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**Demarcating Livelihood Vulnerability and Flood Risk Perceptions of
Villages in the Nadi River Basin, Fiji**

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
Master of Applied Science in Disaster Risk and Resilience

at
Lincoln University
by
James Albert Parrott Sinclair

Lincoln University

2020

Abstract of a thesis submitted in partial fulfilment of the requirements for the Degree of Master of Applied Science in Disaster Risk and Resilience.

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Floods continue to be a serious global concern because of their destructive nature, causing millions of dollars in damages and disruption to people's livelihoods. Despite the growing literature on flood management and vulnerability of urban areas, there is paucity on how rural communities are coping with flood impacts, especially on small island developing states. Research has shown that rural communities tend to be the most impacted during flood events and these events directly impact many of their livelihoods. This study combines the Sustainable Livelihoods Framework and Flood Hazard analysis to investigate the vulnerability of households in three villages situated in the flood-prone Nadi River basin in Fiji. Data collection involved the use of questionnaires distributed to each household in the three villages and focus group (male and female) discussions with participants from each village. The household surveys provided data on the livelihood assets and flood risks, whereas the group discussions investigated asset priority for flood resilience, and flood impacts and coping strategies at a village level. Analysis of the 208 survey responses demonstrated that households have variable access to livelihood assets and enabled mapping and spatial analysis of livelihood asset vulnerability and resilience. Key findings from the research indicate that the villages are well endowed with natural and social capital but seemingly weak in financial and human capital and show gendered differences in attitudes toward assets that might strengthen flood resilience and the degree of flood impacts on their households and villages. A novel contribution in the study was the development of a livelihood capital scoring technique that enabled the five livelihood assets of each household to be compared quantitatively. Anticipated spatial variations were not present and lead to reflections on some of the assumptions underlying commonly used vulnerability assessment tools and assumptions regarding hazard risk and vulnerability assessment. The data provides a useful baseline for targetting and assessing the effectiveness of future resilience strengthening actions. While the study highlights the unequal distribution of livelihood capitals and the contrasting views between men and women, more in-depth research into gendered livelihood roles and associated perceptions of ways to strengthen resilience is needed.

Keywords: Flood vulnerability, Sustainable Livelihood Framework, Rural livelihoods

Acknowledgements

I would like to acknowledge and express my utmost appreciation to everyone who has been a part of my masters journey. Firstly, I thank God for his blessings in my life and all the people he has allowed me to meet. To my thesis supervisors, Dr Hamish Rennie and Dr Crile Doscher, Vinaka Vakalevu for all your guidance, supervision and critics throughout my research journey. You both have always challenged me to do better and I feel truly honoured to have been supervised by two such intelligent and caring individuals. Many thanks to MFAT, the New Zealand Government and Lincoln University for providing me with the opportunity to study in beautiful Aotearoa. It has truly been an amazing and incredible experience.

A big thanks to Dr Ani Kartikasari for your wisdom and advice on how to undertake field surveys – you have taught me so much. To Jone Raituva, whose assistance during data collection was a tremendous blessing, I know I couldn't do it without you bro. Big vinaka as well to Samuela Tuidraki for all your assistance and hospitality and for always making time to help with anything when I was in the field. I must not forget to convey my thanks to the turaga-ni-koro for Sikituru and Yavusania for your kind hospitality and warm welcome into your villages. Nga mihi nui to the villagers of Narewa, Sikituru and Yavusania for all the time and effort you gave towards participating in my research. Thanks also to Jessy Paquette, Carol Chan and Vilimone Raqona for you assistance in providing some of the geospatial data.

To my partner, thank you for sticking by me while I did my research and to my family, especially my grandmother, thank you for all your love and support. Vinaka vakalevu to the P-Town gang and the Jebson crew for all the laughs and the good times when I was stressed with studies. Special thanks to the Krrr krrr squad for the dinner catch-ups and hang-outs. Thank you to everyone that has helped and been there for me, in one way or another, big or small. I truly am grateful for the experiences and lifelong connections I have made in New Zealand. Nga mihi nui! and Vinaka vakalevu!

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List of Abbreviations

ADB	Asian Development Bank
CVA	Climate Vulnerability Assessment
FBoS	Fiji Bureau of Statistics
GDP	Gross Domestic Product
HIES	Household Income and Expenditure Survey
IDS	Institute of Development Studies
JICA	Japan International Cooperation Agency
NDMO	National Disaster Management Office
NGO	Non-government Organisation
SLF	Sustainable Livelihoods Framework
SPC	The Pacific Community (formerly Secretariat of the Pacific Community)
UNDP	United Nations Development Programme
WASH	Water Sanitation and Hygiene
WCED	World Commission on Environment and Development

1

Introduction

Over the last decade, there has been an increase in the frequency and severity of floods around the globe, arguably due to sea-level rise and climate change. Being one of the most frequent and costliest of natural hazards, floods affect millions of people annually causing billions of dollars in damages and disruption to people's livelihoods. River habitats and floodplains provide a plethora of beneficial conditions for human settlements, mainly because of their high productivity, biodiversity, and economic potential. However, these areas tend to have high exposure and susceptibility to flooding hazards. Flooding needs to be better understood, impacts mitigated and the risks minimised in order to prevent or reduce the damage to assets and livelihoods (Dutta & Herath, 2004; Few, 2003; Tariq & Van De Giesen, 2012).

Past efforts typically include the use of structural or engineering defences when managing floods and altering waterways. While attempting to control nature has been quite challenging in the past, a softer approach would be addressing people's flood risk. A comprehensive approach for reducing flood risk includes decreasing vulnerability, increasing adaptive capacities, and building resilience (Brooks, 2003). The United Nations Office for Disaster Risk Reduction (UNDRR) defines vulnerability as "the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards" (UNDRR, 2020b). Adaptive capacity can be broadly described as "the ability or capacity of a system to modify or change its characteristics or behaviour so as to cope better with existing or anticipated external stresses" (Brooks, 2003; Burton, Huq, Lim, Pilifosova, & Schipper, 2002; Intergovernmental Panel On Climate Change, 2001). While resilience is defined by the Sendai Framework as "the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management (UNDRR, 2020a).

Therefore, understanding vulnerability is a crucial first step before attempting to reduce the level of exposure and employ techniques to decrease said vulnerability. In the last few decades, there has been growing focus on social vulnerability research that tries to identify vulnerable population groups, measures their socio-economic status, their potential exposures, and their societal resilience to hazards (Alcántara-Ayala, 2002; Anderson, 1995; Cutter, Mitchell, & Scott, 2000; Vojinovic, 2015). Information on the livelihoods of flood-affected communities and the impacts and barriers they face

are vital for deducing effective flood management and development strategies to decrease their flood vulnerability.

One way to observe rural vulnerability is to adopt the sustainable livelihoods approach in development studies. Chambers and Conway (1992) define a sustainable livelihood as the capabilities, assets and activities required for a means of living that can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities. The sustainable livelihoods approach can be useful when applied to rural communities to identify gaps and shortcomings and to encourage the sustenance and development of local initiatives (Cahn, 2006). The Department for International Development (DFID (UK) sustainable livelihoods framework is the most popular framework to date and can be used as a set of targets to be accomplished, as an analytical model, or as a set of principles (Toner & Franks, 2006). This study utilises the framework as a guide to develop the techniques undertaken for data collection and analysis.

Fiji is susceptible to a myriad of natural hazards but suffers especially from meteorological hazards such as cyclones and floods, which are more frequent during the wet (cyclone) season that runs from November to April (Lal, Singh, & Holland, 2009). Fiji is no stranger to constant riverine flooding, especially in the major towns of the main island. Despite this persistent hazard, little has been done to understand this phenomenon and progress has been slow to manage the risks. Rural communities tend to be the most impacted from flood events, mainly because of their limited range of livelihoods and heavy reliance on natural capital. Therefore, it is crucial to gain an in-depth understanding of their current access to assets and their engagement with floods. While there has been previous research on flood risk mapping and exposure on the Nadi river basin, none has explicitly focused on the livelihood assets and flood risk perceptions of the villagers. Furthermore, as contemporary flood management in Fiji is gaining traction, it is vital to build on previous work and contribute scholarly knowledge on this growing area.

Paquette and Lowry (2012) developed a flood map of the Nadi River basin and identified Narewa, Sikituru and Yavusania Villages as the most vulnerable villages in the catchment but only looked into building quality and education level as indicators of vulnerability. This research attempts to provide an examination of the villages' five livelihood capitals and flood vulnerability through the following research question:

What are the levels of livelihood assets and flood risk perceptions of villagers living in a flood prone area in Nadi, Fiji?

Guided by the overarching question, three research objectives were developed to answer the research question. These include:

Objective 1: To determine the status of livelihood assets owned by the three flood-prone villages in the Nadi River Basin

Objective 2: To assess the flood risk perceptions of the villagers; and,

Objective 3: To develop exposure and vulnerability maps of the vulnerable communities.

The study employed a mixed-methods approach to gather livelihood asset data and flood risk perceptions of the village households to meet the research objectives. The results of this thesis are intended to inform flood management organisations and statutory bodies about the livelihood priorities of these flood-prone villages, and additionally, to provide information to the village leaders themselves on the livelihood shortcomings or issues expressed by their village members. A layout of the thesis structure is summarised in Figure 1. The thesis will first provide a review of the literature and the foundations of the research before describing the quantitative and qualitative methods used to gather, and software used to analyse the data. Then, the results of the household surveys focus group discussions and the exposure and vulnerability maps will be presented, followed by a discussion of the findings. Finally, a summary of the main findings and recommendations for future research will be described in the concluding chapter.

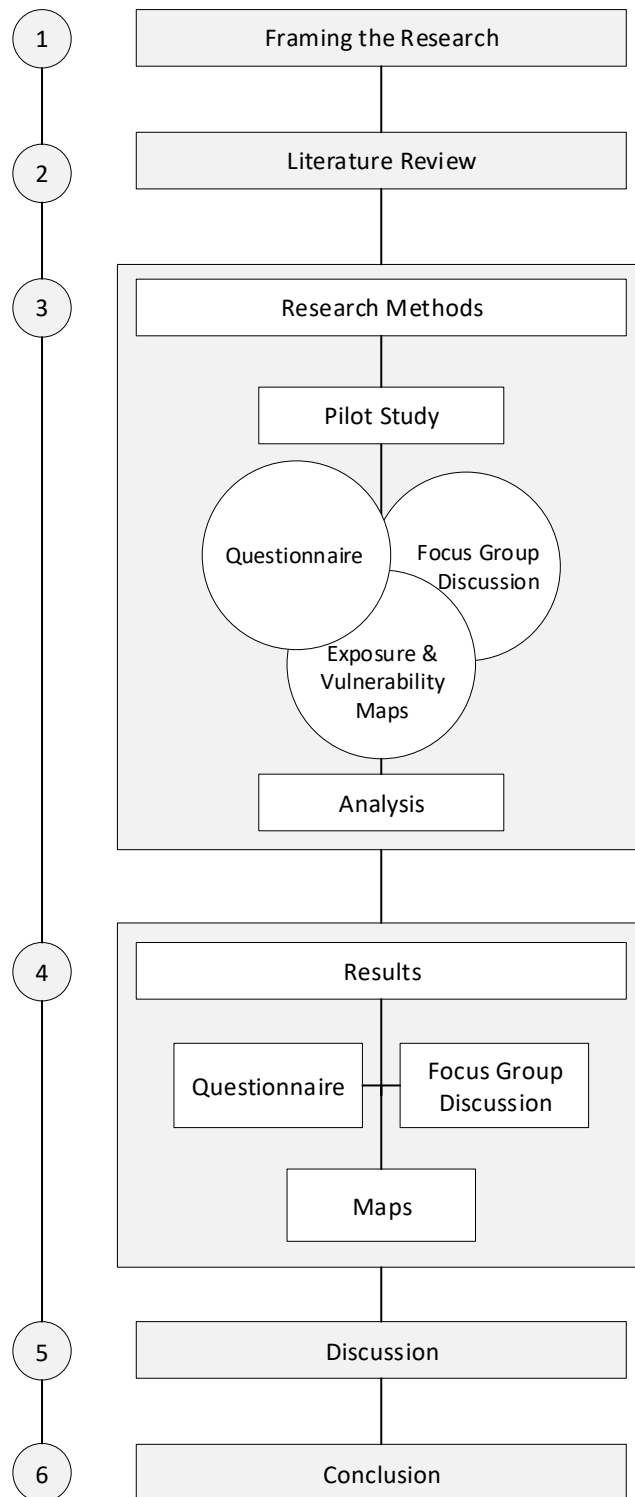


Figure 1: Layout of the thesis structure

Literature Review

This chapter reviews the development of the sustainable livelihoods approach and the definitions associated with the approach. Then, the frameworks that originated from the approach are examined and a brief comparison is provided, as well as a more in-depth description of the DFID sustainable livelihood framework and all the components that make up this livelihood system. The chapter then discusses the association of livelihood vulnerability and floods, with a focus on rural vulnerability, and the need for further vulnerability studies on flood-prone rural areas. Following this, a description of Fiji and its flood vulnerability and flood management profile is provided, along with a description of the development of one of the main tourist areas (Nadi) and how flood management is implemented in the area.

2.1 The Sustainable Livelihoods Approach

The late 1980s saw the evolution of the sustainable livelihoods approach as a means of thinking about livelihoods and poverty reduction (Cahn, 2006). The “Sustainable Livelihoods” concept came to light in a 1987 advisory panel report of the World Commission on Environment and Development (WCED) (WCED, 1987). The report argued that the idea of livelihoods is central to environmental degradation and food security and is highly linked to basic human needs, sustainable agricultural practices, and poverty (WCED, 1987). The WCED panel contended that sustainable livelihoods’ security is a determinant for a stable human population, a precondition for good husbandry and sustainable management, and is a means of reversing destabilising processes (such as urban migration) (Cahn, 2006). The WCED definition of livelihood incorporates the access to resources and incoming earning activities, including assets and reserves, to offset risks, ease shocks and meet contingencies (Cahn, 2006; WCED, 1987).

Grown and Sebstad (1989, p. 941) describe a livelihood system as “the mix of individual and household survival strategies, developed over some time, that seeks to mobilise available resources and opportunities” to meet their livelihood needs and wants. The researchers assume that this proposed livelihood systems framework links the analytical components (such as employment, income and enterprise) and outlines underlying links between and within firms and households. They also state that resources can be social, human, physical, and collective (public property or communal entitlements) (Grown & Sebstad, 1989).

Chambers and Conway’s (1992, pp. 7-8) definition of livelihood is:

A livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation, and which contributes net benefits to other livelihoods and the local and global levels in the long and short term.

It is evident since the late 1980s that the focus on environmental issues and sustainability has had a significant impact on the sustainable livelihoods approach, especially from the Food 2000 report linking environment and sustainable livelihoods, subsequently incorporating social and economic issues to broaden the definition of the approach (WCED, 1987). Carney (2003) argues that the sustainable livelihoods approach can assist in understanding the complexities of livelihood systems, and can support development with a people-centred approach.

Several agencies and organisations incorporated the sustainable livelihoods approach into their development and project strategies during the 1990s. In its overarching sustainable human development mandate in 1995, the United Nations Development Programme (UNDP) included sustainable livelihoods, employment, governance, poverty reduction, protection and regeneration of the environment, and gender as critical issues (Carney, Drinkwater, Rusinow, Neefjes, Wanmali, & Singh, 1999). In the early 1990s, Oxfam adopted a sustainable livelihoods approach addressing, in an integrated way, the issues of gender and social inequality, globalising markets, participation and environmental concerns, and deteriorating economic rights (Carney, 1999). Also derived from Chambers' and Conway's work but focused at the household level, CARE's livelihood model accentuates the status and use of household member's assets, as well as, the affinity and duties of the members within the household (Carney et al., 1999).

Chambers and Conway's definition of livelihoods has endured though many authors have ceased to use the last section of the definition that states livelihoods should provide for the next generation and overall benefit for everyone as it was deemed impractical (Carney et al., 1999). Many organisations and agencies build on the definition and develop their frameworks to implement the sustainable livelihood approach (Cahn, 2006).

2.2 Sustainable Livelihood Frameworks

Most of the Sustainable Livelihood Frameworks were developed in the 1990s and included those from IDS (Scoones, 1998), Oxfam (Carney et al., 1999), CARE (Drinkwater & Rusinow, 1999), DFID (DFID, 1999), Ellis (Ellis, 2000), and, although not a formal framework, UNDP (Carney et al., 1999). While all

the frameworks use the word 'livelihood' in their names, all except Ellis and CARE use the word 'sustainable'. Each framework will be briefly discussed below.

The CARE livelihood framework (Figure 2) whose origin stems from the influences by Chambers and Conway (1992) and CARE's long-range strategic plans interprets a livelihood as the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. CARE's framework comprises three main components which include context, livelihood strategy, and livelihood outcomes. CARE's model incorporates assets and capabilities together under livelihood strategies and only mentions human, social and economic capital in their model. Care's model also only looks into the household level of analysis.

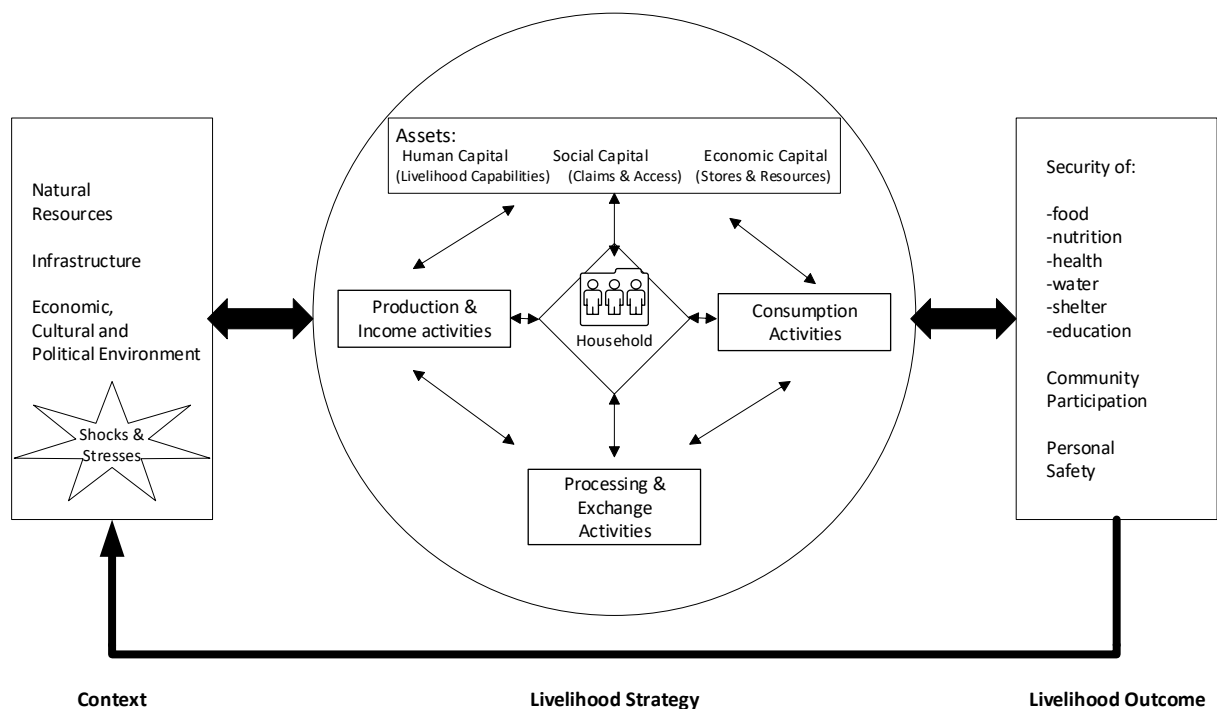


Figure 2: CARE's Livelihood Model. Source Carney et al. (1999)

The IDS sustainable livelihood framework (Figure 3), however, suggests that CARE's framework may have been too narrowly focussed and that livelihood strategies and livelihood assets need to be separated and that institutions and organisations also play a role in influencing livelihood assets and livelihood strategies. Therefore, the IDS model is comprised of five components made up of context, conditions and trends; livelihood resources; institutional processes & organisational structures; livelihood strategies; and sustainable livelihood outcomes. The IDS model builds on from CARE's list of assets to add natural capital into the list of livelihood capitals. The model also separates livelihood from sustainability under their livelihood outcomes component and incorporates trends, as well as climate into their context component. While the CARE framework has a focus on the household level

of analysis, the IDS model incorporates analysis from individuals, households, villages, regional or national levels.

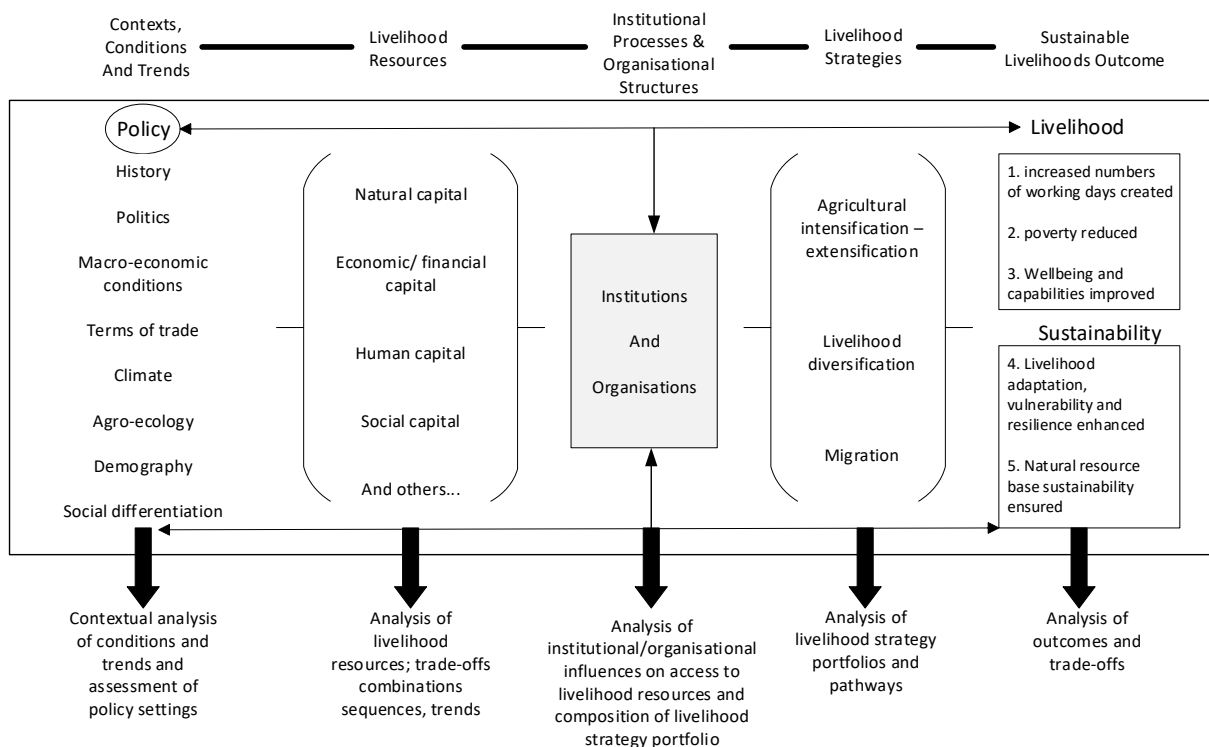


Figure 3: IDS Sustainable Rural Livelihoods: A Framework for Analysis. Source: Scoones (1998)

Building on the work of the IDS framework, the DFID sustainable livelihood framework (Figure 4) incorporates physical capital as an extra livelihood capital, though it still comprises five components similar to the IDS model. The DFID framework incorporates sustainability into its overall livelihood outcomes component and does not separate it like the IDS framework. Compared to CARE’s or IDS’ frameworks, the DFID vulnerability context of the framework, despite being broad, incorporates seasonality as a driving factor. While the linkages surrounding the IDS model highlight two-way influences, and the CARE model shows that all the elements are linked to each other, the DFID model shows two-way linkages within their components and even feedback loops between livelihood outcomes to livelihood capitals, as well as, from transforming structures and processes to vulnerability context. Notably, there does not seem to be a linkage from livelihood outcomes to vulnerability context. Additionally, the inclusion of the term ‘vulnerability’ in the context component, not seen in the CARE and IDS models, suggests that vulnerability is a significant factor under this component. The levels of analysis of the DFID framework differs from the IDS model by not including national-level analyses but incorporates more levels than the CARE model. The DFID model seems to be the most widely used with minor modifications in presentation, such as the Oxfam sustainable livelihood model (Carney, 1999).

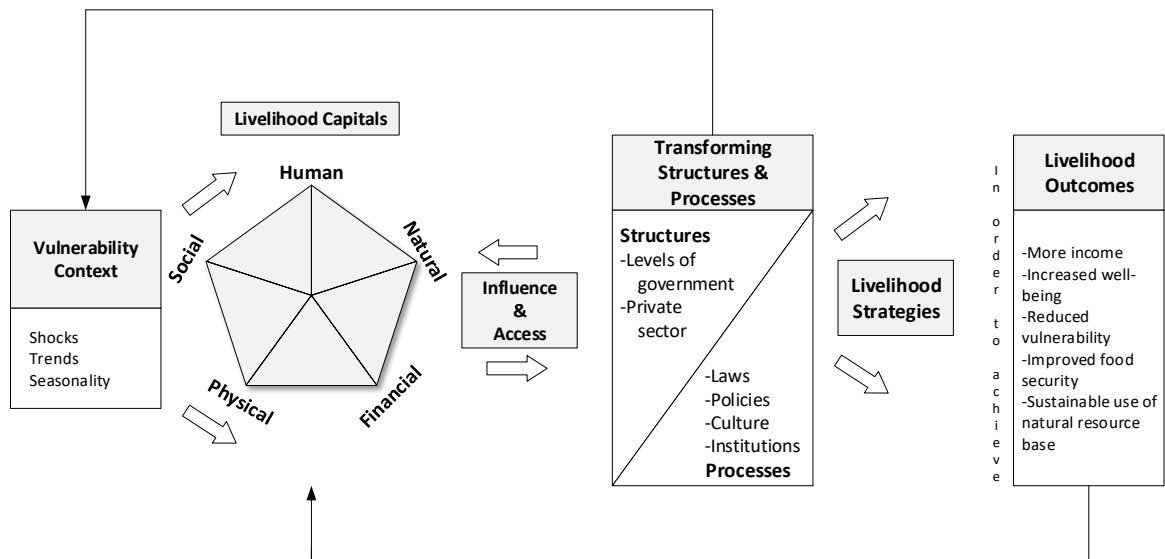


Figure 4: DFID's Sustainable Livelihood Framework. Source: DFID (1999)

Comparatively, the Ellis framework for micro policy analysis of rural livelihoods Ellis (2000) has an entirely different layout (Figure 5) to the frameworks previously mentioned. Ellis's model includes the five capitals similar to that of DFID, however, the model comprises six components with the inclusion of the livelihood strategies being split into natural and non-natural based activities. The model, however, does not mention vulnerability within its title of context but explicitly lists certain driving factors pertaining to trends and shocks. Also, Ellis' framework does not explicitly mention livelihood outcomes but instead describes the consequences of livelihood strategies either under livelihood security or environmental sustainability. Similar to the IDS framework, the Ellis frame can be analysed at the micro-policy level and recognises the influences of macro-policy levels.

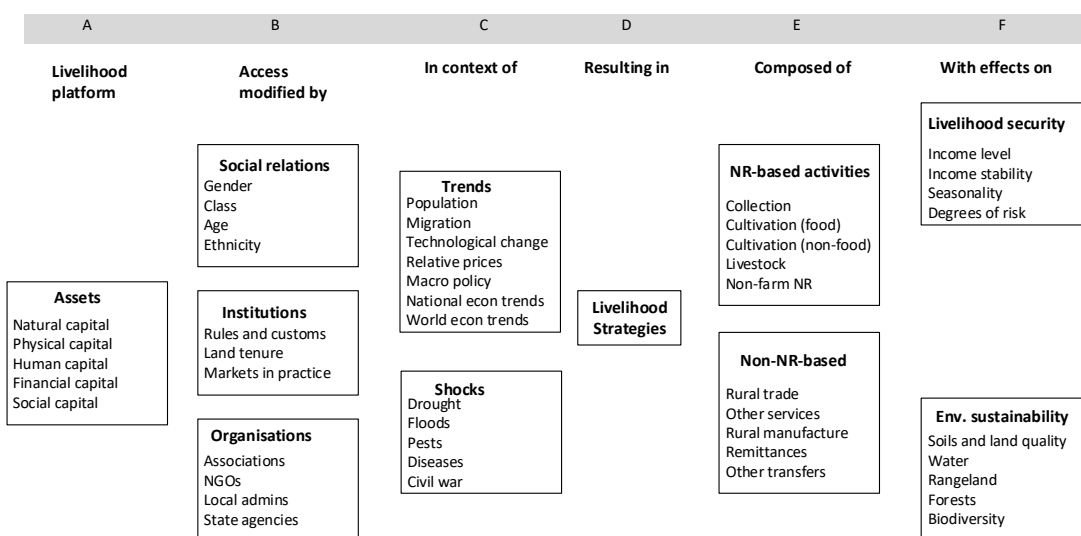


Figure 5: A framework for micro policy analysis of rural livelihoods (Ellis's Livelihood Framework). Source: Ellis (2000)

Cahn (2006) has since argued that culture needs to be included as a livelihood capital, making it six in total and that culture is interwoven into each of the components of the framework. Scoones (1998) categorised livelihood strategies into intensification/extensification of agriculture, livelihood diversification, and migration. Carney (1998) grouped livelihood strategies into natural resource-based, non-natural resource-based, and migration. Similarly, Ellis (2000) has only two categories of livelihood strategies which are natural and non-natural resource-based activities (omitting migration). While all the frameworks have positive aspects, for this study, the DFID framework, which is the most popular model in use in development practice and social science research worldwide (Cahn, 2006; UNDP, 2017), will be discussed in more detail in the next section.

2.3 The DFID Sustainable Livelihood Framework

Developed in 1997 by the British Department for International Development (DFID), DFID's Sustainable Livelihoods Framework has been the most widely used in development and social science research throughout the world (UNDP, 2017). DFID defines livelihoods as:

“the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base” (DFID, 1999, p. 1.1)

As shown in Figure 4, there are five main components of the Sustainable Livelihoods Framework. These are Vulnerability Context, Livelihood Assets, Transforming Structures and Processes, Livelihood Strategies, and Livelihood Outcomes. These components interact within and with each other as shown by the arrows in the framework. The Vulnerability Context represents the shocks, trends and seasonalities that directly or indirectly affect livelihoods, namely the livelihood assets. Figure 4 also shows that Transforming Structures and Processes can also have an impact on the livelihood assets, as demonstrated by the influence and access arrows. A combination of all these components results in a livelihood outcome, and so, realistically, people will always try to achieve a positive (and hopefully sustainable) livelihood goal.

The framework is people orientated and endeavours to provide insight into development projects and to eradicate poverty (Cahn, 2006). It also regards populations in the context of vulnerability by assessing their use of assets and services to meet their livelihood goals (Carney, 1999). The objectives of the framework encourage and attempt to promote improved and equitable access, support, cohesion, management, and security of all resources ranging from social, natural, financial, political, and institutional to health, its core concepts being people-centred, holistic, dynamic, building on strength, macro-micro links, and sustainability (DFID, 1999).

The framework is holistic in the sense that it is non-sectoral, has multiple influences, involves various actors or stakeholders, results in numerous strategies, and produces multiple livelihood outcomes (DFID, 1999; Scoones, 1998). It also highlights the main dimensions that affect people's livelihoods and could be applied to households or wider groups. The main aim of the framework is to identify the differing stakeholder perceptions that promote structured and coherent discussions about the relative importance and inter-relationships of factors that influence livelihoods (DFID, Carney, 1998; 1999; Ellis, 2000).

The sustainable livelihoods approach can be useful to rural communities to identify gaps and shortcomings and encourage the sustenance and development of local initiatives (Cahn, 2006). The approach was used in Cambodia to determine opportunities for programme support and identified a lack of external institutions and legislature and no links between the government body and rural people as important issues (Turton, 2000). The results enabled a concentration of efforts in strengthening the institutional framework of the region. Another example is seen in Kenya, where the approach identified an increased exposure to vulnerability and a decrease in security; at the same time, noting the need for income improvement and livelihood diversification support (Farrington, Carney, Ashley, & Turton, 1999). Further examples of the use of the approach resulting in positive outcomes can be seen in Brock (1999), Pérez Izadi (2000), (Rakodi, 1999), and more recently in Ming'ate, Rennie, and Memon (2014), Pandey, Jha, Alatalo, Archie, and Gupta (2017), Minh, Hao, and Lebailly (2018), Srijuntrapun, Fisher, and Rennie (2018) and Su, Wall, Wang, and Jin (2019).

The sustainable livelihoods approach has evolved into being used as either a set of targets to be accomplished, an analytical model, or as a set of principles (Toner & Franks, 2006). In retrospect, many of the projects implementing the approach have been undertaken in Asia and Africa with very little application in the Pacific, where the rural nature of communities is very different to those in Africa and Asia (Cahn, 2006). The Sustainable Livelihoods Framework developed by DFID is the most popular framework used in development practice today and has proven useful in a variety of settings (UNDP, 2017) (also, refer to the previous paragraph on examples of places the framework has been used). Because of this popularity, the DFID SLF will be used as a guide in this research.

2.3.1 The Vulnerability Context

The Vulnerability Context component depicts the external influence or stresses in which people reside. People's livelihoods tend to be significantly impacted by shocks, trends, and seasonalities, which they tend to have little or no control over. These can include population trends, economic trends, or technological trends; natural hazard shocks, health shocks, or conflict (Glavovic, Scheyvens, & Overton, 2003). Trends and seasonality are not necessarily negative, indeed, seasonality is essential for many

ecosystems and trends may be beneficial (GLOPP, 2008). Cahn (2006) argues that risk perception may be culture-dependent and is significantly influenced by socially entrenched values.

2.3.2 The Asset Pentagon

Situated at the heart of the framework, the assets pentagon (Figure 6) represents the different resource types (financial, physical, natural, social and human) that should be accessible to a person, household or community as part of their livelihood assets (DFID, 1999; Farrington et al., 1999).

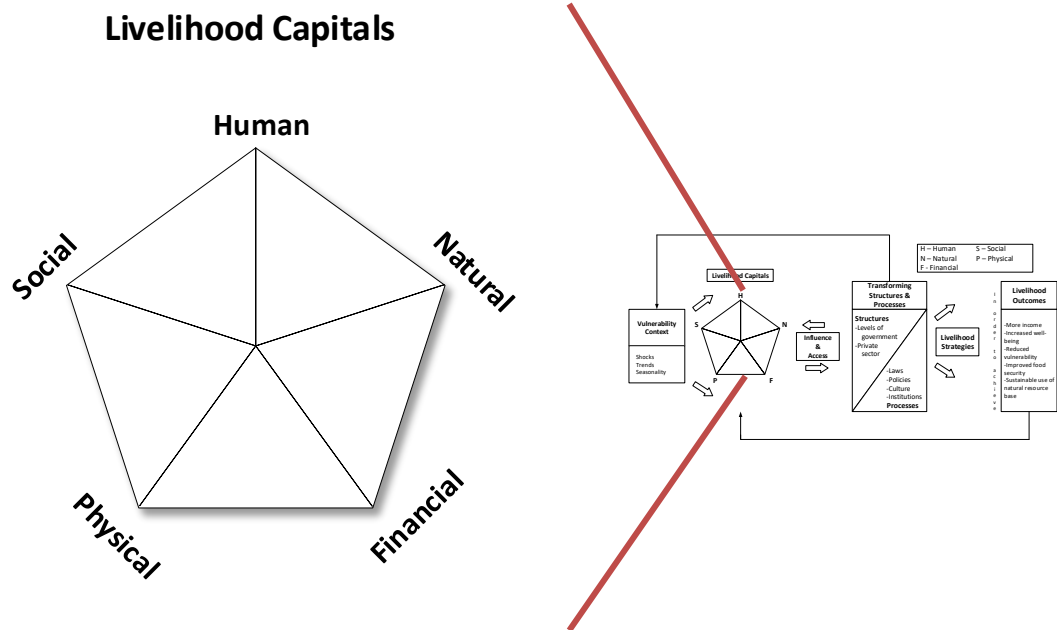


Figure 6: The livelihood component of the sustainable livelihoods framework

Financial capital represents the monetary stocks and flows that contribute to production and consumption, ideally, cash or equivalent. This asset comprises productive or liquifiable financial resources and is the most versatile of all the capitals as it can be transferred or converted into other assets. Physical capital includes the necessary infrastructure and goods required to achieve livelihood objectives, that tends to be easily measured or quantified. Natural Capital consists of the tangible (trees and land) and intangible (air and biodiversity) resources derived from nature and has a close relationship with shocks involving natural hazards of the Vulnerability Context. Social Capital denotes the networks, connectedness, memberships, affiliations, reciprocity, and exchanges that people draw from to achieve their objectives. More insight into social capital can be found in Portes (2000).

