



THE INSTITUTE OF APPLIED SCIENCES

# FIJI RIDGE TO REEF PROJECT

## ACTIVITY 3.1.1.2: DEMOGRAPHIC, SOCIOECONOMIC & BIOPHYSICAL SURVEY - TUVA CATCHMENT DECEMBER, 2019



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**ACTIVITY 3.1.1.2: DEMOGRAPHIC,  
SOCIOECONOMIC & BIOPHYSICAL SURVEY -  
TUVA CATCHMENT**

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## LIST OF ACRONYMS AND ABBREVIATIONS

CI	Conservation International
CC	Climate Change
CCA	Climate Change Adaptation
FBoS	Bureau of Statistics
GEF	Global Environment Facility
iTab	iTaukei Affairs Board
NGO	Non-Government Organisation
NH	Natural Hazards
SL	Sustainable Livelihood
TC	Tropical Cyclone
TK	Traditional Knowledge
WAF	Water Authority of Fiji

### Fijian Terms and Abbreviations

Bose ni Yasana	-	Provincial Meeting
Bose Vanua	-	Chiefly Meeting (involves chiefs /decision makers)
Bose vaka koro	-	Village Meeting
Dalo	-	Taro
Duva	-	Plant or Shrub used as fish bait
Kanakana	-	Traditional land (Food source)
Komiti ni Yaubula	-	Committee (natural resource)
LNy	-	Lewe ni yavusa (Members - clan)
Malea	-	Tilapia fish
Mataqali	-	Clan
TNM	-	Turaga ni Mataqali (Chief-subclan)
TNK	-	Turaga ni koro (village headman)
TNY	-	Turaga ni yavusa (Head - clan)
Ivi	-	Tahitian Chestnut
Mate	-	Death
Oga	-	Engagements
Somate	-	Funeral
Soli vakamisinari	-	Church money collection
Soli ni yasana	-	Province money collection
Soqosoqo vaka marama	-	Womens group
Soqosoqo vaka turaga	-	Mens group
Soqosoqo ni tabagone	-	Youth group
Tevutevu	-	Traditional presentation of Fijian artifacts, gifts for married

		couple
Tokatoka	-	Extended family
Uto	-	Breadfruit
Qoliqoli	-	Traditional fishing ground
Vakamau	-	Wedding
Via kau	-	Swamp taro
Vudi	-	Plantain

## EXECUTIVE SUMMARY

This report highlights the results and key findings from a socioeconomic survey conducted at nine villages and a sugarcane farming settlement in the Tuva catchment area. This is part of the Institute of Applied Sciences technical support for the Ridge to Reef (R2R) project funded by the Global Environment Facility (GEF). UNDP and the Ministry of Environment and Waterways are the main implementing organizations for the project with technical support provided by conservation and research institutions based in Fiji.

Socioeconomic gaps highlighted in the gap analysis report were the fundamental basis of the socioeconomic survey and the data gathered are vital for catchment management work. Detailed demographic data provided by key stakeholders and collected from the field surveys highlight significant information of the selected surveyed population. In terms of socioeconomic livelihoods, village communities in the Tuva catchment areas are predominantly semi-subsistence and produce for personal household consumption and community obligations. However, sale of produce occurs mainly to meet household and community financial needs as per need basis.

Key findings indicate that village communities rely on their natural resources particularly fisheries and agriculture for subsistence use. In addition, there is a high dependency on income earned from non-natural based resources. Livelihood activities are reflected on resource use patterns. Continued exploitation and extraction of natural capital may have implications on their vulnerability to natural hazards and climate change impacts. Governance and decision making processes are vital for resource use management. Traditional Ecological knowledge is thoroughly investigated for the Tuva catchment and findings prove evidence of its existence in village communities. However, the rate of implementation and effective sharing of information to the younger generation varies. TEK needs to be strengthened in all village communities to safeguard our culture, customs, and traditions. A thorough report is tabled separately for the Traditional Ecological Knowledge and Biodiversity Conservation surveys conducted for the catchment.

Biophysical surveys conducted provide a summary assessment of the current biophysical status of the Tuva catchment. Findings indicate the impact of natural and human induced activities. Communities play significant roles in the preservation and conservation of its natural capital in the Tuva catchment region.



## **1.0 INTRODUCTION**

This report presents the socioeconomic results and findings for the Ridge to Reef (R2R) project conducted at the Tuva Catchment from September 16<sup>th</sup> to September 27<sup>th</sup>, 2019 (refer to appendix 2 for timeline). Nine villages and a sugarcane farming settlement (refer to appendix 1 for list) was selected. Household socioeconomic interviews, focus group interviews, Traditional Ecological Knowledge and Biodiversity Conservation surveys and Biophysical surveys are the major survey components for the R2R Tuva catchment project.

Household socioeconomic interviews focused on acquiring reliable and relevant data on household income sources and expenditure categories. The focus group interviews focused on community infrastructure, technology uses, resource use patterns, governance and decision making process, gender roles and responsibilities and perceived threats to the catchment areas. Traditional Ecological Knowledge (TEK) and Biodiversity conservation surveys were conducted at five selected sites. Biophysical surveys involved observations and assessments on waterways and banks, solid and liquid waste, animal husbandry, agriculture and community wellbeing. Five sites were selected from the upper, middle and lower catchment areas for this activity.

This report also outlines background demographic information (see *appendix 5*) and mapping of the surveyed sites at the Tuva catchment (see *appendix 6*). Detailed narrative and illustrations provided in this report will be essential for thorough resource management plan and design work for the Tuva catchment region.

## **2.0 METHODS OF DATA COLLECTION**

The methods of gathering data have been influenced by the purpose of the survey. Detailed socioeconomic survey questionnaire was constructed based on the findings and recommendations of the Gap Analysis Report for the Tuva Catchment. Household socioeconomic interviews, focus group interviews, TEK and Biodiversity conservation interviews and biophysical surveys are the main methods of primary data collection used in the survey.

Tablets and questionnaires were used for household socioeconomic interviews. Household socioeconomic interviews focused on social sanitation and hygiene indicators, household income and expenditure categories, community obligations and resource harvesting methods.

Focus group interviews involved key informants who held leadership roles of various social groups or committees in the villages. This includes the Turaga ni Koro (TNK), Turaga ni Yavusa (TNY), head of the soqosoqo vaka marama (Womens group), head of the soqosoqo ni tabagone (youth group) and soqosoqo ni yaubula (Natural resource committee). Focus group interviews was a talanoa session where resource use patterns, governance and decision making processes, gender roles and responsibilities, perceptions and awareness on environmental issues and perceived threats to the catchment region were thoroughly discussed.

Traditional Ecological Knowledge (TEK) and Biodiversity Conservation interviews involved the elders or matured generation of men and women who had thorough traditional knowledge and experience. All survey interviews were conducted in the iTaukei Bauan and Nadroga dialect. Biophysical surveys were conducted using maps, cameras and biophysical data assessment forms. The survey involved observations, note taking, and photographing of landscapes and other biophysical features depicting evidence of the current biophysical status of the environment. A field assistant from each village was used as a tour guide and respondent to certain questions asked.

### **3.0 OBJECTIVES**

The main objectives of this socioeconomic report are:

- Outline detailed demographic information of the selected villages and settlement in the Tuva Catchment.
- Analyze the village livelihood systems (*household income and expenditure*).
- Assess livelihood activities and resource use patterns.
- Outline governance and decision making processes.
- Identify and outline the Traditional Ecological Knowledge, perception and awareness on environmental issues.
- Analyse and Outline the biophysical status of the Tuva catchment.
- Identify and outline the perceived threats to the Tuva catchment region.

