestic smoke. One way of reducing women's (for both *iTaukei* and Indo-Fijians) exposure to smoke is by using dry wood (wet wood emits more smoke) and this could be done by simply putting the fire wood under cover or in a shed (IFG-1-D). But most fire wood is put out in the sun to dry but when it rains it is not put under cover or in a shed (see Figure 8.10). Another thing that could help females to become less exposed to smoke is by using "smokeless stoves". Smokeless stoves can be bought from the Ministry of Health, Mosquito Yard, Walu Bay, Suva (FFG-2-H).

Figure 8. 9 Ms Nazmeen (my sister) seen here preparing dinner (duck curry) for us. Note she is using *lakkhri wala chulha* (wooden stove)

Older Indo-Fijian participants recalled that when their parents and grand-parents used to cook root crops, such as *tavioka* and *dalo*, they did not add salt before it started to boil. Their thinking was that it will be cooked with less time. Now I realise that their thinking was quite scientific. If you add salt to water and try to cook the food, the water will become hard and it will take longer to boil and cook. Older Indo-Fijian female participants stated that to cook *dhal* (split peas) with less time and wood could be done by putting a steel spoon in the pot. One younger Indo-Fijian participant (IFG-2-M) jokingly said:

> To cook *dhal* with less time you don't have to put a steel spoon in the pot but you need a pressure cooker

Figure 8. 10 Firewood not covered and not kept in a shed

To this, older Indo-Fijian participants replied, their husbands do not like *dhal* cooked in pressure cookers. They like *dhal* to be cooked on wood burning stoves, taking its time and adding that peculiar taste that they enjoy. As for *iTaukei*, it was observed and stated by all *iTaukei* participants that they do not add salt while cooking most food, they add salt while eating. This way they are able to cook food with less time and wood.

For any adaptation intervention, where gender is overlooked, and women's views are not taken into consideration, projects are likely to be inappropriate or unsustainable (Jerneck, 2018; UNDP, 2010; UNDP, 2016c). Women of Vatukarasa and Sovi Bay depend highly on natural resources from the local environment, for both their own and their family's survival. They have huge fishing knowledge (e.g.,

what type of fishing line and baits to use), they know about changing weather patterns and what best could be done in each weather type. Women are important agents (with significant perspectives and traditional knowledge) of change and their voices must be heard as they can inform and influence adaptation strategies to reduce the impacts of climate change (Australian Red Cross, 2014). I have observed, and it was revealed by most participants, that women have great reservoirs of local knowledge and experience in natural resource management. Women, especially at Vatukarasa village, can be considered as managers of biodiversity who have a great deal of insight about local biodiversity.

From my discussions during field work it was apparent that women in both communities have the knowledge, ability, capacity and skills to adapt to climate change and create better livelihoods and food security both for themselves and their communities. All they need is opportunity, power, tools and finance to turn these talents into solutions. Women's unique knowledge and understanding of the natural resources and climate change impacts on these resources must be recognised and valued to achieve environmental goals (UNDP, 2016c). Women are essential for developing sustainable risk management options due to their knowledge, multiple and simultaneous responsibilities and as well as roles in productive areas. Women at both the sites are mostly indirectly involved in decision-making about climate risk management. They are not able to directly contribute during meetings such as Provincial Council and settlement and village meetingsEven when *iTaukei* and Indo-Fijian women are present they hardly speak although they often pass on their suggestions through their male counterparts.. It was revealed and observed that women's knowledge and views benefit the entire community. Some examples are given below.

Both the *iTaukei* and Indo-Fijian female participants believed that to have bigger *tavioka,*one has to prune the plant and to have longer and bigger bananas, one has to cut off the lower-most part of the banana bunch. For domestic animals, the women of Vatukarasa and Sovi Bay stated that if you want to have your hens and ducks to lay eggs earlier, then separate the mother hen and ducks from their chickens and ducklings respectively. If one wants to have healthier and fatter goats, then feed them with some salt, this way they will drink more water, will also eat more grass and will also start eating grass early in the morning, when the grass is still wet and moist.

Women of Vatukarasa and Sovi Bay do not want special treatment but desire equal access, control, and ownership of resources as men (such as land, livestock, property and income opportunities), and access to development resources such as credit, information, training and outreach, and culturally appropriate and labour-saving technology, so that they able to better adapt to the likely impacts of climate change. Women of Vatukarasa and Sovi Bay want to work hand-in-hand with men. They know that they are powerful agents for change and their participation should be considered one of the priorities in adaptation and risk reduction strategies. Their critical knowledge, experience, unique role in agriculture, food security, livelihoods, management of households and natural resources in diverse eco-systems can be a major tool to reduce the likely impacts of climate change, increase community resilience and implement sustainable development and improve the living standards of both the communities.

To improve the gender balance and to have health and safety for all, the women should not feel uncomfortable to have access to food and medical aid and other relief items such as clothes, if they have lost some of these in disasters. This is very common in the Indo-Fijian community. A woman will not come in front of her father-in-law, uncle or any elder male if her clothes are wet and sticking to her body, or her head is not covered, or her *sari* or *shalwar* is missing. Cardona et al. (2012: 81) also noted that in India (Fiji is similar) "Women or other socially marginalized or excluded groups are not vulnerable through biology (except in very particular circumstances) but are made so by societal structures and roles". Indo-Fijian women when married, lose their all property and land rights to their husbands. The husband becomes the owner of all the belongings, cash and property of the wife and becomes the *jeevika* (sustenance provider) of families. Benefits often accrue (including in adaptation to climate change) when men work with women (see Figure 8.11) and both men and women enjoy the same fundamental human rights. "Gender inequalities intersect with climate risks and vulnerabilities" (United Nations Development Programme, Human Development Report 2007/2008 – Fighting climate change: Human solidarity in a divided world, New York, 2007 quoted in United Nations Development Programme. 2013: 6).

Figure 8. 11 Husband Rizu (my late brother-in-law) chopping wood for his wife Nazmeen (my sister).

The research reveals that there are gender inequalities at Vatukarasa and Sovi Bay and there is a need to address these problems at *koro* and settlements level, which is likely to stimulate and generate similar thinking and changes at household level. This could be done by the following:

a) Identify and create business opportunities for women (UNDP, 2016c; United Nations, 2020). For both the communities construction of a mini market between Vatukarasa Village and Sovi Bay would be an ideal project. Upon completion of the project both the communities could sell their produce and products from the market. Women may work in partnership with their male counterparts in running and managing of the market. Small fees could be charged for use of the stalls (money collected could be used for village and settlement projects). *iTaukei* females could sell their vegetables, handicrafts, souvenirs and kava from the stalls. Seasonal fruits can be preserved by making *achaar* (pickles). This could also encourage Indo-Fijian women to sell *achaar*, vegetable and other products from the market.

b) Form women's groups. Religion, tradition, culture and time are major obstacles for women of Vatukarasa and Sovi Bay to successfully participate in village or settlement discussions, gatherings and meetings. The group could identify major concerns of women and could hold meeting at time which is convenient to both working and non-working women. Women's participation opportunities in discussions, gatherings, meetings and *talanoa* sessions should be strengthened. The

findings suggest that there is need for greater emphasis on gender-related perspectives, which are important and significant in increasing resilience, improving coping capabilities and reducing the likely impacts of climate change.

c) Gender roles can be redefined (UNDP, 2016c; United Nations, 2020). The village and settlement elders could help to reduce social stigma attached to men doing women's tasks, such as washing clothes and hanging them outside on drying wire and looking after babies and children. A more caring and sharing attitude, thinking, environment and atmosphere could be created, which is conducive more gender sharing and appreciative roles. This could start from a very early age, where both boys and girls are taught to share household chores. Schools and churches could play significant roles in this. It is significant to make climate change personally relevant to women where, without any fear of victimisation from other family members, they can be motivated to engage in adaptive actions.

d) The females of Vatukarasa and Sovi Bay need to have full access to all information regarding climatic hazards. This is also stated by Cardona et al. (2012: 82) who state "[a]ccess to information related to early warnings, response strategies, coping and adaptation mechanisms, science and technology, and human, social, and financial capital is critical for reduction of vulnerability and increasing resilience".

e) Improve land rights for women, provide more opportunities for resource management and women's health programmes to be integrated with climate change adaptation and environmental conservation strategies (UNDP, 2016c; United Nations, 2020; Nellemann et al., 2011). Despite the wide range of literature and research being carried out, there is still a wide lack of understanding of the linkage between gender and climate change. Women's contributions and needs should be part of the solution to the effects of climate change (Australian Red Cross, 2014).

f) There is a need to address and develop climate change adaptation activities and policies that are gender-sensitive and to ensure that major decision makers understand how the impacts of climate change and environmental degradation are affecting men and women differently. Disaster risk reduction, planning and policy making should take into account the concerns and needs of women (Australian Red Cross, 2014). Engaging women in climate talks is likely to improve long-term resilience. A similar statement was made in UNDP (2013: 28) in a Training module for Asia Pacific "Mainstreaming women's knowledge and gender perspectives into

the planning, financing, implementing and monitoring of all climate change related undertakings will increase benefits for all".