Social capital can facilitate efficiency in carrying out tasks and is arguably very important during crises, response and recovery phases (Pelling & High, 2005; Singh-Peterson & Iranacolaivalu, 2018). Additionally, this capital has been known as the “resource of last resort” (DFID, 1999, p. 2.3.2). Human

Capital is made up of the skills, knowledge, health and ability to labour to pursue various livelihood strategies and achieve livelihood goals.

Despite a person's socioeconomic class (rich, middle or poor), their access to livelihood assets depends on individual efforts, persistence, ability to try new ideas, and the preparedness to learn (Ming'ate, 2012). DFID suggests that the sustainability of assets is achievable if all the resources are maintained and accumulated, while others say that one resource cannot be easily substituted for another (DFID, 1999). In contrast, Ming'ate (2012) suggests that some people who have access to more assets have increased vulnerability as these people may have developed dependencies and expectations of their new ventures if the benefits turn out to be short-lived, due to market fluctuations or saturations, for example.

Cahn suggests that when analysing culture and sustainable livelihoods, culture is related to, and interwoven into, every component of the framework (Cahn, 2006). In the Pacific, culture can be a driving force in the choice of assets and strategies of households and communities. Capitals could either be created or destroyed as a result of the shocks and trends of the Vulnerability Context. Also, the Transforming Structures and Processes component can significantly influence access to assets based on the policies implemented, the access available, and the rates of capital accumulation. Regarding the relationship between assets and Livelihood Strategies and Livelihood Outcomes, people with access to more assets ultimately have a better range of options and strategies and can achieve different livelihood outcomes (DFID, 1999).

2.3.3 Transforming Structures and Processes

Transforming Structures and Processes includes the organisations, institutions, legislation and policies that facilitate and form people's livelihoods. These governing factors influence the access to, terms of exchange of and returns from the various types of capital, and provide the link between micro-level (individuals, households and communities) and macro-level (regional, government and influential bodies) stakeholders (Cahn, 2003; DFID, 1999; Ellis, 2000; Scoones, 1998). For example, fiscal policies can influence the cost of living and taxations while health policies can affect the quality and quantity of healthcare provided to the public. Furthermore, the impacts of external shocks (such as floods and droughts) can be lessened by the implementation of disaster management and disaster relief policies. Understanding institutional processes facilitates the identification of threats and opportunities to sustainable livelihoods and brings to light the processes that govern the sustainability of livelihoods (Cahn, 2003; Scoones, 1998; Scoones & Wolmer, 2003).

2.3.4 Livelihood Strategies and Livelihood Outcomes

The SLF assumes that each person or individual has a livelihood goal, and to achieve this goal, they must have access to diverse livelihoods (Scoones, 1998). The approaches (or combinations of) undertaken by people to achieve their livelihood goals are termed their livelihood strategies (Ellis, 2000). Strategies tend to be context-specific and differ between individuals, households, and communities and may be altered into a coping strategy in times of crises (Cahn, 2003). Being well endowed with assets allows individuals to choose from a variety of livelihood strategies. Also, having favourable transforming structures and processes reduces constraints and challenges to services.

The result or the end product of the implemented livelihood strategy is termed the livelihood outcome, and a focus on the outcome identifies achievements, indicators and progress (Cahn, 2003). Ideally, everyone works towards a positive outcome, although some consequences can turn out to be unfavourable or have no impact on people's livelihoods (DFID, 1999). An evaluation of strategies and outcomes can be undertaken both at the micro-level and the macro level, provided the interventions are appropriate (Cahn, 2003; Scoones, 1998).

2.4 Floods and Livelihood Vulnerability

Every year, thousands of people in Fiji are exposed to natural hazards and, given the current policy settings, the numbers are likely to increase. Floods continue to be one of the most ubiquitous, costliest and frequent hazards affecting the livelihoods of the many people that reside on deltas, floodplains, and coastal areas (Guha-Sapir, Hoyois, Wallemacq, & Below, 2016; Strömberg, 2007). The Integrated Research on Disaster Risk (IRDR) defines a flood as:

The overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher than normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash flooding) (IRDR, 2014, p. 14).

Flooding results from heavy and prolonged rainfall, when the water level in rivers and streams rises over the banks and inundates the surrounding land (NDMO, 2016, p. 1). Floods can be categorised into three distinct types; namely, flash floods (most common in the Pacific) that have little to no warning and that occur within a few hours of heavy rain; rapid-onset floods that occur within several hours of torrential rain, lasts several days and are prevalent in medium-sized catchments; and slow-onset floods that are specific to large river catchments and occur gradually over an extended period (NDMO, 2016). Factors that influence the magnitude and intensity of floods include the morphology of the catchment area, rainfall intensity and duration, land uses that increases runoff and decreases permeability, river

capacities and drainage networks, and tide levels that affect drainage rates (JICA, 2016; NDMO, 2016; Nunez, 2015).

Within the two decades spanning from 1995 to 2015, around 90 per cent of all global disasters were caused by floods, storms, drought and extreme temperatures. Consequently, close to 2.5 billion people were affected by flooding alone in the same period, with close to 45 per cent of global natural disasters being predominantly flood events (CRED and UNISDR, 2015). The Centre for Research on the Epidemiology of Disasters (2015) advises disaster managers to take heed of growing populations and the uncontrolled expansion or development of communities on flood plains and coastal zones when planning for future risk reduction. This advice stems from the increasing damage costs from flood events in the recent past. An Internal Displacement Monitoring Centre (IDMC) (2019) report shows that close to 18 million people globally are at risk of being displaced by flood events annually with close to 20 per cent of those living in rural areas. Around 25,000 people are forced into poverty annually due to economic losses incurred by tropical cyclones and floods (Government of Fiji, World Bank, & Global Facility for Disaster Reduction and Recovery, 2017).

Many people opt to live on floodplains, because of their fertile soils for agricultural production, access to recreational activities, and for their aesthetic allure though this puts the inhabitants of these communities at high risk of being exposed to inundations and flood catastrophes. Interestingly, floods tend to have lower death tolls as compared to earthquakes and tsunamis; however, the frequency of flood events and their recurring impacts on infrastructure and livelihoods of people supersedes all other natural hazards hundreds of times over, when comparing total deaths and recurring damages. Flood risk is not only influenced by the intensity and severity of flood hazards, but also by the socio-economic status, environmental conditions, political and institutional structures, and the physical and human qualities of the exposed communities (Birkmann, 2007; Merz, Thielen, & Gocht, 2007; UNISDR, 2004; UNISDR, 2009b).

Developing countries are consistently among the hardest-hit by natural hazards. Many communities suffer significant losses long after the event has passed, and their risks are likely to worsen due to differential social vulnerabilities (Salami, 2017). It is common for people living in developing countries to take an ambivalent view on flood events as they have long experienced the duality floods entail: on the one hand, a flood can bring about damage, destruction, and death, while on the other hand, it can bring about replenishment, regeneration, and restoration. A typical example of this precedent can be seen in ancient civilisations, such as ancient Egypt and Mesopotamia, where the inhabitants of floodplains relished flood events as they provided agricultural wealth. Failure of these flood events often resulted in famine, disease, and social and civic anxiety. Even today, many rural dwellers view

flooding as a fundamental component of agriculture as it replenishes fields, removes toxins and refills water tables (Few, 2003; NDMO, 2016).

Historically, flood vulnerability research first targeted the frequency, intensity and magnitude of flood hazards, as well as the characteristics of the physical or built environment (Zahran, Brody, Peacock, Vedlitz, & Grover, 2008). This focus led to many of the flood management practices being directed towards using engineering and structural solutions to manage floods (Zahran et al., 2008). In the last few decades, there has been growing focus on social vulnerability research that tries to identify vulnerable population groups, measures their socio-economic status, their potential exposures, and their societal resilience to hazards (Alcántara-Ayala, 2002; Anderson, 1995; Cutter et al., 2000; Vojinovic, 2015).

More often than not, rapid urbanisation results in marginal settlements arising in areas which lack access to essential services and rights; increasing people's vulnerability to natural hazards. In areas of social, political and economic inequality, the risks from natural hazards are exacerbated by the nature of settlement locations and the mode of settlement (Almuth Schaubert, 2014). Further, as highlighted by Rufat, Tate, Burton, and Maroof (2015), a significant influence on the magnitude and severity of floods can be attributed to anthropogenic activities such as urbanisation and flood engineering defences, which dampen the impacts in some cases but exacerbate them in others. Disasters tend to have the potential to disrupt and undermine development and are evident in developing countries which, almost by definition, usually have limited adaptive and coping mechanisms and weak institutional systems (Trujillo, Ordonez, & Hernandez, 2000; Yohe & Tol, 2002). While flood impacts affect everyone, more significant disruption is seen for the poor and marginalised rural populations that tend to lack adequate coping capacities (Sam, Kumar, Kächele, & Müller, 2017).

In a meta-analysis of 67 flood disaster case studies by Rufat et al. (2015), the researchers found that demographic characteristics, socioeconomic status and health were the main drivers of social vulnerability to flood disasters. Moreover, coping capacity and risk perception also have a significant impact on flooding disasters. With all these in mind, the dynamic manifestations of flood events indicate that there is a clear distinction of vulnerability to flooding events compared to other natural hazards.

2.4.1 Villager (Rural) Livelihood Vulnerability

Wilkinson (1991) argues that there are three elements to a rural community. These include a locality, a local society, and a community field. The geographically defined area of the community is defined as a locality, with a specific boundary that may be socially constructed. The people and the organisation of the local population constitute the local society which represents the way the residents operate to

meet their livelihood goals, being somewhat dependent and inclusive. The local society could be expanding or diminishing, culturally analogous or contrasting, close-knit or otherwise, functional or dysfunctional. They are often disorganised, decentralised and continually changing (Wilkinson, 1991). Wilkinson's third element, a community field, represents the interaction between social areas that combine education, agriculture, and health into a comprehensive understanding of the 'local community' that is quite dynamic and broadly focused (Wilkinson, 1991).

Rural communities derive their livelihoods from a range of strategies, both commercial and subsistence, that often include natural resources, micro-enterprises, and remittances (Cahn, 2006; Carney, 1999; Chambers, 1995; Scoones, 1998). Rural communities tend to be the most impacted by flood events as they are highly reliant on agricultural and natural resources that are easily damaged during a flood event. At the same time, weak socio-economic, political and institutional environments increase their levels of vulnerability to flood risk (Patnaik & Narayanan, 2010; Sam et al., 2017). The deterioration of livelihoods brought about by extreme natural events is significantly felt at the household level. Certain demographic groups, such as the sick, elderly, disabled or pregnant women usually need more attention during an evacuation, response, and relief periods, as they require more effort to move around and be cared for. With aid distribution points sometimes being too far away, waiting in queues could be tiresome and even those relatives who have to care for these groups tend to miss out on relief packages (Bündnis Entwicklung Hilft (Alliance Development Help), 2015).

Rural development has always remained micro and locally centred due to policies being implemented by and for the benefit of urban areas (DFID, 1999). This focus stems from rural or village areas being isolated or far-flung and has a significant impact on rural people. Research from Ming'ate (2012) suggests that poor people tend to acquire more livelihood opportunities from development projects and co-management initiatives while middle and high-income classes rarely take part in these initiatives but have more potential to access the incomes from the projects. Carney (1999) argues that enhancing livelihood sustainability and decreasing the vulnerability of the poor is paramount for the success of a community.

2.4.2 The Need for Flood Vulnerability Assessments

While there are many variations in the approaches and definitions of the term "vulnerability" (Adger, 2000; Alexander, 2013; Blaikie, Cannon, Davis, & Wisner, 1994; IPCC, 2007; Trujillo et al., 2000; UNISDR, 2004; UNISDR, 2009b), several researchers have proposed different methods when evaluating or measuring vulnerability. According to Anderson (1995) and Wisner (2016), assessing vulnerability can take one of four different approaches. These comprise: (1) a top-down approach through short-term identification and risk mapping of the affected area and populations; (2) a bottom-up approach through measuring the socio-economic status and understanding people's perceptions and attitudes

toward risk; (3) evaluating the reasons why certain demographic or socio-economic groups are more vulnerable to hazards than others; and (4) Addressing the root causes of vulnerability brought about from economic, political or ecological systems. Blaikie et al. (1994) proposed that evaluation of vulnerable communities can be carried out through identifying their access to or ownership of (or lack thereof) social, environmental, physical, political, and economic determinants.

As Brooks (2003, p. 3) reiterates, “we can only talk meaningfully about the vulnerability of a specified system to a specified hazard”. This notion suggests that vulnerability is context-specific. Therefore, vulnerability assessments should be comprehensively regarded when talking about a specific community. Eakin and Luers (2006) proposed three concepts to evaluate vulnerability, which includes identifying the hazard, the political-economic systems, and ecological resilience. Similarly, to describe a vulnerable circumstance or situation, Füssel (2007) suggests that four necessary dimensions are needed. Firstly, a system (such as a village); secondly, a hazard of concern (such as a flood); thirdly, an aspect of interest (such as human livelihood); and lastly, a time reference (such as May 2019). Essentially, these dimensions, when coupled, are what produces flood risk. As Bates and De Roo (2000), Birkmann (2007) and the UNISDR (2009a) highlight, the flood risk of a specific population is the product of the flood hazard, exposure and vulnerability. Further affirmed by Fekete (2010, p. 18), “everyone is vulnerable in the state of exposure to a hazard and is vulnerable to a certain degree”.

Many Government and Non-Government Organisations have implemented projects associated with the vulnerability paradigm (Lavell & Lopez-Marrero, 2014; Ritchie, 2010). Examples include the World Bank’s World Development Report, which looks at vulnerability and exposure to risk, as well as poverty eradication (Mujumdar, 2001). Another includes the creation and implementation of the economic vulnerability index and monitoring by the United Nations (Wisner, 2016). Adger (2000) argues that to determine a community’s ability to prepare for, respond to and recover from stressors; one must first understand the resources, infrastructure and services owned or accessible by these communities. Kasperson, Kasperson, and Dow (2001) emphasise that altering vulnerability is one effective risk-management strategy. To build on this premise, an understanding of the level of vulnerability of each individual or household is needed. Robert (1983) highlighted that development practices could be improved by gaining a deeper understanding of people’s livelihoods, the risks they are exposed to, and their challenges and quality of access to financial and political services.

Analysis that focuses on people should comprehensively and simultaneously involve identification of people’s resources, what they aspire to achieve, and how they go about attaining their desired objectives. In theory, people with access to a diversity of assets have a more considerable influence and empowerment, and a lower vulnerability (DFID, Chambers, 1995; 1999; Moser, 1998). Livelihoods need to be assessed to understand which areas are lacking and which are thriving. This understanding

enables programme coordinators and institutions to conceptualise inter-sectoral links and to drive sector programs to cater to the populations that are lacking vital resources (DFID, 1999). Vulnerability indicators that have been adequately aggregated and summarised make it easier for decision-makers to understand, allocate resources and prioritise projects (Birkmann, 2006). Koks, Jongman, Husby, and Botzen (2015) emphasise that to reduce risk and improve policy implementation, one must first assess the coping and adaptive capacity of the population at risk to hazards. That being said, factors that determine a household's coping and adaptive capacity include socio-economic, political, cultural, and demographic status (Cutter, Emrich, Webb, & Morath, 2009; V. K. Smith, Carbone, Pope, Hallstrom, & Darden, 2006). This notion highlights the need to quantify and qualify the capacities of communities at the micro-level, namely, households and individuals.

2.5 Fiji's Flood Vulnerability

Located in the Southwest Pacific Ocean and about 3,000 km north of Christchurch, Fiji is an archipelago of over 300 islands (only 110 inhabited) with a total land area of about 18,300 km² and an exclusive economic zone (EEZ) of close to 700,000 km². The largest island of Viti Levu, where the capital city, Suva, and the tourist centre, Nadi, are located, is a landmass of over 10,300 km² and accounts for 60 per cent of the total land area (Government of Fiji et al., 2017). Fiji has a maritime tropical climate with two distinct seasons throughout the year. November to April is the 'wet-summer' period which usually has high rainfall and is also known as the cyclone season, while March to October is the dry-cooler period with average recorded temperatures between 18 to 22 °C. Fiji's climate is greatly influenced by the El Nino Southern Oscillation (ENSO) phenomenon and the South Pacific Convergence Zone (SPCZ). This climate influence, coupled with Fiji's topography, results in the main island having two distinct areas of a wet eastward side (with dense forests) and a dry westward side (with grass and shrubs) (JICA, 2016).

The last census conducted in 2017 showed Fiji has a population of 884,887 people with close to 75 per cent of the people living on Viti Levu (Fiji Bureau of Statistics (FBoS), Registrar Generals Office (Ministry of Justice), & Ministry of Health and Medical Services (MoHMS), 2019). The median age of the population is 27.5 years, with around 44 per cent of people living in rural areas. The number of people between the ages of zero to fourteen is higher in rural areas than in urban areas. However, the opposite is seen for people aged 20 to 40 years (Fiji Bureau of Statistics (FBoS), 2017). The GDP of the country is NZ\$ 6.7 billion, and the GDP per capita is NZ\$ 7,903.9 (United Nations Office for Disaster Risk Reduction (UNDRR) & Asian Disaster Preparedness Centre, 2019), with tourism and sugar cane exports being the most substantial growth sectors in the country (Jayaraman, Choong, & Fatt, 2018). The Western Division is regarded as the economic backbone of the country and accommodates core industries, such as tourism, sugar, and gold mining (McNamara, 2013).

Earthquakes and earthquake-induced tsunamis are possible hazards owing to the fact that the country is situated near the Pacific Ring of Fire. On top of that, hydrometeorological hazards such as cyclones, heavy rain and flooding are an annual occurrence that often lead to destructive landslides. Furthermore, the majority of the population and infrastructure are located close to the coast and are highly threatened by sea-level rise and storm surges (United Nations Office for Disaster Risk Reduction (UNDRR) & Asian Disaster Preparedness Centre, 2019). River floods in Fiji are seen to be a regular occurrence, with the majority of flood events occurring within the first quarter of the year at the peak of the cyclone/wet weather season (JICA, 2016; McGree, Yeo, & Devi, 2010). Most rivers and streams in Fiji are comparatively small and flow from steep mountainous regions. These features, coupled with the high-intensity rainfall associated with tropical depressions and cyclones, catalyse the conditions to bring about flash floods in the lower valleys and plains. There are five major river systems in Viti Levu, namely the Ba, Nadi, Sigatoka, Navua and Rewa Rivers. The Rewa River Basin has the largest area at approximately 2,900 km² while Ba the smallest at around 930 km² (McGree et al., 2010).

Fiji's Risk Index (RI), according to the World Risk Reports by Bündnis Entwicklung Hilft (Alliance Development Help) (2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018), has significantly increased in the past decade. In 2011, Fiji's RI was 13.57 and remained within the same range before a significant increase was seen from 2017 to 2018. From being ranked 19th in 2011, Fiji is now ranked as the 10th highest in the world. Additionally, Fiji's Climate Risk Index (the extent to which Fiji has been affected by weather-related losses between 1998-2017) is deemed High Risk which sits at a rank of 20 (United Nations Office for Disaster Risk Reduction (UNDRR) & Asian Disaster Preparedness Centre, 2019). Fiji is committed to reducing risks from natural disasters mainly through its mandated Disaster Management Plan and Act (currently being reviewed), as well as its support of the Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction (Government of Fiji et al., 2017).

A climate vulnerability assessment (CVA) was undertaken by the Fijian Government, supported by the World Bank, GFDRR, and the Africa Caribbean Pacific (ACP) – European Union (EU) Natural Disaster Risk Reduction (NDRR) Program. The results provided essential data on the country's vulnerability to climate change with medium to long-term impacts outlined (Government of Fiji et al., 2017). The assessment highlighted that annual losses could reach up to 6.5 per cent of Fiji's GDP by 2050 as a result of extreme weather events, exacerbated by climate change. Also, to help Fiji address its climate and disaster vulnerabilities, the CVA identified five priority areas, including the development of land and housing in safe neighbourhoods; strengthening infrastructure in line with the economy and population; sustainable agricultural and fisheries development; improvement of conservation policies; and building socio-economic resilience.

According to the IDMC website, approximately 12,000 people were displaced (similar to the population of Queenstown, New Zealand) in 2018 while 2016 recorded the highest displacement with close to 80,000 people displaced for Fiji (IDMC, 2019). Almost 30,000 people were displaced in 2012, while 2009 and 2010 recorded between 10,000 - 20,000 people displaced (Figure 7). These years correlate with significant weather events that caused significant death and destruction in Fiji. Two minor cyclones swept across Fiji in 2018 (Category 1 – Cyclone Josie and Category 2 – Cyclone Keni) while the strongest one to ever make landfall in the southern hemisphere occurred in 2016 (Category 5 - Cyclone Winston).

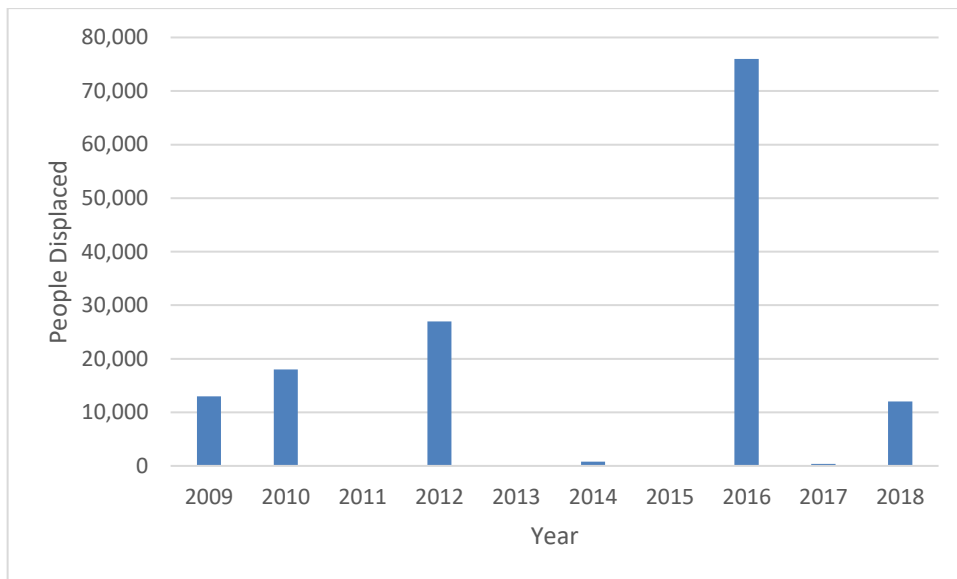


Figure 7: Annual disaster displacement for Fiji from 2009 to 2018. Adapted from IDMC (2019)

Approximately two-thirds (66%) of the population has expressed that they have experienced a cyclone, while close to a quarter (23%) have experienced a flood event (Chaudhury, 2015; Fiji Bureau of Statistics (FBOS), 2016; Government of Fiji et al., 2017). In 2012, major flood events occurred in the western part of the main island, especially in Nadi, that caused up to \$FJD 85 million (NZ\$ 61 million) worth of damages on initial assessment (JICA, 2016). For the past 40 years, Fiji has experienced, on average, more than one flood each year, with significant devastating floods occurring between 2004 and 2014 (McGree et al., 2010). Among the worst on record, were the 2009 and 2012 flood events that claimed the lives of 15 people, directly affected over 160,000 people, and resulted in loss and damages amounting to over FJ\$ 200 million (NZ\$ 143 million) (Government of Fiji et al., 2017; Lal et al., 2009; McGree et al., 2010).

In the past decade alone, reports from JICA (2016) and McGree et al. (2010) highlighted that floods (brought on by tropical depressions and tropical cyclones) caused over FJ\$ 500 million (NZ\$359M) worth of damage, which is equivalent to 5 per cent of Fiji's GDP. This figure shows that there can be up to FJ\$ 50 million (NZ\$35M) in costs annually, which is a significant impact on people's livelihoods

and the country's GDP. Over a third of the population and about one-fifth of all economic activities lie within the very high to high flood impact zones (The World Bank, 2016). Floods in 2004 that affected Navua caused damage and disruption to households, businesses, and livelihoods amounting to over FJ\$ 13 million (NZ\$9M), without accounting for cascading losses (Holland, Ambroz, & Woodruff, 2011). Asset loss or livestock reduction are experienced by close to 80 per cent of the affected population following a flood or cyclone event (Government of Fiji et al., 2017). Losses to sugarcane farms and the four sugar mills from the 2009 floods incurred around FJ\$ 28.9 million (NZ\$20.7M) in damages (Lal, 2011), while flooding in the Penang River and Ba River Catchments caused up to FJ\$ 81.1 million (NZ\$58.3M) in economic damages (Brown, Daigneault, & Gawith, 2014). Although rarer, floods caused by tropical cyclones also contribute a significant fraction to the annual loss estimate (Government of Fiji et al., 2017).

As a result of climate change and an unchanged economy, average annual asset losses from floods may exceed 5 per cent of Fiji's GDP by 2050, with global flood model estimates of average annual asset losses at FJ\$ 250 million (NZ\$179M) (2.6% of GDP), while FJ\$ 2.248 billion (NZ\$1.6bn) (23.3% of GDP) of asset losses are from a 100-year event (Government of Fiji et al., 2017). The World Bank estimates that by 2050, close to 25,000 Fijians could be left in poverty every year due to floods – that is close to 3 per cent of the population (Government of Fiji et al., 2017). These concerning figures highlight the urgent need to strengthen livelihoods and the resilience to flooding hazards so that future impacts are decreased, and people are better able to cope and recover quickly.

In previous decades, apart from Government and NGO projects, flood research in Fiji has predominantly focused on flood modelling (Ba, Nadi) (Nawai, Gusyev, Hasegawa, & Takeuchi, 2015; Paquette & Lowry, 2012), flood-related climate change and adaptation options (Nadi, Navua) (Chandra & Gaganis, 2016; Mataka, Koshy, & Nair, 2006), human/development-induced flood risk (Nadi, Navua) (Bernard & Cook, 2015; Duaibe, 2008), local people's perceptions and management of flood risks (Rewa) (Nolet, 2016), and businesses' perceptions and management of flood risk (Nadi) (McNamara, 2013).

2.6 Fiji's Flood Management

A considerable amount of literature highlights that local communities show a passive attitude towards disaster preparation and mitigation, with a heavy reliance on government and external support as a means of coping with the event, encouraging a culture of dependency (Campbell, 1984; Méheux, Dominey-Howes, & Lloyd, 2010). Flood management in Fiji is very much still in its infancy and is predominantly controlled from the top-down, with structural methods such as engineering defences

as the mitigative methods of choice. Currently, there are no legal provisions for alternative flood control approaches such as utilising retarding basins. However, the elected Government tends to make provisions on an ad-hoc basis, such as halting lease payments for up to a year for residents living in inundated areas following the 2012 floods (JICA, 2016) or the provision for citizens to be able to receive up to FJ\$5,000 (NZ\$3,592) from their superannuation fund following TC Winston in 2016 (Government of Fiji et al., 2017). The Social Pension Scheme (SPS) age was reduced from 70 to 68 at the time of Cyclone Winston and then to 65 by 2018. Top-up payments were issued out to the country's three main social assistance programs within a month of Cyclone Winston. A payout of FJ\$ 19.9 million (NZ\$14.3M) was dispersed among 22,800 households (PBS), 17,800 pensioners (SPS), and 3,300 families (CPA) to help cater for immediate recovery expenses following the devastating cyclones, irrespective if the beneficiaries resided in the affected areas (Government of Fiji et al., 2017).

Currently, there is no integrated early warning system to facilitate information flows before and following a flood or cyclone, nor any other hazard event, while cyclones are the only hazard with a mandated operational plan (Government of Fiji et al., 2017). The National Disaster Management Act (1998) and the National Disaster Management Plan (1995) mandate that the National Disaster Management Office (NDMO) undertake a review and compile a report post-disaster, which is usually carried out with the help of international donors (JICA, 2016). Following a hazard event, situation reports are generated at each level from the local community through to district, then to division. These reports influence emergency response and emergency relief, including the distribution of aid. Notably, these reports are not digitised and are only available as hard copies. This creates some challenges, as some of the reports tend to be improperly compiled and cannot be easily referenced for damage and risk assessments (JICA, 2016). These weaknesses in data management highlight the urgent need for better digital and transparent baseline data of impacts and assessments on individuals and households and are one of the desirable outcomes of this research.

A centralised geospatial platform used for sharing data for disaster risk reduction, termed "GeoNode", is managed by NDMO and contains information about disaster risk, climate, topography, agriculture and demographic data (NDMO, 2017). Sadly, the platform is not regularly maintained and updated, and many of the data are inconsistent (United Nations Office for Disaster Risk Reduction (UNDRR) & Asian Disaster Preparedness Centre, 2019). Evacuation centres around the country are mainly composed of community halls, churches, and school buildings. There have not been any flood or cyclone assessments of the buildings carried out on the 800 centres spread out throughout the country. These centres are not well equipped as an evacuation centre with many of them lacking adequate water and sanitation facilities. The majority of the churches and community halls may have one toilet and tap but usually nothing more. Also, many of these centres do not cater to the elderly or disabled, therefore, providing some challenges during evacuation (Government of Fiji et al., 2017).

Not addressing livelihood discrepancies will leave communities unprepared for extreme natural events, limiting their coping and adaptive capacities, thus decreasing their overall resilience. A list of projects related to disaster risk and flood management is provided in Appendix A. The Japan International Cooperative Agency (JICA), Secretariat of the Pacific Community (SPC/SOPAC), United Nations Development Programme (UNDP), and Asian Development Bank (ADB) have been at the forefront of administering these types of projects (in addition to many others) while working with the state and local communities and organisations.

To increase climate resilience and improve disaster risk management, Fiji secured US\$ 41 million in concessional finance from bilateral and multilateral sources between 2011 and 2014. The Fijian Government spends around FJD\$ 359 million (NZ\$ 257 million and 10% of total budget) on investments to strengthen resilience for the country but an estimated amount of FJ\$ 9.7 billion (NZ\$6bn) over ten years is needed to solidify its resilience efforts (Government of Fiji et al., 2017; The World Bank, 2017). In terms of flood proofing, an estimated FJ\$ 480 million (NZ\$344M), with added recurring maintenance costs, is needed to protect the communities of Fiji against river floods, not to mention the price of equipping the 800 evacuation centres with backup electricity generators requiring more than FJ\$ 20 million (NZ\$14M). For a list of Government projects aimed at increasing the country's resilience, see Appendix 1 of Government of Fiji et al. (2017)

Common in rural areas, a large portion of households depend on the land and sea as a source of income and food (Martin, Nunn, Leon, & Tindale, 2018). Investments tend to focus on large high-density settlements over small low-density settlements because of its practicality. Instead, a myriad of approaches is needed for low-density communities that combine infrastructure, environment-based solutions and adequate planning to provide sufficient flood protection (Brown et al., 2014; Government of Fiji et al., 2017).

2.6.1 Nadi Flood Management

The Ministry of Infrastructure, Transport, Disaster Management and Meteorological Services is the statutory body in charge of disaster management in the country, and the primary facilitator of the National Disaster Management Act (1998) and the National Disaster Management Plan (1995). The Ministry of Waterways and Environment is in charge of flood management and the management of waterways and watersheds. Flood management in Fiji has predominantly been a top-down approach with many of the flood management projects involving structural measures, usually led by the government and donor agencies. The past decade has seen an increase in projects related to capacity development of stakeholders and exposed individuals. As the previous section has demonstrated, there is a relative lack of bottom-up research on rural communities and their vulnerability, or perceptions of it, to flood hazards.

A few predispositions make the Nadi catchment prone to riverine floodings, such as location, catchment characteristics, geology, land-use practices and settlement (Few, 2003; Japan International Cooperation Agency (JICA), 1998; Terry, 2007). Coupled with its booming tourism industry, expanding suburban areas and having the Nadi International Airport, many people's livelihoods and Fiji's economy are at high risk of being impacted by floods. As such, there is an urgent need to develop adaptive strategies that decrease livelihood vulnerability and strengthens resilience.

Within the last decade, the Ministry carried out two major flood control projects throughout Fiji, especially Nadi, which included the Watershed Management Project and the River Dredging Project. The major components of the two projects include the construction of small retention dams and reservoirs, provision of drainage and irrigation systems, flood/drought mitigation and riverbed dredging, riverbank preservation, and land conservation efforts (JICA, 2016). From initial observations, these approaches focus on the physical aspects of flood mitigation and are arguably lacking in the social aspect. The Project for Planning of the Nadi River Flood Control Structures (2016) has seen four of the 12 retarding basins constructed in the Nadi area, while other measures such as ring dikes, river widening, improved forecasting, and flood hazard mapping are still in the progress of being undertaken (Government of Fiji et al., 2017; JICA, 2016).

Interestingly, out of the eighteen rainfall monitoring sites set up within the Nadi river basin, only ten are known to be in operation, while five out of the six water level monitoring sites are in operation (JICA, 2016). This weakness highlights that, despite there being considerable effort put forward to address flood issues, there are still some discrepancies. As the review of literature in sections 2.3 and 2.4 have demonstrated, to reduce vulnerability, a fundamental approach is to strengthen livelihoods (especially the livelihood assets), which in turn promotes resilience. Therefore to effectively improve resilience, a knowledge base must be developed which addresses the needs of a community and their resources. As stated in a report compiled by JICA (2016) following the devastating Nadi River floods in 2009 and 2012, there is an urgent need for a comprehensive river management plan that has provisions for more non-structural measures. The current structural measures in place for flood management of the Nadi River include revetments, groynes, retention dams, riverbed dredging, and tidal gates. Measuring vulnerability can be a complicated task, and as highlighted in the previous sections, multiple factors can influence individual and household vulnerability (Sam et al., 2017).

2.7 Chapter Summary

This chapter has reviewed the literature on the sustainable livelihood approach and frameworks and has evaluated the need for flood vulnerability assessments in rural contexts. With many of the flood management practices undertaken from the top-down and are predominantly structural strategies, there is an urgent need to employ some bottom-up approaches to identify strengths, weaknesses,

opportunities and threats to the livelihoods of villagers living in flood-prone areas. Nolet's (2016) work highlights a gap between national strategies and rural communities' adopted methods of coping with floods, as their perceptions of the origins and consequences of floods may differ from each other. Based on McNamara's (2013) research, the 2009 flood event greatly impacted the local businesses in Nadi, scrutinising the quality of early warning systems, high recovery costs, inadequate insurance, and reduced assistance from government bodies during preparation and recovery phases. Considering these points, there is a lack of bottom-up approaches that target micro-level stakeholders, as it is clear from previous research that the impacts on and perceptions of local communities may differ from their macro-level partners. These gaps provide the basis of this study in using the SLF as a guide to determine the livelihood assets available to flood-prone villagers in the Nadi catchment and assess their perceptions of flood risk, hopefully contributing to socioeconomic resilience, one of the five priority areas for the country, as identified by the recent CVA. In the following chapter, the methods employed in the research are set out in an attempt to answer the research objectives stated in Chapter 1.