Comprehensive consolidated socioeconomic data was collected in the process and would greatly impact the development of the Tuva Catchment Management Plan.

## 4.0 STRUCTURE OF THE REPORT

The structure of this report addresses the key findings gathered from the R2R socioeconomic survey conducted at the Tuva Catchment. Photographs, tables, graphs and illustrations are compiled to complement the consolidated primary data. The intention of this report is to provide comprehensive data that are reliable, valid and accurate for management plan and design at the catchment.

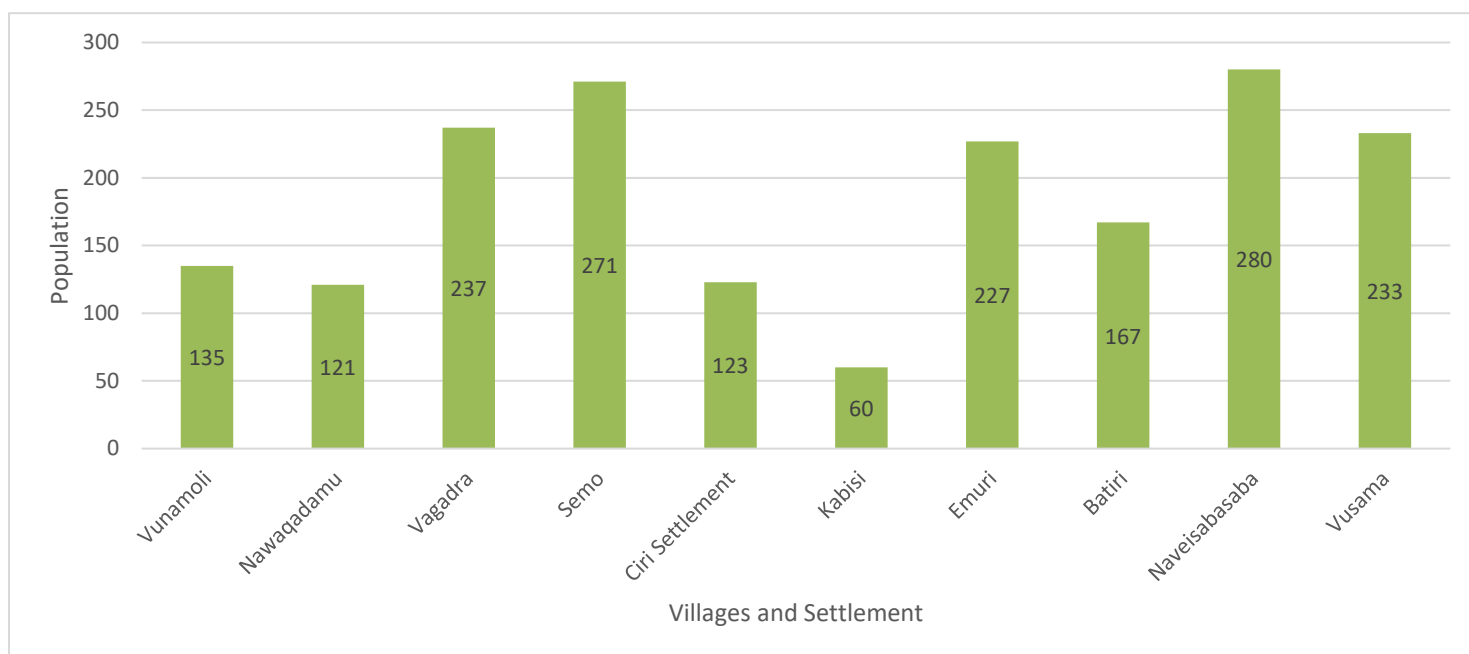
The report presents findings from the three main data collection methods:

- i. household surveys on income and expenditure and resource use methods;
- ii. Biophysical surveys; and
- iii. focus group interviews on perceived threats to the catchment from.

Additionally, appendix 1 outlines the list of villages selected for the socioeconomic survey in the Tuva catchment; appendix 2 provides a timeline of the socioeconomic survey conducted; appendix 3 illustrates a consolidated summary of income and expenses for the catchment; appendix 4 outlines the categories of expenses per year; appendix 5 presents background demographic information of the selected sites; appendix 6 illustrates mapping of the Tuva catchment; and appendix 7 is a compilation of pictures taken during the field work.

## 5.0 DEMOGRAPHIC BACKGROUND INFORMATION

**Figure I:** Total Population of Villages and Sugarcane Farming Settlement



**Figure I** illustrates the total population of each village and settlement in the tuva Catchment that were interviewed.

Seventy percent of the total household population was sampled for the household interviews. Vacant houses were excluded. The figures listed in Table I represent the number of households interviewed for each village and settlement in the catchment.

**Table I:** Number of Households interviewed for the socioeconomic survey

No.	Tuva Communities	No.of Households	Catchment
1	Vunamoli Village	28	Upper
2	Nawaqadamu Village	27	Upper
3	Vagadra Village	35	Middle
4	Semo Village	35	Lower
5	Kabisi Village	14	Lower
6	Emuri Village	15	Lower
7	Ciri Settlement	25	Lower

8	Naveisabasaba Village	35	Lower
9	Batiri Village	25	Lower
10	Vusama Village	35	Lower
11	Sugarcane farmers	3	Lower

Seventy percent of the total household population was sampled for the household interviews. Vacant houses were excluded. The figures listed in Table I represent the number of households interviewed for each village and settlement in the catchment.

## 6.0 COMMUNITY INFRASTRUCTURE AND TECHNOLOGY

Building structures, house designs and style are relatively similar for all villages within the Tuva catchment. However, village sizes and spacing of houses vary. There are concrete, wooden, and tin houses, with some traditional thatched bures in a few villages. Building materials are purchased from either Nadi town or Sigatoka town depending on accessibility, distance, travel time and cost. Every household build their homes according to their own preferences and financial capacity.

**Picture 1, 2, and 3** below depict the types of houses in the Tuva catchment.

Picture 1



Picture 2



Picture 3



Road Infrastructure and Accessibility is not a problem despite the rugged terrain in the upper catchment area. The access roads have enabled villagers to build modern homes. Semi-subsistence farmers are able to transport their produce to the markets daily or on preferred market days. Sugarcane farmers are able to cart their sugarcane to the various sugar mills in

Lautoka and Rakiraki. Working people and school children are able to commute daily by private cars, carriers and school and public buses.

Picture 4



Picture 5



Picture 6



**Picture 4, 5, and 6** depict the types of road access in the Tuva Catchment. Modern Technology and Communication Network systems keep the villagers well informed with the latest local and world news and weather updates. Villages in the upper and middle catchment have access to generator and solar power supply while the lower catchment has access to full power supply (EFL). All villages in the catchment region have access to modern technology such as smartphones, laptops, computers, stereo systems, television to name a few. All these accessories are used for leisure as well as for educational purposes particularly for primary, high school and tertiary students. Villagers communicate with family and relatives locally and abroad. Phones are very useful especially in times of emergency.

Picture 7



Picture 8



**Picture 7** and **8** show evidence of modern technology (*Sky, TV, Stereo system*) in Nawaqadamu village (*Upper Catchment*).