8.11 Traditional environmental knowledge and adaptation

Traditional knowledge is generated by local communities to adapt to their environment. It is unique to each setting and context-dependent, very complex and holistic, influenced by external and internal factors, and passed on from one generation to another in traditional ways, such as *talanoa*. Traditional knowledge, *iTaukei* and their identity, culture and their spiritual and natural environment are all interrelated. Combination of traditional and scientific knowledge can be critical and valuable components of the solutions to reduce the likely impacts of climate change, reduce poverty, increase food security and a significant step towards achieving sustainable development (Agrawal, 1995; Gobin et al., 2000; Gyampoh et al., 2009; IPCC, 2012a; Hannah et al., 2010; Mackinson and Nottestad, 1998; McNamara and Prasad, 2013; Mercer et al., 2007; Moller et al., 2004; Walshe and Nunn, 2012). This combination is also likely to make it easy to monitor, manage, adapt and to become more resilient to the changing climate.

I use the term "traditional knowledge" rather than "indigenous knowledge" because both *iTaukei* and Indo-Fijians have been living in close contact with their environment for generations and, as a result, have "traditional" environmental knowledges that serves as important bases for environmentally sustainable development in Fiji" (Thaman, 2000: 3).The most effective, best use and preservation of nature can be perceived by having a cultural view of the ecosystem being used (Berkes, 2008; Cagivinaka, 2016)."Many indigenous and traditional farming practices have immense potential for wider use to increase adaptation to climate change" (Reid, 2010: 43). Indigenous knowledge is highly localised knowledge and source of wisdom which could be used very effectively to adapt to the likely impacts of climate change among indigenous communities (Makondo and Thomas, 2018).

The role of traditional knowledge is an important component of a bottom-up adaptation approach, as this knowledge is mostly found in the voice of the local community, the members of which have lived with and effectively adapted and responded to changing environment and climate, not to mention social, economic and political change. To the majority of older participants, both *iTauke*i and Indo-Fijians, traditional knowledge is a major foundation on which to improve and maintain the communities' adaptive capacities and resilience to climate. For the

older members of the communities of Vatukarasa and Sovi Bay traditional knowledge is a constituent of themselves and they feel that they are part of their environment. As Thaman stated *iTaukei* are part and parcel of "all terrestrial, freshwater and marine ecosystems (i.e., part of the vanua and qoliqoli), rather than as separate external entities" (Thaman, 2000: 3).

Traditional knowledge is significant in adaptation to climate change because it emphasises relationships between humans and their environment (including all living beings), improving knowledge, better interaction among people and with the environment, better utilisation of ecosystems and conservation of biodiversity. "Traditional resource management systems may thus be viewed as experiments in successful living and drawing upon knowledge of these alternatives may provide insights and speed up the process of adaptive management" (Holling et al.,1998: 359). Use of *wai tabu* in parts of *i qoliqoli* by *iTaukei* coastal villages is a good example of utilising traditional knowledge in safe-guarding and protecting biodiversity. Upon the expiry of the ban, the non-*tabu* nearby fishing grounds are found to be healthier and more productive, in terms of both the number of fish and returning of species that disappeared years ago. Also, for a person to go against the management of *i qoliqoli* is just like going against the *vanua*, ancestors, chiefs and ancestral gods (*Kalou vu*). Many *iTauke*i will never try to go against the management because of the fear of retribution from the supernatural (Robinson, 2008) and also because of the strong peer pressutre.

A related concept is that of local knowledge. This term is often used interchangeably with traditional knowledge, but I consider it to be slightly different. In the contemporary communities that I studies people have a knowledge system that incorporates both traditional knowledge and knowledge from a range of other sources, including from education and mass media. Indeed, the awareness of climate change in the study area reflects not only people's observations of changing conditions but scientific information available through the media and also from government sources. People in the study area discuss traditional knowledge, many decry its diminishing influence, but also incorporate many 'modern' ideas and techniques into their daily lives.

8.11.1 Food security

Food security was a central plank of traditional environmental knowledge in Fiji and included maintaining agro-ecological diversity, hazard resistant species, the

production of surpluses, awareness of famine foods (often located in the bush), food preservation and storage and exchange with other communities (Campbell, 1984, 2006, 2015). Many contemporary agricultural practices reflect traditional knowledge but in some aspects there have been significant changes. Crop diversity has declined significantly as the cultivation of the introduced crop *tavioka*, has increased. Over a century of disaster relief programmes have reduced the need to preserve food and use famine foods and surpluses are less likely to be used for food security but to earn cash from sale of produce.

The older participants emphasised that their parents and grandparents used to visit their farms soon after cyclones, to save and salvage food crops (to reduce food shortages), to clear and reduce secondary damage from fallen trees and to start replanting with minimum delay. Most participants also recalled that their parents, grandparents and great-grandparents used to plant new trees for every tree that was cut down for house construction, making canoes or *lali* (village drums). They used to plant both fast and slow maturing crops.

Older participants recalled that their parents, grand-parents and great grand-parents used to preserve meat in fat. They used to slowly cook meat (salted and herbed) submerged in its own fat, kept in a covered container where it could be stored for several months in dark cool place. Meat also used to be dried (water removed to slow and stop bacteria growth and reduce degradation process). Food can also be preserved by combination of salt, smoke and heat (adding great deal of natural flavour). As water is removed from food, it becomes impossible for microorganisms to thrive. Also salting removes water from food and it becomes resistant to yeast, bacteria and moulds.

Seasonal fruits can be preserved by making *achaar* (pickles). Most Indo-Fijian participants revealed that the most commonly made *achaar* were *nimbu ka achaar* (lemon pickle) and *aam ka achaar* (mango pickle). *Achaar* is made with Indian spices , soaked, covered in mustard oil and traditionally kept in clay pots. Nowadays *achaar* is made by only few families and is kept in plastic containers. Some older participants recalled that their parents, grand-parents and great grand-parents used to make *goash ka achaar* (meat pickle). All the participants both, *iTaukei* and Indo-Fijians, stated that after most tropical cyclones, electricity is out for mostly a week or two. This way of food preserving can be beneficial for both *iTaukei* and Indo-Fijians, when refrigeration is not possible.

8.11.2 Weather prediction

During fieldwork I floated the question, "how can we tell if a tropical cyclone is about to hit". The participants, mostly the older *iTaukei* participants, both from the focus group discussions and *talanoa* sessions, stated that when they go out fishing and when they catch more than three *kahala*or "bad weather cods" (Epinephelus cyanopodus), which are usually very hard to get, that is an indication that cyclone or a storm is about to come. Some older participants stated that when there is plenty of fruit (such as breadfruit, oranges, mandarins and guava) in a particular year, that is an indication that a cyclone is likely to hit the following year.

One *iTaukei* participant (FFG-1-D) mentioned that hornets (*iTaukei - vi*, Hindi-*bar-re*) usually build their nests high in the trees and when they dislodge and bring the nest to a lower level that is an indication of an approaching cyclone or storm. The reason for bringing the nest lower is to achieve more protection from strong winds. Some participants, both *iTaukei* and Indo-Fijian, stated that when big black birds, *manu ni cagi* (bird of the wind) which usually fly high in the sky, come down to ground level, that is a sign that a tropical cyclone is about to come.

One older Indo-Fijian participant (IFG-1-A), during a focus group session, recalled that when he sees some cloudy rings (halos) around the moon, it is likely to rain, or the weather is likely to be bad. The closer the rings are to the moon, the sooner the impacts will occur. For example, if the rings are closer to the moon then it is likely to rain in one or two days. If the rings are further away from the moon, then it would rain in four or five days. One *iTaukei* participant (FFG-2-I) during a focus group discussion suggested that when you hear the reef roaring and crying and it becomes white from waves, this is a sign of an approaching storm or tropical cyclone. Also, one Indo-Fijian participant (IT-1-F) stated that some of his chickens sleep up in the tree and if the same chickens come down and sleep a few feet from the ground; it is a sign that there will be a tropical cyclone or that a bad storm is coming soon. One older *iTaukei* participant (FT-2-I) believed that when the wind is blowing from the sea, the weather is normally fine, but when wind direction changes and it starts blowing from the hill-side, it is likely that the weather is going to be bad.

8.11.3 Loss of traditional knowledge

Most participants, both *iTaukei* and Indo-Fijians, are of the view that their parents, grandparents and great-grandparents were able to better cope with and deal with

climatic hazards, because they had plentiful resources and they had better traditional knowledge to minimise exposure and reduce vulnerability and likely impacts of changing climate. Participants in my research emphasized, highlighted and stressed that social-cultural change is one of the major problems, undermining traditions including knowledge systems, and is eventually leading to vulnerability to climate change and is a prominent factor threatening the daily lives of communities at Vatukarasa and Sovi Bay. To them social change is a catalyst which is lessening communities' ability to effectively deal with the likely impacts of climate change, but it should not be overlooked that social change can also bring about beneficial outcomes for dealing with climate and environmental uncertainty.