3

Research Methodology

This chapter provides an account of the methodology and design undertaken in this study by firstly, introducing the study area, then discussing the philosophical foundation of the research and the principles that guided the method chosen, as well as the techniques used for data collection. The primary aim of this research is to identify the level of vulnerability of flood-prone villages in the Nadi River basin, guided by the DFID SLF. The chapter begins with a brief description of the study area, followed by a mixed methodological approach of data collection and analysis. The quantitative component comprised household questionnaires, while the qualitative portion included focus group discussions. The data gathered were then analysed using MS Excel, SPSS and ArcMap

3.1 Study Area

Located on the western side of Fiji's main island of Viti Levu, the Nadi River Basin (Figure 8) is made up of around 45 catchments. Flowing from the Naloto Range to the east, down the Nadi Valley and emptying into the South Pacific Ocean, the Nadi river has a drainage area of around 520 km² and a length of approximately 62 km. The vegetation and land use features of the Nadi River Basin can be distinguished by having pine forests and grassland from the upper to middle sections, patch-like sugarcane in the middle to low parts and mangroves in the lowermost section. The majority of urban and rural development can be found in the lower sections of the basin which host the tourist hub of the country, the Nadi International Airport and the town.

Nadi Town is the third-largest urban centre in Fiji and based on the 2007 census, around 70,000 people live within the Nadi River Basin with approximately 15,000 households (JICA, 2016) - this averages to 4 to 5 people per household. Also, the majority of the residents live outside of the town in peri-urban and rural or village areas. A few predispositions make the Nadi catchment prone to riverine floodings, such as location, catchment characteristics, geology, land-use practices and settlement (Few, 2003; JICA, 1998; Terry, 2007). Based on flood exposure and vulnerability research by Paquette and Lowry (2012), Narewa, Sikituru, and Yavusania Villages were identified as the most vulnerable villages in the Nadi River Basin. The research showed that about 72 per cent of the buildings in the three villages are in great danger than the other zones studied in Nadi, and that around 71 per cent of the villagers only have a secondary school level of education – as level of education was selected to estimate wealth. Consequently, these three villages were chosen for this study (Figure 9).

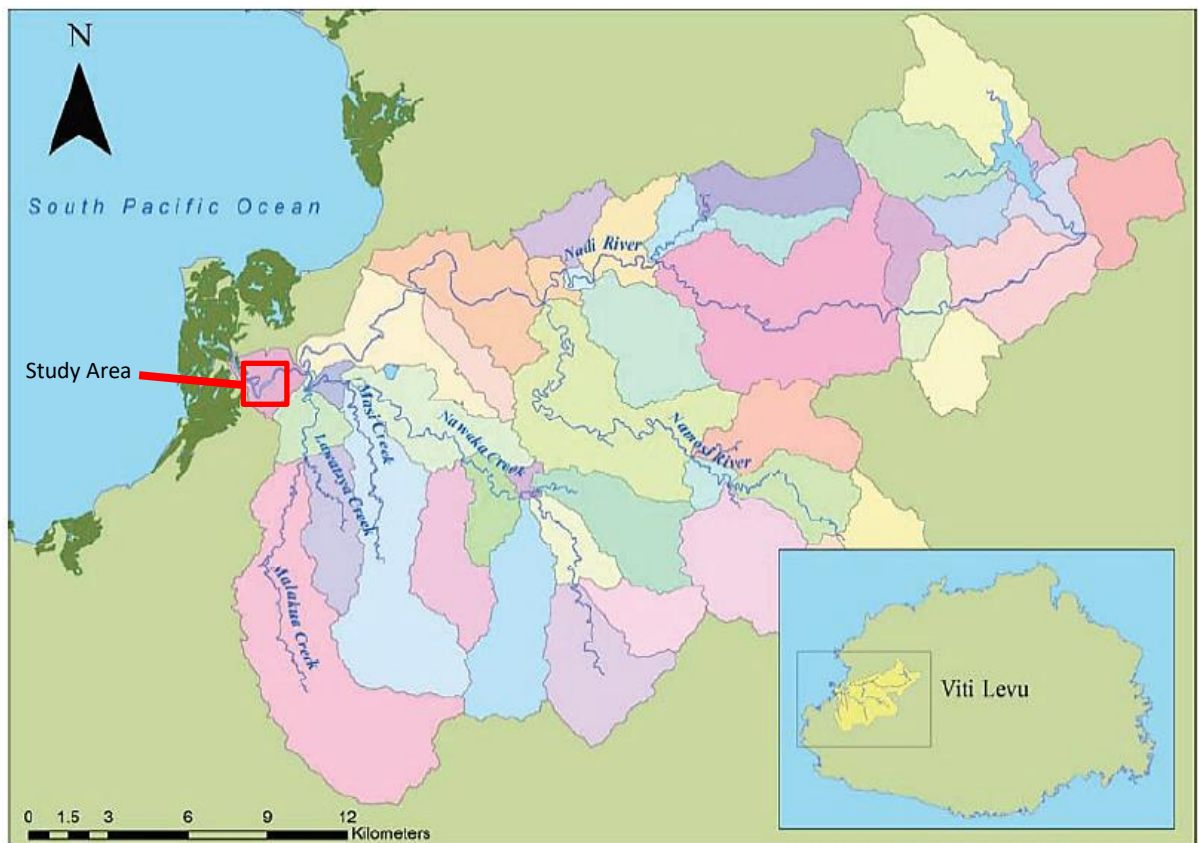


Figure 8: Map of the Nadi River basin with catchments and the location of the study area. Adapted from Paquette (2011)

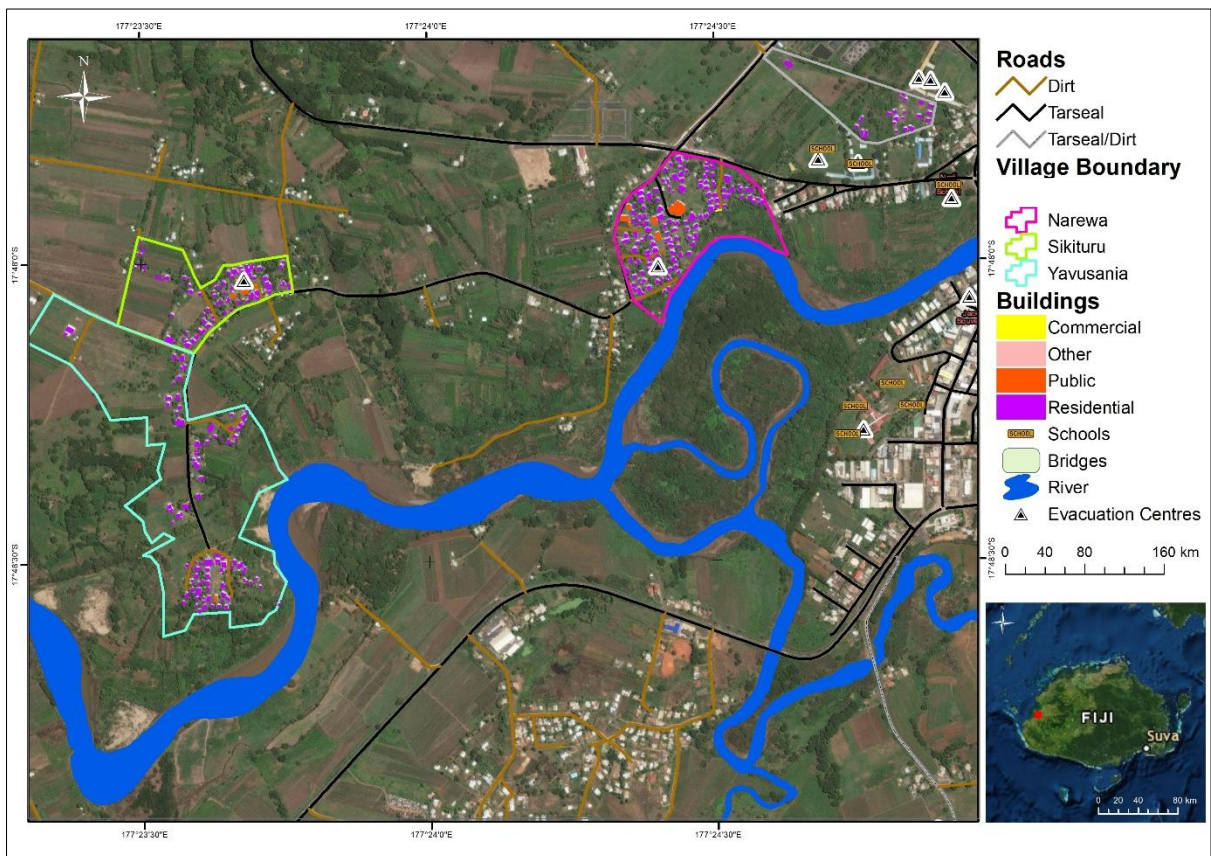


Figure 9: Map of the study area

3.2 Data Collection

The sustainable livelihoods approach provided a guide and a way of thinking to meet the research objectives. The approach, as described in Chapter 2, can be used as a framework, a set of principles or a goal. This study utilised the sustainable livelihoods framework as a set of principles to guide the quantitative and qualitative aspects of the data collection, with a focus on the livelihood asset component of the framework.

Qualitative approaches explore and attempt to understand how individuals or groups react to social problems (such as flooding) by focussing on smaller sample sizes and people's perceptions and experiences (Taylor, Bogdan, & DeVault, 2015). This approach commonly involves collecting data in a local setting, themes transitioning from specific to more general, and the emergence of theories or subjective interpretations of the data (Creswell, 2014). This technique provides more insight and context about people, the community and social issues not easily gathered from quantitative methods (Ambert, Adler, Adler, & Detzner, 1995; Fossey, Harvey, McDermott, & Davidson, 2002). Creswell and Poth (2018) argue that a qualitative standpoint provides an authentic manner of capturing human and social science research. Qualitative research tends to employ guidelines rather than rigid rules, which allows for flexibility (Cahn, 2006). Qualitative approaches and participatory assessments can recognise people's perception of vulnerability and capacity while also generating knowledge and empowering the local people, especially in the context of disaster risk and hazard impacts (Blaikie, Cannon, Davis, & Wisner, 2005; Kuhlicke & Steinführer, 2010; Moser, Norton, Stein, & Georgieva, 2010; Pelling, 2007). On the other hand, quantitative approaches attempt to explore theories by assessing the correlation between variables (Creswell, 2014). This approach is designed and guided by theory and commonly involves numerical data that are evaluated through statistical analysis (Creswell & Clark, 2007).

Birkmann (2007) and Mavhura, Collins, and Bongo (2017) note that in order to gather genuine perceptions from the study populations on the risks and vulnerabilities faced during hazard events, a mixed methods approach can be implemented. Creswell regards mixed methods research as:

An approach to research in the social, behavioural, and health sciences in which the investigator gathers both quantitative (closed-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand the research problems (Creswell, 2014, p. 2).

In this research, data collection included a mixed-method approach by combining quantitative (household questionnaires) and qualitative (focus group discussions) techniques to achieve the research objectives. The justification of this approach is that mixed methods can further enrich the

explanatory power of the data collected as opposed to just using either quantitative or qualitative alone, and adds some depth as well as breadth to the results.

The use of the case study approach with qualitative data in social science research is prevalent and has been extensively and successfully applied to give a more comprehensive overview of study populations as compared to the numerical analysis of data (Stake, 1995; Yin, 2003). Three village communities were chosen based on a study conducted by Paquette (2011) that identified Narewa, Sikituru and Yavusania as the most vulnerable villages in the catchment. The rationale behind choosing more than one village was because of the ease in replicating the results as they emerge and the ability for analytical generalisation (Salami, 2017; Yin, 2003).

A Fijian, male research assistant was recruited to help with the distribution and collection of the questionnaires, as well as to provide support during the focus group discussions. The assistant was proficient in conducting field surveys, has a master's in Climate Change and Food Security and was well versed with the local language.

Respect for participant privacy and autonomy was of the utmost importance with participation in both the questionnaires and focus group discussions being entirely voluntary. Prior to departure for the data collection, approval was granted from the Lincoln University Human Ethics Committee (Appendix B1). Attached with each questionnaire was a research information sheet (RIS) (Appendix B2), clearly stating information about the research, the type of questions to be expected, the estimated time to complete the questionnaire, the participant's right to withdraw or refuse to answer the questions, the scheduled presentation of the data, and the contact details for myself, my supervisor and the University. The completion and submission of the questionnaire were taken as the participant's consent. Also, participants for the focus group discussions were requested to complete a consent form (Appendix B3) similar to the research information sheet, described previously.

Data collection commenced at the beginning of May 2019, after the cyclone season (November to April). This was to ensure that the surveys were conducted during a time when the probability of a cyclone/flooding occurring would be low and, that if one were to occur, there would have been enough time for the villages to recover while still having the experience fresh in their minds. Before data collection within the respective communities, a "sevusevu", which is a traditional Fijian protocol of asking permission from the village headman (Turaga-ni-koro) to enter the village and conduct the survey, was carried out. This ceremony was undertaken with the help of the Turaga-ni-koro for Narewa Village and involved a presentation of yaqona (roots of *Piper methysticum*) to each of the Turaga-ni-koro for the three villages. A summarised flow chart detailing the process of data collection and analysis is shown in Figure 10

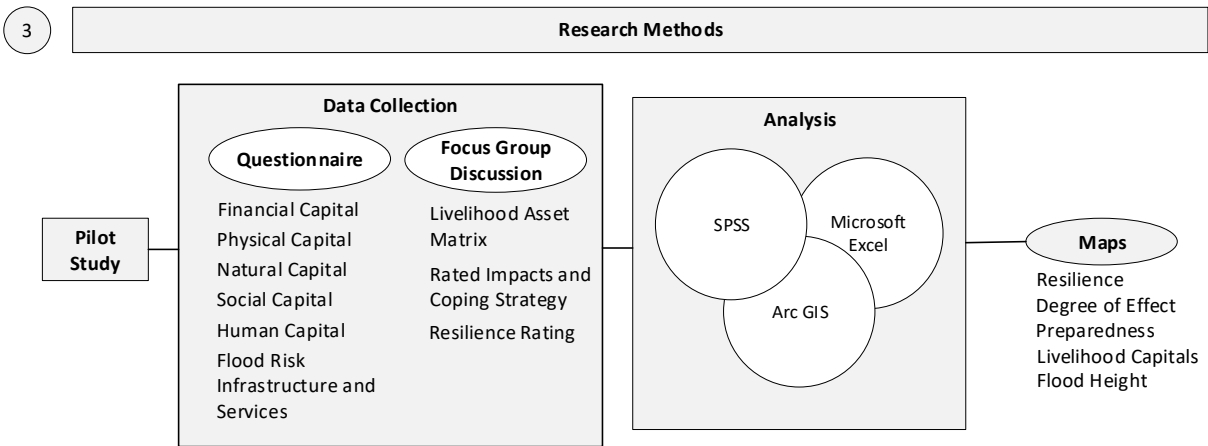


Figure 10: Outline of the methods of data collection and analysis

3.2.1 Pilot Study

Due to time constraints and limited resources, no pilot study was conducted for the questionnaires; however, the questions were based on questions used in another study (see Salami (2017)) and were thoroughly reviewed by the two thesis supervisors and another lecturer who specialises in International Rural Development.

A practice run of the focus group discussion (workshop) was conducted at Lincoln University before leaving for Fiji. Five participants were invited to be part of the workshop that consisted of university colleagues. All discussion sessions were carried out and took three hours to complete. Upon review, the information received from the participants tied in well with achieving the objectives of the research. Consequently, amendments were made to the process based on observations during this practice session and subsequent discussions with feedback from the participants. The alterations and recommendations put forward included having an ‘ice breaker’ opening component to get people more comfortable in interacting; asking participants to elaborate on answers; matching the number of responses with the number of participants during group work; providing a thorough explanation of the rating scheme, and encouraging participants to elaborate on responses or provide examples.

3.2.2 Questionnaire

A questionnaire, adapted from Salami (2017) and modified to represent the five capitals in the sustainable livelihoods framework (DFID, 1999), was distributed throughout Narewa, Sikituru and Yavusania. The questionnaire was modified for the Fiji context by grouping the questions into the five capital types using certain criteria relative to Fiji such as having a retirement fund such as the “FNPF” account, dependence on the land or nearby river, social commitments, flood coping strategies, and small island community demographics, as well as to serve the research question of assessing the levels of livelihood assets and flood risk perceptions of flood-prone villagers. The household questionnaire (Appendix B4) consisted of seven parts. Five were drawn from the five capitals of the livelihood

component of the framework; the sixth was based on flood experience, and the seventh focused on the provision of necessary infrastructure and services. The questions were a combination of multiple-choice, standard ratings and Likert scale questions, while a few offered the option for written responses.

Distribution was to each house within the village in order to achieve the third objective, which was to develop a livelihood exposure and vulnerability map of the community. Administration of the questionnaires was carried out using a door-to-door approach by an introduction and an explanation of the purpose of the visit, followed by information about the research. Interested participants were then given a copy of the questionnaire (which included a research information sheet). Questionnaire distribution and collection were spread out over four and half days respectively (unless arranged otherwise) for the three villages, while seven days were given to complete the questionnaire. As an incentive, all completed questionnaires went into a draw to win movie vouchers for the household at the local movie cinema.

Community buildings such as the village halls, churches, dispensaries, kindergartens and canteens were not surveyed. Houses that were unoccupied at the time of distribution did not receive a questionnaire and collection of the responses were only possible if someone was at home during the collection period or there was an arrangement for a specified pickup time. In countries like Fiji, time as experienced in living moves very differently compared to other regions, and it is common to hear of “island time”, or as Fijians like to call it, “Fiji Time”. Questionnaire distribution and collection were set for three days each but upon commencement, it had to be stretched out over four and a half days. Advice from the village headman was that in the morning, many people in the village tend to start their day late or are free after they have sent their children to school. In the evenings, prayer meetings and dinner with the family occurred around six to seven o’clock. As a result, questionnaire distribution began after 9 am and conclude by 6 pm. My assistant was fluent in the local dialect, which aided in explaining some parts of the research to the villagers that had trouble understanding the research.

3.2.3 Focus Group Discussion

As emphasised by the British DFID (1999), “the full diversity and richness of livelihoods can be understood only by qualitative and participatory analysis at a local level”. Anderson and Woodrow (1998) argue that the inclusion and participation of vulnerable people in vulnerability analysis is a vital approach for them to understand their circumstances, and, consequently, to identify desired methods to effect change. Eight participants from each village (four males and four females) were invited for the discussions selected by each village headman, based on their availability, knowledgeability and experience living with floods (see Ivanoff and Hultberg (2006)). The talks were held over two days, the first day for males and the second for females. This was done to examine if there were gendered

differences of livelihood priorities and flood impacts as gender issues are known to be a significant driver of social vulnerability to natural hazards and that women tend to have different views to their male counterparts (Enarson, 2000). Also, being in a homogenous group encourages the participants to be more open (Liamputtong, 2011; Skeggs & Creese, 1998). The focus group was based on a participatory vulnerability and capacity analysis method by Künzler (2017) which investigated the local population's perceptions on hazard impacts and coping strategies and the importance of livelihood resources and their vulnerability.

Essentially, between two to five villagers from each village participated in the discussions (amounting to 10 to 11 participants for each day). The talks were held at the Community Hall in Sikituru Village, based on the advice of the Narewa Village headman with Sikituru village being central. This location may have had a bearing on the variable attendance of the the participants, although due to its central location, it was the best option. Arguably, there were other events and functions happening in the village and it can be sensible that more participants will attend if the discussions were held within their village. Additionally, a few workshops and community functions were happening at the time of the survey so that may have been an influencing factor for the focus group attendance and questionnaire coverage. Although initially intended to commence at 9 am and end at 1:30 pm, in practice, most participants arrived at 10:30 am, and so the focus group discussions began at 11 am and finished around 4 pm on both days with morning tea and lunch provided in between.

The discussion topics consisted of firstly, Flood-related Livelihood Assets, secondly, Impact and Coping Strategies, and thirdly, Resilience Perception and Action Plan. For Session 1, the participants were asked to sit around in a circle to make it easier to see and hear each other when sharing their ideas and responses, while for Sessions 2 and 3, the participants were divided into their respective villages (Figure 11). This was done to generate a large number of assets in the first session. Fijian people are genuinely very welcoming and helpful, so the villagers were happy to participate in the focus group discussions as it was for a university research project. Also, being in a flood-prone area and having experienced some devastating flood events, I wanted to do something that would provide a positive outcome for the villages in terms of the participants understanding each other's perceptions, the development of an action plan, and then later a report to each village on the analysed results. The participants in the focus groups each gave consent to having photos taken and a voice recording of the sessions done. Before beginning, one of the participants said a word of prayer to bless the discussions and the day, as this is a typical custom to ask for blessings before beginning any activity in Fiji. After the prayer, an introduction by the researcher was given, followed by an overview of the research and an outline of the discussions, before beginning with the first session.



A



B



C

Figure 11: Focus group discussion process. A) Session 1 of the men's focus group. B) Session 2 where the men worked in groups listing flood impacts and coping strategies. C) Women during their final session

Session 1: Flood-related livelihood assets

This session, along with the following sessions utilise participatory rural appraisal techniques that minimise writing wherever possible and the use of visual communication tools for voting or rating (Narayanasamy, 2009). A small sheet of paper (about the size of an A5) was distributed to each participant, and they were asked to list five assets or resources they believed would make them more resilient to flood events. These included any items that were used to help prepare for, mitigate the impacts of, during or recover from flood events. The participants were given fifteen minutes to come up with their responses and then, going around the room, each participant spoke about their five assets. At the end of the presentations, all the sheets were collected and then rewritten on a bigger sheet of paper (about the size of an A2). The assets were categorised according to the five livelihood capital-types and pasted on the wall. As a rating scheme, the participants were given five stickers each (a different colour for each village) to signify importance and were asked to vote on which asset they believed was important, with the condition of not being able to put more than three of their own stickers on a single asset. Once completed, the participants were able to observe which asset had the most stickers signifying high importance, which assets had moderate to low importance and which asset had no significance (no sticker at all) (Figure 12).

Session 2: Impact and Coping strategies

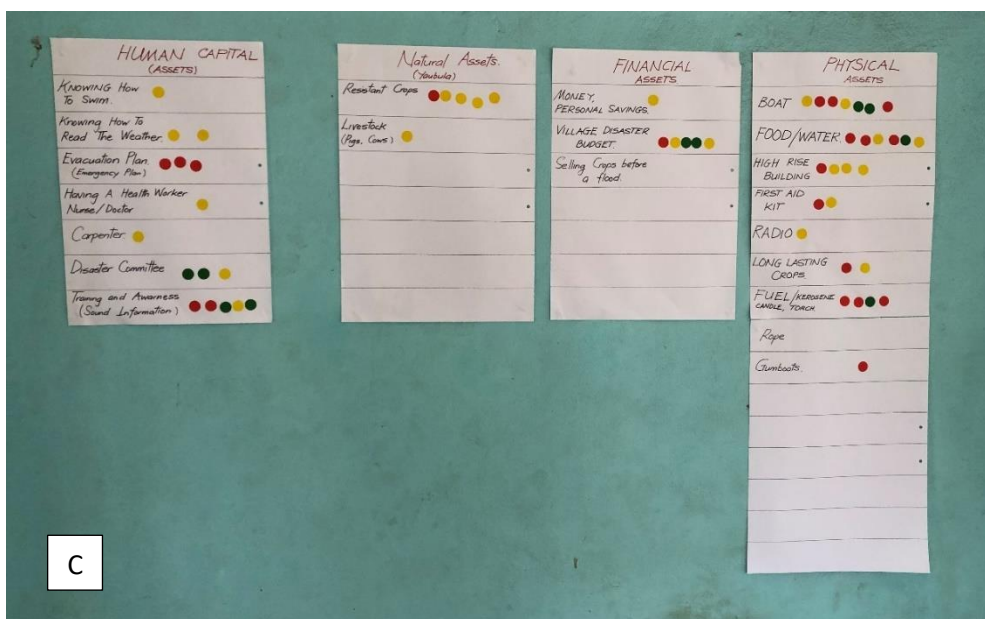
For the second session, the participants were grouped into their villages and asked to list fifteen flood impacts they have experienced in their village. After twenty minutes, the groups were then asked to rate the effects listed, and whether they were of 'high', 'moderate' or 'low' impact. After ten minutes, the groups were then asked to list a corresponding coping strategy for their selected flood impacts. After another twenty minutes, the groups were then asked to speak on their impacts, impact ratings and coping strategies.



A



B



C

Figure 12: Session 1 of the focus group discussions. A) Women applying their importance rating tool on the livelihood assets. B) Men applying their importance rating stickers on their listed assets. C) An example of the completed asset rating sheet.

Session 3: Resilience Perception and Action Plan

For the final session, the groups were asked to mark how resilient they perceived their village to be towards flood events on a scale from zero to ten. After five minutes, the groups were then asked to list three projects or activities that the village was currently doing to increase its resilience to floods. After fifteen minutes, the groups were then asked to identify and list three things that the village could improve on in building its flood resilience. After ten minutes, the groups were given a table to fill which made up the action plan the villagers were likely to take to address the items that need improvements consisting of What, Who, When and How in each column. The descriptions for the column headings included:

What: The listed action or asset that needs improvement.

Who: The individual or group that would be in charge of facilitating the improvement, as well as, the relevant stakeholders to work with to achieve the improvement.

When: The projected timeframe to achieve the improvement.

How much: The anticipated cost of the improvement.

After fifteen minutes, the groups then presented on their resilience rating, community projects that are being undertaken to strengthen flood resilience, tasks or resources that need improvement and their action plans.

The focus group discussion days showcased the “Fiji Time” phenomenon. Expected start time for the sessions was at 9 am, and while one or two participants arrived around the start time, the majority showed up at 10:30 am. Therefore, instead of following the sequence of Session 1 – Morning Tea – Session 2 – Lunch – Session 3, we had to amend the sequence and have morning tea first (while waiting for everyone then have session 1 and 2 without a break in between. After lunch accompanied a 30-minute siesta before the final session. In retrospect, the sequence was Morning Tea – Session 1 – Session 2 – “Extended” Lunch – Session 3 and instead of running from 9 am to 1 pm, the discussions ran from 11 am to about 4 pm on both days. Table 1 provides a summary of the focus group discussion sessions and their allocated times. Despite not having an ice-breaker due to the late start time and time constraints, the participants were quite engaged and actively participated in the focus group sessions.

Table 1: Summary of the focus group process

	Session 1		Session 2			Session 3	
	Activity	Allotted Time (min)	Activity	Allotted Time (min)		Activity	Allotted Time (min)
MORNING TEA	Listing of livelihood assets	15	List of impacts	20	LUNCH	Rating of resilience	5
	Presentation of livelihood assets	2-5 mins per person	Rating of impacts	10		Listing of community resilience projects	15
	Rating of assets*	15	Listing of coping strategies	20		Listing of improvement items	10
	Reflection and discussion	10	Presentation by villages	15		Drafting of an action plan	15
			Reflection and discussions	10		Presentation by villages	15
	Total Time	60		75			60

*Give time to categorise and transfer the listed assets from A5 to A2 paper before voting/rating activity

3.3 Data Analysis

This section describes the analytical techniques used on the collected quantitative and qualitative data. Firstly, the questionnaire data analysis is described, along with the livelihood score calculation technique and followed by a description of how the focus group data were analysed. The last section outlines the development of the exposure and vulnerability maps of the livelihood capitals and flood risk.

3.3.1 Questionnaire Analysis

The statistical software IBM SPSS v7.1 was used for digitising and analysing the questionnaire data. Essential information from each livelihood capital was summarised and analysed through descriptive statistics and presented as tables and graphs.

3.3.1.1 Livelihood Score Calculation Technique

From the questionnaire results, a livelihood scoring system was developed (inspired by the work of (Hahn, Riederer, & Foster, 2009)) to quantify the livelihood status of the village households. The questions were scored out of 10 and then divided by the total score in each category to standardise the scores. For questionnaire answers with a progressive nature, such as number of income earners (lowest to highest) (Figure 13 Q1), the scores were weighted progressively up to 10 (so 0, 2.5, 5, 7.5, 10 or 0, 2, 4, 6, 8, 10 depending on the number of possible answers). While for questions where the answers were not progressive (individual/isolated), the total number of possible answers were divided by ten and the weight assigned to each answer. For example, in the question about insurance in Figure

13 (Q2), there were four potential answers (no insurance = 0). Since the total score for each question would be 10, and there were four possible answers, the weight for each answer would be 10 divided by 4 (10/4 = weight per answer).

Section A: Economic Environment (Financial Capital)	
1. How many income earners are in your household? <input type="radio"/> 1-2 <input checked="" type="radio"/> 3-4 <input type="radio"/> 5-6 <input type="radio"/> 7 or above <input type="radio"/> None	2. What type of insurance do you have? Tick all that apply <input type="radio"/> Life insurance <input type="radio"/> Home insurance <input type="radio"/> Car insurance <input type="radio"/> Others: _____ <input checked="" type="radio"/> No insurance

Figure 13: Examples of questions used to develop the livelihood score.

Table 2 summarises the questions chosen and the total score for each category. To standardise the five livelihood scores to have the same weighting, each livelihood score was divided by the divisible score (which is the total number of questions that were score per capital) to give the actual score. The overall livelihood score was calculated by adding the five livelihood capitals, while the overall flood resilience score was calculated by adding the livelihood score with the flood risk score. These data were then spatially presented, as described in Section 3.3.3. A step-by-step outline of the scoring for one of the households is shown in Appendix B.6.

Table 2: Summary of the questions chosen and assigned scores for the livelihood scoring technique

Livelihood Capital	Questions Scored	Score per question	Divisible Score	Actual Score
Financial	1, 2, 5, 6, 7, 8, 9	10	70	Number of answers or responses divided by divisible score
Physical	13, 14, 15, 16, 18, 20, 21, 22	10	80	
Natural	23, 24, 26, 27	10	40	
Social	32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44	10	110	
Human	63, 65, 66, 71, 73	10	50	
Livelihood Score	Financial + Physical + Natural + Social + Human			
Flood Risk	53, 54, 55, 58	10	40	
Resilience Score	Livelihood Score + flood score			

3.3.2 Focus Group Discussion Analysis

This section describes how the data from each of the focus group sessions were analysed. The first session included a livelihood asset importance rating, the second session composed of listing flood impacts and their coping strategies, as well as rating the listed impacts, while the last session comprised a village resilience rating and the development of an action plan.

Livelihood Asset Importance Analysis

The importance-rating stickers were scored out of 75 for each village, to account for the number of participants from the three communities, as shown in Table 3. This was done to provide consistency across the villages while matching the number of participants. Since the number of participants from each village was not consistent in both gendered workshops, a total score of 75 was used as a common total. For example, during the men’s focus group, four villagers from Narewa, five from Sikituru and two from Yavusania attended the session and were given five stickers each as their importance rating tool. This equates to 20, 25, and 10 total number of votes for Narewa, Sikituru, and Yavusania respectively. The most common number that 20, 25 and 10 can be multiples off while still maintaining two decimal places is 75. Hence 75 divided by the total number of votes represented the weighting for one vote (Narewa: $75/20 = 3.75$; Sikituru: $75/25 = 3$; Yavusania: $75/10 = 7.5$). The same was done for the women’s group.

Table 3: Scoring weights assigned to the participants

	Narewa		Sikituru		Yavusania	
	Men	Women	Men	Women	Men	Women
A. Voting Score (score for 1 vote)	3.75	7.5	3	3	7.5	5
B. Number of participants	4	2	5	5	2	3
C. Total number of votes (1 participant = 5 votes)	20	10	25	25	10	15
Total Score (AxC)	75	75	75	75	75	75

From the scoring system developed above, and the condition of participants not being able to place more than three of their stickers on a single asset, a rating of ‘high’, ‘medium’, and ‘low’ importance was developed, as described in Table 4. Here, three stickers/votes signify high, two stickers signify medium, and one sticker signifies low. Once all the assets were given a score, they were finally arranged from highest to least important and presented.

Table 4: Scoring weights assigned to the sticker votes

Village	Number of votes	Score		Rating
		Men	Women	
Narewa	3	15	22.5	High
	2	7.5	15	Medium
	1	3.75	7.5	Low
Sikituru	3	9	9	High
	2	6	6	Medium
	1	3	3	Low

Yavusania	3	22.5	15	High
	2	15	10	Medium
	1	7.5	5	Low

Rated Impacts and Coping strategies and Resilience and Action Plan Analysis

Responses from the rated flood impacts and their coping strategies session were tabulated, and critical points were highlighted on pie charts and discussed. The development of the action plan was to help the villagers visualise a feasible plan to strengthen their flood resilience by addressing shortcomings of current village projects or specific assets that might be needed to increase their flood resilience. The plan was developed during the discussions and presented back to the groups on the same afternoon. The plan also acted as a tool of encouragement for the villages to strengthen their flood resilience.

3.3.3 Development of Exposure/Vulnerability Maps

Based on the information received from the questionnaire and GIS data from SPC, Ministry of Lands, and Jessy Paquette (a researcher that developed flood maps for the area); exposure and vulnerability maps were created using geospatial software, ArcGIS. This was carried out to examine if there were any spatial patterns of exposure or vulnerability of the village households. The five livelihood capital scores, the total livelihood scores, and the flood resilience scores were assigned to their respective houses and livelihood asset maps were developed on ArcMap, categorising the scores from 100-81 as 'Very High'; 80-61 as 'High'; 60-41 as 'Moderate'; 40-21 as 'Low'; and 20-0 as 'Very Low'. Additionally, questionnaire information relating to the degree of flood effect (Q47), floodwater level (Q50), and level of preparedness (Q55) were also spatially presented. These maps were then examined to determine if there were any spatial patterns of livelihood vulnerability.

3.4 Chapter Summary

This chapter has set out the research methods used in this study of examining the livelihood vulnerability of three flood-prone villages in the Nadi catchment. The study adopted a mixed-methods approach guided by the sustainable livelihoods framework and used household surveys (quantitative) and focus group discussions (qualitative) to gather information of household livelihood capitals and villager perceptions of flood risk. Field data were collected during the period 01/05/2019 to 28/05/2019 with surveys (208) and two focus groups were undertaken to maximise potential response rates and minimise disruptions taking into account local timetables and weather. The primary data, coupled with the secondary data, were used to develop exposure and vulnerability maps of the area. Also described were the ethical procedures adopted during the fieldwork. The chapter also explains how the primary data were analysed, the results of which will be presented in the following chapter

4

Results

This chapter showcases the findings from the investigation of the livelihood vulnerability of flood prone villages in the Nadi River basin based on a questionnaire and focus group discussions that were administered in Narewa, Sikituru and Yavusania. The results are focussed on the current livelihood conditions of the three communities, including their demographic profiles, the status of their financial, physical, natural, social and human asset conditions. Also, their livelihood scores, infrastructure and services ratings, and their flood risk status are reported. Results from the focus group discussions are also presented and this validates the household survey results and provides more depth in the findings by also exploring the participants' experiences and perceptions of flood impacts on livelihood assets. The data from the FGDs included livelihood asset priorities, flood impacts and coping strategies and resilience perceptions at the village community level. The last section includes maps developed from primary and secondary-sourced data and identifies vulnerability patterns of the communities.

4.1 Respondents' Profile

The study administered 233 questionnaires to households (out of 294) in the villages of Narewa, Sikituru, and Yavusania based on a door-to-door survey in May 2019 (Table 5). For the remaining households, the occupants were not present at home when the questionnaires were distributed, while one household declined to take part in the survey. Over 70 per cent of the households in each village were given a questionnaire to complete. A response rate of 89.3 per cent (n=208) was observed, with the remaining either not present at home during the collection, lost the form and declined to fill another, or had not completed filling out the form. The frequency of missing responses ranged from zero to five per cent, while the notable exceptions relate to house value (financial), reasons for being absent from meetings (social), number of mobility members (human), occupation (human), and having an evacuation plan (flood risk).

Narewa Village had the lowest response rate when compared to the other two villages (Table 5). Across the three villages, slightly more females than males filled out the questionnaire on behalf of the household (~ 52 %). Close to a quarter of the respondents were between the ages of 31 and 40, while those with ages between 41 to 50 were 18 per cent. Close to a third of respondents were over 51 years old, while less than 20 per cent made up those under 30 years old. Only about 3 to 4 per cent of respondents failed to fill in their age and gender.