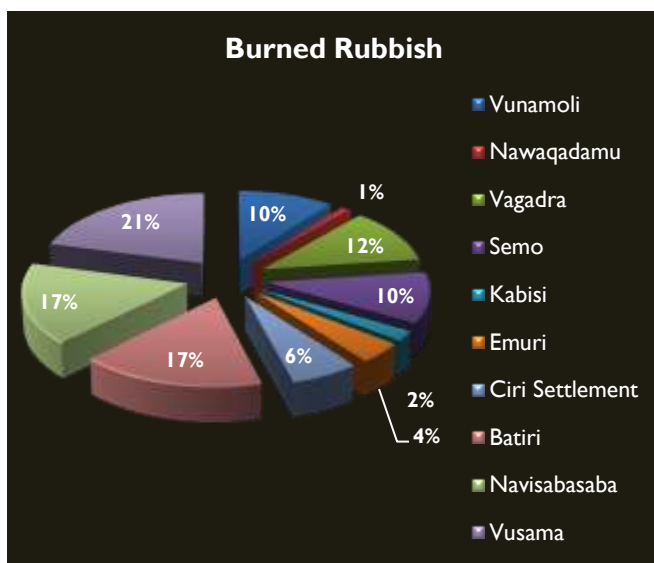
## 7.0 RESOURCE USE METHODS

**Table 2:** Water Sources per household

	<i>Water piped system</i>	<i>Rain water tank</i>	<i>creek / river water</i>	<i>Spring water</i>	<i>Bore Hole</i>
<b>Source of portable drinking water</b>	23	55	-	88	36
<b>Water for irrigation</b>	-	7	-	26	1
<b>Water for washing/bathing</b>	22	52	-	88	36
<b>Water for water sealed toilet or flush toilet</b>	22	49	-	85	35

Villagers and settlements in the Tuva catchment access tap water for drinking, washing and sanitation purposes. However, the sources of water supply vary. The figures illustrated in Table 2 represent the number of households in the catchment and the different sources of water they access for their daily livelihoods. Villages from the upper, middle and a few in the lower catchment access drinking water from springs. A few coastal villages have bore holes and rain water harvesting tanks. Water problem is a critical issue in the lower Tuva catchment areas particularly at Vusama, Batiri, Navisabasaba village and Ciri settlement.

**Figure 2:** Percentage Population that burn rubbish



**Figure 3:** Percentage Population using landfills

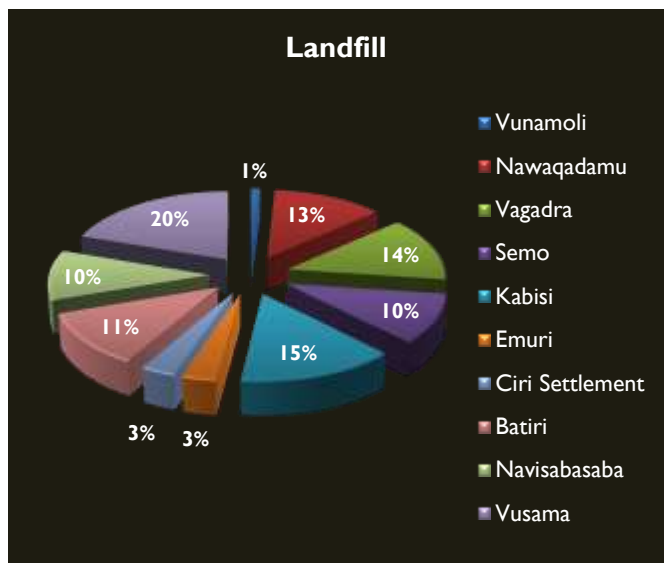


Figure 2 and 3 represent the percentage of population per village that burn rubbish and use landfills as the main avenue of rubbish disposal. Incinerators are provided for burning of paper, cardboards, plastic bags and cartons while landfills are used for disposal of trash or waste that cannot be burned such as cans and bottles. From observations, despite having landfills and incinerators, people continue to litter the village boundaries, waterways and plantations. Picture 11, 12 and 13 depict evidence of improper disposal of household waste in the Tuva catchment area.

Picture 11



Picture 12



Picture 13



## Solid Waste Management - Types of Toilet Facilities used in the Tuva Catchment.

Figure 4: Percentage Population using Pit Toilet Facility

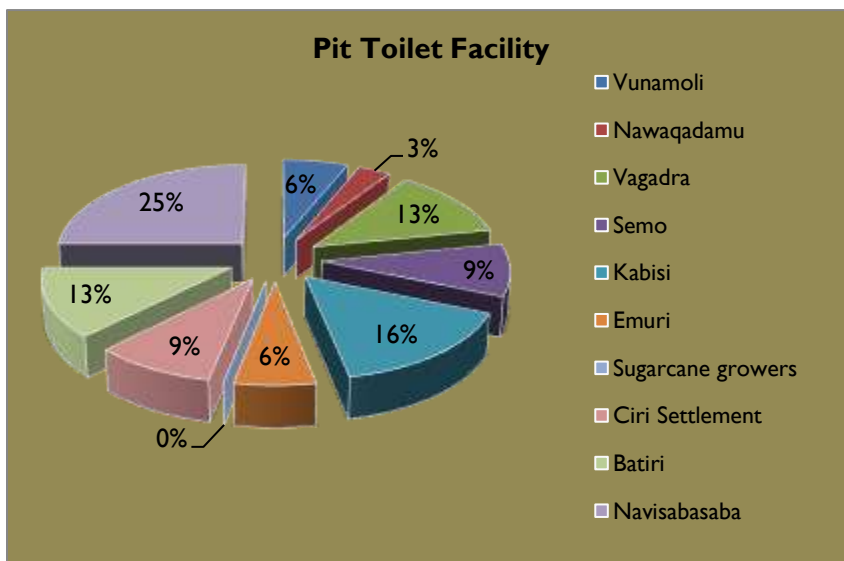




Figure 4 illustrates the percentage population per village that use pit toilet facility. The evidence suggests the continued existence of pit toilets in local villages. The highest percentage of pit toilet uses is recorded for villages in the lower catchment. Based on observations, some households still have pit toilet facilities but no longer use them. They either use water sealed or flush toilet facilities.

**Figure 5:** Percentage Population using Water Sealed Toilet Facility

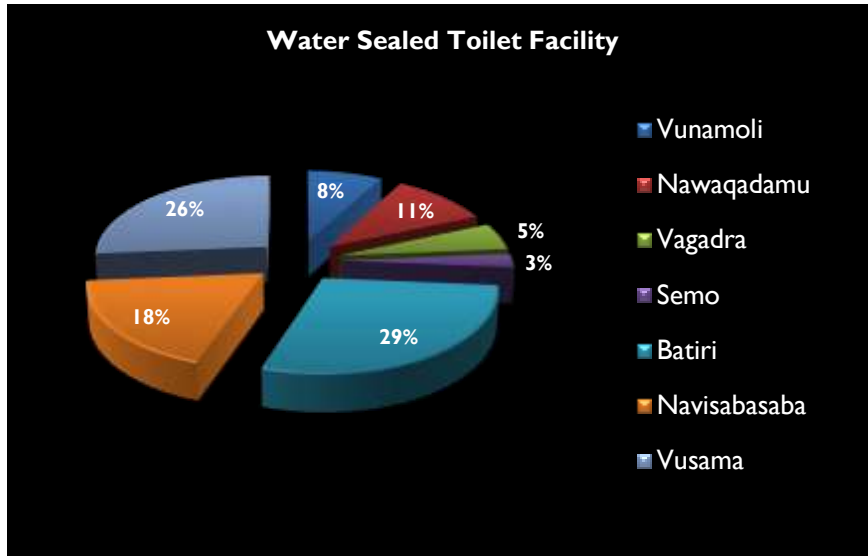
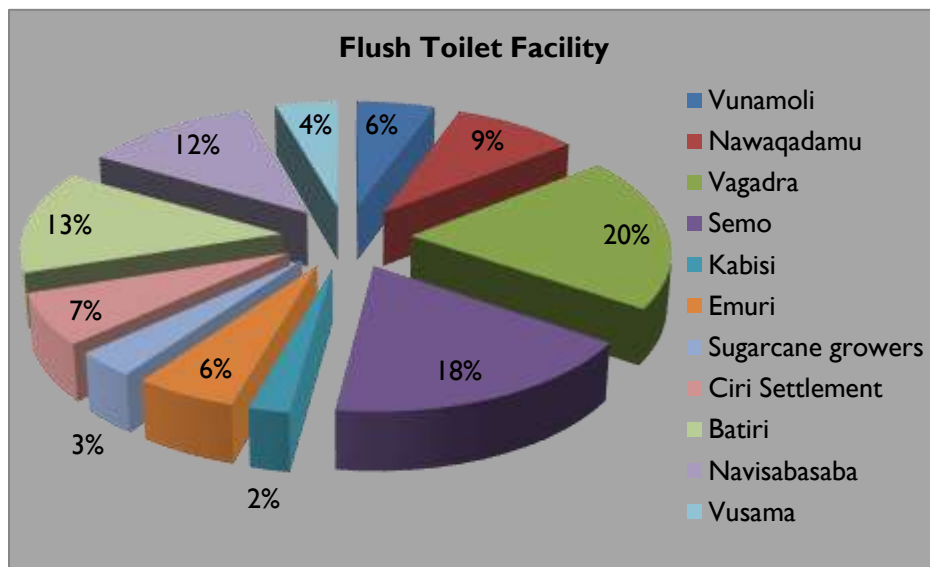