The older participants stressed that members of younger generations are forgetting their roles and responsibilities towards the whole village. Most older participants both (*iTauke*i and Indo-Fijian, men and women) are of the opinion that socio-cultural changes (such as depending too much on imported foods and migration to urban centres and back) are reducing coping and adaptation capabilities to both non-climate and climate impacts. In doing so they are significantly reducing both communities' traditional and local knowledge, including their dissemination and practice and consequently reducing capacity to effectively deal with increasing environmental uncertainty. Many participants voiced their concern that loss of traditional knowledge also means loss of respect for parents and elders, leadership in which *turaga-ni-koro*, chiefs' and settlement heads', governance, policies and rules are less likely to be respected and adhered to. In addition, there has been a decline in communal activities, decreasing intergenerational contact, communication, understanding and tolerance, sharing, caring and cohesion, which are fundamental components of *iTaukei* and to a lesser extent Indo-Fijian society. The older participants believed that one major reason for this may be increasing migration of younger people to urban centres. Reducing importance of traditional knowledge is hindering the ability and flexibility of communities to effectively respond to changing climate and its effects, as discussed in Chapter Four (Section 4.6).

Older participants voiced their concern that nowadays people are not preparing themselves for coming cyclones, so they experience food shortages, soon after each extreme event. To increase food security, practice and preservation of traditional knowledge is imperative and necessary.

Mostly the older participants from both, *iTaukei* and Indo-Fijian communities, are of the view that government should play a major role in reviving traditional knowledge, so that younger people, many of whom are unemployed, would be better able to survive from resources obtained from the sea and land in a sustainable way. Most participants, from both focus group discussions and *talanoa* sessions stated that when cyclones occur after a longer period of inactivity, people tend to be more relaxed, nothing is prepared in advance and most are caught off-guard. Most participants stressed that climate change adaptation strategies, should be embedded into the school system and then up to the degree level. It needs to become a regular component of everyone's daily life. Everybody should take climate change seriously. "The limited nature or the complete lack of content on indigenous Fijian sustainable knowledge in the school curriculum is something that needs to be addressed" (Cagivinaka, 2016: 16).

The older participants, both *iTaukei* and Indo-Fijians, are of the view that traditional knowledge is slowly dying away, that the younger generation is not engaging with the older generation and that they are not learning from them and not taking advantage of the knowledge that is likely to soon be lost. Some participants also emphasised that village and settlement elders should share more often their knowledge regarding adaptation measures relevant to tropical cyclones, flood and drought with younger generations. In some cases, traditional norms can increase exposure and vulnerability to the impacts of climate change. Especially for Indo-Fijian women, who are not permitted to leave their home without the permission of a senior male household member. This attitude is likely to make an Indo-Fijian woman, hesitant to take any action on her own in case of disaster risk.

What I have observed and what the participants have stated is that their ability to effectively deal with the increasing problem of climate variability and extreme events is declining. For this there could be three reasons. Firstly, the problem itself is increasing (having more effects to deal with compared to the past). Secondly, the declining importance and implementation of traditional knowledge has caused resilience to decline and this may be major reason which has made recent extreme events seem larger, more intense and frequent. Thirdly, the numerous 'non-climatic' impacts that are affecting the communities 'development goals', such as more dependence on overseas 'formal' disaster relief has undermined traditional coping risk reduction practices. The older participants of Vatukarasa and Sovi Bay emphasised that too much dependence on relief, reduces motivation to replant, soon after disasters and to have a habit of planting at all times, as this may help communities deal with post

disaster food shortages. At Vatukarasa and Sovi Bay traditional knowledge which the local communities have acquired and tested, traditions, experience and engagement with the environment, through generations could play a very important role. Traditional knowledge (using resources sustainably and not wasting) has and can continue providing both communities with natural resources from land and sea.

To have effective and positive outcomes from adaptation strategies it is necessary to understand the needs, and to a lesser extent the wants, of the communities. Once the communities see that their needs and wants are met with, they will take more interest, they will devote more time and energy to such activities, whether they are shorter or longer-term coping strategies, whether they are based on scientific knowledge or traditional knowledge or a combination of both (how scientific knowledge and traditional knowledge could be utilised successfully is discussed in Chapter Four, (Section 4.6). As Barnett and Campbell (2010: 137) state "solutions will only have traction when they are integrated with existing community concerns, values, needs and aspirations".

8.12 Community-based adaptation

While there is some international support for communities in developing countries to implement adaptation (such as the Adaptation Fund), the massive amounts of destruction and loss resulting and likely to rapidly increase in the years ahead, such support is almost certain to be greatly inadequate. At the same time, national governments are unlikely to have the resources to support all adaptation. "CBA has been discussed for nearly 10 years, but there are still tensions about how to implement it or to integrate it more fully within more formal climate change policies... CBA should not be seen as an overly localist approach to risk assessment, but instead forms part of a trend of linking international development and climate change policies" (Forsyth, 2013: 1).

Accordingly, much adaptation will have to be carried out by the communities that are affected. Indeed, because impacts are mostly at the local level, the scale of much adaptive activity will be most effectively conducted at the community scale. Reid et al. (2009: 13) noted that "[c]ommunity-based adaptation...is a community-led process, based on communities' priorities, needs, knowledge, and capacities...to plan for and cope with the impacts of climate change". Community-based adaptation (CBA) is especially important for communities who are in remote areas, do not have government support or access to the required services, or who are marginalised (Huq, 2008; Reid et al., 2009). CBA must meet the needs of local

people and must be congruent with both marine and terrestrial local environmental conditions. Reducing climate-related threats at the community level can help to create sustainable and resilient communities, to better cope with climate change risks and impacts (Ayers and Forsyth, 2009). "Community-based adaptation to climate change focuses on empowering communities to use their own knowledge and decision-making processes to take action" (International Institute for Environment and Development, 2019: 1).

CBA is usually a bottom-up approach (Reisinger, 2009), which includes projects or activities, where local communities' knowledges and experiences are utilised for adaptation actions to increase resilience and build adaptive capacity (Ayers and Forsyth, 2009; Gero et al., 2011; McNamara et al., n.d; McNaught et al., 2014; Mortreux and Barnett, 2009; Nunn et al., 2016). CBA involves the empowerment of local communities to help themselves, to identify and prioritize local impacts and to find least expensive adaptation strategies, using local knowledge, ability and capacity (Bryan and Behrman, 2013; McNamara and Westoby, 2011; Weir and Pittock, 2017; Ayers and Forsyth, 2009).

To be successful CBA should be anticipatory, planned and proactive (Leary et al., 2008b; IPCC, 2014b). CBA projects could be implemented for the communities with the most pressing needs for local adaptation (Reid et al., 2009; Remling and Veitayaki, 2016; UNDP, 2010), carried out by local communities, where they are able to identify their own vulnerabilities and where the interest of the most vulnerable groups could be served. One example of CBA at Vatukarasa and Sovi Bay is prohibiting the use of beach seines.

In CBA, adaptation choices to enhance self-reliance should not be imposed from the top (outside). It should be based on local communities' goals and priorities, so local communities could "help themselves" (McNamara and Prasad, 2014; McNaught et al., 2014; Warrick, 2011. For CBA to be more successful both communities' needs and priorities should be central to development programmes. "Adaptation to climate change generates larger benefit...when delivered in conjunction with other development activities, such as disaster risk reduction and community-based approaches to development" (Nurse et al., 2014: 1616).CBA provides opportunities for both women and men to be incorporated into all activities. Women have valuable knowledge and significant skills for adaptation which can be easily included in CBA (UNDP, 2010).

Community-based adaptation is community-led requiring community involvement at every stage, such as planning, designing, implementing and evaluation and requires a participatory approach (it is done "with" and not "for" the communities) to be successfully implemented and to have desired result (Warrick, 2011. "Adaptation and risk management policies and practices will be more successful if they take the dynamic nature of vulnerability and exposure into account, including the explicit characterization of uncertainty and complexity at each stage of planning and practice" (Cardona et al., 2012: 67). CBA involves communities making a wider range of choices, revising them when new knowledge becomes available and implementing new adaptation strategies when funding options emerge (Ayers and Forsyth, 2009). CBA, being location specific and locally managed, provides relevant and important information with practical examples on how to reduce the likely impacts of climate change, in the format which is appropriate, acceptable and appreciated by communities (United Nations Development Programe, 2020).

CBA is necessary at Vatukarasa and Sovi Bay, because both communities depend on natural resources for their survival, which are sensitive to changing climate. I observed that for CBA projects to be successful at Vatukarasa and Sovi Bay it is necessary that the following are taken into consideration: First, there is a need to increase climate change awareness including information about the range of adaptation options, their benefits and costs. Second, the communities should decide about climate change adaptation by themselves. Third, there is a need for the communities to have better networks, which could enable access to information and resources needed to implement urgent and better adaptation strategies. "Adaptation and risk management policies and practices will be more successful if they take the dynamic nature of vulnerability and exposure into account, including the explicit characterization of uncertainty and complexity at each stage of planning and practice" (Cardona et al., 2012: 67).

A good example of CBA at Vatukarasa and Sovi Bay could be composting where people start reusing waste. Composting vegetable scraps, garden waste, and kitchen waste is a great way to reduce throw away waste. Composting yields many benefits as it is likely to enhance food security, improve soil fertility (maintaining soil microorganisms, earthworms and nutrients) and increase composting skills and know-how. Composting also creates a cleaner "green" environment by recycling plant and food waste through natural processes, where compost can be used as natural fertilizers, reducing the need for artificial chemical fertilizers.

Waste, not composted and burned, will produce carbon dioxide and nitrous dioxide (both greenhouse gases). Food waste not burned and left to decompose will produce the greenhouse gas methane. Composting is also likely to prevent and/or minimise groundwater and waterways pollution, control and minimise soil erosion and helps in balancing soil pH. Compositing is cheap, environmentally friendly, reduces use of manufactured fertilizers, helps in recycling of organic waste, improves soil structure and moisture-retaining capability. Composting toilets also reduce the use of fresh water.