Table 5: Questionnaires and respondent's profile

Parameters	Village						Total
	Narewa		Sikituru		Yavusania		
A. Total number of houses in the village	134		90		70		294
B. Number of questionnaires distributed (% = B/Ax100)	106 (79.1%)		77 (85.6%)		50 (71.4%)		233 (79.3%)
C. Number of questionnaires collected	88		71		49		208
Response Rate (C/Bx100)	83.0 %		92.2 %		98.0 %		89.3 %
Respondent's age							
<20	5	5.7 %	0	0 %	2	4.1 %	7 3.4 %
21 - 30	12	13.6 %	10	14.1 %	11	22.4 %	33 15.9 %
31 - 40	20	22.7 %	19	26.8 %	16	32.7 %	55 26.4 %
41 - 50	16	18.2 %	11	15.5 %	11	22.4 %	38 18.3 %
51 - 60	16	18.2 %	19	26.8 %	4	8.2 %	39 18.8 %
>61	16	18.2 %	11	15.5 %	3	6.1 %	30 14.4 %
Missing	3	3.4 %	1	1.4 %	2	4.1 %	6 2.9 %
Respondent's gender							
Male	38	43.2 %	33	46.5 %	20	40.8 %	91 43.8 %
Female	46	52.3 %	35	49.3 %	27	55.1 %	108 51.9 %
Missing	4	4.5 %	3	4.2 %	2	4.1 %	9 4.3 %

4.2 Livelihood Asset Status

This section presents the results from each of the livelihood capitals examined in the questionnaire. First is the financial capital, followed by physical, natural, social then human capital. Following this is a description of the livelihood score and resilience score results and a summary of the infrastructure and services rating.

4.2.1 Financial Capital Status

In order to gauge the villager's financial capital status, data on the number of income earners, household monthly income and monthly food expenditure were gathered. As shown in Table 6, over 60 per cent of the households in the villages had one to two income earners, while close to 15 per cent had three to four. About 2 per cent recorded having more than seven income earners in the house while 10 per cent listed there being no income earners present in the house. Interestingly, Yavusania village had no households with more than five income earners. Close to two-thirds of the households have a combined monthly income of less than \$1000, with close to 45 per cent earning less than \$500 per month. Around 20 per cent of the households were earning between \$1000 and \$2000, while only about 7 per cent were earning above \$2000 monthly. In terms of the amount of money spent on food items every month, about one-third of the households spend between \$100 and \$200, while close to 20 per cent spend up to \$100 and between \$200 to \$300. A little over one-quarter of the households spend more than \$300 on food items per month. In summary, these figures equate to households

spending close to 40 per cent of their monthly income on food, and that majority of households have a combined monthly income up to FJ\$ 500.

Table 6: Summary of income earners, monthly income and monthly food expenditure for the three villages (\$ is in Fiji dollars)

Parameters	Narewa		Sikituru		Yavusania		Total	
Number of income earners								
1 – 2	55	62.5 %	51	71.8 %	34	69.4 %	140	67.3 %
3 – 4	17	19.3 %	11	15.5 %	7	14.3 %	35	16.8 %
5 – 6	4	4.5 %	1	1.4 %	0	0	5	2.4 %
>7	3	3.4 %	1	1.4 %	0	0	4	1.9 %
None	8	9.1 %	6	8.5 %	7	14.3 %	21	10.1 %
Missing	1	1.1 %	1	1.4 %	1	2.0 %	3	1.4 %
Monthly income								
\$0 - \$500	33	37.5 %	35	49.3 %	25	51.0 %	93	44.7 %
\$500 - \$1000	29	33.0 %	17	23.9 %	7	14.3 %	53	25.5 %
\$1000 - \$1500	11	12.5 %	8	11.3 %	7	14.3 %	26	12.5 %
\$1500 - \$2000	5	5.7 %	6	8.5 %	2	4.1 %	13	6.3 %
\$2000 - \$3000	2	2.3 %	2	2.8 %	4	8.2 %	8	3.8 %
<\$3000	4	4.5 %	1	1.4 %	2	4.1 %	7	3.4 %
Missing	4	4.5 %	2	2.8 %	2	4.1 %	8	3.8 %
Monthly food expenditure								
\$0 - \$100	13	14.8 %	17	23.9 %	8	16.3 %	38	18.3 %
\$100 - \$200	23	26.1 %	26	36.6 %	17	34.7 %	66	31.7 %
\$200 - \$300	24	27.3 %	10	14.1 %	11	22.4 %	45	21.6 %
\$300 - \$400	17	19.3 %	9	12.7 %	9	18.4 %	35	16.8 %
>\$400	9	10.2 %	9	12.7 %	3	6.1 %	21	10.1 %
Missing	2	2.3 %	0	0	1	2.0 %	3	1.4 %

See Appendix C.1 for Insurance information, other financial revenues and expenditures. Only about a third of the respondents had life insurance and only around 11.5 per cent had vehicle insurance, while a meagre 2 per cent had some form of home insurance. Regarding revenues for the households, close to 30 per cent of the population were receiving income from leasing land, while social welfare benefits and overseas remittances were secondary revenue sources of 14 per cent and 12.5 per cent of respondents respectively. The highest household liabilities comprised loan repayments for around 30 per cent of the households while goods on hire purchase, leasing land and mortgage repayments were all under 7 per cent. In summary, having any form of insurance was not common, and income from land lease provided a significant amount of cash flow to some household, while loan repayments was a significant household expenditure.

4.2.2 Physical Capital Status

In order to evaluate the physical capital status of the villagers, housing parameters such as age, wall type, and floor type were surveyed. Approximately three quarters of all the houses surveyed were built more than nine years ago, while the remainder were spread out equally between 6 to 8 per cent (Table

7). Regarding the wall types of the dwellings, close to 50 per cent of the houses had concrete walls, while close to a third were built from timber or wood. Less than 14 per cent of the houses had galvanised iron walls. Mud or thatched walls were not common at all. Almost 50 per cent of the houses had concrete floors, while about 30 per cent had their floors tiled. Wooden floors made up around 20 per cent of the floor types in the village houses. Interestingly, the houses in Narewa village had an almost equal distribution of concrete and tiled floor types (Table 7). In summary, the housing stock comprises mostly well-established and solid dwellings.

Table 7: Summary of house age and housing construction materials for the three villages

Parameters	Narewa		Sikituru		Yavusania		Total	
Age of house								
1 – 3 years ago	3	3.4 %	6	8.5 %	4	8.2 %	13	6.3 %
4 – 6 years ago	2	2.3 %	8	11.3 %	5	10.2 %	15	7.2 %
7 – 9 years ago	5	5.7 %	6	8.5 %	6	12.2 %	17	8.2 %
> 9 years ago	73	83.0 %	50	70.4 %	33	67.3 %	156	75.0 %
Missing	5	5.7 %	1	1.4 %	1	2.0 %	7	3.4 %
Wall type								
Concrete blocks	61	69.3 %	29	40.8 %	27	55.1 %	117	56.3 %
Timber/wood	21	23.9 %	21	29.6 %	17	34.7 %	59	28.4 %
Galvanised iron	4	4.5 %	20	28.2 %	4	8.2 %	28	13.5 %
Thatch/bamboo	0	0 %	0	0 %	0	0 %	0	0 %
Mud	1	1.1 %	0	0 %	1	2.0 %	2	1.0 %
Missing	1	1.1 %	1	1.4 %	0	0 %	2	1.0 %
Floor-type								
Tiled	35	39.8 %	10	14.1 %	17	34.7 %	62	29.8 %
Concrete	34	38.6 %	41	57.7 %	25	51.0 %	100	48.1 %
Wood	18	20.5 %	19	26.8 %	7	14.3 %	44	21.2 %
Earth	1	1.1 %	1	1.4 %	0	0 %	2	1.0 %
Missing	0	0 %	0	0 %	0	0 %	0	0 %

See Appendix C.2 for information on place of cooking, cooking fuels and items owned. Close to two-thirds of the households cook their food inside the house, and about one-quarter have a cooking shed outside, while around 12.5 per cent of households alternate or cook food both inside and outside. Regarding cooking fuel, the prevalent fuel is kerosene (71%), followed by gas (53%) then firewood (42 %). Interestingly, about 15 per cent of households sometimes use electricity as a source of fuel to cook their meals. In terms of items owned, about 35 per cent of households own a first aid kit, while only 7 per cent have emergency food kits. Close to 23 per cent of households own a car, while only 8 per cent and 5 per cent of households conveyed that they owned water tanks and diesel generators respectively, and only two people noted that they own boats. In summary, although the villagers live near a river, virtually no one owns a boat, the households are primarily dependent on non-renewable sources of fuel for cooking, and only about half the households that own cars, have them insured.

4.2.3 Natural Capital Status

In order to determine the natural capital status of the villagers, the ownership of farms or plantations, and livestock were regarded. Close to three quarters of all the village households own land, and, approximately 68 per cent are used for farming or planting vegetables (Table 8). Only about 5 per cent of households own land but do not use it to grow vegetables or rear livestock and about 25 per cent expressed the view that they do not own land. Only about a third of the respondent's household own livestock such as cows, chickens and pigs. Over 50 per cent of Yavusania and 40 per cent of Sikituru households own livestock, while only about 20 per cent of Narewa households own livestock animals (Table 8).

Table 8: Summary of land and livestock ownership for the three villages

Parameters	Narewa		Sikituru		Yavusania		Total	
Farm/plantation ownership								
Yes, land used for farming	59	67.0 %	49	69.0 %	33	67.3 %	141	67.8 %
Own land but not used for farming	7	8.0 %	1	1.4 %	3	6.1 %	11	5.3 %
Do not own land	21	23.9 %	21	29.6 %	11	22.4 %	53	25.5 %
Missing	1	1.1 %	0	0 %	2	4.1 %	3	1.4 %
Livestock ownership								
Yes	17	19.3 %	29	40.8 %	28	57.1 %	74	35.6 %
Missing	5	5.7 %	2	2.8 %	2	4.1 %	9	4.3 %

See Appendix C.3 for further information on subsistence farming, fishing frequency, riparian habitat importance and the household's dependence on the river and land. Close to 47 per cent of households indicated that they sometimes grow their own vegetables while around 44 per cent revealed that they do it frequently. Only about 7 per cent noted that they have either never or only once grown their own vegetables. For subsistence fishing, close to half of the sampled households go fishing while around 29 per cent never go, and 12.5 per cent seldom go fishing. Only about 9 per cent of respondents indicated that they often or almost always go fishing.

The findings from the riparian habitat importance question indicated that 40 per cent of households felt that it was 'very important' while about 31 per cent felt that it was 'extremely important'. About 6 per cent noted that the habitat was 'moderately important' while 13.5 per cent of the households said that it was only 'slightly important'. Interestingly, about 8 per cent of respondents expressed that the areas beside and surrounding the river were 'not important at all'. Regarding the households' dependence on the river, around 40 per cent indicated that they were not dependent, 24 per cent were slightly dependent, 14 per cent were moderately dependent, 12 per cent were very dependent, and only 8 per cent were extremely dependent. On the other hand, dependence on the land was quite

the opposite with more than half of the households expressing that they were extremely dependent, 32 per cent were very dependent, 4 per cent were moderately dependent, 3 per cent were slightly, and only 1.5 per cent were not dependent at all. In summary, almost every household owns land that is used for agricultural purposes and that the villagers were more dependent on and prized the land more so than the river.

4.2.4 Social Capital Status

To observe social capital, group memberships, group leader status and the likelihood to voice opinions were regarded as shown in Table 9. Close to 95 per cent of the respondents were part of a religious, sports or social group, with over a third of the villagers (33.7 %) being members of at least one of the mentioned groups. A little over 20 per cent indicated that they were members of more than three groups, while only about 5 per cent were not part of any group or did not answer the question. In terms of being a group leader, about 40 per cent of the respondents were leaders in their respective groups. Interestingly, over 50 per cent of respondents in Sikituru were group leaders. Regarding the likelihood of respondents voicing their opinions or ideas in their respective groups, about 50 per cent noted they would sometimes do it, while 'almost always' and 'often' were recorded less than 20 per cent each. About 8 per cent of respondents seldom express themselves and the same percentage never do so (Table 9). In summary, almost all the households are socially active, with many having senior or leadership roles in their respective groups.

Table 9: Summary of group memberships, group leader status and likelihood to voice opinions for the three villages

Parameters	Narewa		Sikituru		Yavusania		Total	
Social/sports/religious group member								
1	26	29.5 %	26	36.6 %	18	36.7 %	70	33.7 %
2	28	31.8 %	14	19.7 %	14	28.6 %	56	26.9 %
3	13	14.8 %	8	11.3 %	5	10.2 %	26	12.5 %
> 3	15	17.0 %	20	28.2 %	9	18.4 %	44	21.2 %
Not part of any	4	4.5 %	2	2.8 %	3	6.1 %	9	4.3 %
Missing	2	2.3 %	1	1.4 %	0	0 %	3	1.4 %
Group leader								
Yes	28	31.8 %	36	50.7 %	17	34.7 %	81	38.9 %
No	55	62.5 %	31	43.7 %	27	55.1 %	113	54.3 %
Note part of any group	3	3.4 %	3	4.2 %	4	8.2 %	10	4.8 %
Missing	2	2.3 %	1	1.4 %	1	2.0 %	4	1.9 %
Likelihood to voice opinions/ideas								
Almost always	13	14.8 %	16	22.5 %	6	12.2 %	35	16.8 %
Often	14	15.9 %	15	21.1 %	10	20.4 %	39	18.8 %
Sometimes	40	45.5 %	30	42.3 %	26	53.1 %	96	46.2 %
Seldom	11	12.5 %	4	5.6 %	2	4.1 %	17	8.2 %
Never	4	8.0 %	5	7.0 %	4	8.2 %	16	7.7 %
Missing	3	3.4 %	1	1.4 %	1	2.0 %	5	2.4 %

See Appendix C.4 for tabulated results of trust, helping a neighbour, and community participation. Based on the responses to questions on the levels of trust amongst the villagers, around 65 per cent of respondents trusted a few people in the village, around 14.5 per cent trusted almost everyone, close to 10 per cent trusted everyone, and about 6 per cent trusted no one. In terms of helping a sick neighbour, the majority of the households (~60 %) reported helping a sick neighbour a couple of times, 27 per cent frequently, while around 12 per cent only helped their sick neighbour once or have never done so. On the other hand, close to 40 per cent of respondents conveyed that they have never loaned money to a neighbour, while around 30 per cent have done so a couple of times. Around 22 per cent have only loaned money to a neighbour once, and less than 5 per cent do so frequently.

Regarding the respondent's participation in community projects, close to 60 per cent said they participate a couple of times, 23 per cent frequently, 12.5 per cent once, and less than 3 per cent have never participated. Attending community meetings is a similar story with around 52 per cent of participants attending meetings a couple of times, 23 per cent frequently, 17 per cent once, and less than 6.5 per cent never attend community meetings. The predominant reason for missing out on the meetings is mostly because the respondent is busy (67 %), followed by other reasons (9 %), and to a small extent is not feeling like their voice is heard (5 %). In summary, there is a high level of trust and support amongst the villagers and would mainly miss a meeting if they were busy with other commitments.

4.2.5 Human Capital Status

To observe human capital, the parameters of the gender of the household head, respondent's education level and occupation were regarded. As shown in Table 10, a little over 80 per cent of the households have men as the head while about 14 per cent have women. Interestingly, only Narewa village had recorded both a man and women together as being the head. Primary or secondary level education was the highest form of education for about 50 per cent of the respondents, while close to 33 per cent had obtained a certificate or diploma qualification. Only about 2 per cent had no formal education and about 5 per cent have a bachelor's degree. Interestingly, Yavusania village recorded the highest percentage of respondents graduating with a bachelor's degree, while Sikituru recorded the only person with a master's degree or higher.

Regarding the occupational profile of the three villages, close to 30 per cent of the respondents are employed within the tourism industry. On the other hand, Sikituru has more people employed as farmers or fishers than in the tourism industry as opposed to Narewa and Yavusania. There is also a significant percentage of respondents having other occupations other than the ones listed (Table 10). Trade and ancillary skills possessed by the respondents were sparingly distributed between the three

villages. First aid knowledge followed by carpentry were the two highest in Narewa and Sikituru, while for Yavusania, carpentry was the highest followed by plumbing then first aid. In summary, men were the leaders of the majority of households and that almost all the households reported having some form of formal education with only one person having a postgraduate degree. Also, with the villages located within a tourist hotspot and almost everyone owning land, the highest form of employment is working in the tourism industry and being a farmer.

See Appendix C.5 for tabulated findings of mobility members, household sizes, unemployed members, number of children or dependents and ancillary skills. Regarding mobility or special needs members, all villages had indicated having at least ten to twenty village members that would need special assistance during times of evacuation. Close to half of the surveyed households noted that there were 4-6 people in the household, 27 per cent had 7-9 people, 15 per cent had 1-2 people, and 6 per cent had more than 10 people as living together as part of a household. Consequently, less than 9 per cent of the households expressed that they had no unemployed persons in the house while over 87 per cent of households mentioned that they had at least one unemployed person living in the house. The majority of households had 1-2 unemployed persons (53 %), 25.5 per cent had 3-4, 6.7 per cent had 5-6, while about 2.4 per cent had more than seven unemployed persons as part of the household.

Regarding the number of children in households, around 18 per cent do not have any, while close to 80 per cent have at least one child living with them. These figures translate to 50 per cent of households having 1-3, 26 per cent having 4-6, and about 2.5 per cent having more than seven children or dependents. In summary, each village reported having at least ten people that would require special assistance during an evacuation, and that there was a high number of unemployed and children living in large households in the village.

Table 10: Summary of household head, education level and occupation for the three villages

Parameters	Narewa		Sikituru		Yavusania		Total	
Head of household								
Man	69	78.4 %	59	83.1 %	43	87.8 %	171	82.2 %
Woman	14	15.9 %	11	15.5 %	5	10.2 %	30	14.4 %
Both	2	2.3 %	0	0 %	0	0 %	2	1.0 %
Missing	3	3.4 %	1	1.4 %	1	2.0 %	5	2.4 %
Highest education level								
No formal education	2	2.3 %	1	1.4 %	1	2.0 %	4	1.9 %
Primary/Secondary	40	45.5 %	46	64.8 %	25	51.0 %	111	53.4 %
Certificate/Diploma	37	42.0 %	14	19.7 %	17	34.7 %	68	32.7 %
Bachelor's degree	2	2.3 %	4	5.6 %	5	10.2 %	11	5.3 %
Master's degree or higher	0	0 %	1	1.4 %	0	0 %	1	0.5 %
Missing	7	8.0 %	5	7.0 %	1	2.0 %	13	6.3 %
Occupation								
Civil servant	4	4.5 %	1	1.4 %	2	4.1 %	7	3.4 %
Tradesman	4	4.5 %	4	5.6 %	5	10.2 %	13	6.3 %

Student	2	2.3 %	2	2.8 %	4	8.2 %	8	3.8 %
Consultant	2	2.3 %	2	2.8 %	1	2.0 %	5	2.4 %
Tourism industry	34	38.6 %	8	11.3 %	17	34.7 %	59	28.4 %
Food and beverage industry	5	5.7 %	1	1.4 %	3	6.1 %	9	4.3 %
Business owner	6	6.8 %	4	5.6 %	1	2.0 %	11	5.3 %
Farmer/fisherman	10	11.4 %	21	29.6 %	10	20.4 %	41	19.7 %
Other	17	19.3 %	24	33.8 %	6	12.2 %	47	22.6 %
Missing	4	4.5 %	4	5.6 %	0	0 %	8	3.8 %

4.2.6 Livelihood Score

In order to quantify all the data obtained from the livelihood sections of the questionnaire, a scoring system was developed as discussed in the methods chapter. Based on the average scores from the five livelihood capitals (financial, physical, natural, social, and human), natural capital had the highest score, while social capital came in second highest amongst all the three villages. Sikituru and Yavusania had similar average scores for natural capital (58), while Narewa and Yavusania had a similar score of 37 for financial capital. Yavusania had the highest average score for four out of the five of the livelihood assets, while Sikituru had the highest average score for social capital across the three villages. Incorporating the flood risk data into the livelihood radar plot indicates that all three villages have similar flood risk results (Figure 14).

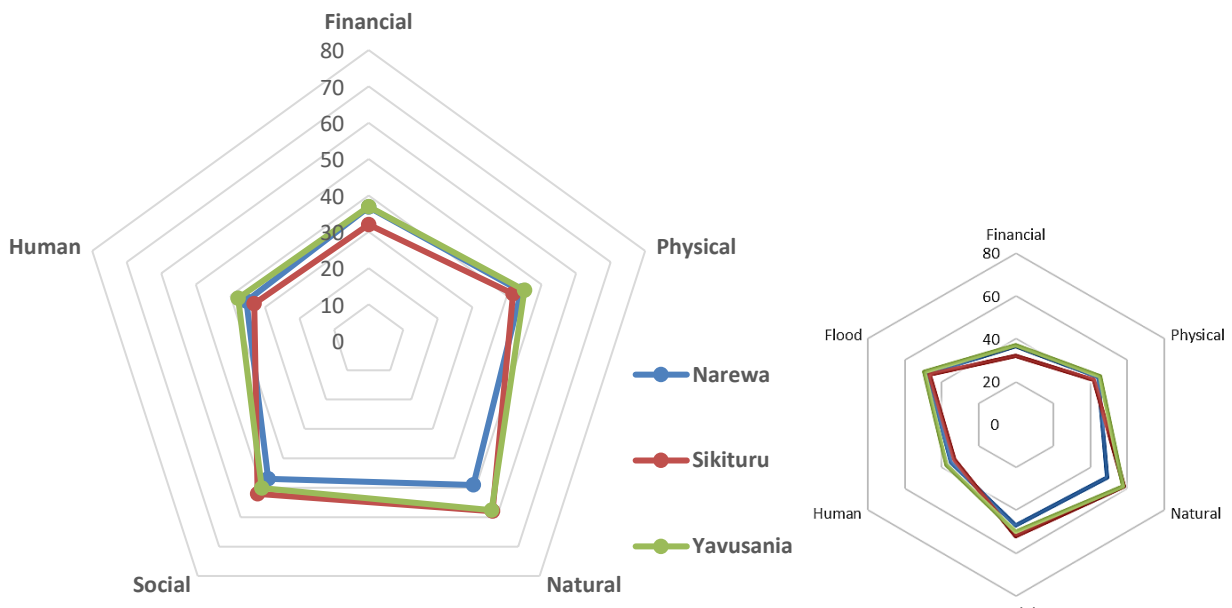


Figure 14: Radar chart of the five livelihood capitals for the three villages. The smaller radar chart incorporates flood risk into the five livelihoods.

The aggregate scores presented in Table 11 suggest that Yavusania had higher financial, physical, and human capital resilience than Narewa and Sikituru, while Sikituru had better natural and social resilience than Narewa and Yavusania. A Yavusania household had the highest score for financial capital, Narewa scored the highest for physical and human capital, and Sikituru scored the highest for natural and social capitals. Narewa and Sikituru both shared the lowest financial, social and human

capitals score, while Sikituru and Yavusania shared the lowest natural capital score. The lowest physical capital score was observed from Narewa. Notably, the highest livelihood score and resilience score came from Sikituru, while the lowest livelihood score came from Yavusania and the lowest resilience score from Narewa. Representations of these figures are shown in Section 4.5.

Table 11: Summary of the mean livelihood scores for the three villages, as well as, their maximum and minimum scores

		Financial	Physical	Natural	Social	Human	Livelihood	Resilience
Narewa	Mean	36.77	44.16	49.05	47.01	35.38	212.38	259.99
	Min	3.57	23.14	12.50	0	0	113.56	113.56
	Max	60.94	66.02	87.50	83.12	77.42	305.36	348.18
Sikituru	Mean	31.98	41.78	57.98	52.03	33.11	216.89	263.47
	Min	3.57	28.08	0	0	0	121.87	162.18
	Max	58.56	65.91	100.00	89.08	75.72	340.80	405.00
Yavusania	Mean	36.93	45.07	57.61	50.11	37.77	227.50	276.82
	Min	7.14	28.89	0	20.99	6.34	90.36	143.51
	Max	66.66	59.86	93.75	81.17	73.04	326.79	382.04

4.2.7 Infrastructure and Services

Because there was not much difference in the average ratings between the three villages, the results were presented as a combined average rating of the services (Figure 15). Regarding the ratings of the ten infrastructure and services provided within the area to the households, the villagers had a positive rating for electricity supply, water supply, food access, schools and public transport. Health services and government support were fair, while, insurance, bank loans and waste management services were rated as poor from the villagers. Detailed service ratings for each village can be found in Appendix C.7

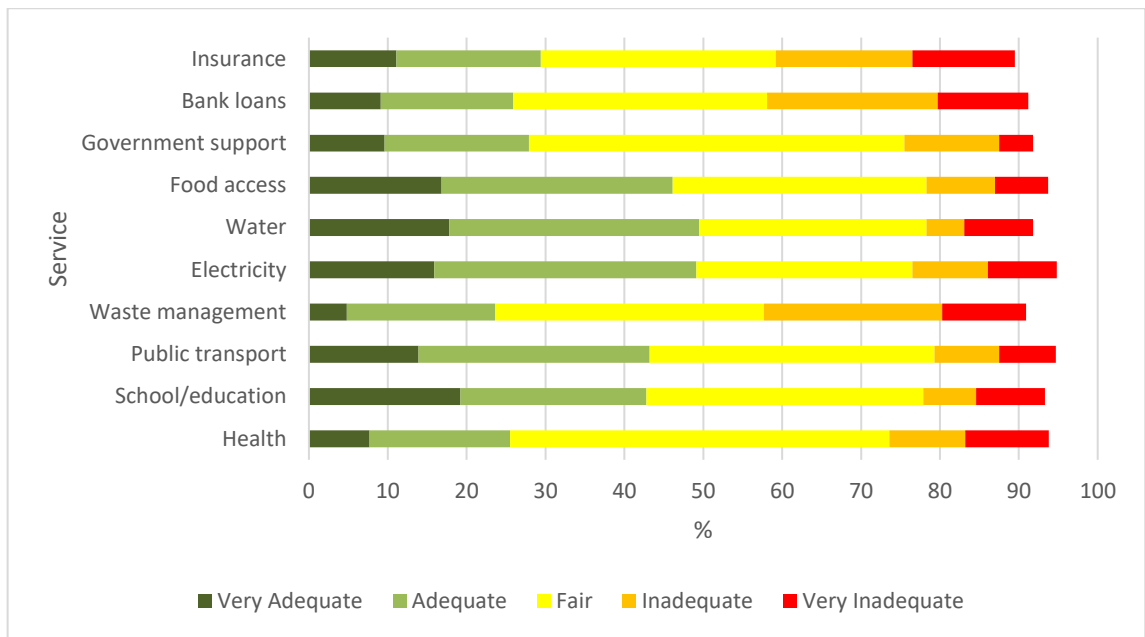


Figure 15: Combined services rating for the three villages

4.3 Flood Risk Status

This section describes the results from the flood risk component of the questionnaire that attempts to present the household attributes relating to flood risk, including the degree of flood effect from the last flood event, types of loss, average amounts spent on repairs, perceived causes of flooding, popular mode of tracking flood warnings, level of preparedness, and flood coping strategies. Subsequently, ratings of relocation, the current early warning system, flooding support before, during and after flood events, and flood awareness and education.

Figure 16 highlights the level of flood impact on the village households on their most recent flood event. Over 60 per cent of households had been severely affected by their most recent flood event, with Sikituru households being the highest (~70 %). Around 30 per cent of residents in Yavusania and Narewa mentioned that they had been affected but only minorly, while the same degree was observed by only 25 per cent of Sikituru households. Less than 5 per cent of households expressed that they were not affected at all by their most recent flood.

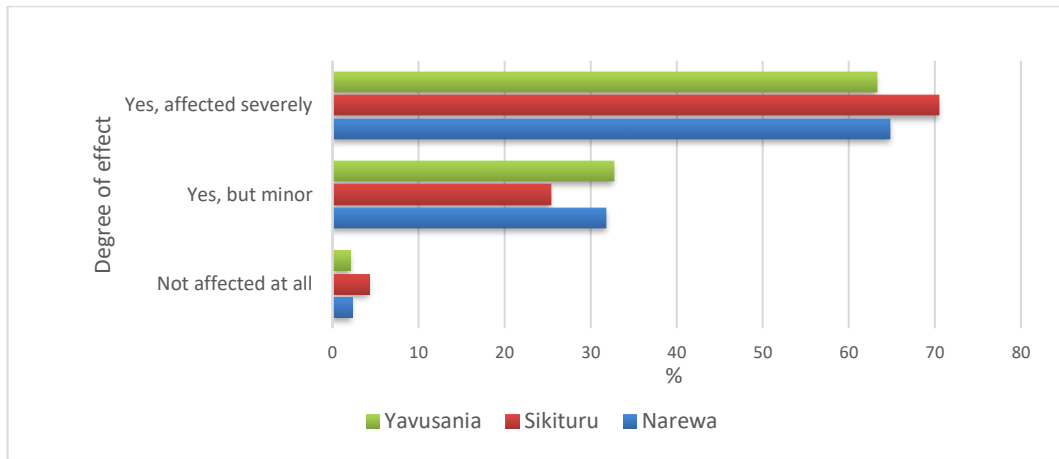


Figure 16: Degree of effect from all three villages of their last flood event

Household asset damage was the highest type of loss experienced by all the villages in the study area, amounting to around 70 per cent of the total respondents (Figure 17). Close to 40 per cent of respondents in Narewa and Yavusania noted that they had experienced house damage, while a little under 30 per cent expressed the same type of loss in Sikituru. Around 30 per cent of residents had experienced illness and disease from their most recent flood event. Close to 10 per cent of Sikituru and Yavusania villages had expressed that they had experienced other types of loss, while less than 3 per cent of households lost a loved one from previous flood events.

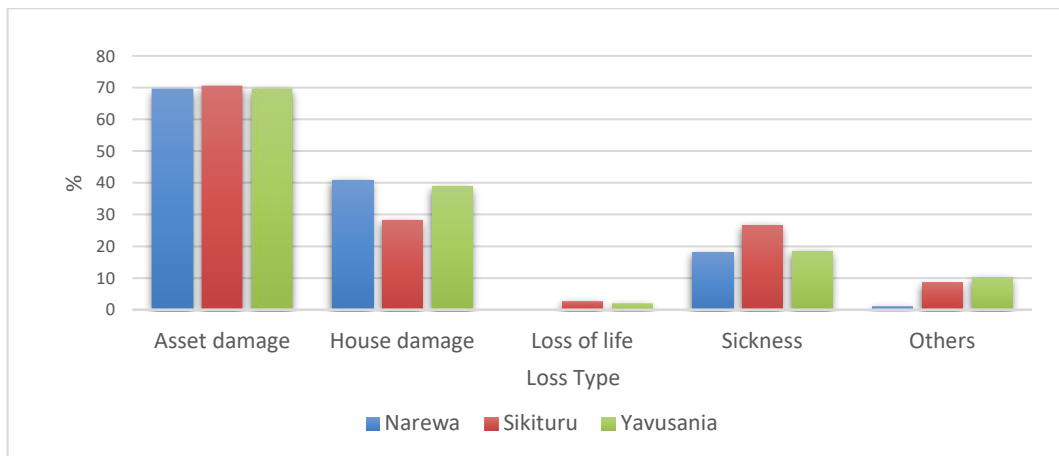


Figure 17: Types of flood loss experienced by the three villages

Figure 18 showcases the amount of money spent on repairs from the village households' most recent flood event. Most of the surveyed households had spent \$500 to \$1000 on repairing damages from their last flood event. Around 30 per cent of Sikituru, and 25 per cent of Narewa and Yavusania households spent between \$500 and \$1000 on repairs. Close to 25 per cent of households in Narewa spent more than \$2000 on repairs, while around 15 per cent of households in Sikituru and Yavusania spent the same amount. Under 20 per cent of households across the study area spent between \$1000 and \$2000 on repairs. A little over 20 per cent of households in Yavusania spent just under \$500, while

a little under 20 per cent of households in Narewa and Sikituru spent the same amount from their last flood experience. Around 17 per cent of Sikituru households noted that they did not spend anything on their most recent flood event, while around 10 per cent of households in Narewa and Yavusania mentioned that they spend nothing as well.

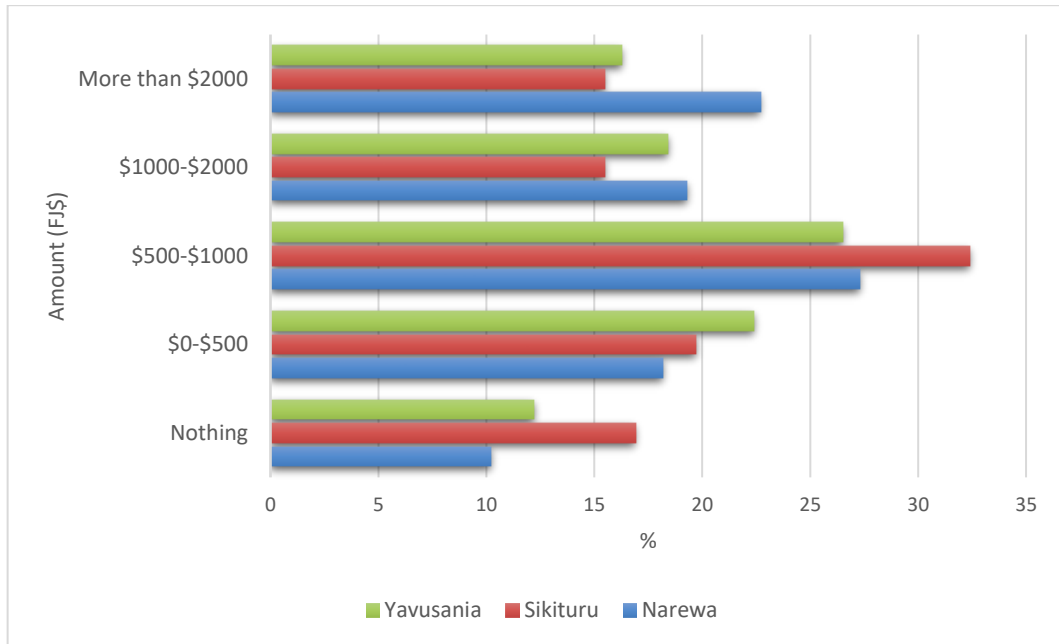


Figure 18: Amount of money spent on repairs from flood loss

Regarding the villager’s perceived causes of flood, high rainfall and poor drainage were the highest-ranked causes. Figure 19 shows that around 60 per cent of households in Narewa, 55 per cent in Yavusania and 50 per cent in Sikituru regarded flooding as being caused by high rainfall. Close to 60 per cent of the households in Sikituru and Yavusania, while 40 per cent Narewa regarded flooding as being caused by poor drainage. Around 20 per cent of households across the three villages felt that flooding was caused by improper planning and land use. Close to 15 per cent of households in Narewa and around 5 per cent of households in Sikituru and Yavusania perceived flooding to be caused by cyclones.

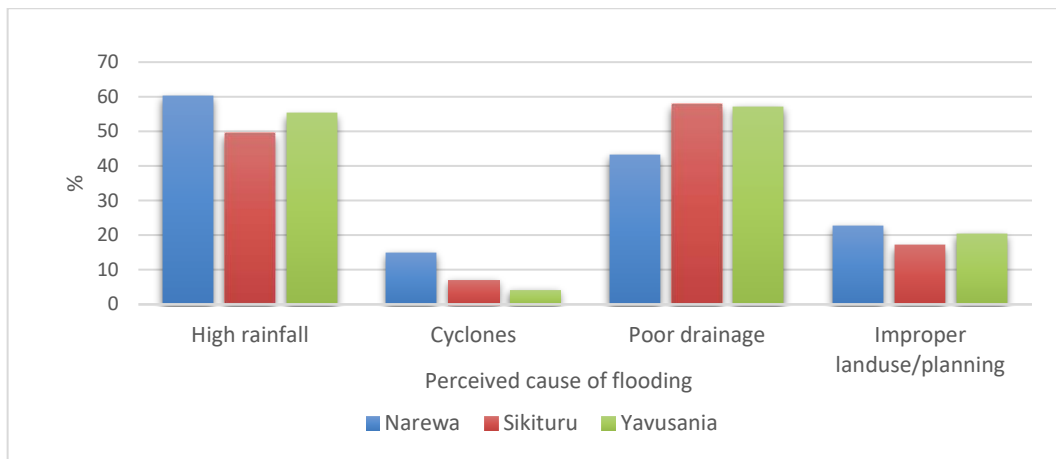


Figure 19: Perceived causes of flooding by the villages

Using radios to keep track of flood warnings is the most popular mode across all three villages with about 80 per cent of households using this form of tracking (Figure 20). About 50 per cent of households in Yavusania, 45 per cent in Sikituru and 35 per cent in Narewa use televisions to keep track of flood warnings. Close to 40 per cent of all households use mobile phones, and around 30 per cent rely on environmental signals. Family and friends usually inform about 20 per cent of households. Approximately 25 per cent of households in Yavusania, 20 per cent in Narewa and 10 per cent in Sikituru track flood warning through social media, such as Facebook.