Figure 5 demonstrates the percentage population of villages in the catchment that use water sealed toilet facilities. Villages in the lower catchment record the highest and lowest uses. Water sealed toilets are more hygienically clean compared to pit toilet facility. Carting of water may be a challenge at times.

**Figure 6:** Percentage Population using Flush Toilet Facility



**Figure 6** represents the population percentage of villages and settlement that use flush toilet facility in the Tuva catchment. Findings show higher population having access to flush toilets compared to water sealed and pit toilets. However, flush toilet facilities need to be well planned and constructed. Flush toilets are user friendly and hygienically clean, however the only issue is water supply especially for villages in the lower catchment. Some households have flush toilets but resort to pit toilets when there is water crisis.

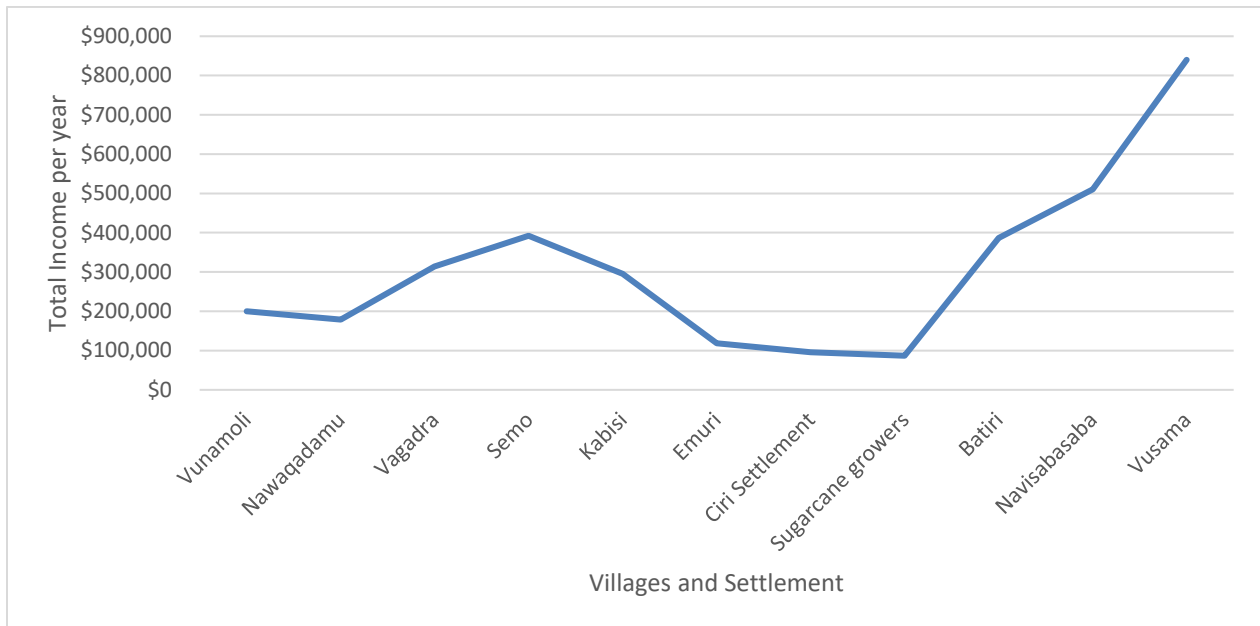
## 8.0 HOUSEHOLD INCOME AND EXPENDITURE

**Table 3:** Total Annual Income earned per Village and Settlement

<b>No.</b>	<b>Survey sites</b>	<b>Amount</b>
1.	Vusama village	\$840,044
2.	Naveisabasaba village	\$510,656
3.	Semo village	\$391,916
4.	Batiri village	\$386,628
5.	Vagadra village	\$313,988
6.	Kabisi village	\$295,192
7.	Vunamoli village	\$200,034
8.	Nawaqadamu village	\$178,610
9.	Emuri village	\$118,196
10.	Ciri settlement	\$95,870
11.	Sugarcane growers	\$86,896
	<b>Total</b>	<b>\$3,418,030</b>

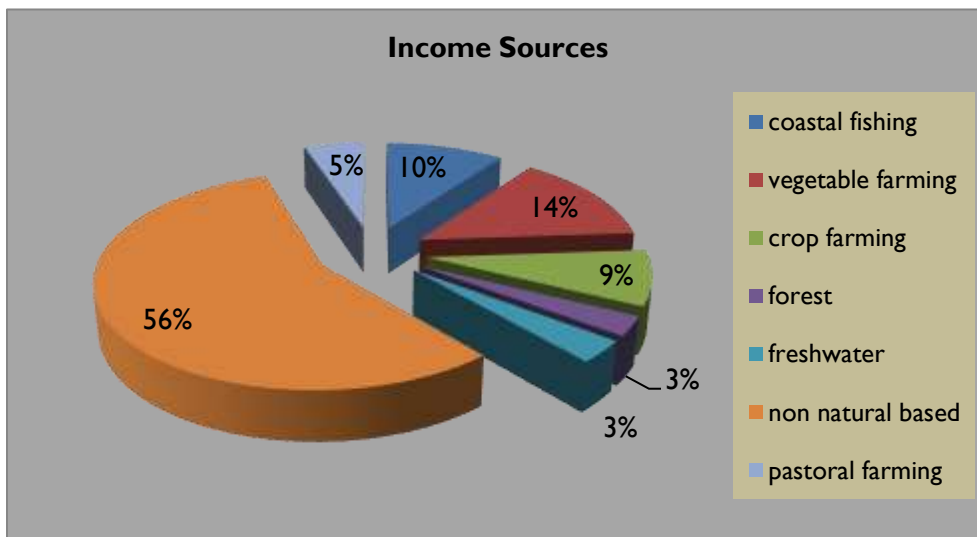
Table 3 illustrates the total income earned per village per year. The figures are arranged in descending order from the highest to the lowest annual income. By contrast, Vusama village records the highest annual income and sugarcane growers (*3 farmers*) record the lowest annual income. Income is generated from natural and non-natural resource based enterprise.