Most participants also stated that there is a need for marine reserves (*wai tabu*, forbidden or 'no take zones') in their area, while some were of the view that having protected areas means fewer fish to catch. But marine reserves can provide undisturbed habitats, where fish populations and those of other marine organisms can spawn, expand and increase in number and sizes. As the population of marine species, such as fish, eels, and crabs will increase they can and will migrate to surrounding areas and this can be a major catalyst in replenishing stocks. "Traditional practices can be an important component of the coastal management toolkit" (Nicholls et al., 2007: 345).

Such an action (*wai tabu*) was taken by Malomalo village in Nadroga province in 2006 (I visited this village in 2006, when doing my Post Graduate Diploma in Environmental Studies). After three years when the restriction was uplifted, the number and the species of fish increased. The *turanga-ni-koro* and the village elders then were able to impose conditions that nobody may use nets and could only use hand lines to catch fish. The *turanga-ni-koro* and elders were also able to appoint fish wardens, who could arrest people, take fishing gear and fish away from them and ban the person caught from even using hand lines for the next three months or so from the date of the arrest.

"Adaptation, to be successful, needs to operate at the scale at which most of the important decisions about social organization are made…this most often means at the level of villages" (Barnett and Campbell, 2010: 178). Marine reserves at Vatukarasa and Sovi Bay may also provide or increase the opportunities for resident fish and other marine organisms to attain their maturity and produce more offspring. Even fish eggs produced in the marine reserve are likely to be dispersed outside the marine reserve and help to increase the number of that particular species significantly. Marine protected areas may reduce near-by fishing areas, may force fishermen to travel longer distances to reach new fishing grounds incurring increased expenses (FT-3-N).

This may also increase competition amongst fishers, increasing conflict and reducing abilities to meet their daily needs. With marine protected areas, women and the elderly from Vatukarasa and Sovi Bay may be affected the most as these two groups of people are most likely to catch fish from shallow inshore waters, while men may still continue fishing in deeper water beyond reefs, using modern technology and equipment (spear guns and night vision torches). Taking into account social factors, such as communities' changing behaviours, obligations, responsibilities and interests, is imperative for both marine and terrestrial resource conservation. "Responding to the novel hazards of climate change requires social learning systems that can respond to the multiple scale and sectors through which risk is felt and adaptations undertaken" (Pelling, 2011: 60). CBA can be a significant tool for sustainable development and proper management of common property resources.

What I have observed and heard from the participants at Vatukarasa and Sovi Bay is that any adaptation, and CBA is no exception, could be more effective, resilience would increase and vulnerability to climate change could decrease if the social, cultural, physical and financial foundations of communities were improved. Nurse et al.(2014) noted that community involvement in locally managed marine areas is an important element in boosting biodiversity and in turn lowering poverty in coastal areas . To make CBA successful at Vatukarasa and Sovi Bay, there is a need to combine traditional, local and scientific knowledge and combination of both top-down and bottom-up approaches.

A key to successful community based adaptation is having community structures and organization that enables the levels of cooperation and planning. Vatukarasa has recently established a village *komiti* (Figure 8.12) which could be an excellent vehicle for community based adaptation. As the Figure shows, some of the activities are already clearly linked to issues raised in this research, especially those of the *Komiti ni Wai* which has responsibilities for water supply, fisheries, coastal erosion and flood management. It would perhaps be a useful innovation if the Indo-Fijian community could develop a similar organisational arrangement, in line with its own cultural requirements. For effective adaptation, and taking into account that both communities are facing a number of similar impacts or are affected or likely to be affected by the same climate change effects, a joint *komiti* could ensure that adaptation activities are mutually beneficial, complementary, not maladaptive and not duplicating each other.

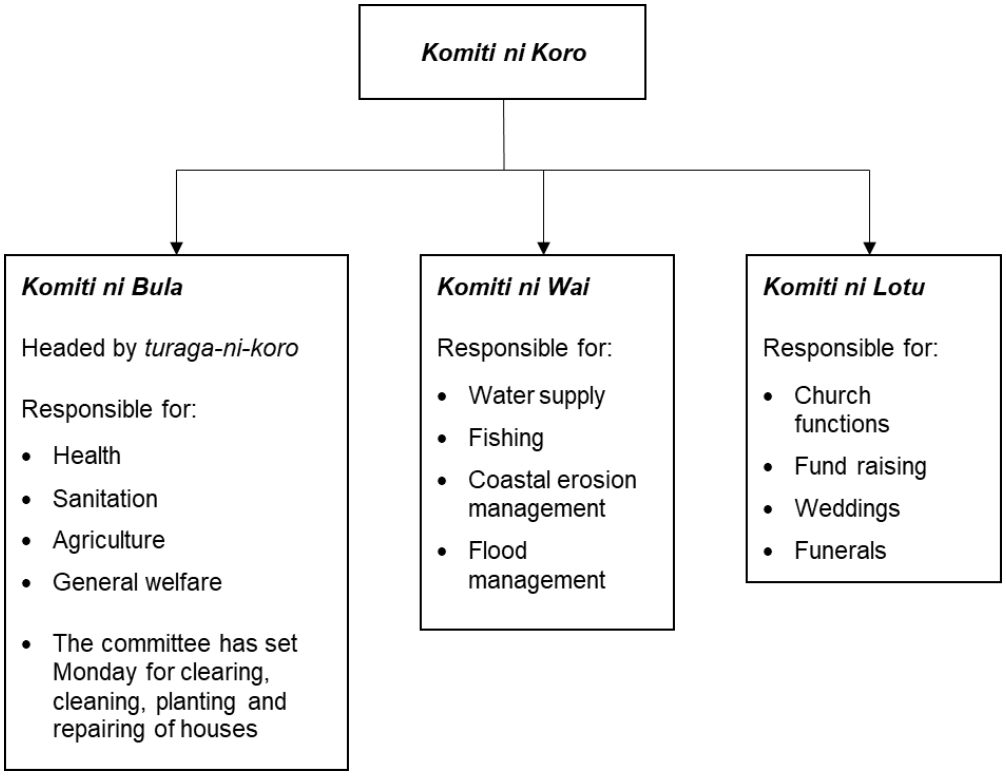

Figure 8. 12 Functions of Vatukarasa village committee. Source: Field notes, 2019.

8.13 Evaluating adaptation options

Both the communities are feeling the effects of climate change (but with varying degrees of disruption). Even with CBA there will be a need for cooperation between the communities and outside agencies including government agencies (at national and provincial government levels), and non-government organisations. Table 8.3 lists the various adaptation activities discussed in the thesis and evaluates their economic, cultural, technical, and environmental soundness, as well as gender issues and long-term sustainability. The agencies beyond the communities that could help in each of the adaptation options are identified.

Table 8. 3Types of adaptation, its economic feasibility, cultural acceptability, technical feasibility, its environmental soundness, gender issue, long-term sustainability and the departments that could help in each of the adaptation options.

Type of Adaptation	Economic Feasibility	Cultural Acceptability		Environmentally Sound.	Gender Issue	Long – term Sustainability	Departments That Could Help
Sea wall	L	M	L	L	L	L	*iTaukei* Affairs Board; Department of Environment
Accommodation	M	M	L	L	L	L	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board
Retreat	M	M	M	M	L	H	*Department* of Foreign Affairs; Republic of *Fiji* Military Forces; Department of Waterways; *iTauke*i Lands Trust Board.
Vertiver Grass	H	M	H	H	L	H	*iTaukei* Affairs Board; Department of Environment
Artificial Reefs	H	M	H	H	M	H	*iTaukei* Affairs Board; Department of Environment
Reviving Natural Coral Reefs	H	M	H	H	M	H	Nadroga/Navosa Provincial Council; Department of Fisheries; *iTaukei* Affairs Board; Department of Environment; iTaukei Lands and Fisheries Commission
Reviving Sea Grass Beds	H	M	H	H	M	H	Nadroga/Navosa Provincial Council; Department of Fisheries; *iTaukei* Affairs Board; Department of Environment; *iTaukei* Lands and Fisheries Commission
Reviving Mangroves	H	M	H	H	H	H	Nadroga/Navosa Provincial Council; Department of Fisheries; *iTaukei* Affairs Board; Department of Environment; *iTaukei* Lands and Fisheries Commission
Beach Nourishment	H	M	H	H	M	H	Nadroga/Navosa Provincial Council; Department of Fisheries; *iTaukei* Affairs Board; Department of Environment; *iTaukei* Lands and Fisheries Commission
External Roof Tie-Down Systems	H	M	H	M	L	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board;
Planting Trees	H	M	M	H	M	H	Department of Forestry; Department of Environment; *iTaukei* Land Trust Board; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board;
Water Tanks With Foul Tanks	H	L	M	M	M	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; *Department* of Foreign Affairs; Republic of *Fiji* Military Forces; Department of Waterways.
Zoning of Rivers	H	L	M	M	M	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Environment; Department of Waterways.
Planting Extra Crops	H	M	M	M	H	H	Department of Agriculture and Land Use Planning