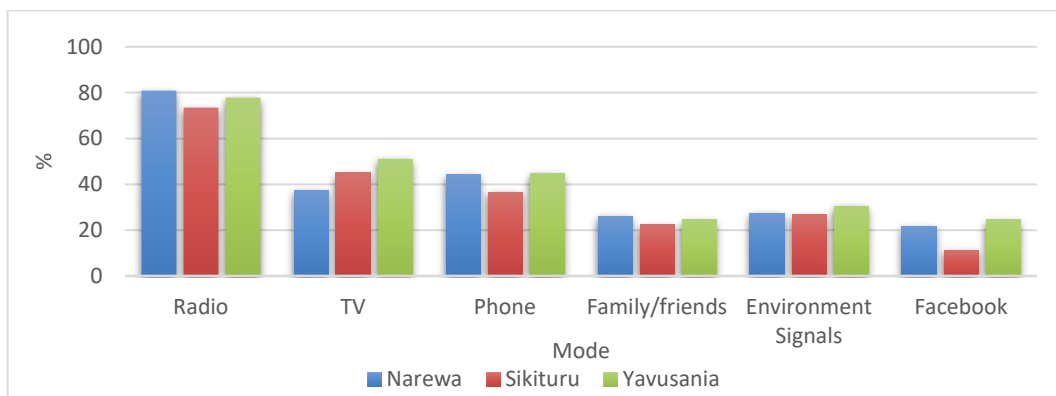


Figure 20: Modes of tracking flood warnings by the villages

Figure 21 illustrates the level of preparedness of the households in each village. Around 80 per cent of all the households noted that they were either well or very well prepared. Approximately 40 per cent of Yavusania, 30 per cent of Narewa, and 20 per cent of Sikituru households said that they were very well prepared. Close to 50 per cent of households in all the villages said that they were very well prepared. About 25 per cent of Sikituru, 15 per cent of Narewa and 10 per cent of Yavusania households said that they were only slightly prepared, while less than 4 per cent of households stated that they were not prepared.

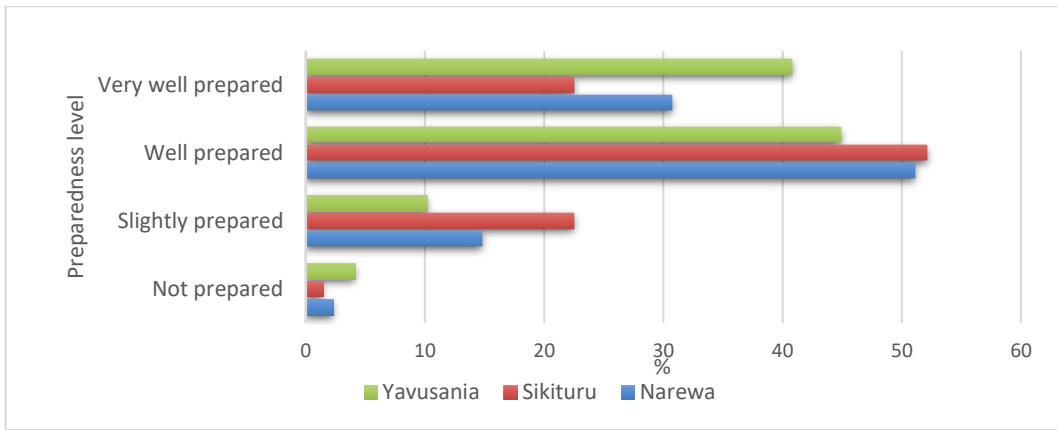


Figure 21: Perceived levels of flood preparedness by the villages

Coping strategies following a flood event are summarised in Figure 22. Around 60 per cent of all the households rely on government support after a flood. Repairing damages was the second most popular coping strategy, with around 50 per cent of Yavusania, 30 per cent of Narewa and 25 per cent of Sikituru households using this strategy. Praying was also a significant coping strategy with around 20 per cent of Sikituru and Yavusania, and 15 per cent of Narewa households utilising this strategy. Relying on family and friends after a flood is utilised by about 10 per cent of households across the three villages. Coping strategies such as loans, insurance, relocation and others comprised around 5 per cent or less.

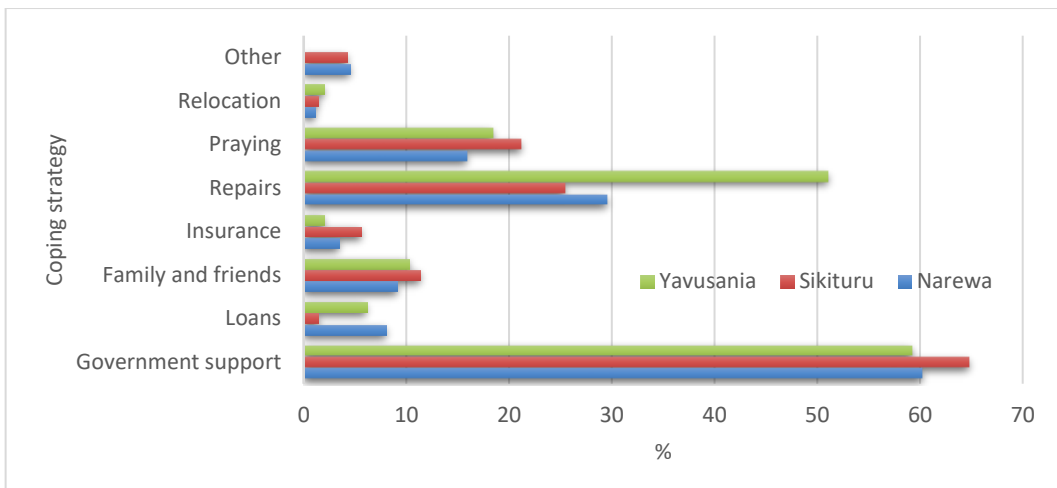


Figure 22: Bar graph showing the coping strategies of the villages

4.3.1 Relocation Likelihood and EWS Rating

Figure 23 highlights the early warning system ratings by the village households. Households are generally happy with the current early warning system present in the villages with figures of around 70 per cent of households either perceive the system to be good or very good. Between 15 to 20 per

cent of households felt the system was fair, while around 5 per cent felt the system was poor or very poor.

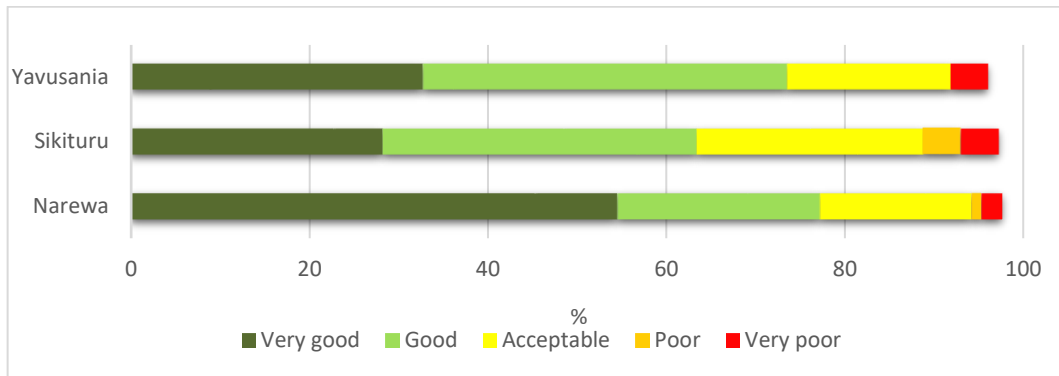


Figure 23: Graph depicting the early warning system ratings by the villages

Figure 24 highlights the relocation likelihood of village households. Around 40 per cent of households in the three villages are likely or very likely to relocate because of their exposure to floods. Around 20 per cent of Sikituru and Narewa, while 30 per cent of Yavusania households were undecided on the matter. Close to 30 per cent of Narewa and Sikituru, while 20 per cent of Yavusania households are unlikely or very unlikely to relocate because of floods.

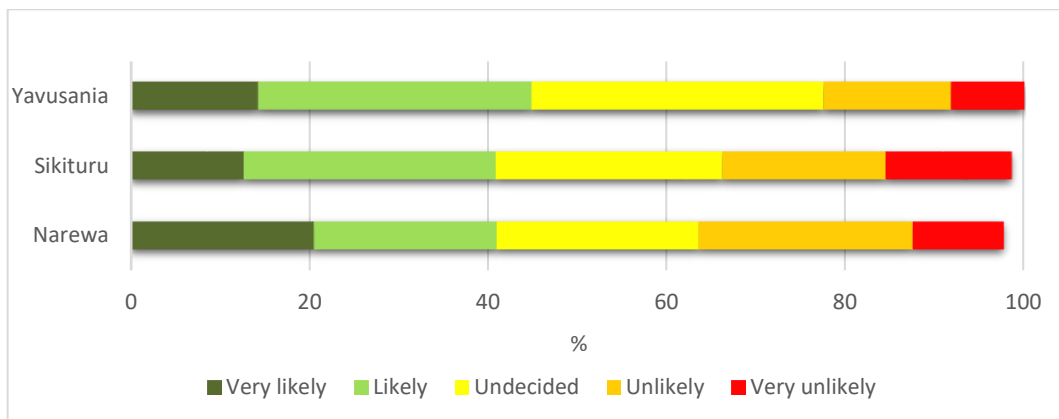


Figure 24: Graph depicting the villages' likelihood rating of relocation

4.3.2 Flooding Support

Figure 25 highlights the preparation support obtained for flood events rating. Close to 35 per cent of households in Narewa, Sikituru, and Yavusania felt that the support they are given to prepare for floods is adequate and very adequate. Approximately 40 per cent of Yavusania and 30 per cent of both Narewa and Sikituru felt that preparation support is fair. On the other hand, around 20 per cent of households in the three villages felt that preparation support is inadequate or very inadequate.

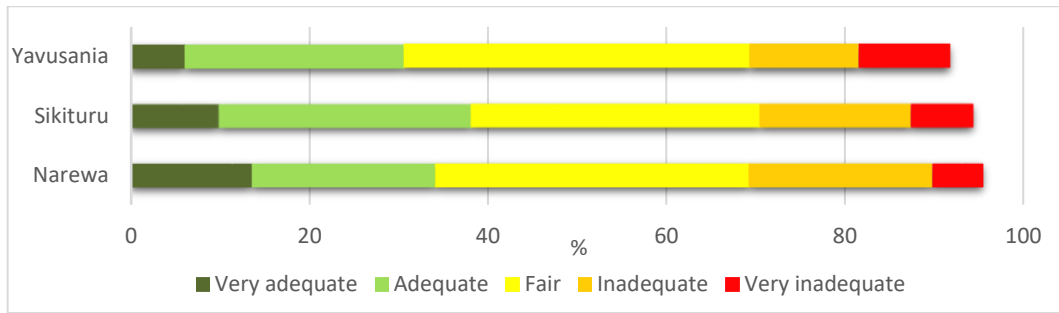


Figure 25: Graph depicting the flood preparation support rating by the villages

Figure 26 highlights the ratings of support received during flood events. Close to 35 per cent of households in Sikituru, 30 per cent of Yavusania and 25 per cent of Narewa expressed that the support they are given during floods are adequate and very adequate. Approximately 45 per cent of Narewa, 40 per cent of Yavusania and 35 per cent of Sikituru indicated that the support is fair. On the other hand, around 25 per cent of households in Narewa and 20 per cent in both Sikituru and Yavusania felt that support during flood events are inadequate or very inadequate.

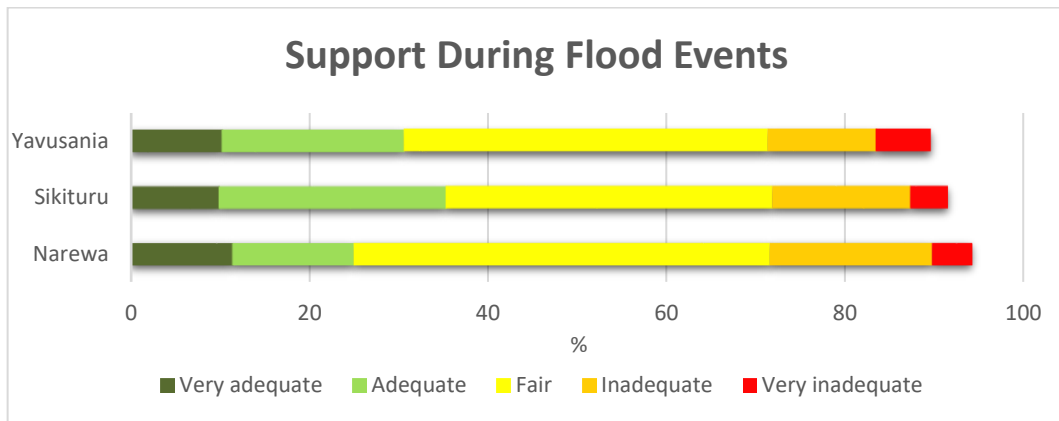


Figure 26: Graph depicting the support during floods rating by the villages

Figure 27 highlights the ratings of support received after flood events. Close to 35 per cent of Sikituru and Yavusania households, while 25 per cent of Narewa households felt that the support they receive after flood events are adequate or very adequate. Close to 40 per cent of Narewa and Sikituru households, while 35 per cent of Yavusania households indicated that the support they receive is fair. On the other hand, close to 25 per cent of Narewa, 20 per cent of Yavusania and 15 per cent of Sikituru households noted that they receive inadequate or very inadequate support after flood events.

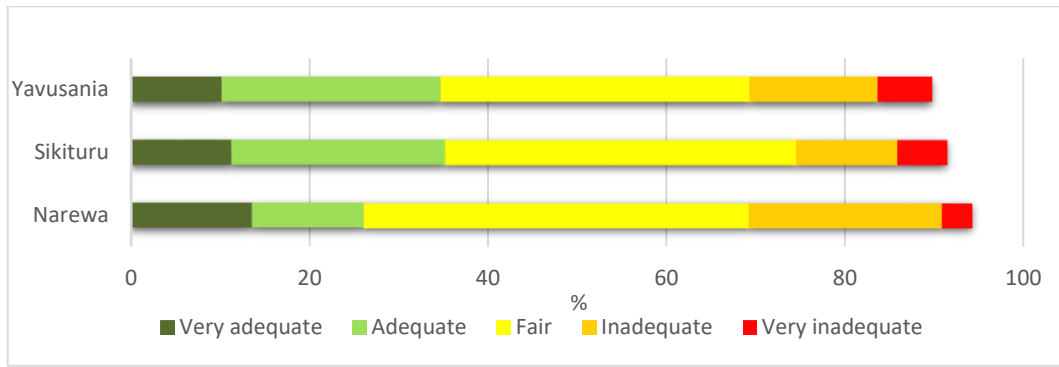


Figure 27: Graph depicting the ratings of the support received post-flood by the villages

Figure 28 highlights the ratings of disaster awareness and disaster education in the study area. Close to 40 per cent of all the households expressed that they have adequate access to disaster information. Around 40 per cent of Sikituru and Yavusania households, while around 30 per cent of Narewa households felt that they receive a fair amount of disaster education. On the other hand, approximately 25 per cent of Narewa, 15 per cent of Yavusania and 10 per cent of Sikituru households expressed that the disaster information and education they have access to are inadequate or very inadequate.

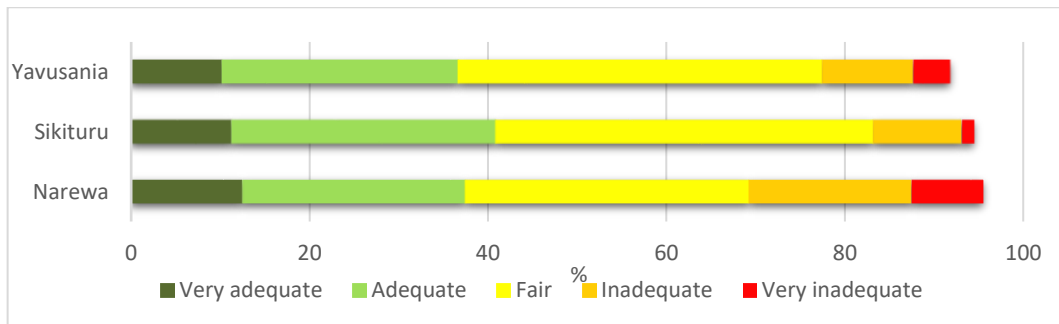


Figure 28: Graph depicting the rating of the flood awareness and disaster education accessible by the villages

4.4 Flood Risk Perceptions

Focus group discussions were used to determine the flood risk perceptions of the men and women of Narewa, Sikituru and Yavusania villages. Three approaches were used to investigate their perceptions, namely determining the types of livelihood assets the villages use during flood events and their importance, rated flood impacts and their coping strategies, and their perceptions on their village's resilience level. The discussions were carried out as gender-separate groups. Hence the results are presented as separate male and female groupings.

4.4.1 Modified Livelihood Matrix

Table 12 illustrates the top six main assets (out of 21) used or preferred by men in the three villages, ranked in order of importance, while the rest of the assets and their rankings can be found in Appendix D.1. Owning and the use of a boat was the highest-ranked asset across the three villages, with Narewa men rating it as high and both Sikituru and Yavusania men as of medium importance. Training and flood risk awareness was ranked second, while food/water and a village disaster budget were tied as third. Consumables such as kerosene, candles and torches had the fourth-highest importance, and having a disaster committee was the fifth most important. Also, the majority of the assets composed of physical assets, followed by human, financial then natural, while there were no social assets listed.

Table 12: The six most important assets as rated by the men's group discussions

MEN					
Asset	Capital Type	Narewa	Sikituru	Yavusania	Rank
Boat	Physical	High	Medium	Medium	1
Training and awareness of flood risk	Human	Medium	Low	Medium	2
Food/Water	Physical	High	Medium	Low	3
Village disaster budget	Financial	Low	Medium	Medium	3
Fuel (kerosene, candles, torches)	Physical	High		Low	4
Disaster committee	Human		Low	Medium	5
KEY:	High		Medium	Low	

Table 13 illustrates the six main assets (out of 21) used or preferred by women in the three villages, ranked in order of importance, while the remaining assets and their rankings can be found in Appendix D.2. Having money or personal savings was ranked the highest by the women of the three villages. Sikituru and Yavusania women rated money as 'very high' and 'high' respectively, while Narewa women rated it a medium. High-rise house, having a farm or plantation, and food and water were second, third and fourth highest ranked asset by the women. Owning solar power panels was ranked fifth and knowing how to farm vegetables or root crops was the sixth-highest asset. Like the men,

physical capital made up the majority of the listed assets, followed by natural, human, then financial, while there were no social assets listed.

Table 13: The six most important assets as rated by the women’s group discussions

WOMEN					
Asset	Capital	Narewa	Sikitoru	Yavusania	Rank
Money, personal savings	Financial	High	High	High	1
Raised house	Physical	High	Medium	Medium	2
Farmland/plantation	Natural	Medium	High		3
Food/Water	Physical		Medium	Medium	4
Solar Power Panels	Physical	Medium	Medium	Medium	5
Knowing how to plant vegetables/root crops	Human			High	6
KEY:					
	High		Medium		Low

In terms of the assets that would strengthen flood resilience for the villages, financial assets were the third most popular asset in the men’s focus group discussion, while for women, it was their fourth. However, money and savings were rated as the most crucial asset by women, while men rated it as the twelfth most important. The financial assets listed by the men that related to strengthening flood resilience (in terms of assets used to aid with preparation, response, and recovery) included having a village disaster budget, money or savings, and the sale of crops, while women only listed money or savings. Physical assets were the most popular assets listed in both the men’s and women’s focus group discussions. However, owning a boat was rated as the most important asset by the men while women rated it as the seventh most important. The physical assets listed by men related to flood resilience include having a boat, sufficient food and water, fuel, a raised house, first aid kit, resistant crops, gumboots, radios and ropes; while women listed high-rise house, sufficient food and water, solar power panels, boat, fuel, kerosene, first aid kits, cleaning equipment, evacuation centre, clothes, road access, car, furniture and owning a generator.

Natural assets were the fourth most popular of the listed assets in the men’s focus group discussion, while for women, it was the second. The natural assets listed by men related to increasing flood resilience include having resistant crops and livestock, while women listed owning land, stocking up on root crops, seeds and owning livestock as factors that strengthen flood resilience. There were no listed assets by the men and women that could be categorised as social capital during the focus group discussions. Human assets were the second most popular of listed assets in the men’s focus group discussion, while for women, it was the third. The human assets listed by men related to increasing flood resilience include training and awareness of flood risk, having a disaster committee, knowing an evacuation plan, knowing how to read the weather, knowing how to swim, knowing first aid, and

having knowledge of carpentry. The women listed knowledge of farming, knowing how to swim, and knowing how to cook as human assets that contribute to flood resilience.

4.4.2 Flood Impacts and Coping Strategies

Flood impacts and their ratings were gathered from the men and women of Narewa, Sikituru and Yavusania villages. Figure 29 below summarises the different flood impacts and their ratings as determined by the focus group participants from Narewa village. Both men and women found damage to farm and crops, sickness, and damage to the water supply as having high impacts on Narewa village. They also had similar views on road damage and disruption to school or work as having a moderate and low impact respectively. On the other hand, they had different views when it came to livestock death, house and infrastructure damage, and power outage. Here, men felt that these impacts had a medium impact rating while women felt that they had a high impact rating. A summarised table showcasing all the listed impacts, the impact’s rating and their coping strategy for Narewa village is shown in Appendix D.3.

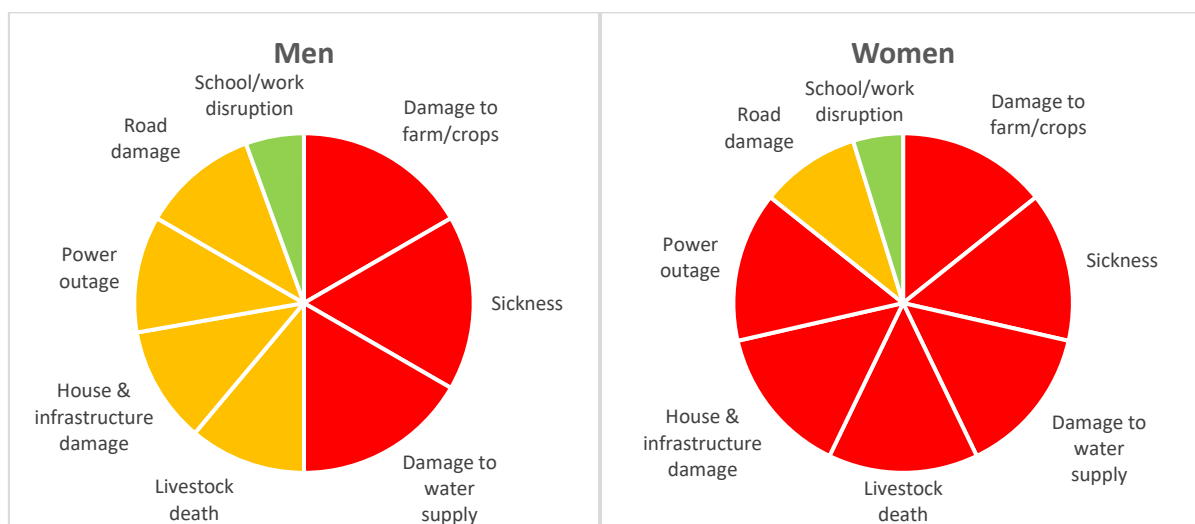


Figure 29: Pie chart highlighting the rated common flood impacts by the men and women of Narewa. Key: Red = High, Yellow = Moderate, and Green = Low

Figure 30 below summarises the different flood impacts and their ratings as determined by the focus group participants from Sikituru village. Both men and women found house damage, unclean water and contamination, poor sanitation and rubbish, poor drainage and stagnant water, and power outages as having high impacts on the households of Sikituru. On the other hand, they had different views when it came to road damage, furniture damage, destruction of crops and livestock, and sickness. Here, men felt that road and furniture damage were high while women thought them moderate, and men thought the destruction of livestock and crops, and sickness as moderate, while women thought them to have a high impact. A summarised table highlighting all the listed impacts, the impact’s rating and their coping strategy for Sikituru village is shown in Appendix D.3.

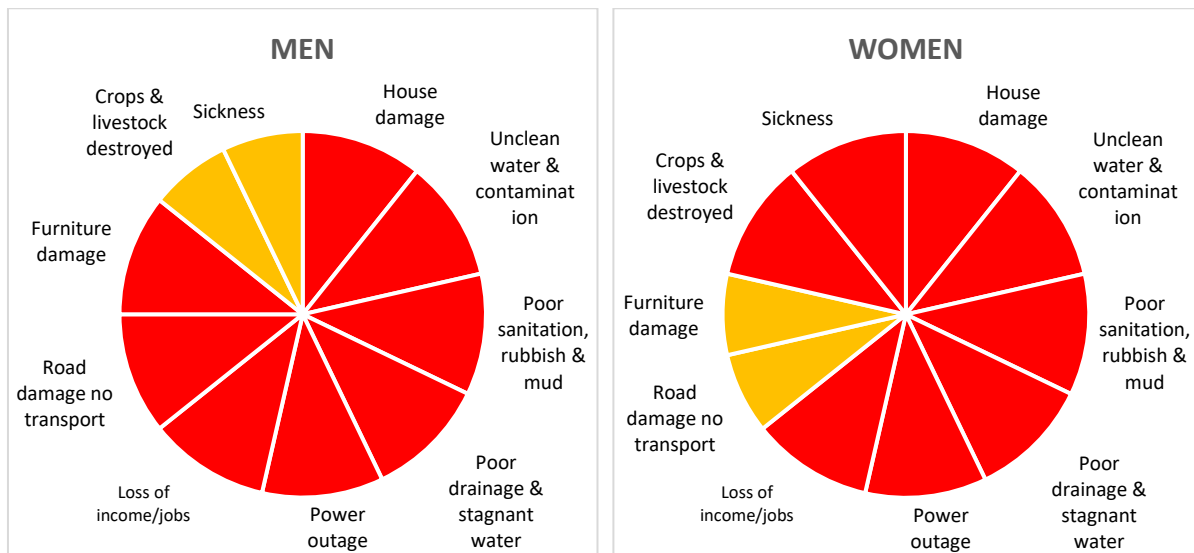


Figure 30: Pie chart highlighting the rated common flood impacts by the men and women of Sikituru. Key: Red = High, Yellow = Moderate, and Green = Low

Figure 31 below summarises the different flood impacts and their ratings as determined by the focus group participants from Sikituru village. Both men and women found damage to farms and crops, road damage, soil erosion, and sickness as having high impacts on the households of Yavusania. On the other hand, they had different views when it came to power outages, dead or missing livestock, house and furniture damage, and loss of life. Consequently, men felt that power outages had a high impact, while women thought them moderate. Also, Yavusania men felt that dead or missing livestock, house and furniture damage, and loss of life as having a low impact, while women felt that these had high impacts on the village. A summarised table highlighting all the listed impacts, the impact's rating and their coping strategy for Yavusania village is shown in Appendix D.3

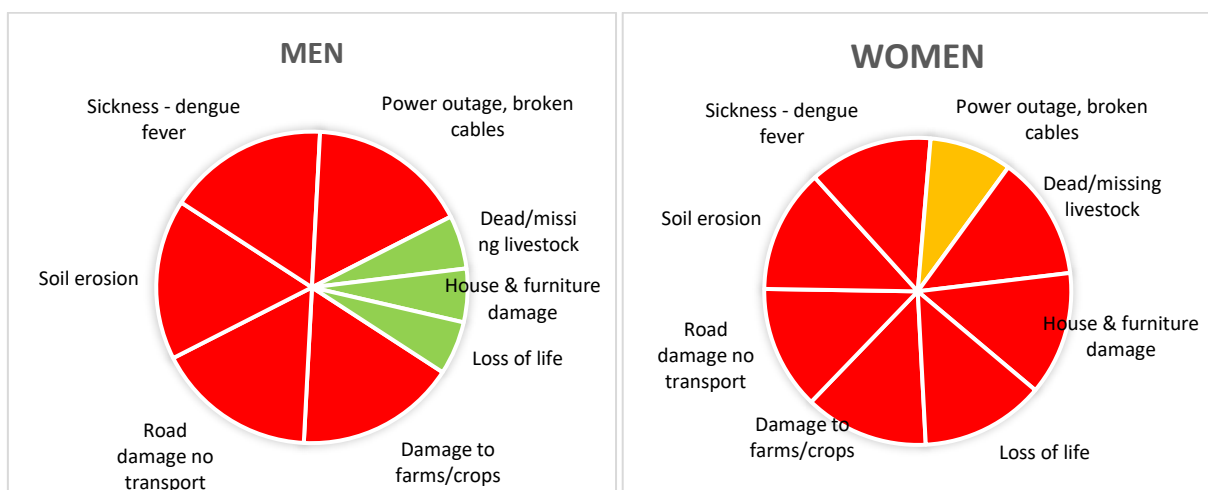


Figure 31: Pie chart highlighting the rated common flood impacts by the men and women of Yavusania. Key: Red = High, Yellow = Moderate, and Green = Low

The most common flood impacts that affect all three villages as listed by men include power outages, damage to roads, sickness, damage to houses/infrastructure and livestock death. Power outage and

road damage were rated 'high' by Sikituru and Yavusania while 'low' by Narewa. Also, damage to house or infrastructure received mixed ratings and was 'high' for Sikituru but 'moderate' for Narewa, and, surprisingly, 'low' Yavusania men. On the other hand, the most common flood impacts captured from the women's group discussion include damage to houses and furniture, destruction of farms and livestock, sickness, results in poor drainage, disruption of water and electricity supply, road damage, and disruption of school services. Notably, the first four out of the six common impacts were rated as 'high' by all three villages. Disruption of electricity and water were rated 'high' by Narewa and Sikituru, while 'low' by Yavusania; road damage was 'high' by Yavusania, while 'moderate' by both Narewa and Sikituru; and disruption of schools was 'high' by Sikituru, while 'low' by both Narewa and Yavusania.

The men's coping strategies for their commonly listed impacts include: reporting to the Electricity Fiji Limited (EFL) or using candles and torches during power outages, not doing anything or just walking when the roads are damaged, repairing or rebuilding damaged homes, and not doing anything when livestock are killed during floods. Otherwise, the women's coping strategies for their common impacts comprise not doing anything or planting vegetables in plastic bottles after the flood has destroyed their land; cleaning drains/tunnels and requesting government assistance when drains are blocked, and clearing trees and informing the relevant authorities for blocked or damaged roads.

4.4.3 Resilience Perception

In order to gauge how the men and women of Narewa, Sikituru and Yavusania villages perceive the resilience of their villages, they were asked to mark on a scale of zero to ten, with zero having no resilience and 10 being highly resilient, on how resilient they thought their village was and why. Figure 33 summarises their choices. Firstly, Narewa men feel that their village has a resilience rating of 7. This is because "there are still a lot of things to be done" (Man 1), and "the [village] committee is not perfect; we know we can do much better" (Man 2). On the other hand, Narewa women felt that their village has a resilience rating of ten. This is because "from 2012, the villagers are aware, and most of them know what to do when the warning is given" (Woman 1). Also, "people who have houses with low foundation, they know they have to put everything high" (Woman 2).

As for Sikituru men, they felt that their village has a resilience rating of nine because "we believe when there is a flood, we are always well prepared" (Man 3), "small shortcomings in preparation" (Man 4), and "now when a house is built, the main thing to consider is flood" (Man 5). Alternatively, Sikituru women felt that because "we have two community halls which are used as evacuation centres and a disaster committee" (Woman 3), "[we have] sirens, it gives a warning, and the village headman beats the lali" (Woman 4), and "mobile networks...gives the warning...to be alert and prepared" (Woman 5); they have chosen six as their village's resilience rating.

Yavusania village men are on the border with their resilience rating of five. This is because “it is 50-50” (Man 6). However, their female counterparts felt that Yavusania village is highly resilient with a rating of ten. This was mainly because “we are used to it and are very well prepared, and we have a flood warning gauge and rain gauge... [that] passes on a message that the water is coming” (Woman 6), and “we have a disaster committee, and disaster response plan, that helps informs us and helps you know what to do when the disaster comes” (Woman 7).

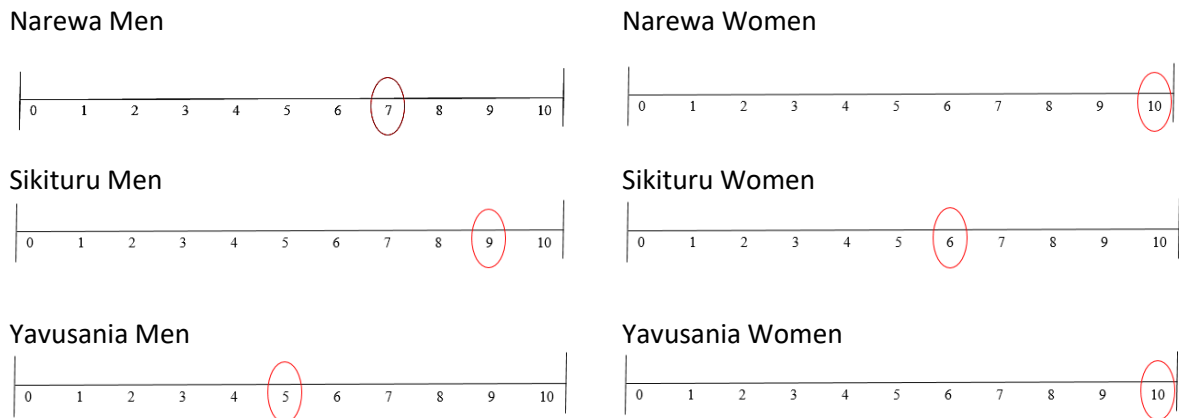


Figure 32: Perceived village resilience by the men and women during session 3 of the group discussions

Overall, Narewa women and Yavusania women indicated that their villages had high resilience compared to their male counterparts, while the Sikituru men and women see the opposite.

4.5 Spatial Vulnerability

Information gathered from the household survey was used to map out the five livelihood asset scores for each household, as well as attributes that represented the degree of flood effect, flood water level, level of preparedness and, flood resilience level.

There were no distinct spatial patterns observed from the five livelihood capitals maps developed. However, there are apparent differences in houses that are strong in one capital and weak in another (Figures 33 to 35). A description of the averages, maximums, and minimums was described in Section 4.2.6. Results from the analysis of the degree of flood effect showed that floods had severely impacted close to two-thirds of the surveyed households while about a third have only suffered minor impacts. Apart from these statistics, there are no distinct spatial patterns of the degree of flood impacts of the households (Figure 36).

The households were asked to note how high the floodwaters were from their most recent flood event. The results indicated that around 35 per cent of households noted that the previous floodwaters were

up to 2 m high, 21 per cent noted up to 1 m, 20 per cent noted up to 3 m, and 20 per cent noted 4 m high and over. The most common flood level expressed by all three villages was up to 2 m high, while close to one-quarter of households in Yavusania and one-fifth of households in Narewa revealed that floodwaters were over 3 m high (Figure 37).

The participants were asked to rate their level of preparedness from 'very well', 'well', 'slightly' to 'not prepared at all'. Findings from the analysis highlighted that the majority of the households across the three villages reported they were well prepared (Figure 38), while combined figures up to 80 per cent are in the 'well' to the 'very well-prepared' range. Around ten to twenty per cent of households are slightly prepared while a handful of families expressed that they were not prepared at all. Despite these figures, there are no discernible patterns of the level of preparedness of the households.