**Graph I:** Trends and Variations of Total Income per year



Graph I correlates with Table 3. The line graph demonstrates trends and variations by catchment i.e. income earnings recorded beginning from Vunamoli village (*upper catchment*) to Vusama village (*coast - lower catchment*). The data shows that Vagadra village (*middle catchment*) generates higher annual income than Vunamoli and Nawaqadamu village (*upper catchment*). However, majority of the villages in the lower catchment generate the highest annual income earnings. On the other hand, the graph depicts a decrease in annual earnings beginning from Kabisi village, Emuri village, Ciri settlement and sugarcane growers. They are relatively small in size with average socioeconomic backgrounds.

**Figure 7:** Percentage population per Income Sources



The main sources of generating income are coastal fishing, vegetable farming, crop farming, forest, freshwater sources, pastoral farming and non-natural resources. The evidence suggests that the highest source of income for the catchment is generated from non-natural resource based enterprise. There is a great disparity between natural (*fourteen percent*) and non-natural resource based enterprise (*fifty six percent*). This indicates that people prefer fulltime employment as an income source with the benefit of FNPF as their retirement plan. Majority of these working individuals utilize their natural resources mainly for subsistence use and community obligations.

**Figure 8:** Percentage of Households that depend on Non-Natural Based Resources

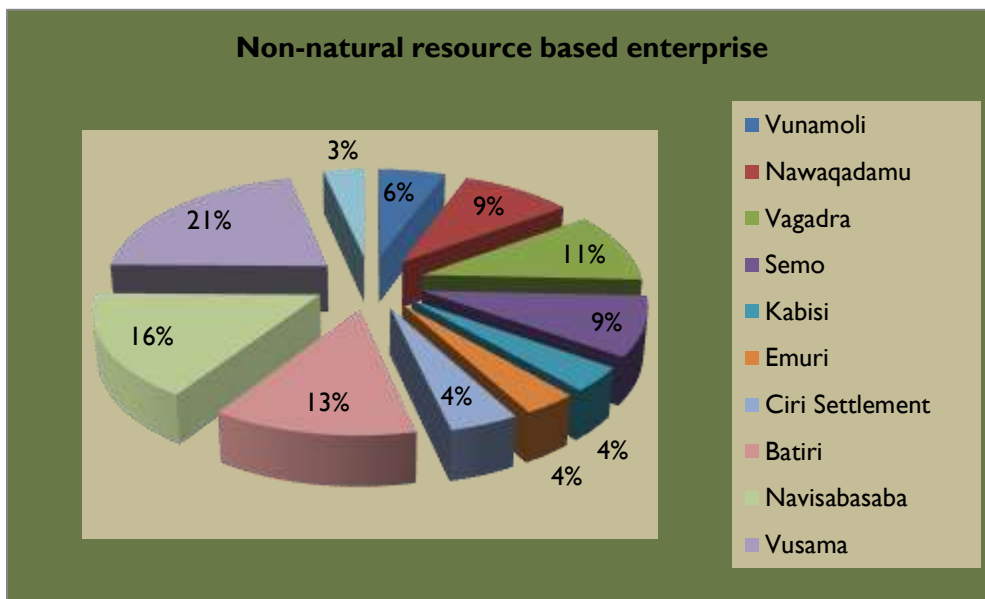


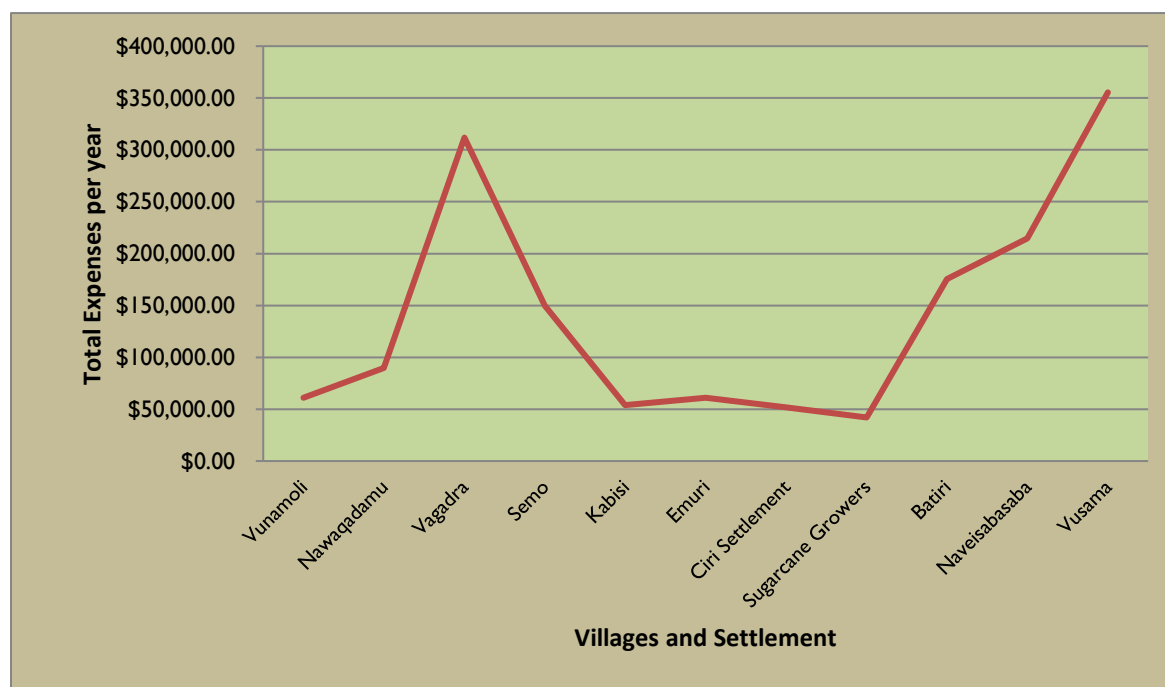
Figure 8 illustrates the percentage of households per village and settlement that depend on non-natural resource based enterprise as their main source of income. Non-natural resources include canteens or stores, transport business (*carriers or vans*), wages (*employment*), land leases, remittances and social welfare. Vusama, Navisabasaba, Batiri (*lower catchment*) and Vagadra village (*middle catchment*) record the highest percentage of dependency on non-natural resources as their major source of income.

**Table 4:** Total Annual Expenses per Village and Settlement

<b>No.</b>	<b>Survey sites</b>	<b>Amount</b>
1.	Vusama village	\$355,461.86
2.	Vagadra village	\$311,809.31
3.	Naveisabasaba village	\$214,535.00
4.	Batiri village	\$175,365.07
5.	Semo village	\$149,955.56
6.	Nawaqadamu village	\$89,728.20
7.	Vunamoli village	\$61,102.43
8.	Emuri village	\$61,002.80
9.	Kabisi village	\$53,955.44
10.	Ciri Settlement	\$51,899.80
11.	Sugarcane Growers	\$42,020.72
	<b>Total</b>	<b>\$1,566,836.19</b>

Table 4 demonstrates the total annual expenses per village and settlement from the highest to the lowest (*descending order*) in ranking. Vusama village records the highest annual expenses for the catchment. Villages in the lower catchment dominate the highest annual expenses except for Vagadra village (*middle catchment*). Vagadra village is ranked fifth (*refer to Table 3*) on the annual income earnings per year but is ranked second highest in the annual expenses category.