Crop Diversification	H	M	M	M	M	H	Department of Agriculture and Land Use Planning
Mulching	H	M	M	H	M	H	Department of Agriculture and Land Use Planning
Contour Planting	H	M	M	H	L	H	Department of Agriculture and Land Use Planning
Remittances	H	H	L	L	H	L	Department of Finance (charge no commissions)
Fencing Water-catchment Area	M	M	M	H	M	H	Department of Agriculture and Land Use Planning; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Environment; Department of Waterways.
Building Pig Pens Away From River Banks	M	L	M	L	L	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Environment; Department of Waterways.
Communal Rubbish Pit	M	L	L	H	L	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Environment
Environmental Control-Dengue Fever	M	M	M	H	L	H	Department of Health; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Environment
Smokeless Stoves	M	M	M	H	H	H	*Ministry* for social welfare, *women* and poverty alleviation; Department of Health
Redefining Gender Roles	L	L	M	M	H	M	*Ministry* for social welfare, *women* and poverty alleviation
Traditional Knowledge	H	H	M	H	M	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Education
Local Knowledge	H	H	M	H	H	H	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Education
Scientific Knowledge	H	L	M	M	L	H	*Ministry* for social welfare, *women* and poverty alleviation; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Education
Sustainable Development	H	M	H	H	M	H	*Ministry* for social welfare, *women* and poverty alleviation; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Education; Department of Agriculture and Land Use Planning.
River Dredging	M	M	L	M	L	L	Department of Land and Water Resource Management
Food Preservation	M	M	M	L	M	M	*Ministry* for social welfare, *women* and poverty alleviation;

Community Based Adaptation	H	M	M	H	M	H	*Ministry* for social welfare, *women* and poverty alleviation; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Agriculture and Land Use Planning.
Top Down Approach	L	L	L	M	L	L	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Agriculture and Land Use Planning.
Bottom Up Approach	H	H	H	H	L	H	*Ministry* for social welfare, *women* and poverty alleviation; Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Agriculture and Land Use Planning.
Compositing	M	M	M	H	L	H	*Ministry* for social welfare, *women* and poverty alleviation; Department of Agriculture and Land Use Planning.
Wai Tabu (no take zone; fishing)	M	M	M	M	M	M	Nadroga/Navosa Provincial Council; *iTaukei* Affairs Board; Department of Fisheries; *iTaukei* Affairs Board; Department of Environment; *iTaukei* Lands and Fisheries Commission

L = Low. M = Medium. H = High.

8.14 Barriers to adaptation

At Vatukarasa and Sovi Bay barriers to adaptation are mostly due to the following:

1) Lack of funds - both the communities lack funds to appropriately adapt to the impacts of climate change. Furthermore, some adaptation measures, such as construction of seawalls are simply too expensive for the communities to carry-out on their own. Government and/or international assistancewould be essential.

2) People's perceptions – Some people have limited understanding of climate change and there are no specific terms in *iTaukei* and Hindi language which could sufficiently describe climate change. Some people think that sea level rise is God's punishment for their sins and nothing to do with global warming. Unless people fully understand the concept of climate change, they are unlikely to be part of a plan to adapt. They may also think that risks and impacts are small and actions (measures to reduce the impacts) can be delayed or may even think that there is no need for such measures.

3) Cultural factors and social norms – Women's views and opinions are not fully taken into account or considered during adaptation – decision making processes.

8.15 Establishing an adaptation programme for the two communities.

After talking to the participants from both communities I feel that the best approach to minimise the impacts of the climate change would be to follow or to work keeping in mind the following four steps. The *komiti* discussed in Section 8.12 could be an ideal instrument through which these steps could be implemented.

First, identify the risks. Both communities to identify the present and likely future impacts of climate change. They are to identify the areas where safety and resilience is needed the most. Identify and rate the livelihood and consequences of harm.

Second, be proactive. Act quickly now and in the future to limit the harm or don't act and face more severe risks and consequences. Both communities should manage their actions and resources together. There is always connectivity between ecosystems: if one is affected it is likely to impact the health and resilience of another. For example, clearing and logging in coastal catchment is likely to affect coral reefs ecosystems. Assess and identify exposure, sensitivity and adaptive capacity. Actions should be proactive but they also need to be carefully thought through and developed otherwise maladaptation may result

Third, provide means to facilitate adaptation. Combine both the top-down and bottom-up approaches. Resources to be made available, to enable communities to develop their own CBA

activities. Agree with the donor agencies on the most desired and acceptable outcome and actions. Also there has to be a good foundation for adaptation and this could be made possible through community-based risk reduction.

Fourth, incorporate adaptation into development. Appropriately planned development, such as sustainable development and poverty reduction can be a catalyst for climate change adaptation or vice-versa. These two to have a long term implementation policies. Assess to what extent actions have been implemented and to what extent assets have moved towards desired outcomes. It is also important to see that development activities and projects do not create new vulnerabilities to climate change.

8.16 Summary

Adaptation is an activity that communities in Fiji (and around the world) will have to carry out. Doing nothing would result in opting to deal with impacts and losses after they occur. It would be the most disruptive and expensive option. Adaptation is an important and significant issue of its own and it should not be taken as an alternative to mitigation, which unfortunately Fiji, let alone the study communities, have little control over. Both adaptation and mitigation are needed to prevent or minimise the dangerous impacts of climate change. Adaptation is enhancing the coping ability to effectively deal with present climate variability and future climate uncertainty. Community-based adaptation cannot be solely learned in schools, colleges, universities or in training workshops. It can only be learned through communities' enthusiasm, participation and practice. For community-based adaptation, communities should be in the "driving seat" of every aspect and stage of the adaptation programme. The next chapter contains the summary of the findings of my research, directly relating to aims and objectives of the thesis.

CHAPTER NINE

Conclusion

9.1Introduction

My research set out to identify the effects of climate change in the two communities of Sovi Bay and Vatukarasa and to canvas the options for adapting to these effects. This chapter summarises the findings of the study, considers opportunities for further research, and sets out some recommendations for the communities to help them cope with the effects of climate change.

The research used a multi-method approach of data collection, using focus group discussions, participation observation and *talanoa* sessions. Triangulation of data throughout the research provided rich in-depth information and helped in obtaining deep understanding of the issues raised by the research questions. The threats and risks posed by climate change and its associated sea level rise on coastal communities are real, some are already being experienced, and greater disruption and losses are likely to be inevitable in the future.

Most participants have stated that climate change and sea level rise are expected to have significantecological, socioeconomic, cultural, health and political impacts on both the *iTaukei* and Indo-Fijian communities at Vatukarasa and Sovi Bay, by affecting biodiversity, food and water security, degradingcoastal ecosystems and increasing vectors and water borne diseases. In recent decades both the communities faced with a lack of alternative sources of cash income have intensified theiragricultural activities, leading to reduced fallows, decreased crop diversity and excessive use of chemical fertilizers and over-exploited marine resources and engaged in destructive fisheries activities. These have increased the vulnerability of the communities to climate change change.

The lives of *iTaukei* and Indo-Fijians (to a lesser extent) are intimately, culturally, economically and politicallyintertwined with the sea and land. In particular, *vanua* and *qoliqoli* are the sources of livelihood and cultural security for *iTaukei*. Any changes to marine and terrestrial ecosystemscaused by climate changeare significantly felt by the coastal communities of Vatukarasa and Sovi Bay. Climate change is increasingly becoming a major barrier to sustainable development and likely cause of increased inequality amongthe people of Vatukarasa and Sovi Bay. The sensitivity, vulnerability, adpative capacity and resilience to future climate change and sea level rise are major concerns of both the communities. Climate

change will require environmental, social, cultural, economic, political and biophysical solutions to effectively respond and deal with environmental uncertainity.

9.2 The impacts of climate change

My thesis set out to assess the impacts of climate change on the people of Vatukarasa and Sovi Bay, Nadroga, Fiji Islands. In doing so, I sought to answer three research questions as follows:

1) Are *iTaukei* and Indo-Fijian communities of Vatukarasa and Sovi Bay vulnerable to the impacts of climate change and if so, why?
2) Are *iTaukei* and Indo-Fijian communities affected differently by climate change at Vatukarasa and Sovi Bay?
3) What adaptation options have been implemented and what further could be done to reduce the impacts of the climate change on both the *iTaukei* and the Indo-Fijian communities at Vatukarasa and Sovi Bay?

9.3 Vulnerability

The research revealed that climate change is presenting perhaps the greatest social, cultural, economic and environmental challenges to the people of Vatukarasa and Sovi Bay and these challenges are likely to become worse in years to come. For the communities, their rural economies and food security are based upon, and are dominated by, agriculture and coastal fisheries, both of which are highly sensitive to climate variations.While both communities are exposed to the effects of climate change and sea level rise, their vulnerability reflects their respective characteristics such as resilience (or lack thereof), adaptive capacity, degree of dependence on local resources and existing levels of livelihood, health, land and cultural security. It was observed that at Vatukarasa and Sovi Bay, those who are most vulnerable are the ones that are most exposed, have higher sensitivity and lower coping ability. Through the research it was evident that men and women are differently impacted by climate change; since women rely more on their local natural resources and have fewer assets, they are both more exposed than males to climate change effects and have greater sensitivity. Unless these issues are addressed these differences are likely to become greater as climate change continues.