The livelihood score for each household was added to the flood risk score to yield the 'resilience score'. No distinct resilience patterns of the surveyed houses in the three villages was apparent from viewing the spatial distributions using ArcGIS (Figure 39). However, a few noteworthy points include: the majority of households in Narewa and Yavusania have 'high' resilience scores while Sikituru's scores were mainly 'moderate'; there are more households with 'very low' resilience scores than 'very high' in Narewa and Sikituru while Yavusania has equal figures; there are equal number of homes with 'high' to 'very high' and 'low' to 'very low' resilience in Narewa, Sikituru had more 'low' to 'very low' than 'high' to 'very high', and Yavusania had more 'high' to 'very high' than 'low' to 'very low' resilience scores.

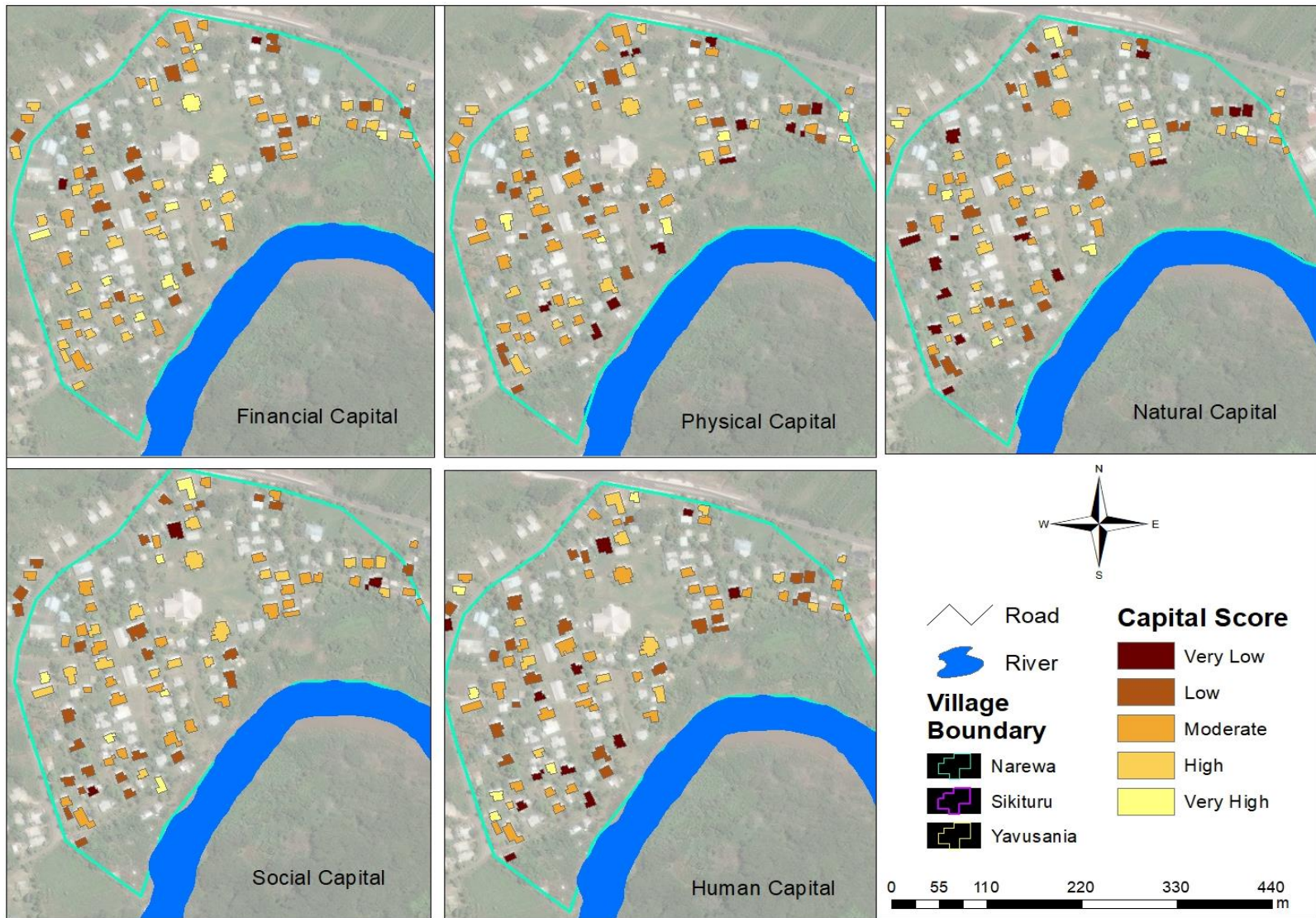
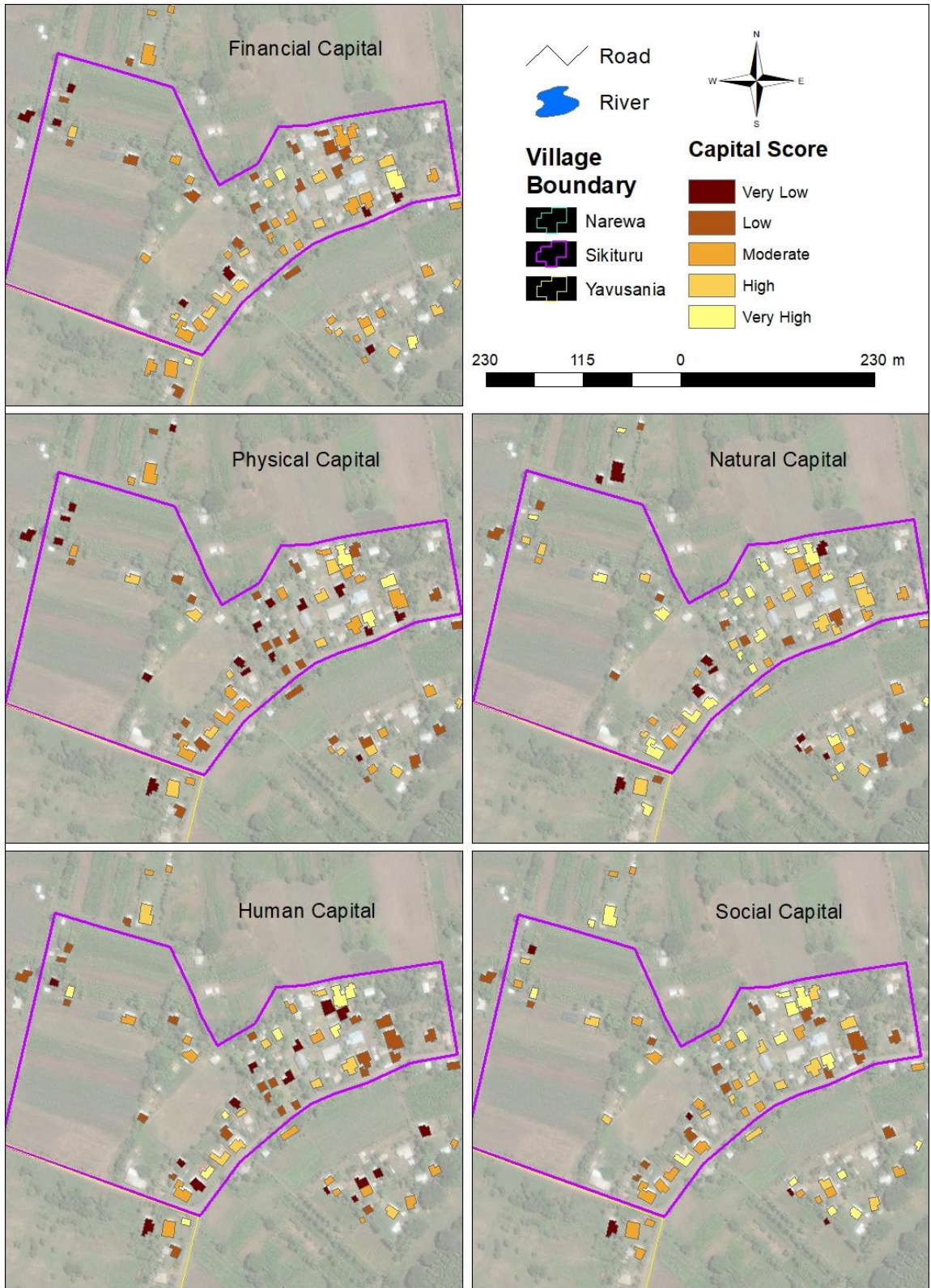


Figure 33: Map of Narewa Village highlighting the five livelihood scores for each household



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Figure 34: Map of Sikituru Village highlighting the five livelihood scores for each household

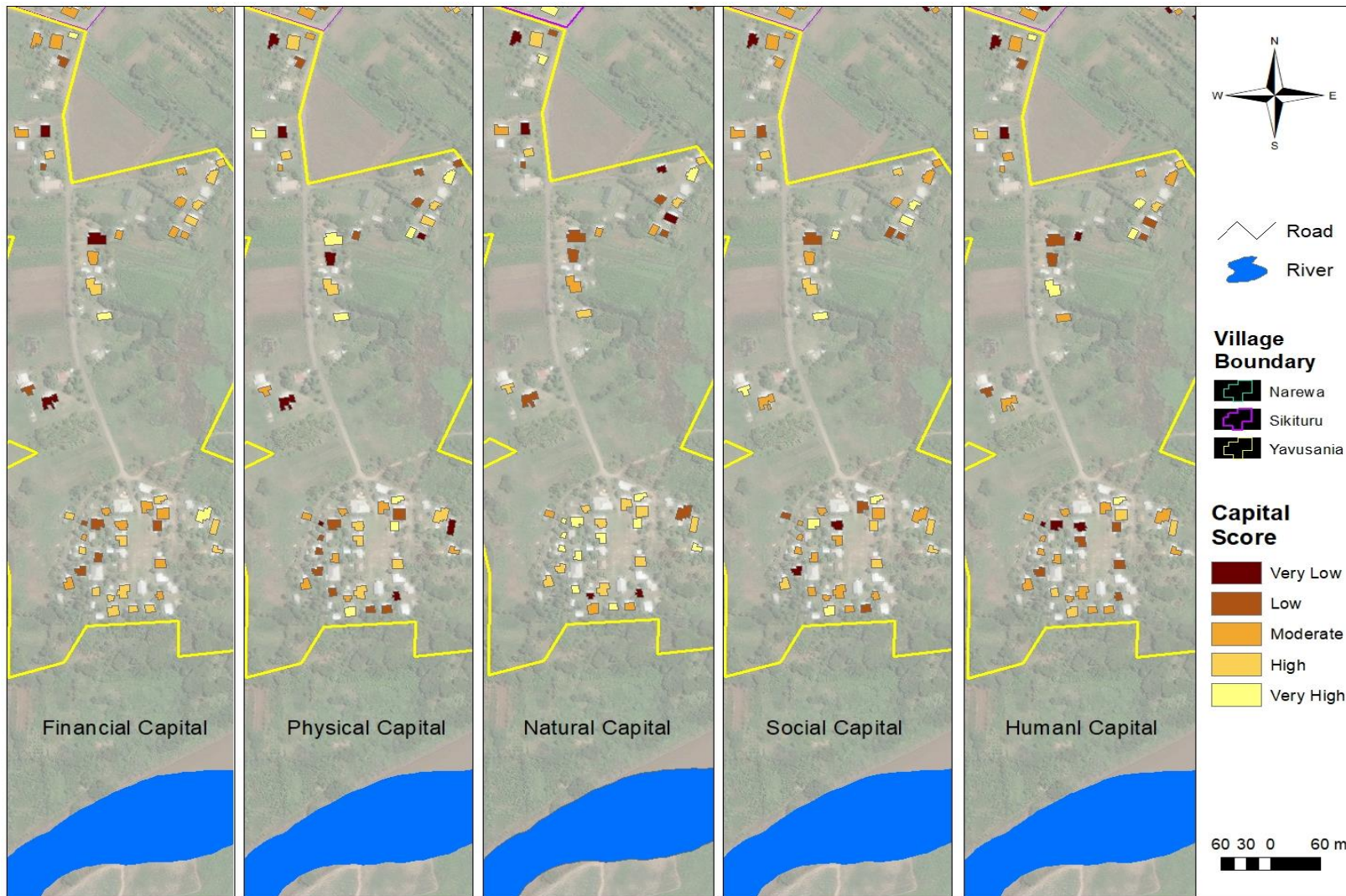


Figure 35: Map of Yavusania Village highlighting the five livelihood scores for each household

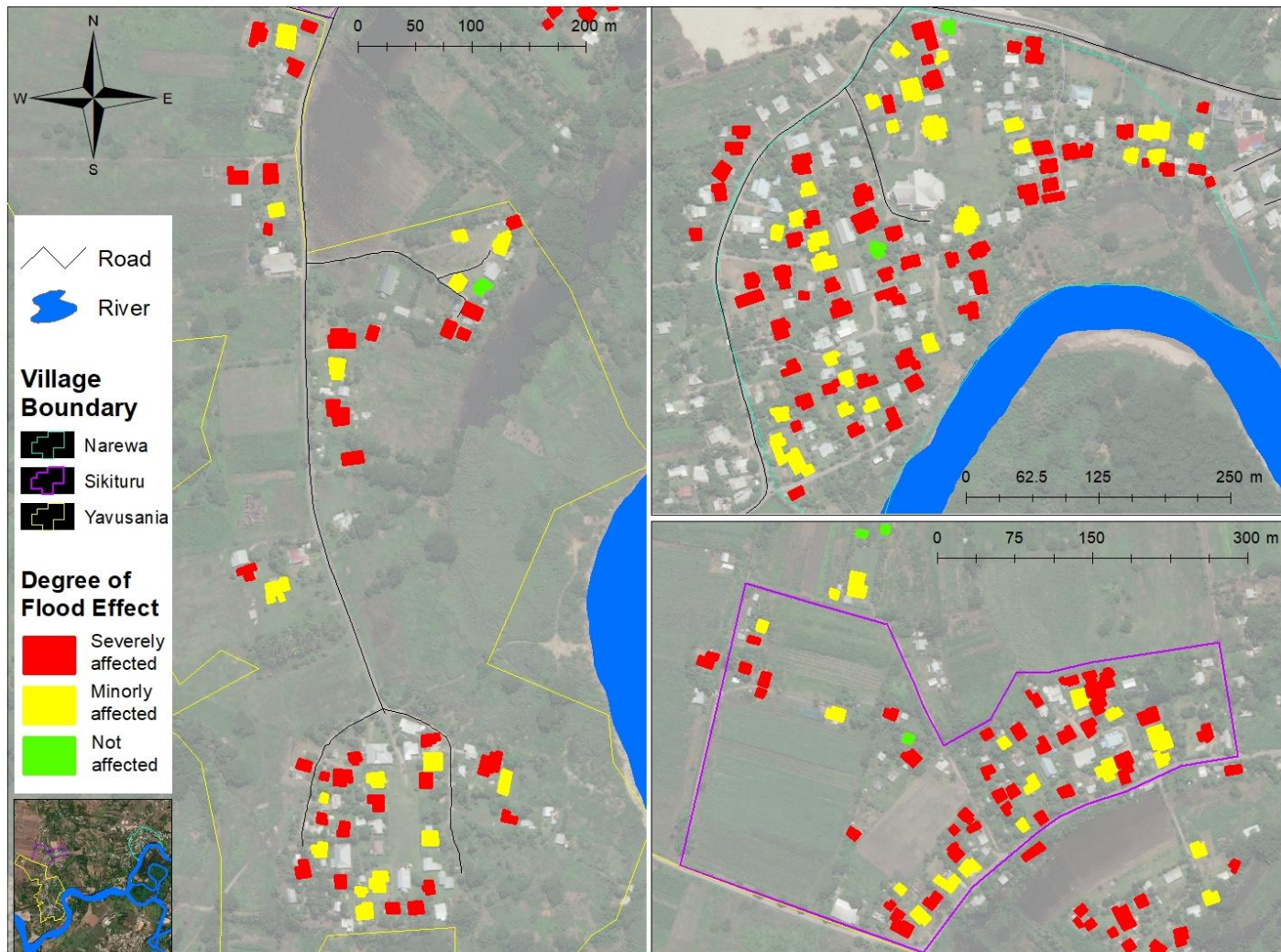


Figure 36: Map of the three villages highlighting the degree of flood effect from their recent flood experience



Figure 37: Map for the villages showcasing flood water heights from their recent flood event

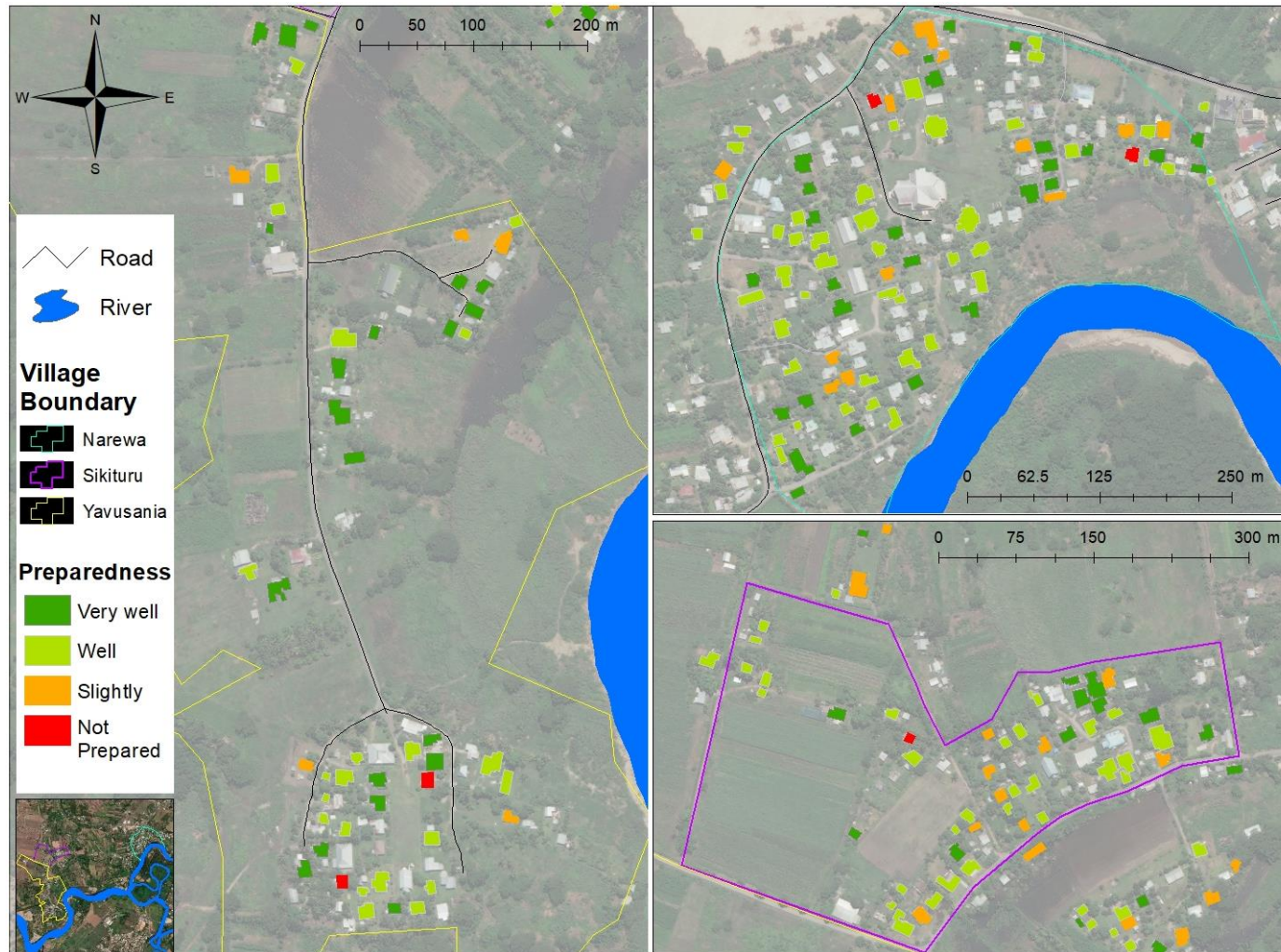


Figure 38: Map of the three villages depicting their perceived flood preparedness level



Figure 39: Map of the three villages illustrating the overall flood resilience levels of the households

4.6 Chapter Summary

This chapter presented the findings from the employed methods of assessing the level of livelihood vulnerability of the three villages in the Nadi River basin. Around 250 questionnaires were distributed across Narewa, Sikituru and Yavusania based on the livelihood asset component of the sustainable livelihood framework, which included information relating to financial, physical, natural, social, and human capital. A livelihood score, which attempted to quantify the five capital types, was calculated and presented to showcase the livelihood vulnerability of the village households. Also, information on the household's flood risk status was gathered, which focussed around flood effects, flood loss, level of preparedness, perceived causes of flooding, tracking floods, coping strategies, and flood support. The second part of the results assessed the villager's perceptions on livelihood asset priorities related to floods, flood impacts and coping strategies and resilience perceptions. Cumulative information from the questionnaire was used to develop exposure and vulnerability maps of the village area. There were no distinct spatial patterns of vulnerability from the generated maps. The next chapter will attempt to discuss these findings and conceivably shed some light on the livelihood vulnerability of the flood-prone villages.

5

Discussion

This chapter draws together the quantitative (household questionnaire), the qualitative (focus group discussions) results along with the spatial analyses and discusses the findings in relation to relevant existing literature and empirical works. The study adopted a mixed-methods approach to assess the level of livelihood vulnerability of villagers living in flood-prone areas of the Nadi River Basin and to determine their perceptions of flood risk, evaluating if there are spatial patterns to their vulnerability. This chapter first discusses the status of livelihood assets owned by flood-prone villagers in the Nadi River Basin, then the flood risk perceptions of the villagers; and, finally the exposure and vulnerability patterns of the village communities

5.1 Livelihood Vulnerability

Livelihood assets are not just a person's means of living but give "meaning to a person's world" (Bebbington, 1999, p. 2022) and, the access to assets may be the most significant asset of all when referring to attaining sustainable livelihoods (Bebbington, 1999). The results from the previous chapter highlight that the households in the three villages have varying ownership and access to specific livelihood assets. The study does not go into precise details for each livelihood capital but instead examines general areas of each to paint a picture of the level of livelihood assets of the village households. This section addresses the status of livelihood assets owned by flood-prone villagers in the Nadi River Basin. Here, each of the five livelihood capitals owned and accessible by the villages are evaluated, integrating service ratings and asset priority from both quantitative and qualitative analysis.

5.1.1 Financial Capital

The results from the analysis of the financial assets indicate that the majority of households within the study area have predominantly one to two income earners that earn up to FJ\$ 500 (NZ\$359) a month, and the majority spend up to 40 per cent of their monthly income on food items. According to the Household Income and Expenditure Survey (HIES) 2008-09, the average annual income of rural households sits at FJ\$ 11,608 (NZ\$8,339), which is about FJ\$ 970 (NZ\$696) per month (Fiji Bureau of Statistics (FBoS) & Narsey, 2011; Government of Fiji et al., 2017). The results from the study indicate that the incomes of people in these villages are well below the country's average, highlighting that this could be a significant influence on the households' resilience level to hazards because, in a community, the lowest-income households tend to have the highest vulnerability to environmental hazards (Blaikie et al., 2005; Rumbach & Shirgaokar, 2017; Taş, Taş, Durak, & Atanur, 2013). Poor people in Fiji spend close to 29 per cent of their income on food, while some spend even more (Fiji Bureau of Statistics

(FBoS), 2016). The findings from the study suggest that the villagers spend considerably more than the average (40 % of their income). Interestingly, only about 51 per cent of people aged 15 and above have bank accounts in rural areas (Fiji Bureau of Statistics (FBoS), 2017). This could be a reason for low financial security; however, income from land leases provide subsidiary support of the livelihoods of the villagers.

Despite overseas remittances being a low form of secondary revenue in the study, the 2008-09 HIES reported that rural households in the western division draw in around FJ\$ 9 million (NZ\$6M) from foreign remittances (double that of the rural eastern), and contributes close to FJ\$ 250 million (NZ\$179M) into the economy (Fiji Bureau of Statistics (FBoS) & Narsey, 2011). The HIES 2008-09 report also states that loan repayments and religious contributions are high forms of expenditure for the people of Fiji (Fiji Bureau of Statistics (FBoS) & Narsey, 2011). Results from the study suggest the same for loan repayments; however, while the study did not include religious contributions as one of the options, there was an option for 'other expenditure' that the respondents could have filled in.

It was interesting to note that not many people have access to adequate insurance cover for their homes, cars, or even life insurance. This lack of insurance could be due to several reasons, such as the villagers cannot afford it, insurance companies do not want to provide cover, or the claims process could be difficult and time-consuming. A recommendation for future research would be to examine more profound reasons underlying the lack of financial assets. The study focused on the household's assets, as other researchers have done, which may have missed crucial secondary system components that a more holistic systems approach might take. Such issues may be exacerbated post-disaster as experienced in Bua where women fishers expressed their hardships of trying to gain access to credit or finances to cope with the challenges of rebuilding their livelihoods (Thomas, Mangubhai, Vandervord, Fox, & Nand, 2019). There are plans in place to bridge this insurance gap by the national government as support towards JICA's 'Project for the Planning of the Nadi River Flood Control Structures' has led to investigations into expanding housing insurance and social safety nets (Government of Fiji et al., 2017).

The results from the group discussions suggest that women value money over men as an essential asset to help strengthen their flood resilience and that having enough money allows them to purchase other assets during times of crises. Other studies in Solomon Islands and other parts of Fiji have highlighted women's favour of having cash whereby it is used to meet household's material needs, provide support for children and fulfilling social obligations such as church donations, expressing that by doing so, they receive respect from family and friends (McKinnon, Carnegie, Gibson, & Rowland, 2016). Overall, the financial capital score was observed to be the lowest scoring capital out of the five livelihood capital scores, while the data suggested that Yavusania had higher financial resilience than

Narewa and Sikituru. Possible reasons for this is because there are less households in Yavusania compared to Narewa and Sikituru – this may have an influence on the statistical calculations of financial resilience. Notably Yavusania only surpassed Narewa and Sikituru by a resilience score of 16.83 and 13.35 respectively. The small difference could have been due to Yavusania villagers having more family members overseas sending them money through remittances, more income earners to household ratio, and close to half the households have at least one form of insurance.

5.1.2 Physical Capital

Housing structures such as walls, floors and roof types, can serve as predictors of vulnerability to flood hazards and that those who invest in better housing materials have a lower chance of facing severe damage during hazard events (Rumbach & Shirgaokar, 2017). The findings from the analysis of the physical assets of the households demonstrate that many of the houses are made from sturdy building material and generally, were built over nine years ago. About half of the houses had concrete walls and floors, while a third had their floors tiled. Timber frame and flooring made up the second most popular structure, and the last was iron cladding. Although the construction of timber-framed houses is cheaper than concrete, the majority of the houses in the villagers are made of concrete which implies that the villagers have invested in structurally sound housing that can withstand the impacts of natural hazards (cyclones and floods) and that it does not correlate with the HIES 2008-09 report that stipulates iron house types comprise the majority of house types in rural areas, followed by wooden then concrete (Fiji Bureau of Statistics (FBoS) & Narsey, 2011). Suffice to say, the construction of many of the houses should be able to withstand most of the hazards they are exposed to and contradicts, for this area at least, the Government's general view (Government of Fiji, 2018) that much of the rural house construction types are not very climate-resilient or built with climate/disaster risk in mind.

Aquino et al. (2018) suggest that many of the houses found in village settings are built by the villagers themselves, who tend to have little formal education in engineering or construction and whose knowledge has been passed down through generations. Although this type of information was not gathered in the survey, the fact that three-quarters of the houses were constructed over nine years ago and withstood some devastating floods and cyclones can attest to the sturdiness of the construction quality. These results support Hallegate et al.'s (2018) suggestion that more robust reconstruction could decrease the overall disaster-related livelihood losses by more than 40 per cent.

Thulstrup and Bervoets (2018) suggest that vulnerable populations have very limited access to cooking fuel which has a considerable impact on their nutrition and in turn their livelihoods. Consequently, the access to different types of cooking fuels was investigated to add to the assessment of the livelihood vulnerability of the households. The use of kerosene was the most popular across all the villages; however, the use of gas over firewood was observed from Narewa and Yavusania villages, while in

Sikituru, more people used firewood than gas. In Fiji, kerosene is a cheaper fossil fuel compared to gas while gathering or using firewood requires more time and effort. The HIES 2008-09 report states that popular cooking methods in rural areas range from wood, kerosene, gas then, least popular, electricity; however, the overall results from this research suggest kerosene, gas, wood then electricity. Interestingly, Sikituru uses wood more than gas as cooking fuel. These findings could be due to the fact that the villagers are located very close to urban centres and will have an urban influence on their way of life. Kerosene is readily available in the nearby shops (Nadi town or the nearest supermarket is only 5 minutes away by taxi) which requires less effort than using firewood.

Many households stocked a first aid kit over an emergency food kit, about one-fifth of households, owned a car, less than a handful owned a diesel generator, and about two people owned a boat. The lack of an emergency food kit implies that food is not a big priority when preparing for disasters; instead, it could be gathered quickly before a crisis. Rumbach and Shirgaokar (2017) propose that residents who have access to a generator stipulate the ability and financial security to increase flood resilience. The findings indicate that only a handful of households own a generator and that the assurance of financial security is also not apparent, as seen from the previous section. Only a relatively small portion of villagers own cars and this is also reflected in the report from Fiji Bureau of Statistics (FBoS) and Narsey (2011).

Electricity, water and public transport services all generally received adequate ratings, while waste management was predominantly rated as inadequate. The adequate ratings of the electricity, water and public transport services by the households indicate they were happy with the current provisions. In the past decade, and even more so after Cyclone Winston (2016), the Fijian Government has made significant improvements to infrastructure management and trying to reduce infrastructure vulnerability to natural hazards (Government of Fiji et al., 2017). Interestingly, a few days into the survey, a roadside collection service had been implemented in Narewa instead of residents having to take their waste to the communal skip bin.

The findings from the group discussions suggest that men value owning a boat as an essential asset to help strengthen their flood resilience and that having a boat can increase the efficiency during evacuation and response times, as well as, be used by the youths or for tourist activities during normal times. Their value of having a boat was not obvious from the household survey as only two household indicated that they owned a boat. This is however reflected in the action plan by the villagers to purchase a boat as they know the costs and how to go about purchasing one. It will be worthwhile to return to the village in a year or two to assess if more boats were purchased or the action plan was carried out successfully or not. Overall, the physical capital scores of the villagers were midway of the other capitals and that Yavusania had higher physical capital resilience than Narewa and Sikituru.

5.1.3 Natural Capital

The results from the questionnaires imply a heavy reliance on land, more so than the river, as a source of livelihood and that rearing livestock is not very popular in the three villages. Also, the river was noted to have little practicality and use for the villagers, although, they did understand the importance of the ecosystems surrounding the river and the riparian habitat. Martin et al. (2018) suggest that a large portion of rural households depend on the land as a source of income and food. This is also reflected in the human capitals section as farming is the second most common occupation in the area. Close to 40 per cent of Fijian households (65,000) rely on some form of agriculture as a source of income, representing around eight per cent of GDP (2015). The land and sea are vital to Pacific islanders and can be seen to have cultural, social and physical significance (Cahn, 2006).

In Fiji, land management is under three complementary systems; native land (83%), freehold land (10%) and crown land (7%) (Department of Town and Country Planning, 2015). Ownership and access to native land are governed by an individual's relation to a mataqali (or clan) unless formally acquired through the statutory authority known as the Native Land Trust Board (Becker, 2017; Department of Town and Country Planning, 2015). Therefore, the Fijian communal (or extended family) ownership of land provides security that everyone in the village has access to a plot of land in which they could use to plant vegetables and root crops for their livelihoods. The Fiji agriculture sector has incurred at least FJ\$ 791 million (NZ\$568M) in damages and losses from cyclones and floods in the last 16 years. The villages in this study are usually the first to be affected by flash flooding in the Nadi Basin due to its location and as expressed by a few of the villagers.

The results demonstrate that men perceive land to be essential but having resistant and long-lasting crops is more important, while women had a different point of view of storing seeds to use once the flood has receded. Also noted in work by McKinnon et al. (2016), men would make decisions concerning which crops to plant, while their wives would sell the produce and handle the spending to meet the household's needs. This is also reflected in the financial capital section and is probably one of the reasons women rated money or savings as 'highly' important. The men have also adapted their farming practices to suit the cyclone/flooding season and grow crops that are more resistant and have longer shelf lives. Similarly, the villagers of Lomanikoro in Rewa have also adopted the same farming practice of planting more resistant crops (Nolet, 2016). Overall, the natural capital scores for all the villages was higher than the other livelihood capitals, mainly due to the high land ownership and farming practices. Also, Sikituru had higher natural capital resilience than Narewa and Yavusania.

5.1.4 Social Capital

The findings from the social capital analysis indicate that the villagers have a robust social intra- and interconnectedness with each other and that many villagers have leadership qualities. In iTaukei communities, it is more common to be called by your provincial relationship to the person than by your actual name. For example, if two people are from the same province, they will call each other 'kaivata' or 'kai' for short, and the same goes for people whose (old) gods are partners or friends as 'tauvu' (tau = friend, Vu = god) or 'tau' for short (Nainoca, 2011). It is common in villages for extended families to live close to each other and are usually the first point of contact when asking for help or a favour. The villagers are quite helpful people and seem to work together to help a sick neighbour when needed.

It is common in village settings, and some cases urban settings, for neighbours to care for a sick neighbour – usually doing chores, errands or going with them to the hospital if no one else is free to help. Popular in Melanesian culture is the sharing of food and work among family and friends (or neighbours) and that 'individualism' is not a feature of iTaukei (Indigenous Fijians) societies (McKinnon et al., 2016; Nainoca, 2011). Pelling and High (2005) suggest that during times of crisis, social networks become extremely important to speed up assistance and mobilise collective action by members of a community, especially one that is built on quality connections and trust. This study shows that the villagers have strong social networks and that anecdotal evidence suggests that the villagers help each other during flood events. Singh-Peterson and Iranacolaivalu (2018) suggest that close-knit communities tend to care for and support each other, especially during and following a disaster.

The villagers are generally active members of the community and unless preoccupied, will attend and participate in community gatherings. The same strong social networks and support system observed in this study was identified in rural men and women in the north of Fiji (Chattier, 2012). The findings from the group discussions suggest that social capital was a secondary thought as there were no listed assets that could be categorised as social capital. Bebbington (1999) emphasises that access to social capital (access to networks and organisations) is essential in expanding assets and capabilities. Overall, from these results, it is evident that the villagers have active access to social capital, and that compared to Narewa and Yavusania, Sikituru had higher natural capital resilience.

5.1.5 Human Capital

Typically, gender can play a significant role in livelihood priorities – as seen from the focus group discussions. A male-headed household will implement coping strategies prioritise certain assets different to that of women-led households. Kumar and Quisumbing (2013) show that female-headed households in Ethiopia have limited resources, lower education levels and fewer social networks.

Supporting this notion is a study from Fuller and Lain (2020) that showcase that female-headed households in twelve countries across Africa, Asia, and Latin America have lower resilience than male-headed households. Contrary to this, findings from Andersen, Verner, and Wiebelt (2017) suggest that female-headed households in Peru, Brazil and Mexico tend to be less vulnerable and more resilient than male-headed households.

Analysing the gender of the household heads can tie in with the data presented from the focus group discussions possibly indicating a link between heads and their coping strategies. The human capital analysis indicates that many households had men as the head of the household while, interestingly, a few had women, and only one had both a man and a woman. These results suggest that the households still follow the traditional system of having a patriarchal head of the house, mainly because men are customarily regarded as breadwinners and leaders of a house (Narsey, 2007). Research from other flood-prone areas in developing countries highlight the same findings (Brouwer et al., 2007). This is common in Fiji where societies have male-dominated hierarchies (Chattier, 2015). The findings also suggest that not many people have high formal education and that the ones that have certificates and diplomas would be specific to the business sectors present around the area. Most of the respondents either farm for a living or work in a nearby hotel as that would be adapting to what is around them – owning land and being in an area that is a tourist hub.