**Graph 2:** Trends and Variations of total expenses per year



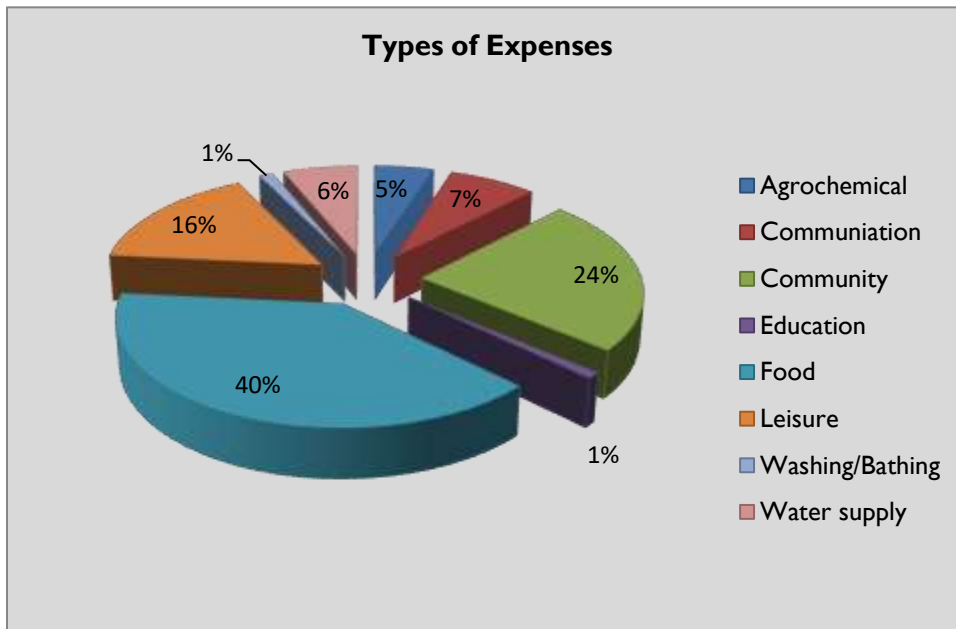
Graph 2 demonstrates the total annual expenditure trends by catchment. There are similarities and differences in the trends and variations of total annual income and expenses shown in Graph 1 and Graph 2. Yunamoli village recorded higher annual income than Nawaqadamu village (*both upper catchment*) but has lesser annual expenditure. Vagadra village (*middle catchment*) recorded very high annual expenditure almost exceeding its annual income. The trend shows that villages with high annual incomes also have high annual expenditures.

**Table 5:** Food Expenses per year

No.	Village / Settlement	Amount
1.	Vagadra village	\$210,235
2.	Vusama village	\$90,118.36
3.	Naveisabasaba village	\$62,201
4.	Batiri village	\$53,768.24
5.	Semo village	\$34,953
6.	Nawaqadamu village	\$27,300
7.	Emuri village	\$19,334.96
8.	Yunamoli village	\$15,521.36
9.	Ciri settlement	\$11,592.60
10.	Sugarcane growers	\$14,409.30

Table 5 illustrates the total amount of money used on food per year. The highest amount of expenses for the catchment is spent on food. This includes food for the individual households and community obligations. Vagadra village (*middle catchment*) spends the highest expenses on food (*i.e.* \$210,235). Other categories of expenditures are also outlined (*refer to appendix 4*).

**Figure 9:** Percentage of Total Annual Expenses for the Tuva Catchment



In Figure 9, the two highest expenses are recorded for food (*forty percent*) and community obligations (*24 percent*). Community obligations include church, provincial (*yasana*), clan (*yavusa*) and sub-clan (*mataqali*) financial commitments (*solu*). Engagements (*oga*), weddings (*tevutevu*, *vakamau*) and funerals (*somate*) are also included. Seven percent of the total annual expenses are used on communication. This includes internet data and cellphone recharge. Education (one percent) is recorded as the least expenses due to free education and free transportation for school children. Furthermore, washing and bathing essentials (*one percent*) records the least expenses for the catchment.

## 9.0 LIVELIHOOD ACTIVITIES AND RESOURCE USE PATTERNS

People utilize the natural resources to generate income, better wellbeing, food security and positive livelihood outcomes. Farming is an important source of livelihood but requires hardwork

and good time management skills. Livelihood activities in village communities are discussed and determined within individual households. Activities are planned and heads of households address the activities according to needs and priority basis. Communal activities and commitments are also incorporated into individual family workplans and daily activity timetable (*unwritten - verbally communicated*).

### **Similarities**

Livelihood activities for men (*Tuva catchment*) generally involve hunting, rearing animals (cattle and pigs), farming (solesolevaki), fishing, building, and casual labour work (farm). Apart from the ordinary housekeeping duties, livelihood activities for women include sewing, mat weaving, handicraft work, tapa making, fishing, farming, baking and cooking for fundraising. In addition, people commute daily from their respective villages to their work places.

Farming is done in stages on a monthly basis to cater for subsistence use and community obligations. Crops such as cassava are planted every month to ensure consistent supply of food for the family and for sale at the markets. Furthermore, traditional crop calendar is still followed today in the villages. Fruits are harvested in their fruiting season and sold at the local markets. Young men and women or boys and girls do the picking but ladies do the marketing. This includes *ivi (Tahitian chestnut)*, mangoes, kavika, kumquat, mandarins, avocado pear, guava, and pineapples. *Dalo (taro)* does not grow well in this region however, cassava, vudi (plantain), uto (breadfruit) and yams are supplementary crop varieties used for subsistence and for sale in the catchment.

### **Differences**

#### **Lower Catchment**

The physical landscapes and terrain vary. There are more areas of flat and gentle slope land ideal for large scale farming in the lower catchment. Farmers access assistance from the Ministry of Agriculture for the use of machinery at subsidized costs for land preparation. Mechanized farming increases production, yield and income. More local buyers are interested because of good road accessibility and distance. Farmers may sell their produce at the local markets (Nadi or Sigatoka) or directly to the buyers from their farms. There are varieties of crop and vegetable production due to the availability and accessibility of seedlings and market options. Furthermore, people have



more employment opportunities through tourism. Fulltime employment provides consistent income for the households apart from farming and other means of economic activities.

### ***Middle and Upper Catchment***

Farmers utilize land around the villages before proceeding further inland to search for fertile land ideal for farming. The rugged terrain limits potential expansion of farming capabilities. Farmers mainly use bullocks to plough the land. Food produce to be sold are transported to the Nadi market every week. The main crop sold is cassava.

### ***Resource Use***

People access agricultural land, forests, rivers, and seas for their daily livelihoods. Food supplies continue to be harvested and sold at the market daily. Land and marine resources are extracted daily either for subsistence use or for sale. Forests are logged either for general clearing and planting or for timber. All surveyed households use firewood for cooking daily. Tree branches are cut and gathered every day to meet the increasing demand. Furthermore, forest ecosystems are disturbed when village men go out hunting pigs for special occasions especially in the upper catchment. The absence of ethical farm management skills impacts the natural resources.

**Picture 9:** Tuva River



**Picture 10:** Crop farming



Picture 9 shows the Tuva River (*lower catchment*) which villagers' access to get freshwater fish and prawns for their daily livelihoods. Horses (*as depicted in Picture 9*) are the main means of transportation to the farms and are also used to cart produce to the village. In addition, Picture 10 illustrates a farm in the buffer zone along the river plains in the lower catchment.

## 10.0 GOVERNANCE AND DECISION MAKING PROCESSES

Liuliu or Turaga Ni Yavusa (*Head of the clan*) and the Turaga Ni Mataqali (*Head of the sub-clan*) are the leaders in the Vanua. They make decisions during the 'Bose Vanua' (meeting of the vanua) where important issues are discussed namely land leases, qoliqoli or church development issues. Only the Turaga Ni Yavusa (*clan*), Turaga Ni Mataqali (*sub-clan*), Matanivanua (*chiefs spokesman*) and selected elders of the vanua are present in the 'Bose Vanua'.