The vulnerabilities of the people and communities in the study area to these effects reflects their dependence upon natural resources, locations in relation to rivers and the coast, social organisation (e.g., kinship relations and obligations), networks beyond their places of residence and lands and options for external employment and incomes. As illustrated in Chapters Seven and Eight, participants from both communities felt that traditional coping mechanisms had declined and increasing dependence on the cash economy had reduced their food security and contributed to environmental deterioration that reduced the

resilience of their farming and fisheries systems. The people of Vatukarasa and Sovi Bay have long-standing relationships with their environment and their dependence on natural resources to survive is quite evident. The pressure on ecosystems at Vatukarasa and Sovi Bay is increasing as more and more people are relying on fewer and less productive ecosystems. As the pressure has increased, the carrying capacity of the ecosystems has been reduced and more destabilised, thus making ecosystems more vulnerable to the likely impacts of climate change. If, as is projected, climate change continues, the communities are likely to become increasingly exposed and vulnerabilities further laid bare.

While SIDS and PICs are often described as being highly vulnerable to climate change, I found that the communities that I was involved with were in many ways remarkably resilient. They have had to cope with a range of extreme events over the years and changes in average environmental conditions as a result of climate change. However, this resilience does not mean that the communities are safe from the effects of global warming. Traditional knowledge developed over centuries, particularly in the case of *iTaukei*, involved adaptation to a different set of environmental parameters from the current conditions and those projected for the future. Traditional knowledges will provide considerable support for further successful adaptation but the nature of projected changes, especially sea level rise, will make it difficult for these measures alone to combat climate change. Moreover, like all cultures, traditions and customs, traditional knowledges have also been transformed through time.

Chapter Seven outlines the effects of climate change on the two communities. The main direct effects include coastal impacts (erosion, inundation, salinization and coral reef, seagrass and mangrove degradation), increasing magnitude, if not frequency, of tropical cyclones and droughts, reduced reliability of critical seasonal weather patterns and increasing temperatures. These, in turn, are reflected in indirect effects including reduced agricultural and fisheries production, reductions in freshwater quality and quantity and increasing incidence of dengue fever and diarrhoea. At the human level the n^{th} order impacts encompass loss of both subsistence production and cash incomes from sale of produce, both of which threaten food security. Other opportunities for employment may also decline. One of the most serious issues is the security of the settlements in the face of coastal inundation and extreme events. Community relocation may be required at some point in the future (Section 9.6).

9.4 Differences between the *iTaukei* and Indo-Fijian Communities

To a large extent the communities share many of the exposures and vulnerabilities to climate change. Nevertheless, as Chapter Seven showed (see Table 7.5) there are some

significant differences. In particular, these reflect the closeness of the *iTaukei koro*, Vatukarasa, to the ocean and its greater level of exposure to the coastal effects of climate change and the greater dependence of the *iTaukei* community on natural resources including agricultural land, fisheries and forest resources. The Indo-Fijian communities have larger numbers employed outside of the settlements or self-employed reducing the effects of reduced resource productivity on food and financial security. In addition, they also have larger numbers of kin living outside the study area in urban places of Fiji and overseas, and remittances from these people may help offset the reductions in livelihoods brought about by climate change. On the other hand, if relocation were to become unavoidable, the Vatukarasa *mataqali* have *vanua* to which they could relocate, an option that is not so easily available to the Indo-Fijian communities.

Given both these shared vulnerabilities and differences, it is important that development and implementation of adaptation activities should on the one hand be culturally, socially and economically compatible with each of the respective communities, but on the other hand relevant to both where the adaptive strategies are likely to be common. This is discussed further in Section 9.5.

9.5 Adapting to Climate change

Planned adaptation can support processes, which can reduce exposure, sensitivity and increase adaptive capacity. Building resilience at community level is important in achieving sustainable development and thus, adaptation should not lead to greater inequality and disparities within and between the communitiesgroups. The research revealed that for adaptation to be successful it should also be part and parcel of disaster risk reduction and sustainable development initiatives. Community-based adaptation and traditional knowledge are important in dealing with the likely impacts of climate change at Vatukarasa and Sovi Bay. My review concluded that adaptation at Vatukarasa and Sovi Bay is mostly impact focused and vulnerability is largely a result of development related failures, many of which are outside the control of the local communities. Both vulnerability and adaptation are socially constructed biophysical, socioeconomic and environmental climate change problems. “CBA...offers significant advantages in seeking to make adaptation interventions more relevant to vulnerable people, and by considering the range of social, political, and economic factors that drive vulnerability. These steps can reduce vulnerability more directly, and increase the likelihood of success of adaptation interventions” (Forsyth, 2013: 6).

Ideally, for CBA to be successfully implemented there will need to be a community structure that can set priorities and coordinate activities. The current *komiti ni koro* in Vatukarasa, together with its resource-oriented subcommittees would be suitable for such a role. A similar organisation does not exist in Sovi Bay where the community members are, perhaps, more individualistic. Nevertheless, some sort of community structure will be necessary. Moreover, because some of the exposures and vulnerabilities are shared between the two communities, some form of joint organisation will also be necessary. This will require quite a lot of organisation and commitment from the communities to be successful. One of the findings of the study was that relations between the *iTaukei* and Indo-Fijian communities are not as cordial as was the case prior to the coups. An important prerequisite for successful CBA will be cooperation between the two communities. The provision of funding (after all climate change is not caused by the communities affected by its impacts) will be a critical factor in getting the committees established and enabling them to implement adaptation strategies.

"CBA offers a difference to other forms of adaptation to climate change because it seeks to engage with poorer, and more vulnerable, people and allow them to identify and help shape responses to the risks posed by climate change" (Forsyth, 2013: 2). However, CBA alone is not likely to be sufficient and external assistance will also be necessary. Coastal protection can be a very expensive proposition, well beyond the means of these communities. Developing drought or salt resistant varieties of crops is also something that is more likely to be efficient at the national or even regional level. Implementing the planting of such crops, could however, be conducted through the community organisations. To date international commitments to fund adaptation in developing countries has been inadequate and negotiations on loss and damage are not yet considering the need for compensation to those communities and countries that are (likely to be) worst affected. These issues will need to be addressed for communities such as Vatukarasa and Sovi Bay to be adequately supported to face the challenges of climate change.

Both mitigation and adaptation actions are needed to appropriately manage the challenges of climate change. Communities with different social, economic and ethnic characteristics are likely to be impacted differently even where they face similar likely biophysical sffects of climate change. Accordingly some of the strategies that could be implemented to reduce or minimise the likely impacts of climate change may differ among island communities, even where they are located relatively close to each other. There are psychological, social and institutional influences upon individual people's and communities' engagements with climate change. Having knowledge about climate change is not enough, one must care about the environment, get engaged, 'dirty' their hands, be motivated and take appropriate action.

Coordinated and balanced efforts to enhance adaptive capacity and minimize exposure and sensitivity of the villagers may enable the community at Vatukarasa villagers to remain at their ancestral *koro* and become more resilient to the likely impacts of climate change and rising sea level. Sustainable development should be part of environmental protection (providing an integral link between environment and human well-being) and ecological sustainability, so that basic human needs could be met with, achieving equality and improving and maintaining ecological integrity (Klarin, 2018). Sustainable development can help to reduce the negative impacts and effects of past unsustainable usage and help to rectify the damages done to natural resources, so that future generations could also benefit from it. Both the communities, *iTaukei* and Indo-Fijians and their future generation have the right and privilege to a viable future. "Everyone has the right to life, liberty, and security of person" (Universal Declaration of Human Rights, Article 3 quoted in Pelling, 2011: 175).

9.6 Relocation

Rising sea level may also force the coastal communities of Vatukarasa and Sovi Bay to move agriculture inland to marginal hills and steep areas, which may lead to more soil erosion and land degradation, which, in turn, may adversely affect the food production and increase the siltation of the coastal areas. The research revealed that from a practical perspective, relocation will not be easy, as it expensive and both the study communities are not rich; they usually live on day-to-day earnings. It also means moving to a new place and adjusting to a new way of life. But, most importantly, especially for *iTaukei*, the cultural costs may be insurmountable. Because of these reasons relocation needs to be a last resort, but this does not mean some level of proactive planning should not proceed. Finding suitable and acceptable sites for community relocation is likely to be a complicated and lengthy process.

During relocation the subsistence farmers of Vatukarasa and Sovi Bay will be moved away from fertile low-lands and fishers will be moved away from the coast. This is likely to cause more hardship and lack of food, which may lead to malnutrition, which, in turn, may make them more prone to diseases, increasing medical bills and less hours working in farms and greater morbidity. Relocation may also result into loss of tools, equipment and common resource areas, and dispersal of family members. The communities of Vatukarasa and Sovi Bay agree that extreme weather events are becoming more intense and pronounced now than they were during their grandparents' and great grand-parents' time.

As the land of Sovi Bay is *mataqali* land, the *iTaukei* community may be forced to take back their land from the Indo-Fijian community now living at Sovi Bay. They, then, would

be forced to leave the land and look for land elsewhere. Vatukarasa is closer to the sea and at a lower elevation and one can conclude that the *iTaukei* community of Vatukarasa will be initially affected more than the Indo-Fijian community of Sovi Bay. However, in the end the Indo-Fijian community living at Sovi Bay and Vatukarasa are likely to be more affected if forced to move away. Land tenure will be a critical factor in relocation for Indo-Fijians. My review concluded that changing climate and rising sea level is a major threat that the communities of Vatukarasa and Sovi Bay will not be able solve on their own, so local, national, regional and international support is very much needed to ensure survival of these two communities.