The results also indicate there is a high unemployment rate in the villages. According to the 2008-09 HIES, more females are full-time household workers than males, as well as, there are more unemployed women. This study suggests the same, as the majority of females that filled out the questionnaire stated their occupation as domestic duties (unemployed). This is in keeping with the population and housing census for 2017, which found there are more unemployed females than males in the western division (Fiji Bureau of Statistics (FBoS), 2017). Also, research by Chattier (2012) that explored gender equality in northern rural areas in Fiji identified that women mostly did housework while men worked on farms which supports the findings from my study. This does not necessarily mean there is a strict divide but suggests that that is where most of their time is spent.

Large-sized households were common in the surveyed villages and families tend to have more than one child. This implies that more resources are needed to care for each person; however, there are many people to help around the house when needed. Rumbach and Shirgaokar (2017) report that an increase in household size usually results in the shift in the allocation of resources from maintaining or improving structural measures to other consumables such as food and health care. Consequently, these villages appear less likely to be able to invest in measures to support their capital assets than if they had fewer children. An implication of this towards flood resilience and recovery is that large

households may have more people to help during evacuations and recovery, greater social networks, and more people to feed and look out for.

The elderly and people with disabilities tend to have a higher risk of injury or death because either they are usually forgotten during evacuation procedures or because there are many obstacles present that prevent them from safely evacuating in time. Also, emergency shelters and evacuation centres are not often equipped to cater to their particular needs (Christoffel-Blindenmission, 2014; Hemingway & Priestley, 2006). Fiji's 2017 census report (Fiji Bureau of Statistics (FBoS), 2017) states that almost 14 per cent of the population, aged three and above, have a reported disability. All three villages in this study had indicated having around 20 per cent of their villagers needing special assistance during disaster preparation, evacuation, response and recovery, which is higher than the nation's reported figure. While during the group discussions, Yavusania men and Narewa women both highlighted flooding having a 'moderate' impact on disabled relatives, highlighting that they cannot get enough assistance and that their coping strategies were to evacuate early, quickly and to search for more wheelchairs. Notably, there has been an increase in disability-inclusive disaster response in Fiji whereby security forces personnel, youth groups, women's groups and village headmen will be trained to become first responders to persons with disabilities during disasters (Sauvakacolo, 2019). Also, the inclusion of sign language translation of hazard warnings and updates by NDMO (Fiji) (Forgaty, 2020) highlight how the Fiji government is being more inclusive to all their citizens.

The villagers were generally happy with the available educational services and were generally impartial to the quality and quantity of available health services. Notably, the Fiji government has rolled out initiatives to further reduce the country's vulnerability in critical sectors, such as the setup of a Construction Implementation Unit (CIU) to oversee resilient reconstruction in the education and health sectors (Government of Fiji et al., 2017). The results from the group discussions imply that men believed that practical skills used in preparation for and recovery from hazards are needed to strengthen flood resilience. Overall, the human capital scores of the villages were quite low compared to the other capitals and that Yavusania seemed to have higher human capital resilience than Narewa and Sikituru.

5.1.6 Livelihood and Resilience Scores

This study was able to quantify the livelihood capitals and give a score for each household regarding their financial, physical, natural, social and human capitals, and their overall livelihood and resilience status, relative to each other. This was undertaken to give a figure to each household, calculated consistently across all three villages, to be able to understand and compare the level of assets owned and accessible by the village households. The findings suggest that, generally, all the village households are well endowed with natural and social capital but seemingly weak in financial and human capital.

However, when compared with each other, Yavusania seemed to have better livelihood scores than Narewa and Sikituru.

The findings allow the village heads, as well as any organisation or person interested in the development of the area to be able to view how the people are provided with livelihood assets. The findings can best be interpreted by looking at the average scores for the villages, including the minimum and maximum scores, or by looking at the maps to see the spatial distribution of the livelihood scores of each household. The sub-components (questions) used to construct the scoring technique were subjectively selected as they were the easiest to quantify given the scope and timeframe available. Further research could look into utilising other sub-components for a more robust assessment. It is important to note that these scores do not necessarily provide a simple index for the livelihoods of these complex rural communities and would need to be regarded as a small part of a bigger picture of livelihood vulnerability (see Vincent (2007) and Hahn et al. (2009)).

The livelihood scoring technique could be used to assess the impact of a programme or policy on a particular area or region by conducting one before and another after the implementation of a policy. Once the post-implementation scores have been calculated, they could be compared with the pre-implementation scores to assess if the targeted livelihood has increased and by how much.

5.2 Flood Risk and Flood Perceptions

This section discusses the flood risk perceptions of the village households by integrating the findings from both the questionnaire and focus group discussion results. First discussed are the perceived causes of flooding, flooding support and awareness, followed by flood preparation and keeping track of flood warning. The last section discusses the flood impacts and coping strategies results.

Natural disasters are significantly felt at the local level, where houses and assets are destroyed, livelihoods are jeopardised, socio-economic losses lay bare, and there may be illness or loss of life in the affected areas (Krishnamurthy & Krishnamurthy, 2011; K. Smith, 2003; Tran et al. 2009). The villagers of Narewa felt that the leading cause of flooding was heavy rain while Sikituru and Yavusania villagers felt that weak drainage systems predominantly caused floods. The analysis of the support rating questions indicated that the villagers felt that the support received when preparing for, during, and after flood events were generally noted as 'fair' by the village households with more people leaning towards adequate than inadequate.

The majority of the households indicated that they believed they were 'well' to 'very well' prepared for flood events. In hindsight, the villages were generally happy with the current early warning system in place with more than half of the villagers in Narewa noting the system as very good. This suggests that they should be well equipped for the next flood or at least able to recover if an event were to

occur. Those who have experienced floods or any other hazard event in the past will tend to take preventative actions to reduce their risk, provided that they have the resources to do so (Wachinger, Renn, Begg, & Kuhlicke, 2013). The works by Armaş and Avram (2009); Scolobig, De Marchi, and Borga (2012) and Vu and Ranzi (2017) have exemplified the connection between previous flood experience and preparedness; and the work by Burningham et al. (2008) suggest that the public are likely to appraise information on flood risk based on their own experience and their degree of trust in those who administer the information. The villagers in this study, many having lived in the area for more than nine years, coupled with few of them expressing that they were used to it [floods], seem to have a high level of preparedness, as shown in the results.

5.2.1 Flood Effects and Flood Impacts

Questionnaire analysis indicated that close to two-thirds of the households indicated that they had been severely affected from their most recent flood event and that damage to household assets was the highest type of loss experienced followed by damage to the house then sickness. Also, the majority of households have expressed that they had spent up to FJ\$ 1000 (NZ\$718) on flood damage repairs, while in some instances more than FJ\$ 2000 (NZ\$1436), especially in Narewa. From this, it is difficult to insinuate that Narewa is more exposed or had more valuable assets, seeing as there were no patterns observed from the spatial analysis (that is, whether the location of the house relative to river affect degree of impact) and there were no questions relating to what exactly the money was spent on. Suffice to say, these costs amount to double than what the majority of households earn in a month.

The focus group discussion analysis for the village men demonstrated that, interestingly, not one of the listed impacts was rated as high by all three villages. Instead, two villages would rate an impact high, and one would rate it as moderate. For women, many of the listed impacts had the same rating by all three villages. This highlights that many of the women share the same thoughts on flood impacts while men have different perceptions. Safi, Smith, and Liu (2012) argue that gender plays a vital role in risk perception. Gendered perceptions in hazards research can be seen that women tend to be more concerned than men about hazards and risk (Leiserowitz, 2006; Saleh Safi, James Smith Jr, & Liu, 2012; Sundblad, Biel, & Gärling, 2007). Gender inequality is still a critical challenge in Fiji with the behaviour and roles of Fijian women greatly influenced by island customary values and societal systems (Government of Fiji et al., 2017; Nainoca, 2011).

Scolobig et al. (2012) suggest that residents who suffer severe damage from floods tend to have a higher feeling of fear. This research contests this finding as many participants during the discussions expressed that “this is a flood-prone area and we are doomed to have a flood, nothing new to us and its part of us”. Research by Nolet (2016) also highlighted the same sentiments as a considerable number of villagers of Lomanikoro in the Rewa Delta expressed that they were not afraid of floods and

that floods were “a normal thing to Rewa” (Nolet, 2016, p. 725). This belief can be seen as a normalisation of flood risk (Deeming, 2008) and is present here in the villagers as many of the villagers, during the focus group discussions, have mentioned that they were used to it and that their villages were synonymous with flood hazards.

5.2.2 Flood Coping Strategies

From the household surveys, the most popular coping strategy after a flood event was to rely on government support, followed by undertaking repairs and then, praying. Similarly, the findings from the group discussions presented a similar picture where many of the listed coping strategies included requesting government assistance or reporting to the relevant authority. Interestingly, not doing anything was also a common coping strategy. Research from the Rewa River Basin has shown that floods strengthen the sense of community and solidarity and even encourages people to pray or return to church (Nolet, 2016). While praying was the third most popular coping strategy from the household surveys, there was no suggestion of prayer or other religious activity, nor was strengthening community networks referred to, although some of the activities to clear drains, sending youths to check on neighbours and relying on social networks when jobless may well have achieved this. Studies that were undertaken by Champion and Venzke (2013) and Nolet (2016) also reported similar coping strategies, such as moving assets to higher ground, doing nothing, dredging the river, constructing drainage channels in the neighbourhood, cleaning the house while floodwaters recede, but also relying on God and having a positive attitude.

Sickness, caused by the flood or preceding flooding, was rated as having a ‘high’ impact by virtually all the village groups. The standard coping strategies include seeking medical attention (either from the village health worker or zone nurse), cleaning the house, and boiling all drinking water. It is common for disease and sickness rates to rise following a hazard event, as much of the water facilities may have been compromised, and many people tend to evacuate to overcrowded places which can increase the spread of germs. A month after the January and March 2012 floods there was a spike in dengue fever and leptospirosis cases in the Western division, with a few evacuation centres also reporting some cases of leptospirosis. Transmission of these diseases, including typhoid, is high in these evacuation centres influenced by the proximity of people and the compromised WASH facilities (Government of Fiji et al., 2017).

Sikituru women highlighted that the removal of mangrove forests and the surrounding tourist developments had affected their livelihoods, as well as altering the river drainage patterns. They expressed that “as a result of the development, floods are still coming”. This was perceived to be a ‘high’ impact and their coping strategy was to “just wait and see”. Like Sikituru, the inhabitants of Lomanikoro village in Rewa also believe that the presence of a mangrove forest plays a protective role

to mitigate flood impacts (Nolet, 2016). Hence, the nearby tourism development was perceived to have decreased the village's protection and increased their exposure due to its practice of clearing the mangroves and altering the river's ecosystem and drainage rates.

The disruption of school services was a common impact by all the women, while Narewa men were the only group to mention it during the discussions. The common coping mechanism was to study at home until advised (by the government) to return to school. UNWomen (2014) report that vulnerable groups such as children have also been found to be significantly impacted by hazard events, mainly because one, the schools they attend are being used as evacuation shelters and still have people occupying them, two, the roads are damaged or blocked by debris, and three, many of them are forced to remain at home to care for their siblings/relatives, or to earn money in various means. For the surveyed villages, the same reasons hold for schools being disrupted due to them being used as evacuation centres, as well as, damaged roads prevent children from travelling to school. Although, the thirds reason by UNWomen was not expressed in the group discussions.

5.3 Spatial Patterns

This final section discusses the exposure and vulnerability maps of the communities. Hatfield (2006) argues that the integration of GIS tools into risk research is important because it presents social vulnerabilities and can influence policies targetted at assisting vulnerable populations. The use of hazard and risk maps is highly contentious and is dependent on the user, use, and expected audience (Koslov, 2019; Mathews & Barnes, 2016). Hazard maps can aid with town planning and zoning, as well as influence insurance rates and building standards. On the other hand, knowing of or living in flooded areas can influence property values, hamper investment projects, and create social unrest (Auyero & Swistun, 2008; Ghertner, 2010; Koslov, 2019).

Despite the differences noted in the previous sections between the household survey data and the perceptions of the focus groups from different villages, and an expectation based on hazards research and practice generally that mapping data gathered would yield distinctive spatial patterns and variations (Brouwer et al., 2007; Jakariya & Islam, 2017; Krishnamurthy & Krishnamurthy, 2011; Tran et al., 2009), the spatial analyses conducted did not show any obvious patterns, apart from showing exactly which houses had lower capital scores compared to their neighbours. This information can make targeting resilience projects easily when choosing which household to assist. Alternatively, some households may be unhappy to have their resilience scores comparatively showcased. It is hoped that with this information readily available, households, village heads, and development organisations can better target their efforts to increase their resilience and decrease their vulnerability.

There were no distinct spatial patterns of vulnerability observed from the degree of flood effect, floodwater heights, preparedness level, and overall resilience level. However, there is still a considerable number of households that need to strengthen their flood resilience and increase their livelihood capital scores. The map, therefore, provides more of a baseline for assessing spatial variability and effectiveness of future actions that might be taken to reduce the impacts of flooding on these communities. Also, the time constraints posed by a masters thesis means that only the first broad analysis of key (expected to be dominant and visible) variables was undertaken. There is still potential to further explore the spatial dimensions of the data, with greater refinement, that may yield interesting patterns.

5.4 Chapter Summary

This chapter has discussed the research results from the household questionnaires and focus group discussions with selected residents from Narewa, Sikituru and Yavusania. After living in a flood-prone area for several years, the villagers generally perceived themselves to be prepared for floods and have high flood resilience – as shown from their resilience ratings. On the other hand, the livelihood scores and resilience scores were mostly in the middle range. This finding can suggest that despite having limited livelihood assets, households in Narewa, Sikituru and Yavusania may perceive it to be enough to cope with flood hazards – this could be further investigated in the future. Apart from the constant exposure to flood hazards, the villages have weak financial assets that would be strained when an event occurs, and even more stress may be put on the women of the villages as financial difficulties may be quite high following an event. Many of the houses are built of sturdy materials which should be able to withstand the majority of natural hazards that the communities are exposed to, such as cyclones and flooding. In addition, the households only lack in physical assets that would be useful during flood events, such as emergency food kits, generators and a boat; otherwise, they seem to have the essential physical assets covered and even some lavish assets, such as cars.

The high dependence on natural capital shows that during normal times, the families may be prosperous when harvesting crops or selling livestock. However, during a flood event, there is a high chance of all their natural assets being destroyed. There is high social activity amongst the villagers, which shows that the communities are close-knit and are supportive of each other. This will be useful during flood events as neighbours will likely help each other out during evacuation and even after a flood. It is not common to have bachelors degrees or higher qualifications in the villages. However, many villagers own land that they rely on for sustenance and as a source of income, while others have diplomas and certificates which have allowed them to utilise the booming tourism industry in the area.

Flood events can have significant impacts on these sectors as road damage can prevent people from travelling to work or farmers from accessing the markets to sell their produce, or hotels may lay-off

staff because of reduced guest numbers or business being closed for some time while cleaning up or recovering from flood damage; all, on top of taking care of their own families and households first. The livelihoods of the three villages examined were not so different from each other, though there were marked differences when comparing their five livelihood capitals with each other. In general, natural and social capital were the two most abundant types, while financial and human capital were the least. Also, the livelihood scoring technique provided a way to quantify the five livelihood assets of the households, which facilitated comparison. However, while these comparisons might enable better targeting when designing livelihood development and flood management projects, it must be borne in mind that, at this stage in its development, this is quite a simplification of the complex reality of rural livelihoods. More testing of the approach is needed.

Similar flood impacts are experienced by all the villages since the villages are located within the same area, however, specific demographics express differences in their degree of impact. This may be attributed to their level of vulnerability and how likely they are to cope with the hazard. Arguably, if a particular flood has a 'low' impact on a person, then that person might have the adequate coping mechanisms to address that impact, whereas if someone expresses that a particular impact is high, then they might not always have the resources required to cope with the impact. While many of the coping strategies listed by the villagers provide efficient and practical coping mechanisms, a significant number of strategies indicate the reliance on relevant authorities or the government for assistance during flood disasters; however, these are understandable given the flood impacts relate to roads, schools, drainage, and utilities.

Surprisingly, there were no apparent vulnerability patterns observed from the maps, though many households were noted as having low resilience scores. The maps provide a basis on which to assess future vulnerability reduction actions. These results can be a good starting point for the village leaders, local authorities, NGOs and government bodies to identify areas that need improvement and strengthening, and also highlight the areas the villages might like prioritised when reviewing development plans and flood management projects. The next chapter provides an overall summary of the study and its outcomes with recommendations for future research.

6

Conclusion

This research aimed to determine levels of livelihood assets and flood risk perceptions of Narewa, Sikituru and Yavusania villagers living in a flood prone area in Nadi, Fiji. Based on quantitative analysis of the five livelihood capitals of the villages, it can be concluded that natural and social capital were high, and human and financial capital were low when compared with each other. Also, the livelihood aggregate scores suggested that Yavusania had higher financial, physical, and human capital resilience than Narewa and Sikituru, while Sikituru had better natural and social resilience than its neighbours. Qualitative analysis of the flood risk perceptions concluded that men valued physical capital the most while women valued financial capital when attempting to strengthen flood resilience.

A novel contribution in the study was the development of livelihood scores for each household based on the five livelihood assets of the sustainable livelihood framework. The idea behind quantifying the livelihood capitals of the villages was pragmatic because it can paint a current picture of the livelihood assets of the communities for policymakers to understand the status of these flood-prone communities easily. The livelihood scoring method attempted to provide a comprehensive, repeatable technique for quantifying all the assets and giving a relative score for each household. However, using the technique provides some challenges as each question will need a specific weight or design when calculating their scores. Consequently, further research could look into developing a more efficient method, similar to the livelihood vulnerability index, at the same time trying to incorporate assets from each of the five livelihood capitals to present a comprehensive and efficient scoring system. The scoring technique could be employed in other villages throughout Fiji or in other rural areas around the world to compare the results and even include a temporal factor into the assessment to measure if the scores change over time, especially before and after flood events or before and after the implementation of a project or policy.

The results expressed in this research do not necessarily reflect the actual vulnerability of all the villages in the Nadi Basin, nor any village living in a flood-prone area. However, the results do provide contextual understandings of the livelihoods and flood risk perceptions of villagers frequently exposed to riverine flooding in Nadi. While the findings provide some good insight and a baseline into the livelihood vulnerability of the villages, there is potential to investigate more deeply into each of the livelihood capitals to address specific areas that the village households are lacking in. To better understand the implications of the research, future studies could address the reasons underlying the lack of financial capital in the villages and how the present human capital aspects of the households have enabled the villages to sustain their livelihoods despite living in a flood-prone area. Rural

development, and the overall development goals of the country, will continue to be significantly impacted by floods and the changing climate. While the current government body and NGOs are actively addressing some of the flood risks, there are still areas that need improvement – especially those relating to livelihood vulnerability. Understanding the livelihoods and vulnerability of flood-prone villages is essential, especially in the context of disaster risk and climate change, as they will invariably play a pivotal role in community response and mould the factors that build community resilience. Finally, managing livelihood and flood vulnerability through systematic risk reduction, livelihood protection and adequate planning is crucial in a context where wellbeing and the lives of people are dependent on the environment and infrastructure that are highly susceptible to flood hazards.

7 References

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Appendix A

Past and Present Flood Management Related Projects

Project/Activity	Outline/Description	Implementing Agency	Project Period
Improvement of Equipment for Disaster Risk Management	Importation of equipment to observe weather, ocean and tidal systems and collect real-time data to aid in observation of factors that cause natural hazards in Fiji.	JICA	2013 - 2015
Strengthening Community Disaster Risk Management in the Pacific Region	Strengthening and reinforcing evacuation processes of people residing in flood-prone areas. The target area was the Ba River Basin with 1-2 villages.	JICA	2010 - 2013
Reinforcing Meteorological Training Function of Fiji Meteorological Service (FMS)	Strengthening the capability of forecasting and warning services, including upskilling and maintenance of personnel and equipment.	JICA	2014 - 2018
Risk Assessment Capacity Support	Evaluation and improvement of current disaster management support including the revision of policies, frameworks, information dissemination and access and overall support to other projects and partners.	JICA	2014 - 2016
Integrated Flood Management in the Pacific	Development of a flood inundation model of Nadi Town and its surrounding areas	SPC/SOPAC	2010 - 2014
Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI)	Development and maintenance of the Pacific Risk Information System (PacRIS) as a web-based tool for the provision of geospatial datasets and evaluation of disaster risk in the Pacific	SPC/SOPAC	Ongoing
Development and Implementation of a joint Disaster Risk Management/Climate Change National Adaptation Plan	To formulate a comprehensive framework to assist in adaptation to disaster risk and climate change	SPC/SOPAC	2012 - 2013
Improvement of Capacity and Performance of DRM Agencies through country-specific materials and training	Development of a disaster management system and training courses in 4 areas in Fiji to facilitate immediate action centres, initial damage evaluation, disaster risk reduction, shelter management and evacuation drills	SPC/SOPAC	2010 - 2013
Integration of DRM and Climate Change into school curricula (mainly primary and secondary)	Development of educational tools and materials to increase disaster risk and climate change awareness in primary and secondary schools	SPC/SOPAC	2011 - 2015

Project/Activity	Outline/Description	Implementing Agency	Project Period
Integrated Water Resource Management (IWRM) and Water Use Efficiency (WUE)	Improvement and effective implementation of water resource and wastewater management through the reform of policy and legislation	SPC/SOPAC	2009 - 2013
Pacific Disaster Risk Management Training Program	To develop a low-budget early warning system at the community level, facilitate the training of emergency operation centres at the regional level and training on primary disaster damage evaluation.	TAF	2009 - 2012
Strengthening Disaster and Climate Risk Resilience in Urban Development in the Pacific	Provision of technical assistance in the inclusion of disaster and climate risk information into urban development plans in the Pacific	ADB	Ongoing
Fiji Flood Rehabilitation Project	Data collection	ADB	2012 - 2014
Pacific Risk Resilience Program: Working towards resilient communities in the Pacific	Inclusion of risk management/governance into policy and budget at the national level, as well as, strengthening coping capacity, adaptive capacity, and overall resilience at the community level	UNDP	2013 - 2017
Pacific Community-focused Integrated Disaster Risk Reduction	Disaster management training and development of a Community Disaster Plan. Disaster response training through simulation exercises	NCCA	2007
Navua Local Level Risk Management	Education and community awareness for pre-existing early warning flood system in addition to multi-stakeholder involvement in long-term community awareness activities	UNDP/SOPAC	2009

JICA: Japan International Cooperative Agency; **SPC:** The Pacific Community; **SOPAC:** Pacific Islands Applied Geoscience Commission (now a division of SPC); **TAF:** Telecommunication Authority of Fiji; **ADB:** Asian Development Bank; **UNDP:** United Nations Development Program; **NCCA:** National Council of Churches in Australia

Appendix B

Research Documents

B.1 Human Ethics Approval

Research Management Office

T 64 3 423 0817
PO Box 85084, Lincoln University
Lincoln 7647, Christchurch
New Zealand
www.lincoln.ac.nz

26 April 2019

Application No: 2019-15

Title: Demarcating Livelihood Vulnerability and Flood Risk Perceptions of Villagers in the Nadi River Basin, Fiji

Applicant: J Sinclair

The Lincoln University Human Ethics Committee has reviewed the above noted application.
Thank you for your response to the questions which were forwarded to you on the Committee's behalf.

I am satisfied on the Committee's behalf that the issues of concern have been satisfactorily addressed. I am pleased to give final approval to your project.

Please note that this approval is valid for three years from today's date at which time you will need to reapply for renewal.

Once your field work has finished can you please advise the Human Ethics Secretary, Alison Hind, and confirm that you have complied with the terms of the ethical approval.

May I, on behalf of the Committee, wish you success in your research.

Yours sincerely



Grant Taviner
Chair, Human Ethics Committee

PLEASE NOTE: The Human Ethics Committee has an audit process in place for applications. Please see 7.3 of the Human Ethics Committee Operating Procedures (ACHE) in the Lincoln University Policies and Procedures Manual for more information.

B.2 Questionnaire Research Information Sheet

Research Information Sheet



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LINCOLN
UNIVERSITY
TE WHARE WĀNAKA O AORAKI

I would like to invite you to participate in a project entitled:

“Demarcating Livelihood Vulnerability and Flood Risk Perception of Villages in the Nadi River Basin”.

The main aim of this research is to determine the level of vulnerability, livelihood status and flood risk perceptions of villages in the Nadi River Basin. This information sheet and questionnaire is being provided to you either by me (James Sinclair) or my authorized research assistant (Jone Raituva)

Lincoln University
PO Box 85084, Lincoln University,
Lincoln 7647, New Zealand
0800 10 60 10
www.lincoln.ac.nz

The project is part of my Master of Applied Science in Disaster Risk and Resilience thesis research and your participation will involve completing a questionnaire which I estimate will take 15 to 20 minutes to complete. The questions are based on livelihood assets that you own or have access to from housing conditions, community participation, financial status, education level, etc.

Participation in this research is voluntary and you may decline to answer any question. You may withdraw from the project, including withdrawing any information you have provided, up to May 30th 2019 by contacting me (James Sinclair) through the contact details below.

The results of the project will be presented in my thesis, oral presentations, and if possible, submitted for publication in academic journals. The findings will be used to create exposure/vulnerability maps as well as a standard risk assessment that could spatially represent assets and potential damage. However, you may be assured of your anonymity in this investigation: the identity of any participant will not be made public, or made known to any person other than the Human Ethics Committee in the event of an audit. To ensure anonymity, individual survey data will be seen only by me and will be stored in an electronic form with password protection. Only aggregated data will be presented in any publications and no information will be reported in a way that might identify individuals.

This project has been reviewed and approved by the Lincoln University Human Ethics Committee. If you have any queries or concerns about your participation in the project, please contact me; I would be happy to discuss any concerns you have about the project.

All fully completed questionnaires will go into the draw to win movie vouchers for the whole household to Life Cinema, Martintar. The draw will be done on May 31st 2019.

The questionnaires will be collected between 16th – 20th May. Please advise whomever is at home that we will be stopping by to collect it.

<u>Researcher</u>	<u>Supervisor</u>
<p>James Sinclair Faculty of Environment, Society and Design Lincoln University New Zealand james.sinclair2@lincolnuni.ac.nz or japsinclair@gmail.com Mobile: +679 7104686 or +64 225264721</p>	<p>Dr Hamish Rennie Associate Professor Faculty of Environment, Society and Design Lincoln University New Zealand hamish.rennie@lincoln.ac.nz</p>



B.3 FGD Research Information Sheet

Research Information & Consent Form

I would like to invite you to participate in a research project entitled:

“Demarcating Livelihood Vulnerability and Flood Risk Perception of Villages in the Nadi River Basin”.

The main aim of this research is to determine the level of vulnerability, livelihood status and flood risk perceptions of villages in the Nadi River Basin.

The project is part of my Master of Applied Science in Disaster Risk and Resilience thesis research and your participation will involve being part of a workshop that will take approximately 3-6 hours. The workshop will involve discussions on livelihood assets or resources, flood impacts and coping strategies, and measuring village resilience and an action plan. Participation in this research is voluntary, anonymous (other than fellow participants) and no personal details will be shared.

The results of the project will be presented in my thesis, oral presentations, and if possible, submitted for publication in academic journals. However, you may be assured of your anonymity in this investigation: the identity of any participant will not be made public, or made known to any person other than the Human Ethics Committee in the event of an audit. Only aggregated data will be presented in any publications and no information will be reported in a way that might identify individuals.

This project has been reviewed and approved by the Lincoln University Human Ethics Committee. If you have any queries or concerns about your participation in the project, please contact me; I would be happy to discuss any concerns you have about the project.



Lincoln University
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Lincoln 7647, New Zealand
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<u>Researcher</u>	<u>Supervisor</u>
<p>James Sinclair <i>Faculty of Environment, Society and Design</i> <i>Lincoln University</i> <i>New Zealand</i> james.sinclair2@lincolnuni.ac.nz or japsinclair@gmail.com <i>Mobile: +679 7104686 or +64 225264721</i></p>	<p>Dr Hamish Rennie Associate Professor <i>Faculty of Environment, Society and Design</i> <i>Lincoln University</i> <i>New Zealand</i> hamish.rennie@lincoln.ac.nz</p>

Date:

Time:

Venue:



B.4 FGD Consent Form



LINCOLN
UNIVERSITY
TE WHARE WĀNAKA O AORAKI

***“Demarcating Livelihood Vulnerability and Flood Risk Perception of Villages
in the Nadi River Basin”***

Lincoln University
PO Box 85084, Lincoln University,
Lincoln 7647, New Zealand
0800 10 60 10
www.lincoln.ac.nz

I have read and understood the description of the above-named project. On this basis I agree to participate in the project, and I consent to publication of the results of the project with the understanding that anonymity will be preserved. I understand also that I may withdraw from the project, including withdrawal of any information I have provided, up to May 30th 2019.

I understand that by signing this document, I am giving consent to having an audio or video recording made of the workshop as well as to notes being made of the workshop’s discussion.

I will respect the privacy of information given to me by others participating in the workshop and not discuss the information they have provided, or disclose who participated with other people outside of the workshop

Signed: _____

Name: _____

Date: _____



B.5 Questionnaire

fes

James Sinclair
japsinclair@gmail.com
+679 7104686 or +64 225264721

Section A: Economic Environment (Financial Capital)

1. **How many income earners are in your household?**
 - 1-2
 - 3-4
 - 5-6
 - 7 or above
 - None
2. **What type of insurance do you have?**

Tick all that apply

 - Life insurance
 - Home insurance
 - Car insurance
 - Others: _____
 - No insurance
3. **How much do you normally spend on food per month?**
 - \$0-100
 - \$100-200
 - \$200-300
 - \$300-400
 - \$400 and above
4. **Please tick any financial liabilities you may have (If you are paying for something)**
 - Loan repayment
 - Mortgage repayment
 - Leasing land
 - Other: _____
 - None
5. **Please tick any financial assets you may have (If you are receiving money from...)**
 - Investments
 - Land Lease
 - Renting property/vehicles
 - Other: _____
 - None
6. **What is the household's total monthly income?**
 - \$0 - 500
 - \$500 - \$1000
 - \$1000 - 1500
 - \$1500 - 2000
 - \$2000 - 3000
 - More than \$3000
7. **Please tick if you receive any of the following**
 - Remittance (money sent from overseas)
 - Pension
 - Social Welfare benefit
 - None of the above
8. **Do you have a bank/savings account?**
 - Yes
 - No



9. Do you have an FNPF account?

- Yes
 No

10. What is the total value of your house?

\$ _____

Section B: Dwelling Environment (Physical Capital)

11. When was this house built?

- 1-3 years ago
 4-6 years ago
 7-9 years ago
 Over 9 years ago

12. Which best describes your house type?

- Double storey house
 Double storey flats
 Single storey house
 Single storey flats
 Other: _____

13. What are the walls made of?

- Mud
 Cement blocks
 Timber / wood
 Galvanized iron
 Thatch / bamboo

14. Which best describes your floor type?

- Tiles
 Concrete
 Wood
 Earth

15. Where is cooking conducted?

- Inside the main house
 Outside in a shed
 Other: _____

16. How many cars does your household own?

- 1
 2
 More than 2
 None

17. Where do you get water from?

- Piped water
 Borehole / Well
 Water tank / Rain water
 River
 Bottled water

18. Which type of cooking fuel do you use?

- Firewood
 Kerosene
 Gas
 Electricity
 Other: _____



19. What is the source of your electricity?

- Prepay electricity
- Post-pay electricity
- Generator
- Solar
- No electricity

20. How do you dispose of rubbish at home?

- Pick up by rubbish truck
- Burying / Compost
- Burning
- Other: _____

21. Please tick the items you own?

- | | |
|--|-------------------------------------|
| <input type="radio"/> Water tank | <input type="radio"/> TV |
| <input type="radio"/> Landline/telephone | <input type="radio"/> Water pump |
| <input type="radio"/> Portable generator | <input type="radio"/> First aid kit |
| <input type="radio"/> Emergency food kit | <input type="radio"/> Boat |
| <input type="radio"/> Radio | |

22. Which is your mobile network provider?

- Inkk
- Digicel
- Vodafone
- Other: _____
- Do not own a mobile phone

Section C: Natural Resources (Natural Capital)

23. Do you own land that is used for farming/plantation?

- Yes, own a farm/plantation
- Yes, own land but not used for farming
- No

24. How often do you grow your own vegetables?

- Never
- Once
- Sometimes
- Frequently

25. Do you own any pets? (eg. Dogs, cats, birds, etc.)

- Yes
- No

26. Do you own any farm animals (eg. Pigs, chickens, or cows)?

- Yes
- No

27. How often do you fish for food?

- Almost always
- Often
- Sometimes
- Seldom
- Never

28. How would you rate your dependence on the river (source of food, water or fun)?

- Extremely dependent
- Very dependent
- Moderately dependent
- Slightly dependent
- Not at all dependent



29. How would you rate the importance of the plants and animals that live in or near the river?

- Extremely important
- Very important
- Moderately important
- Slightly important
- Not at all important

30. How would you rate your dependence on the land as a source of food, shelter, or oxygen?

- Extremely dependent
- Very dependent
- Moderately dependent
- Slightly dependent
- Not at all dependent

31. Would you rather save money and damage the environment or save the environment and spend more money?

- Save money
- Save the environment

Section D: Social Environment (Social Capital)

32. How many social, sports, or religious groups are you a member of?

- 1
- 2
- 3
- More than 3
- Not part of any group

33. Are you the leader/manager or hold a high post in any social/ sports/ church group?

- Yes
- No
- Not part of any group

34. How likely are you to voice your opinions or give ideas at the social, sports, or religious groups you are a part of?

- Almost always
- Often
- Sometimes
- Seldom
- Never

35. How many people do you know in this village that you would trust your life to (or the life of the person you care about most)?

- No one
- A few
- Half the village
- Almost everyone
- Everyone



36. How often do you volunteer for a charitable organisation?

- Never
- Once
- A couple of times
- Frequently

38. How often do you attend community meetings?

- Never
- Once
- A couple of times
- Frequently

40. How many times have you helped a sick a neighbour?

- Never
- Once
- A couple of times
- Frequently

42. How would you rate your ability to work with others?

- Extremely self-reliant
- Very self-reliant
- Equal amount of self-reliance and inter-dependence
- Very inter-dependent
- Extremely inter-dependent

37. On average, how many times do you visit friends?

- Never
- Once a week
- Every fortnight
- Once a month

39. How often do you help with community projects?

- Never
- Once
- A couple of times
- Frequently

41. How many times have you loaned money to someone?

- Never
- Once
- A couple of times
- Frequently

43. How would you solve a dispute between you and a neighbour?

- Do not solve the issue
- Sort it out yourselves
- Discuss the issue with your friends
- Talk to the village headman
- Fight/argue with each other
- Other: _____



James Sinclair
japsinclair@gmail.com
+679 7104686 or +64 225264721

44. Which country/continent do you have close relatives residing in?

Tick all that apply

- Australia
- New Zealand
- Other Pacific Islands
- Asia
- America
- Europe
- Africa
- None living overseas

45. What would be the main reason for not attending community meetings or social gatherings?

- Not enough money
- Lazy
- Busy
- Issue with the committee leaders
- Issue with another member
- I don't feel like my voice is heard
- Other: _____

46. How often do you use Facebook?

- Almost always
- Often
- Sometimes
- Seldom
- Don't have an account

Section E: Flood Events Experience

47. Has your household been affected by a flood before?

- Not affected at all
- Yes, but minor
- Yes, affected severely

48. When was your last flood event?

- Less than a year ago
- 1-3 years ago
- 3-6 years ago
- 6-9 years ago
- More than 9 years ago
- Have not experienced a flood before



49. What kind of loss have you encountered from flood hazards?

- Damage to household assets
- Damage to the house
- Loss of life
- Sickness or injury
- Other: _____
- None

50. How high was the water level at your house during the last flood?

- Less than 1 metre
- 1-2 metres
- 2-3 metres
- 3-4 metres
- Greater than 4 metres

51. How much have you had to pay in repairs from flooding damage

- Nothing
- \$1 - \$500
- \$500 - \$1000
- \$1000 - \$2000
- \$2000 or more

52. What do you think is the major cause of floods in your area?

- Heavy rainfall
- Cyclones
- Poor drainage systems
- Improper planning or poor land-use
- Don't know
- Other: _____

53. How do you keep track of flood warnings and information?

- Radio
- Television
- Mobile phones (texts and calls)
- Through friends and family
- Environmental signals
- Facebook
- Other: _____

54. What type of evacuation plan do you have when there is a flood?

- I have my own plan
- I just follow others or where I am told to go by officials
- No plan
- Don't know

55. What is your level of preparedness for flood events?

- Not prepared at all
- Slightly prepared
- Well prepared
- Very well prepared

56. How would you rate the Early Warning System present for your village?

- Very good
- Good
- Acceptable
- Poor
- Very poor
- Don't know



57. How likely are you to relocate/move your whole house to another area safe from flooding?

- Very likely
- Likely
- Undecided
- Unlikely
- Very Unlikely

58. Which one best describes your coping strategy after a flood event?

- Government support
- Borrowing money/loans
- Turning to family and friends
- Insurance
- Repair/maintain house
- Praying
- Move to a new house
- Other: _____

Section F: Infrastructure and Services

59. How would you rate the following services in your area?

	Very Inadequate	Inadequate	Fair	Adequate	Very Adequate
a) Health facilities and services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) Schools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) Public transportation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) Waste disposal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) Electricity Supply	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) Water Supply	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) Access to food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) Access to government support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i) Access to bank loans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j) Access to insurance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k) Support when preparing for hazards such as floods/cyclones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l) Support during a hazard event	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m) Support after a hazard event	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n) Disaster awareness and education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Section G: Demographic Profile (Human Capital)

60. What is your gender?

- Male
 Female

61. Are there any special-needs members in the household or someone that would require special assistance during an evacuation? How many?