'Bose Vakoro' (*village meetings*) is the development forum for the villages. Inventory of different village committees and their mandate is presented during village council meetings. The members of the village council (*villagers*) are given opportunity to share their views on issues of interest. Meetings are held monthly either once or twice depending on various issues or activities that arise. The timing and processes varies for different villages.

The Turaga Ni koro (*TNK*) or Liuliu / Turaga Ni Yavusa (*TNY*) chairs the village council meetings. All villages have different sub-committees and social working groups that look after different development events. This includes Soqosoqo Ni Tabagone (*youth group*), Soqosoqo Vakamarama (*women's group*), Soqosoqo Ni Turaga (*mens group*), and Komiti Ni Yaubula (*Natural resource committee*) to name a few.

Resource conflicts occur in local villages. This includes overfishing, exceeding farm boundary, excessive or unnecessary cutting of trees, stealing from other farms. These conflicts can be resolved by both parties involved but could be addressed in village council meetings to avoid repetition. Critical issues such as land leases issues or criminal offences such as drug cultivation or possession will be discussed in the Bose Vanua (*chiefly meeting*) and referred to legal authority.

## 11.0 GENDER ROLES AND RESPONSIBILITIES

Gender roles and responsibilities are relatively the same for all villages. Roles and responsibilities are equally shared among family members nowadays. Men, women, and children have customary roles that are traditionally common in every Fijian village community.

Findings indicate that the heads of households and their wives communicate to agree to the activities planned for the week and the individual tasks that are to be carried out. The priority is to ensure that food security is maintained at all times. A lot of hardwork and time management is emphasized on men's roles in the villages. Gathering and stocking firewood and food supplies either daily or weekly. They manage daily farm activities from planting to harvesting and keep record. They ensure that village activities, rules and obligations are observed and followed. Furthermore, they play vital roles in traditional protocols during traditional gatherings or ceremonies. They are well aware of their specific social statuses and their different roles and responsibilities and when to carry them out.

Women's presence empowers and strengthens individual households and village communities as a whole. Villages within the Tuva catchment appreciate the value of women as their roles are not confined to the walls of their homes. They have very high self-esteem, knowledge and skills to perform their responsibilities efficiently and effectively. They not only manage housekeeping activities but also get actively involved in farming, fishing, handicraft, and preparation and presentation of food during traditional occasions or ceremonies in the village.

As customary in all traditional villages, young girls help out with their mothers while boys help out with their fathers in various tasks. School children have specific tasks assigned for them to do upon returning from school in the afternoons. Tasks for boys may vary from weeding in the plantation, husking and scraping coconuts, feeding pigs or preparing the fishing baits and line for fishing. The girls tasks include dinner preparation, wash uniforms, and sweeping the house or cleaning the flower beds and compound.

Most families in the catchment continue to have daily devotion and family meetings. Family meeting is normally chaired by the heads of the households where rules, reminders, tasks and activities for the next day are emphasized. Wives take time to address various issues to their children. Children are also given time to speak their mind or raise concern with regard to school, family or village.

## **12.0 STAKEHOLDER ANALYSIS – CATCHMENT ACTORS AND DRIVERS**

The following Stakeholders are the main actors and drivers in the Tuva catchment:

- Villagers (Natural Resource users)
- Landowning Units (mataqali)
- Lessees (commercial farmers or commercial companies and businesses)
- Ministry of Forestry
- Ministry of Fisheries
- Ministry of Agriculture
- Ministry of Health and Medical Services
- Ministry of Infrastructure and Transport
- Ministry of Tourism
- Ministry of iTaukei Affairs
- Non-Government Organisations

## **13.0 ATTITUDE TOWARD CATCHMENT MANAGEMENT**

Positive feedback was shown by villagers towards the R2R project at the Tuva catchment. People's knowledge and awareness about the project was reinforced during talanoa sessions. The villagers who are key stakeholders and natural resource users of the catchment area fully support the R2R project and its initiatives. They will endorse any management plan(s), activities and interventions that will benefit their natural capital and its people in particular the future generation. However, awareness, consultations, communication and the implementation of catchment activities need to be thorough and consistent.

## **14.0 BIOPHYSICAL ASSESSMENT OF THE TUVA CATCHMENT**

The purpose of the Biophysical survey was to assess the current biophysical status of the Tuva catchment. The survey was conducted at five selected villages from the upper, middle and lower Tuva catchment which covered a total transact length of 3km. Vunamoli village (*upper catchment*), Vagadra village (*middle catchment*), Semo, Emuri, and Batiri village (*lower catchment*) were selected for the assessment.

### **Upper Catchment**

The survey conducted in the upper catchment concluded that the study site had good drainage systems with free flow of water as the village sits on a high elevated location. The river was very shallow and muddy due to animals especially horses and cows crossing and bathing. Solid and liquid waste control is good as there was no evidence of any form of waste disposal. There was also no sign of grey or black water flow. Cattle are well fenced while horses are tied at various locations according to the owner's preference. Agricultural soil condition supports quality growth of crops such as cassava, yams, sweet potatoes and yaqona. However, invasive trees (African tulips) and weeds grow wildly and affect the growth of crops. Community wellbeing in terms of social interactions and interrelationships is good. There are no serious illnesses or sicknesses reported in the past. In addition, women empowerment is gradually improving as women are now involved in development planning for various village projects and initiatives.

### **Middle Catchment**

The findings indicate that the village drainage system in general lacks depth and width which leads to poor drainage. The river is used as a dumping site which is not only an eyesore but very harmful to the innocent creatures and the ecosystem as a whole. More awareness needs to be undertaken to address safekeeping of the waterways and banks. Some houses have stagnant pools due to poor outlets from the bathrooms and toilet facilities. Solid waste dumping is seen particularly in the bushes and little plantations along the village peripheries. Grey water flow is evident due to poor drainage and poor wastewater treatment facility. This becomes a health hazard for the residing population. Black water flow is also seen in some houses due to poor water outlet. There are no animal husbandry measures undertaken. Pigs are left loose in the

village and they only congregate during meals then they disperse again into the village green or the bushes or waterways. Crops grow well and are sold at the Nadi markets. Invasive trees (*African tulips*) are seen to be invading farming areas. Community wellbeing is good; people are well and healthy and enjoy village life. Although slow with average socioeconomic background, they are content with what they have and what they do. Women empowerment continues to grow from strength to strength. They support plans and activities for the village and effectively contribute during village meetings.

### **Lower Catchment**

The findings show that the drainage systems are good due to the elevated position of the village sites. The waterways at the first site looks visibly clean and clear however the community uses them for bathing and so do the animals (horses in particular). The second site is also clean but part of it is shallow due to flooding and erosion. River at the third site continues to be polluted. Crops and vegetable farming as well as livestock grazing occur within the buffer zones along the river banks. The first two study sites experience bank erosion due to farming activities and flooding. Solid wastes (*for example plastic bags, diapers, tin, wrappers, and cans*) are carelessly disposed along the outskirts of the village. The findings indicate that two study sites do not have proper landfills or disposable areas provided. The third site had a few incinerators, rubbish pits and composting spots but was open and exposed. Some households will need drainage upgrade systems to avoid grey water flow from the kitchen and bathrooms. Due to poor drainage and piping systems, black water is seen flowing directly into open drains which lead to the river and the mangrove areas. Horses are used to transport people and cart farm produce from the farms. Grazed cattle are well fenced but some cattle continue to freely roam the village. At times, cattle and horses are tied closer to the village but are let loose to freely move around and feed on the village greens. Soil condition and crop health is good. Crops and vegetables such as cassava, kumala, eggplants, corns, English cabbages, tomatoes, beans and tobacco etc. grow well. Invasive trees (*African tulip*), shrubs and weeds are affecting agricultural fields and activities in the catchment. Community wellbeing in the lower catchment is good. People are happy and healthy and enjoy village life. Women empowerment continues to grow and many of them are actively involved in collective community engagements and employment in the tourism industry.