9.7 Areas for further research

This thesis provides an in-depth study of vulnerabilities of *iTaukei* and Indo-Fijians of Vatukarasa and Sovi Bay. It has identified existing and likely climate change effects, the exposure and vulnerabilities of the two communities and a range of possible adaptation options. The research suggests that community based adaptation should be a priority, but also that the communities are also likely to need external assistance. Further it has found that tradition knowledge in both communities can be an asset in the community adaptation process.

An important next step would be to conduct in-depth participatory or action research around implementing adaptation in the communities. This would include investigating which structures at the community level would be most useful in developing and implementing adaptation options including mobilising community resources and establishing effective networks beyond the community to government and international agencies.

There is a need to further investigate coastal processes in the study area to identify the areas most exposed to coastal erosion and inundation and to help the community to evaluate appropriate adaptation options. If, at some point relocation of the either community at Vatukarasa is unavoidable it will be important for detailed research on the cultural, social, economic, environmental and biophysical implications of the relocation. It is suggested that planning for relocation is most likely to yield successful results if it is a pro-active, long-term process, involving all community members, rather than a rushed reactive response.

The links between climate change and health are not yet known with accuracy. Accordingly, there is a need for more research on the links between climate change and diseases such as dengue and diarrhoea as well as the characteristics of public health infrastructure and the quality of health care under climate change scenarios. It is also important that the role of

socio-economic factors and their role in the spread of diseases is also better understood as changing some of these may play an important role in adaptation.

Like other researchers, such as Barnett and Campbell (2010) and Fujieda and Kobayashi (2013), I am also of the opinion that local communities should not depend too much on external assistance. This raises the need for studies that could explore alternative solutions (such as combination of scientific and traditional environmental knowledge). There is also a need to carry out a comparative study how climate change is differently affecting men and women of Vatukarasa and Sovi Bay.

9.8 Concluding statement

The environmental impacts of climate change are likely to provide major challenges to the sustainable development of the two communities. At Vatukarasa and Sovi Bay the local economies and food supplies are closely linked to climatic events and any changes in climate will have significant impacts.

Both *iTaukei* and Indo-Fijians are impacted by climate change and share a number of commonalities. However, there are differences in the types of some impacts and the degrees of exposure and vulnerability. Accordingly, responding to climate change at the community level will need to take into account both the similarities and the differences. A one size fits all approach is not likely to be successful. Furthermore, to better adapt to the impacts of climate change, community based approaches are likely to be most successful where appropriate and there is a need to combine traditional and scientific knowledge and to deal with both non-climatic and climatic problems, to increase resilience and decrease exposure and vulnerability of local communities.

At Vatukarasa and Sovi Bay the local economy and food supply is closely linked to climatic events and any changes in climate will have significant impacts on both the communities. If communities are not able to adapt effectively, natural disasters such as tropical cyclones and flooding, are likely to become human disasters.

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APPENDICES

Appendix 1. Information Sheet

Geography Programme
School of Social Sciences
Faculty of Arts and Social Sciences
Te Kura Kete Aronui
The University of Waikato
Private Bag 3105
Hamilton, New Zealand
Phone +64 7 838 4046
www.waikato.ac.nz

UNIVERSITY OF WAIKATO
FACULTY OF ARTS AND SOCIAL SCIENCES.

Title of Research Project: The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands.

I am a PhD student at the University of Waikato, as part of my PhD thesis I am undertaking research on "The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands". The aim of my research is to examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change. I am interested in examining people's views on climate change and its likely impacts on coastal communities.

Participant Observations, *Talanoa* and Focus Group Discussions

The researcher hopes to conduct Participation Observations for 20 days, if the need be it will be increased, 15 *Talanoa* sessions and 10 Focus Group Discussions. The Participation Observations will be ongoing for the duration of the data collection period. Focus Group Discussions will be approximately 1 hour long and *Talanoa* will be an hour and half. You are invited to participate in this research and your opinions, views and thoughts are very important for my research so please feel free to discuss these with me and with other group members. There will be 6-8 participants in each focus group discussions. The researcher will be audio recording the sessions to keep an accurate account of your views, opinions and thoughts (the permission will be requested from the participants prior to audio recording of the sessions).

Your rights as participants

If you participate in my research, you have the right to:

- Ask any question about the research at any time.
- Decline to be audio recorded
- Refuse to answer any question(s) or make any suggestion(s).
- Withdraw from the research up to 2 weeks after the participation
- Request that any material, opinions, suggestions and thoughts be erased

Confidentiality

All data collected will remain confidential and no names will be used in any publications. All recorded data, notes and transcripts will be kept under lock and key. All information stored on a computer will only be accessible through a changed password and this will only be known to the researcher.

"This research project has been approved by the Human Research Ethic Committee of the Faculty of Arts and Social Sciences. Any questions about the ethical conduct of this research may be sent to the Secretary of the Committee, email fass-ethic@waikato.ac.nz, postal address, Faculty of Arts and Social Sciences, Te kura Kete Aronui, University of Waikato, Te whare Wananga o Waikato, Private Bag 3105, Hamilton."

The results

The results of this research will be used as part of my PhD Thesis. The findings may also be used in presentations and journal publications.

"I wish to receive a copy of the findings" YES NO (Please circle your choice)

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

What next

If you are willing to take part, I will contact you in a week so as to organise a time to meet. If you have any further inquiries regarding the research, please do not hesitate to contact me or my Chief Supervisor.

Nur Ali

(09) 2662609

nnuraali@yahoo.co.nz

Appendix 2

Geography Programme
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The University of Waikato
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RESEARCH CONSENT FORM – PARTICIPANT OBSERVATION

Description of project: The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands. More specifically it will examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change.

I have read the information sheet and understand that:

- My identity will remain anonymous
- All information collected will remain confidential
- All information collected will be kept under lock and key or on a computer accessible by password only
- Information collected will only be used for PhD thesis, presentations and journal articles.
- I have right to refuse to answer any question, terminate the session at any time and can withdraw from the research up to 2 weeks after the session.

I consent to our conservation being audio recorded YES NO (please circle)

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

I (state your name)_____agree to participate in this research and acknowledge receipt of a copy this consent form and the research project information sheet.

.....	.....
Signature of participant and date	Signature of the researcher and date

Appendix 3

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Geography Programme
School of Social Sciences
Faculty of Arts and Social Sciences
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RESEARCH CONSENT FORM – *TALANOA*

Description of project: The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands. More specifically it will examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change.

I have read the information sheet and understand that:

- My identity will remain anonymous
- All information collected will remain confidential
- All information collected will be kept under lock and key or on a computer accessible by password only
- Information collected will only be used for PhD thesis, presentations and journal articles.
- I have right to refuse to answer any question, terminate the session at any time and can withdraw from the research up to 2 weeks after the session.

I consent to our conservation being audio recorded YES NO (please circle).

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

I (state your name)_____agree to participate in this research and acknowledge receipt of a copy this consent form and the research project information sheet.

.....	.....
Signature of participant and date	Signature of the researcher and date

Appendix 4

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

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RESEARCH CONSENT FORM – FOCUS GROUP DISCUSSIONS

Description of project: The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands. More specifically it will examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change.

I have read the information sheet and understand that:

- My identity will remain anonymous
- All information collected will remain confidential
- All information collected will be kept under lock and key or on a computer accessible by password only
- Information collected will only be used for PhD thesis, presentations and journal articles.
- I have right to refuse to answer any question, terminate my involvement in the session at any time and can withdraw from the research up to 2 weeks after the session.

I consent to our conservation being audio recorded YES NO (please circle).

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

I (state your name)_____agree to participate in this research and acknowledge receipt of a copy this consent form and the research project information sheet.

....

Signature of participant and date Signature of the researcher and date

Appendix 5

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

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RESEARCH CONSENT FORM – VATUKARASA VILLAGE-TURANGA-NI-KORO

I am a PhD student at the University of Waikato, as part of my PhD thesis I am undertaking research on "The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands". The aim of my research is to examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change. I am interested in examining people's views on climate change and its likely impacts on coastal communities. Your permission to carry out the research at Vatukarasa village is very much needed and it will be highly appreciated,

Participant Observation, *Talanoa* and Focus Group Discussions

The researcher hopes to conduct Participation Observation for 20 days, or if the need be it will be increased, 15 *Talanoa* sessions and 10 Focus Group Discussions. The Participation Observations will be ongoing for the duration of the data collection period. Focus Group Discussions will be approximately 1 hour long and *Talanoa* will be an hour and half. You are invited to participate in this research and your opinions, views and thoughts are very important for my research so please feel free to discuss these with me and with other group members. There will be 6-8 participants in each focus group discussions. The researcher will be audio recording the sessions to keep an accurate account of your views, opinions and thoughts (the permission will be requested from the participants prior to audio recording of the sessions).

Participants who could best provide information on the impacts of climate change on coastal communities will be selected and keeping above in mind the following criteria will be used:

(a). People who were born at Vatukarasa and SoviBay

(b). People who are still staying at the study sites.

(c). Adults - at least 25 years of age.

(d). Equal number of males and females

(e). People who lived closer to sea and/or river

(f). People who have their farms nearer to sea and/or river.