- Yes: _____
 None

62. Who is the head of the household?

- Man
 Woman
 Group
 Other: _____

63. What is the size of your household?

- 1-3 people
 4-6 people
 7-9 people
 10 people or above

64. How many children/dependents (under the age of 18) are in your household?

- None
 1-3
 4-6
 7-9
 10 or above

65. What is your employment status?

- Employed
 Unemployed
 Retired
 Self-employed / Entrepreneur
 Part-time / Casual

66. Do you have a second job?

- Yes
 No

67. How many people are present at home during the day? (8am-4pm)

- 0-2
 3-5
 More than 5 people

68. How long have you lived in this house/village?

- 2 years or below
 3-4 years
 5-6 years
 7-8 years
 9-10 years
 11 years or more

69. How old are you?

- 20 years or below
 21 - 30
 31 - 40
 41 - 50
 51 - 60
 61 years or above



70. How many people, present in your household, are unemployed?

- None
- 1-2
- 3-4
- 5-6
- 7 or above

72. What is your occupation?

- Civil Servant
- Tradesman
- Student
- Consultant
- Other: _____

71. What is your highest education level?

- No formal education
- Primary/Secondary education
- Certificate/Diploma
- Bachelor's degree
- Master's degree or higher

- Work in Tourism Industry
- Work in Food and Beverage
- Business owner
- Farmer/Fisherman

73. Please tick any of the trade skills, qualifications or trainings that you or anyone in your household may have. Tick all that apply

- Carpentry
- Plumbing
- Electrician
- Builder/Construction
- First aid
- Counselling
- Medical professional
- Driving license
- Sign language
- Emergency services (fire, police, army)
- Able to speak a language other than English or Fijian
- Farming
- Fishing
- Hunting
- Start a fire using natural resources



B.6 Livelihood Scoring Technique Example

Section A: Economic Environment (Financial Capital)

1. How many income earners are in your household?

1-2

3-4

5-6

7 or above

None

2. What type of insurance do you have?

Tick all that apply

Life insurance

Home insurance

Car insurance

Others: _____

No insurance

3. How much do you normally spend on food per month?

\$0-100

\$100-200

\$200-300

\$300-400

\$400 and above

4. Please tick any financial liabilities you may have (If you are paying for something)

Loan repayment

Mortgage repayment

Leasing land

Other: _____

None

5. Please tick any financial assets you may have (If you are receiving money from...)

Investments

Land Lease

Renting property/vehicles

Other: _____

None

6. What is the household's total monthly income?

\$0 - 500

\$500 - \$1000

\$1000 - 1500

\$1500 - 2000

\$2000 - 3000

More than \$3000

7. Please tick if you receive any of the following

Remittance (money sent from overseas)

Pension

Social Welfare benefit

None of the above

8. Do you have a bank/savings account?

Yes

No

9. Do you have an FNPf account?

Yes

No

10. What is the total value of your house?

\$ _____

Financial Capital:	
Q#	Score
1	5
2	0
5	0
6	0
7	0
8	10
9	10
Total 25/70	
Actual Score 25/70x100	
35.7	
Financial Capital Score = 35.7	

Section B: Dwelling Environment (Physical Capital)

11. When was this house built?

- 1-3 years ago
- 4-6 years ago
- 7-9 years ago
- Over 9 years ago

12. Which best describes your house type?

- Double storey house
- Double storey flats
- Single storey house
- Single storey flats
- Other: _____

13. What are the walls made of?

- Mud
- Cement blocks
- Timber / wood
- Galvanized iron
- Thatch / bamboo

14. Which best describes your floor type?

- Tiles
- Concrete
- Wood
- Earth

15. Where is cooking conducted?

- Inside the main house
- Outside in a shed
- Other: _____

16. How many cars does your household own?

- 1
- 2
- More than 2
- None

17. Where do you get water from?

- Piped water
- Borehole / Well
- Water tank / Rain water
- River
- Bottled water

18. Which type of cooking fuel do you use?

- Firewood
- Kerosene
- Gas
- Electricity
- Other: _____

19. What is the source of your electricity?

- Prepay electricity
- Post-pay electricity
- Generator
- Solar
- No electricity

20. How do you dispose of rubbish at home?

- Pick up by rubbish truck
- Burying / Compost
- Burning
- Other: _____

21. Please tick the items you own?

- Water tank
- Landline/telephone
- Portable generator
- Emergency food kit
- Radio
- TV
- Water pump
- First aid kit
- Boat

22. Which is your mobile network provider?

- Inkk
- Digicel
- Vodafone
- Other: _____
- Do not own a mobile phone

Physical Capital:

Q#	Score
13	8
14	5
15	4
16	0
18	7.5
20	3.3
21	3.3
22	3.3

Total 34.4/80
Actual Score 34.4/80x100
43.0

Physical Capital Score = 43.0

Section C: Natural Resources (Natural Capital)

23. Do you own land that is used for farming/plantation?

Yes, own a farm/plantation

Yes, own land but not used for farming

No

24. How often do you grow your own vegetables?

Never

Once

Sometimes

Frequently

25. Do you own any pets? (eg. Dogs, cats, birds, etc.)

Yes

No

26. Do you own any farm animals (eg. Pigs, chickens, or cows)?

Yes

No

27. How often do you fish for food?

Almost always

Often

Sometimes

Seldom

Never

28. How would you rate your dependence on the river (source of food, water or fun)?

Extremely dependent

Very dependent

Moderately dependent

Slightly dependent

Not at all dependent

29. How would you rate the importance of the plants and animals that live in or near the river?

Extremely important

Very important

Moderately important

Slightly important

Not at all important

30. How would you rate your dependence on the land as a source of food, shelter, or oxygen?

Extremely dependent

Very dependent

Moderately dependent

Slightly dependent

Not at all dependent

31. Would you rather save money and damage the environment or save the environment and spend more money?

Save money

Save the environment

Natural Capital:	
<u>Q#</u>	<u>Score</u>
23	10
24	6.7
26	10
27	5
Total	31.7/40
Actual Score	31.7/40x100
	79.3
Natural Capital Score = 79.3	

Section D: Social Environment (Social Capital)

32. How many social, sports, or religious groups are you a member of?

1

2

3

More than 3

Not part of any group

33. Are you the leader/manager or hold a high post in any social/ sports/ church group?

Yes

No

Not part of any group

34. How likely are you to voice your opinions or give ideas at the social, sports, or religious groups you are a part of?

Almost always

Often

Sometimes

Seldom

Never

35. How many people do you know in this village that you would trust your life to (or the life of the person you care about most)?

No one

A few

Half the village

Almost everyone

Everyone

36. How often do you volunteer for a charitable organisation?

Never

Once

A couple of times

Frequently

37. On average, how many times do you visit friends?

Never

Once a week

Every fortnight

Once a month

38. How often do you attend community meetings?

Never

Once

A couple of times

Frequently

39. How often do you help with community projects?

Never

Once

A couple of times

Frequently

40. How many times have you helped a sick neighbour?

Never

Once

A couple of times

Frequently

41. How many times have you loaned money to someone?

Never

Once

A couple of times

Frequently

42. How would you rate your ability to work with others?

Extremely self-reliant

Very self-reliant

Equal amount of self-reliance and inter-dependence

Very inter-dependent

Extremely inter-dependent

43. How would you solve a dispute between you and a neighbour?

Do not solve the issue

Sort it out yourselves

Discuss the issue with your friends

Talk to the village headman

Fight/argue with each other

Other: _____

Social Capital:	
Q#	Score
32	5
33	10
34	5
35	2.5
36	6.7
37	3.3
38	6.7
39	6.7
40	6.7
41	6.7
44	1.4
Total	60.7/110
Actual Score	60.7/110x100
	55.2
Social Capital Score = 55.2	

44. Which country/continent do you have close relatives residing in?

Tick all that apply

- Australia
- New Zealand
- Other Pacific Islands
- Asia
- America
- Europe
- Africa
- None living overseas

45. What would be the main reason for not attending community meetings or social gatherings?

- Not enough money
- Lazy
- Busy
- Issue with the committee leaders
- Issue with another member
- I don't feel like my voice is heard
- Other: _____

46. How often do you use Facebook?

- Almost always
- Often
- Sometimes
- Seldom
- Don't have an account

Section E: Flood Events Experience

47. Has your household been affected by a flood before?

- Not affected at all
- Yes, but minor
- Yes, affected severely

48. When was your last flood event?

- Less than a year ago
- 1-3 years ago
- 3-6 years ago
- 6-9 years ago
- More than 9 years ago
- Have not experienced a flood before

Flood Risk Score:

Q#	Score
53	1.7
54	5
55	10
58	1.3
Total	18/40
Actual Score	$18/40 \times 100$
	45.0

Flood Risk Score = 45.0

49. What kind of loss have you encountered from flood hazards?

- Damage to household assets
- Damage to the house
- Loss of life
- Sickness or injury
- Other: _____
- None

50. How high was the water level at your house during the last flood?

- Less than 1 metre
- 1-2 metres
- 2-3 metres
- 3-4 metres
- Greater than 4 metres

51. How much have you had to pay in repairs from flooding damage?

- Nothing
- \$1 - \$500
- \$500 - \$1000
- \$1000 - \$2000
- \$2000 or more

52. What do you think is the major cause of floods in your area?

- Heavy rainfall
- Cyclones
- Poor drainage systems
- Improper planning or poor land-use
- Don't know
- Other: _____

53. How do you keep track of flood warnings and information?

- Radio
- Television
- Mobile phones (texts and calls)
- Through friends and family
- Environmental signals
- Facebook
- Other: _____

54. What type of evacuation plan do you have when there is a flood?

- I have my own plan
- I just follow others or where I am told to go by officials
- No plan
- Don't know

55. What is your level of preparedness for flood events?

- Not prepared at all
- Slightly prepared
- Well prepared
- Very well prepared

56. How would you rate the Early Warning System present for your village?

- Very good
- Good
- Acceptable
- Poor
- Very poor
- Don't know

57. How likely are you to relocate/move your whole house to another area safe from flooding?

- Very likely
- Likely
- Undecided
- Unlikely
- Very unlikely

58. Which one best describes your coping strategy after a flood event?

- Government support
- Borrowing money/loans
- Turning to family and friends
- Insurance
- Repair/maintain house
- Praying
- Move to a new house
- Other: _____

Section G: Demographic Profile (Human Capital)

60. What is your gender?

- Male
 Female

61. Are there any special-needs members in the household or someone that would require special assistance during an evacuation? How many?

- Yes: _____
 None

62. Who is the head of the household?

- Man
 Woman
 Group
 Other: _____

63. What is the size of your household?

- 1-3 people
 4-6 people
 7-9 people
 10 people or above

64. How many children/dependents (under the age of 18) are in your household?

- None
 1-3
 4-6
 7-9
 10 or above

65. What is your employment status?

- Employed
 Unemployed
 Retired
 Self-employed / Entrepreneur
 Part-time / Casual

66. Do you have a second job?

- Yes
 No

67. How many people are present at home during the day? (8am-4pm)

- 0-2
 3-5
 More than 5 people

68. How long have you lived in this house/village?

- 2 years or below
 3-4 years
 5-6 years
 7-8 years
 9-10 years
 11 years or more

69. How old are you?

- 20 years or below
 21 - 30
 31 - 40
 41 - 50
 51 - 60
 61 years or above

Human Capital Score:

Q#	Score
63	5
65	10
66	0
71	2.5
73	3.5

Total 21/50
 Actual Score 21/50x100

Human Capital Score = 42.0

70. How many people, present in your household, are unemployed?

- None
- 1-2
- 3-4
- 5-6
- 7 or above

71. What is your highest education level?

- No formal education
- Primary/Secondary education
- Certificate/Diploma
- Bachelor's degree
- Master's degree or higher

72. What is your occupation?

- Civil Servant
- Tradesman
- Student
- Consultant
- Other: _____
- Work in Tourism Industry
- Work in Food and Beverage
- Business owner
- Farmer/Fisherman

73. Please tick any of the trade skills, qualifications or trainings that you or anyone in your household may have. Tick all that apply

- Carpentry
- Plumbing
- Electrician
- Builder/Construction
- First aid
- Counselling
- Medical professional
- Driving license
- Sign language
- Emergency services (fire, police, army)
- Able to speak a language other than English or Fijian
- Farming
- Fishing
- Hunting
- Start a fire using natural resources

$$\begin{aligned}
 \text{Livelihood Score} &= \text{Financial} + \text{Physical} + \text{Natural} + \text{Social} + \text{Human} \\
 &= 35.7 + 43.0 + 79.3 + 55.2 + 42.0 \\
 &= 255.2/500
 \end{aligned}$$

$$\begin{aligned}
 \text{Resilience Score} &= \text{Livelihood Score} + \text{Flood Risk Score} \\
 &= 255.2 + 45.0 \\
 &= 300.2/600
 \end{aligned}$$

Appendix C

Questionnaire Data

C.1 Financial Capital – Insurance, Revenues and Expenditures

Parameters	Narewa		Sikituru		Yavusania		Total	
Insurance								
Life	31	35.2 %	19	26.8 %	17	34.7 %	67	32.2 %
Home	3	3.4 %	0	0 %	1	2.0 %	4	1.9 %
Car	16	18.2 %	3	4.2 %	5	10.2 %	24	11.5 %
Others	2	2.3 %	4	5.6 %	0	0 %	6	2.9 %
Missing	2	2.3 %	3	4.2 %	1	2.0 %	6	2.9 %
Other Revenues								
Investments	5	5.7 %	1	1.4 %	2	4.3 %	8	3.8 %
Land lease	43	48.9 %	11	15.5 %	8	16.3 %	62	29.8 %
Property/vehicle rentals	10	11.4 %	4	5.6 %	5	10.2 %	19	9.1 %
Remittances	8	9.1 %	7	9.9 %	11	22.4 %	26	12.5 %
Pensions	4	4.5 %	4	5.6 %	3	6.1 %	11	5.3 %
Social welfare benefits	8	9.1 %	14	19.7 %	8	16.3 %	30	14.4 %
Missing	1	1.1 %	0	0 %	2	4.1 %	3	1.4 %
Other Expenditures/Liabilities								
Loan repayment	28	31.8 %	21	29.6 %	12	24.5 %	61	29.3 %
Mortgage	2	2.3 %	1	1.4 %	3	6.1 %	6	2.9 %
Leasing land	2	2.3 %	4	5.6 %	4	8.2 %	10	4.8 %
Hire purchase	8	9.1 %	3	4.2 %	3	6.1 %	14	6.7 %
Missing	0	0 %	0	0 %	3	6.1 %	3	1.4 %

C.2 Physical Capital – Place of cooking, Cooking fuel, and Items owned

Parameters	Narewa		Sikituru		Yavusania		Total	
Place of cooking								
Inside the house	63	71.6 %	35	49.3 %	34	69.4 %	132	63.5 %
Outside the house (separate shed)	16	18.2 %	23	32.4 %	9	18.4 %	48	23.1 %
Both inside and outside	9	10.2 %	11	15.5 %	6	12.2 %	26	12.5 %
Missing	0	0 %	2	2.8 %	0	0 %	2	1.0 %
Cooking fuel used								
Firewood	27	30.7 %	34	47.9 %	26	53.1 %	87	41.8 %
Kerosene	60	68.2 %	57	80.3 %	31	63.3 %	148	71.2 %
Gas	52	59.1 %	29	40.8 %	29	59.2 %	110	52.9 %
Electricity	7	8.0 %	12	16.9 %	12	24.5 %	31	14.9 %
Missing	0	0 %	0	0 %	0	0 %	0	0 %
Items owned								
Car owners	25	28.4 %	10	14.1 %	12	24.5 %	47	22.6 %
Water tank	12	13.6 %	2	2.8 %	2	4.1 %	16	7.7 %
Generator	0	0 %	2	2.8 %	5	10.2 %	7	3.4 %
Emergency food kit	7	8.0 %	3	4.2 %	4	8.2 %	14	6.7 %
First aid kit	31	35.2 %	25	35.2 %	16	32.7 %	72	34.6 %

C.3 Natural Capital – Subsistence farming, Fishing frequency, and Ecosystem importance and dependence

Parameters	Narewa		Sikitoru		Yavusania		Total	
Frequency of growing own vegetables								
Never	5	5.7 %	5	7.0 %	1	2.0 %	11	5.3 %
Once	2	2.3 %	0	0 %	2	4.1 %	4	1.9 %
Sometimes	45	51.1 %	28	39.4 %	24	49.0 %	97	46.6 %
Frequently	34	38.6 %	37	52.1 %	20	40.8 %	91	43.8 %
Missing	2	2.3 %	1	1.4 %	2	4.1 %	5	2.4 %
Frequency of fishing								
Never	29	33.0 %	14	19.7 %	17	34.7 %	60	28.8 %
Seldom	10	11.4 %	8	11.3 %	8	16.3 %	26	12.5 %
Sometimes	43	48.9 %	37	52.1 %	22	44.9 %	102	49.0 %
Often	2	2.3 %	8	11.3 %	1	2.0 %	11	5.3 %
Almost always	3	3.4 %	4	5.6 %	0	0 %	7	3.4 %
Missing	1	1.1 %	0	0 %	1	2.0 %	2	1.0 %
Riparian habitat importance								
Extremely important	21	23.9 %	27	38.0 %	16	32.7 %	64	30.8 %
Very important	36	40.9 %	25	35.2 %	21	42.9 %	82	39.4 %
Moderately important	4	4.5 %	5	7.0 %	3	6.1 %	12	5.8 %
Slightly important	14	15.9 %	8	11.3 %	6	12.2 %	28	13.5 %
Not important	10	11.4 %	3	4.2 %	3	6.1 %	16	7.7 %
Missing	3	3.4 %	3	4.2 %	0	0 %	6	2.9 %
River dependence								
Extremely dependent	5	5.7 %	11	15.5 %	1	2.0 %	17	8.2 %
Very dependent	9	10.2 %	13	18.3 %	3	6.1 %	25	12.0 %
Moderately dependent	10	11.4 %	10	14.1 %	9	18.4 %	29	13.9 %
Slightly dependent	19	21.6 %	12	16.9 %	19	38.8 %	50	24.0 %
Not dependent	43	48.9 %	24	33.8 %	15	30.6 %	82	39.4 %
Missing	2	2.3 %	1	1.4 %	2	4.1 %	5	2.4 %
Land dependence								
Extremely dependent	49	55.7 %	38	53.5 %	29	59.2 %	116	55.8 %
Very dependent	26	29.5 %	25	35.2 %	15	30.6 %	66	31.7 %
Moderately dependent	4	4.5 %	3	4.2 %	2	4.1 %	9	4.3 %
Slightly dependent	4	4.5 %	1	1.4 %	2	4.1 %	7	3.4 %
Not dependent	1	1.1 %	1	1.4 %	1	2.0 %	3	1.4 %
Missing	4	4.5 %	3	4.2 %	0	0 %	7	3.4 %

C.4 Social Capital – Trust, Helping a neighbour, and Community participation

Parameters	Narewa		Sikituru		Yavusania		Total	
Trust								
No one	6	6.8 %	5	7.0 %	1	2.0 %	12	5.8 %
A few	56	63.6 %	46	64.8 %	32	65.3 %	134	64.4 %
Half the village	5	5.7 %	3	4.2 %	1	2.0 %	9	4.3 %
Almost everyone	15	17.0 %	7	9.9 %	8	16.3 %	30	14.4 %
Everyone	5	5.7 %	9	12.7 %	6	12.2 %	20	9.6 %
Missing	1	1.1 %	1	1.4 %	1	2.0 %	3	1.4 %
Help sick neighbour								
Never	2	2.3 %	0	0 %	0	0 %	2	1.0 %
Once	11	12.5 %	4	5.6 %	7	14.3 %	22	10.6 %
A couple of times	51	58.0 %	46	64.8 %	27	55.1 %	124	59.6 %
Frequently	23	26.1 %	19	26.8 %	14	28.6 %	56	26.9 %
Missing	1	1.1 %	2	2.8 %	1	2.0 %	4	1.9 %
Loaned money to a neighbour								
Never	36	40.9 %	29	40.8 %	21	42.9 %	86	41.3 %
Once	25	28.4 %	9	12.7 %	12	24.5 %	46	22.1 %
A couple of times	25	28.4 %	24	33.8 %	12	24.5 %	61	29.3 %
Frequently	0	0 %	7	9.9 %	2	4.1 %	9	4.3 %
Missing	2	2.3 %	2	2.8 %	2	4.1 %	6	2.9 %
Community projects participation								
Never	2	2.3 %	3	4.2 %	1	2.0 %	6	2.9 %
Once	16	18.2 %	6	8.5 %	4	8.2 %	26	12.5 %
A couple of times	51	58.0 %	46	64.8 %	25	51.0 %	122	58.7 %
Frequently	17	19.3 %	14	19.7 %	17	34.7 %	48	23.1 %
Missing	2	2.3 %	2	2.8 %	2	4.1 %	6	2.9 %
Community meeting attendance								
Never	5	5.7 %	6	8.5 %	2	4.1 %	13	6.3 %
Once	21	23.9 %	5	7.0 %	9	18.4 %	35	16.8 %
A couple of times	42	47.7 %	41	57.7 %	26	53.1 %	109	52.4 %
Frequently	19	21.6 %	17	23.9 %	11	22.4 %	47	22.6 %
Missing	1	1.1 %	2	2.8 %	1	2.0 %	4	1.9 %
Reason for not attending meetings/gatherings								
Not enough money	2	2.3 %	1	1.4 %	3	6.1 %	6	2.9 %
Lazy	3	3.4 %	2	2.8 %	1	2.0 %	6	2.9 %
Busy	62	70.5 %	49	69.0 %	28	57.1 %	139	66.8 %
Issue with leader	4	4.5 %	1	1.4 %	1	2.0 %	6	2.9 %
Issue with another member	4	4.5 %	2	2.8 %	0	0 %	6	2.9 %
I don't feel like my voice is heard	1	1.1 %	3	4.2 %	7	14.3 %	11	5.3 %
Other	7	8.0 %	7	9.9 %	5	10.2 %	19	9.1 %
Missing	5	5.7 %	6	8.5 %	4	8.2 %	15	7.2 %

C.5 Human Capital – Mobility members, Household size, Unemployed, Children or dependents, and Trade skills

Mobility/special needs members								
Yes	16	18.2 %	18	25.4 %	12	24.5 %	46	22.1 %
Missing	8	9.1 %	4	5.6 %	2	4.1 %	14	6.7 %
Household size								
1 – 3 people	10	11.4 %	15	21.1 %	7	14.3 %	32	15.4 %
4 – 6 people	43	48.9 %	34	47.9 %	23	46.9 %	100	48.1 %
7 – 9 people	27	30.7 %	18	25.4 %	11	22.4 %	56	26.9 %
> 10 people	5	5.7 %	3	4.2 %	5	10.2 %	13	6.3 %
Missing	3	3.4 %	1	1.4 %	3	6.1 %	7	3.4 %
Number of unemployed in household								
None	7	8.0 %	7	9.9 %	4	8.2 %	18	8.7 %
1 – 2 people	52	59.1 %	34	47.9 %	24	49.0 %	110	52.9 %
3 – 4 people	20	22.7 %	17	23.9 %	16	32.7 %	53	25.5 %
5 – 6 people	5	5.7 %	7	9.9 %	2	4.1 %	14	6.7 %
> 7 people	0	0 %	3	4.2 %	2	4.1 %	5	2.4 %
Missing	4	4.5 %	3	4.2 %	1	2.0 %	8	3.8 %
Number of children								
None	13	14.8 %	17	23.9 %	7	14.3 %	37	17.8 %
1 – 3 people	42	47.7 %	33	46.5 %	29	59.2 %	104	50.0 %
4 – 6 people	27	30.7 %	17	23.9 %	10	20.4 %	54	26.0 %
7 – 9 people	2	2.3 %	2	2.8 %	0	0 %	4	1.9 %
> 10 people	0	0 %	1	1.4 %	0	0 %	1	0.5 %
Missing	4	4.5 %	1	1.4 %	3	6.1 %	8	3.8 %
Trade skills/qualifications								
Carpentry	14	15.9 %	18	25.4 %	12	24.5 %	44	21.2 %
Plumbing	5	5.7 %	13	18.3 %	10	20.4 %	28	13.5 %
Electrical	6	6.8 %	8	11.3 %	2	4.1 %	16	7.7 %
Building/construction	14	15.9 %	11	15.5 %	5	10.2 %	30	14.4 %
First aid	28	31.8 %	22	31.0 %	9	18.4 %	59	28.4 %

C.6 Infrastructure and Services Ratings

Narewa						
Service	Very Adequate	Adequate	Fair	Inadequate	Very Inadequate	Missing
Health	9.1	18.2	44.3	11.4	12.5	4.5
School/education	23.9	19.3	27.3	10.2	11.4	8
Public transport	19.3	28.4	30.7	8	10.2	3.4
Waste management	4.5	12.5	33	30.7	10.2	9.1
Electricity	19.3	26.1	27.3	11.4	12.5	3.4
Water	21.6	26.1	22.7	6.8	13.6	9.1
Food access	21.6	28.4	26.1	11.4	6.8	5.7
Government support	10.2	17	46.6	13.6	6.8	5.7
Bank loans	10.2	18.2	31.8	21.6	9.1	9.1
Insurance	13.6	17	31.8	21.6	6.8	9.1

Sikituru						
Service	Very Adequate	Adequate	Fair	Inadequate	Very Inadequate	Missing
Health	2.8	16.9	45.1	12.7	15.5	7
School/education	12.7	29.6	39.4	4.2	8.5	5.6
Public transport	9.9	29.6	40.8	8.5	7	4.2
Waste management	5.6	23.9	36.6	14.1	11.3	8.5
Electricity	8.5	45.1	28.2	5.6	7	5.6
Water	14.1	40.8	28.2	2.8	5.6	8.5
Food access	12.7	32.4	35.2	7	5.6	7
Government support	9.9	19.7	45.1	11.3	2.8	11.3
Bank loans	11.3	15.5	31	22.5	12.7	7
Insurance	12.7	22.5	25.4	12.7	15.5	9.1

Yavusania						
Service	Very Adequate	Adequate	Fair	Inadequate	Very Inadequate	Missing
Health	12.2	18.4	59.2	2	0	8.2
School/education	20.4	22.4	42.9	4.1	4.1	6.1
Public transport	10.2	30.6	38.8	8.2	2	10.2
Waste management	4.1	22.4	32.7	20.4	10.2	10.2
Electricity	20.4	28.6	26.5	12.2	4.1	8.2
Water	16.3	28.6	40.8	4.1	4.1	6.1
Food access	14.3	26.5	38.8	6.1	8.2	6.1
Government support	8.2	18.4	53.1	10.2	2	8.2
Bank loans	4.1	16.3	34.7	20.4	14.3	10.2
Insurance	4.1	14.3	32.7	16.3	20.4	12.2

Appendix D

Focus Group

D.1 Livelihood Matrix Men

Asset	Capital	Narewa	Sikitoru	Yavusania	Total	Rank
Boat	Physical	11.25	6	15	32.25	1
Training and awareness of flood risk	Human	7.5	3	15	25.5	2
Food/Water	Physical	11.25	6	7.5	24.75	3
Village disaster budget	Financial	3.75	6	15	24.75	3
Fuel (kerosene, candles, torches)	Physical	11.25		7.5	18.75	4
Disaster committee	Human		3	15	18	5
Resistant crops	Natural	3.75	12		15.75	6
High-rise House	Physical	3.75	9		12.75	7
Evacuation/Emergency plan	Human	11.25			11.25	8
First aid kit	Physical	3.75	3		6.75	9
Long lasting crops	Physical	3.75	3		6.75	9
Knowing how to read weather patterns	Human		6		6	10
Gumboots	Physical	3.75			3.75	11
Radio	Physical		3		3	12
Knowing how to swim	Human		3		3	12
Health worker/Knowledge of first aid	Human		3		3	12
Knowledge of carpentry	Human		3		3	12
Money, personal savings	Financial		3		3	12
Livestock	Natural		3		3	12
Rope	Physical				0	
Selling crops before a flood	Financial				0	

D.2 Livelihood Matrix Women

Asset	Capital	Narewa	Sikitoru	Yavusania	Total	Rank
Money, personal savings	Financial	15	12	15	42	1
High rise house	Physical	22.5	6	10	38.5	2
Farmland/plantation	Natural	7.5	9		16.5	3
Food/Water	Physical		6	10	16	4
Solar Power Panels	Physical	7.5	3	5	15.5	5
Knowing how to plant vegetables/root crops	Human			15	15	6
Boat	Physical		9	5	14	7
Root crops	Natural	7.5	6		13.5	8
Fuel (kerosene, batteries, candles)	Physical		6	5	11	9
First Aid Kit	Physical	7.5	3		10.5	10
Cleaning Equipment	Physical		3	5	8	11
Seeds	Natural	7.5			7.5	12
Livestock	Natural			5	5	13
Evacuation Centre	Physical		3		3	14
Clothes	Physical		3		3	14
Road (access)	Physical		3		3	14
Knowing how to swim	Human		3		3	14
Car	Physical				0	18
Furniture	Physical				0	18
Generator	Physical				0	18
Knowing how to cook	Human				0	18

D.3 Flood Impacts and Coping Strategies (Men)

Flood Impact	Narewa	Sikituru	Yavusania
Power outage	Report to EFL, Use candles, solar lamp and torch	Use candles, solar power and fuel	Use generator, solar power, candles
Damage to road	Beyond our control – walk	nothing	Buy a village transporter
Sickness	Report to medical centre	Improve communication	Seek medical assistance
Damage to house/infrastructure	Rebuild house	Repair/Rebuild new high-rise houses	Build high rise/durable house
Livestock death	nothing	Taking livestock to higher ground	Move to high ground
Water contamination (drinking)	Boil drinking water	Report to WAF, boil all drinking water	
Loss of income	Repair what you can	Social networks	
Soil erosion	Gabions – not completed due to high cost		Nothing can do – expensive
Damage to farm/crops	Have a backyard garden		Replant root crops
Death	RIP – immediate burial		Can't do anything
A lot of debris (rubbish)		Cleaning (especially soon after waters recede), Relocate farms to higher ground	Dig more drainage and dredging
Damage/Overflow of sewer lines	Report to WAF		
Damage to cars	nothing		
Loss of business	Continue business with a “never give up” attitude		
Disruption to school/work	Study at home, stay home until advised to go to work		
Stagnant water (up to 6 weeks) - breeds mosquitoes		Dig proper drainage channels or wait for natural drainage	
Food shortage/impact		Rationing	
Stress		Awareness and counselling	
Damage to communication lines		Ask youths to look for a boat for help	
Lack of resources for emergency rescue/retrieving dead bodies		Increase awareness	
Clear evacuation centre			More evacuation centres
Look after disabled patient/relative			Provide more wheelchairs

D.4 Flood Impacts and Coping Strategies (Women)

Flood Impact	Narewa	Sikitoru	Yavusania
Damage to house, furniture and leaves mud	Build double storey house	Raise your foundation	Put on higher place
Damages/destroys farms, livestock and gardens	Plant vegetables in plastic bottles or pot plant basins	Good drainage system, nothing	Move to higher place/have a higher permanent space, appropriate crops at appropriate times
Causes sickness and disease	Boil drinking water, buy ORS in cases of diarrhoea, VHW-to get supplies from Z/nurse	Live in clean surroundings, clean the house	Avoid drinking dirty water. Boil water. Stop breeding mosquitoes
Results in poor drainage – breeds mosquitoes	Clean drains and big tunnels	Need resource (ask help from govt or NGO)	Clean drains (govt assistance)
Affects water and electricity supply	Water tank/filled beforehand. Use rain water or buy from the supermarket, use solar	Boil your water, get prepared in advance - buy candles	We can use generator
Bad road condition – poor accessibility	Inform the government, Clear the trees and whatever we can do	Contact local authority regarding roads	Maintenance of roads
No school for our children	Wait for the Ministry of Education	Occupy children at home to do home studies	Good facilities
Financial need – loss of jobs		Look for resources instead of waiting for jobs	Good facilities (roads)
Poor sanitation		Make sure surroundings are well kept	Clean area and clean drains (during floods)
Vulnerables (disabled) – can't get enough assistance	Evacuate quickly		
Fatal injuries	Nothing		
Price of food goes up		Report to relevant authority	
Tourism development – change ecosystem		Development are good but they destroyed our livelihoods- crab, fish. As a result of development, floods are still coming (we just wait and see)	
Poor service public hospital		A clear mind-set from health authorities to accept us in a situation. Village nurse upgrade	
Deforestation			Plant more trees
Soil erosion			Save trees (big) (stop dredging)
Loss of lives			Warning family members during disaster (take hints of warning)
Lack of clothes			Eliminating dirtying and wetting of clothes
Shortage of food			Prepare before disasters

D.5 Resilience and Action Plan

Narewa

What	Who	When	How Much
Education Training	TK (headman) NGOs Govt	In 3 months	\$5000.00
Village Plan/ Map	TK Development Committee (DisMAC) Committee	3 months	\$250.00
Safety/ Rescue Equipment	TK DISMAC Committee Village Council	1-3 years	\$20,000.00

What	Who	When	How Much
Water tanks (6)	TK Yavusa (Y3) Office WAF	3-6 months	1/3 from Y3 Office: \$2000 2/3 from Govt: \$4000
Boat (1 fibre)	Village Committee TK Y3 Office Govt	Depends on the approval from Govt	Boat: \$10,000.00 Engine: \$7,000.00 (\$20,000.00)
First Aid Kit (2)	VHW MoH Y3 Office	1 month	\$800 - \$1,000.00

Sikitoru

What	Who	When	How Much
Communication devices such as RTs (4)	TK Dos Office Govt (NGO)	3 months	\$6000.00
Strengthen Committee Including resources such as rope, lights, etc	TK	6 months	Lights: \$2100.00 Rope: \$500.00
Dredging/Drainage	TK Govt DO Office	Upon approval from govt	\$1M

What	Who	When	How Much
Drainage	Disaster committee Village headman	1 year	\$80,000
New double storey church	New Bethlehem Church Committee	5 years	\$130,000
Awareness	NGOs Govt	When they are free or available	Free

Yavusania

What	Who	When	How Much
Boat	TK NGOs Govt (DO)	1 year	\$20,000.00 (\$10,000-\$20,000)
Disaster Training	TK NGOs	3 months	\$2500.00
Double Storey houses	Villagers Sponsors	2 years	\$250,000.00

What	Who	When	How Much
Boat (4)	Silver Water Fiji Ltd Sponsorship from overseas village members	5 years	\$32,000 (\$8,000 each)
Evacuation Centres	Dept. of Town Planning Housing scheme TK	5 years	\$100,000 (\$50,000 each)
Housing schemes	Housing Authority of Fiji	5 years	\$30,000 per house