Your rights as participants

If you participate in my research, you have the right to:

- Ask any question about the research at any time.
- Decline to be audio recorded
- Refuse to answer any question(s) or make any suggestion(s).
- Withdraw from the research up to 2 weeks after the participation
- Request that any material, opinions, suggestions and thoughts be erased.

Confidentiality

All data collected will remain confidential and no names will be used in any publications. All recorded data, notes and transcripts will be kept under lock and key. All information stored on a computer will only be accessible through a changed password and this will only be known to the researcher.

"This research project has been approved by the Human Research Ethic Committee of the Faculty of Arts and Social Sciences. Any questions about the ethical conduct of this research may be sent to the Secretary of the Committee, email fass-ethic@waikato.ac.nz, postal address, Faculty of Arts and Social Sciences, Te kura Kete Aronui, University of Waikato, Te whare Wananga o Waikato, Private Bag 3105, Hamilton."

The results

The results of this research will be used as part of my PhD Thesis. The findings may also be used in presentations and journal publications.

“I wish to receive a copy of the findings” YES NO (Please circle your choice)

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

What next

If you are willing to take part, I will contact you in a week so as to organise a time to meet. If you have any further inquiries regarding the research, please do not hesitate to contact me or my Chief Supervisor.

Nur Ali

(09) 2662609

nnuraali@yahoo.co.nz

Associate Professor John Campbell

(07) 838 4466 ext: 8089

jrc@waikato.ac.nz

Appendix 6

THE UNIVERSITY OF
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RESEARCH CONSENT FORM – SOVI BAY-HEADMAN

I am a PhD student at the University of Waikato, as part of my PhD thesis I am undertaking research on "The impacts of climate change on the people of Vatukarasa and SoviBay, Nadroga, FijiIslands". The aim of my research is to examine whether or not the Fijian and Indian-Fijian communities at these two locations are affected differently by climate change. I am interested in examining people's views on climate change and its likely impacts on coastal communities. Your permission to carry out the research at SoviBay settlement is very much needed and it will be highly appreciated,

Participant Observations, *Talanoa* and Focus Group Discussions

The researcher hopes to conduct Participation Observations for 20 days, if the need be it will be increased, 15 *Talanoa* sessions and 10 Focus Group Discussions. The Participation Observations will be ongoing for the duration of the data collection period. Focus Group Discussions will be approximately 1 hour long and *Talanoa* will be an hour and half. You are invited to participate in this research and your opinions, views and thoughts are very important for my research so please feel free to discuss these with me and with other group members. There will be 6-8 participants in each focus group discussions. The researcher will be audio recording the sessions to keep an accurate account of your views, opinions and thoughts (the permission will be requested from the participants prior to audio recording of the sessions).

Participants who could best provide information on the impacts of climate change on coastal communities will be selected and keeping above in mind the following criteria will be used:

(a). People who were born at Vatukarasa and SoviBay

(b). People who are still staying at the study sites.

(c). Adults - at least 25 years of age.

(d). Equal number of males and females

(e). People who lived closer to sea and/or river

(f). People who have their farms nearer to sea and/or river.

Your rights as participants

If you participate in my research, you have the right to:

- Ask any question about the research at any time.
- Decline to be audio recorded
- Refuse to answer any question(s) or make any suggestion(s).
- Withdraw from the research up to 2 weeks after the participation
- Request that any material, opinions, suggestions and thoughts be erased.

Confidentiality

All data collected will remain confidential and no names will be used in any publications. All recorded data, notes and transcripts will be kept under lock and key. All information stored on a computer will only be accessible through a changed password and this will only be known to the researcher.

"This research project has been approved by the Human Research Ethic Committee of the Faculty of Arts and Social Sciences. Any questions about the ethical conduct of this research may be sent to the Secretary of the Committee, email fass-ethic@waikato.ac.nz, postal address, Faculty of Arts and Social Sciences, Te kura Kete Aronui, University of Waikato, Te whare Wananga o Waikato, Private Bag 3105, Hamilton."

The results

The results of this research will be used as part of my PhD Thesis. The findings may also be used in presentations and journal publications.

“I wish to receive a copy of the findings” YES NO (Please circle your choice)

If you circle yes, then I promise to return a copy of the findings to you and you may distribute them as you think appropriate.

What next

If you are willing to take part, I will contact you in a week so as to organise a time to meet. If you have any further inquiries regarding the research, please do not hesitate to contact me or my Chief Supervisor.

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Appendix 7

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***Talanoa* Session Schedule**

Outlined here are some of the topics that I would like to discuss during our sessions. You are welcome to bring up other issues not covered in this schedule. I am particularly interested in hearing about your thoughts and opinions on climate change, how it is affecting you and what are some of the things you are doing to minimise the likely impacts of climate change?

1. For how many years you have been living in this coastal village/ settlement?

Prompts:

a) Were you born here?

b) How your village/settlement has changed over the years?

2. How far was your house from the river bank/sea coast about 20 years ago?

Prompt:

a) How far it is now?

3. Do you have problem of salt water coming in your village/settlement?

Prompts:

a) Are you able to plant all the crops that you wanted to?

b) What are you doing to minimise salt water coming in your village/settlement?

4. Is the sea level rising?

Prompts:

a) Does the sea water enter the village during high tides?

b) Is rugby ground lost to river?

b) What you are doing to minimise or stop this impact?

5. Is washing away of sand by the sea a problem in this coastal village/settlement?

Prompts:

a) Is the beach decreasing?

b) Is village crop land lost to river?

c) What are you doing to minimise or stop the coastal erosion?

6. When did you experience the last tropical cyclone?

Prompts:

a) What happened during this cyclone?

b) Were the houses and gardens damaged?

7. When did you experience the last flooding?

Prompts:

a) What happened during this last flooding?

b) Were the houses and gardens damaged?

c) What could be done to minimise the impacts of flooding?

8. Has the mangrove forest declined in the last 20 years? If yes, what you think are the major causes for the decline of the mangrove forest?

Prompts:

a) Cutting down of mangrove forest

b) Tropical cyclone

9. Who does the coastal fishing for the family use?

Prompts:

a) Men

b) Women

c) How many hours do you have to spend fishing now to catch enough fish for your family?

10. Has the coastal fishing catch increased or decreased in the last 20 years? If decreased, what are the contributing factors?

Prompts:

a) More net fishing
b) Use of poison and dynamites
c) Destruction or destroying of places where fish live.
d) What could be done to increase the coastal catch?

11. Who does the farming?

Prompts:

a). Women

b). Men

c). Has the farm yield or produce increased or decreased? If increased, what have you done? If decreased, what you could do to increase the yield?

d) Do you think drought, heat and salt resistant crops may help to improve food security?

12. Do you have problem of water shortage here?

Prompts:

a) What type of water supply do you have?

b) Do you have alternative water resource such as roof catchment?

b) How could we improve the water supply?

c) Do you think user pay will work here?

13. Do you or any of your family members had diarrhoea cases in last 3 years? (Last 3 years easy to recall).

Prompts:

a) Was the patient treated at home or at the hospital?

b) Was the patient admitted?

c) What type of water supply do you have?

d) What type of sanitary accommodation (toilet) do you have?

c) What could be done to reduce the number of diarrhoea cases here?

14. Do you or any of your family members had dengue fever in last 3 years? (Last 3 years easy to recall).

Prompts:

a) Was the patient treated at home or at the hospital?

b) Was the patient admitted?

c) During what period (time) do the mosquitoes normally bite here?

c) What could be done to reduce the number of dengue fever cases?

15. Do you or any of your family members had fish poisoning in last 3 years? (Last 3 years easy to recall).

Prompts:

a) Was the patient treated at home or at the hospital?

b) Was the patient admitted?

c) From which reef were these fish caught?

d) Can you recall which month(s) was it?

c) What could be done to reduce the number of fish poisoning cases here?

Appendix 8

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Focus Group Schedule

Outlined here are some of the topics that I would like to discuss during our sessions. You are welcome to bring up other issues not covered in this schedule. I am particularly interested in hearing about your thoughts and opinions on climate change, how it is affecting you and what are some of the things you are doing to minimise the likely impacts of climate change?

1. For how many years you have been living in this coastal village/ settlement?
2. How far was your house from the river bank/sea coast about 20 years ago?
3. Do you have problem of salt water coming in your village/settlement?
4. Is the sea level rising?
5. Is washing away of sand by the sea a problem in this coastal village/settlement?
6. When did you experience the last tropical cyclone?
7. When did you experience the last flooding?
8. Has the mangrove forest declined or became less in the last 20 years? If yes, what you think are the major causes for the decline of the mangrove forest?
9. Who does the coastal fishing for the family use?
10. Has the coastal fishing catch increased or decreased in the last 20 years? If decreased, what are the contributing factors?
11. Who does the farming?
12. Has the farm yield or produceincreased or decreased in the last 10 years?
13. If increased what are the likely contributing factors?
14. If decreased what are the likely contributing factors?
15. What could be done to increase the farm yields or produce?

16. Do you have problem of water shortage here?
17. Do you or any of your family members had diarrhoea cases in last 3 years? (Last 3 years easy to recall).
18. Do you or any of your family members had dengue fever in last 3 years? (Last 3 years easy to recall).
19. Do you or any of your family members had fish poisoning cases in last 3 years? (Last 3 years easy to recall).