## **15.0 THREATS TO THE TUVA CATCHMENT**

### **15.1 Threats to the Forests**

#### **Vunamoli Village**

Forest fire/burning causes soil erosion and Native birds are slowly disappearing. This affects the villagers financially as burned land turn out to be new grasslands where cows feed. Soil erosion in such areas affects food supply for the livestock and income for the farmers. Cultural obligations are also affected particularly with the loss of native trees. However, no major social issues/problems are experienced from such activity.

Deforestation is also a major cause of soil erosion and destruction of native trees in the area. Road access is hugely affected by logging machineries. Logging contractors tend to exceed boundaries over buffer zones to the river. Villagers earn a living by working for the logging companies. Loss of native trees is a loss of cultural and traditional identities of the people. Due to the increased rate of deforestation and burning, wild pigs resort to village farms as their food source. This impacts sources of income as well.

In the past, the elders manage their forests thinking of the future generations but now there are a lot of mismanagement practices. Nowadays, yaqona planting is carried out in the forestlands. Other crops are grown along the flat areas and the lower ridges. There has not been any rehabilitation program or sustainable management of forest lands or deforested areas. There are no current plans for reforestation particularly of native trees.

Pigeon shooting is a threat as people with shooting licenses take advantage of such opportunity. However, native bird population continue to exist nowadays though not as many as before. This includes bats, Fijian dove, and parrots to name a few. In the past, sounds of birds would be heard in the morning and evenings. According to the elders, this signifies the dawn of a new morning and the sound in the evening meant a day's work is over. Nowadays they hardly hear those sounds which indicate that the habitats of those birds are destroyed and the birds have disappeared.

### **Vagadra Village**

Deforestation has led to the disappearance of native trees. Water source is usually affected therefore water shortage in the village occurs. Soil erosion causes the destruction of fish habitats. The river is becoming shallower and affects the river ecosystem. Food chain is disrupted and food sources affected. Forest fire destroys native trees. In addition, reeds used for thatching traditional Fijian bures are destroyed as well. The loss of such resources leads to the loss of tradition and their cultural identity [*for example weaving and thatching bures*].

### **Semo Village**

Key informants indicated that the environmental changes experienced nowadays are due to the change in time and the constant change in climate. This has led to the non-existence of abundance of habitats and species that once existed within their peripheries. Biodiversity and richness of the forests is no longer the same as in the past. The absence of such unique features leads to the loss of cultural identities and values.

Forest fire destroys all plants/trees particularly native trees. These native trees have a lot of meaning to the people. Excessive logging activities cause soil erosion and rivers to get shallower. In addition, various fish species and mussels commonly found before have since disappeared. This leads to the loss of cultural identity. Invasive species such as the African Tulips are dominating forest lands and taking over native trees. Mahogany tree planting are also destroying native trees. Deforestation leads to the loss of wild yams. Wild yams are alternatives to staple food and this is a practice ancestors followed. When they are destroyed it means the knowledge, culture and learnings associated are also lost. This may lead to scarce food supply.

### **Kabisi Village**

African tulips and flaming trees have suppressed native trees. These native trees are the cultural identity of the villagers. The people are closely connected to their natural environment. They feel a sense of belonging and pride in their natural resources. Therefore, when trees and birds or other native creatures are destroyed or disappear, they get very disappointed

Logging activities occur almost everywhere. Uncontrolled logging occurs as the code of logging is not strictly followed. Landowners are no longer informed prior to any logging activities. Logging activities are not monitored and loggers tend to trespass. Fruit trees and Goshawks continue to



diminish. Peoples sources of income and livelihood is affected. The villagers fear that there will be no more fruits available in the near future.

### **Navisabasaba Village**

Landslides and soil erosion are causing the premature falling of trees. The loss of tree species due to such unfortunate circumstances negatively impacts the ecosystem. Habitats are destroyed and living species are left vulnerable.

### **Vusama Village**

There are no native forests at Vusama village. However, there is interest shown for planting of native tree seedlings.

### **Emuri Village**

The clearing of forest for agriculture, forest fire or burning, commercial logging and cattle farming are the major threats affecting the forest. These threats affect the river system which leads to the decrease of freshwater resource population. They also affect the community's livelihood and sources of income. Furthermore, soil gets infertile when there are activities such as excessive burning. However, these threats do not affect them financially.

On the other hand, it does affect their cultural obligation especially when clearing of forests and commercial logging is done, trees that are used for building a traditional Fijian bure are harvested too. It is very hard and expensive to look for these trees from other places. The main social issues/ problems experienced are the lack of sources of income and food and their chances to build houses in the village.

### **Nawaqadamu Village**

Clearing of forest for agriculture, forest fire or burning, clearing for mining prospecting, commercial logging, and landslide are major threats to the native natural forest. The Manganese mining in the 1950s impacted the forests and agricultural land. Most of the fertile lands were lost. Freshwater resources and streams dried up. Logging took place in the 1970s. Mr. Khan logged all native trees in the forest.

**Picture 14:** Land deforestation (logging) at Nawaqadamu



## **15.2 Threats to the Waterways, Creeks, and Rivers**

### **Vunamoli Village**

The use of chemicals during fishing is killing prawns, eels, and fish of all sizes in the river. Human health is at great risk. Village income is affected due to the disappearance of various freshwater resources. Cultural obligations are also affected. Freshwater prawns are a traditional meal and cultural identity for the people of Vunamoli. They are traditionally cooked and prepared for special occasions. This is no longer happening due to the diminishing prawn population as a result of the use of chemicals.

Furthermore, rivers are becoming shallow. This has led to the loss of prawns, fish and eel population. Villagers find it hard to access these freshwater resources for income nowadays. However, if there is a meeting planned to be held in Vunamoli village, the waterways are banned from any forms of fishing. Traditional ban will be lifted in time for the meeting. Freshwater resources accessed will be used to cater for the participants of the meeting.

### **Vagadra Village**

Water continues to become shallow due to erosion. Fish habitats in the river are destroyed. Fish sizes that used to be sold in the market before are no longer available. A reduction in fish sizes

and fish population affects their income and source of livelihood. River bank erosion widens the river and causes land retreat, hence, lesser supply and income for the farmers. In addition, key informants indicated that certain fish species that used to exist in the river before have diminished. The loss of fish species would also mean the loss of traditional and cultural identity for the people. Use of chemicals to kill fish destroys all living creatures in the river. Source of food and income is affected. Continuous dumping of rubbish such as diapers and plastic bags pollute the river and lead to the disappearance of many sources of food and income. Furthermore, excessive flooding is seen as a threat and cause for the disappearance of fish population. The bigger fish population has migrated downstream due to constant flooding.

Climate change is also said to have had major impacts on the water level in the waterways.

### **Semo Village**

The river and its ecosystem are disturbed due to gravel extraction. There are various unique creatures in the river that represent the culture and tradition of a particular place and its inhabitants. Their removal or destruction affects the cultural identity and traditional beliefs and teachings of the people. This may lead to conflicts and arguments.

Boat speeding upstream and logging techniques (by Fiji Pine) causes river bank erosion and further land retreat. The absence of various fish species affects people's livelihoods. Fish like grass carp used to survive in the river are now disappearing. Clearing of paragrass on the river banks destroys the habitats of fresh water fish and also leads to river bank erosion and further land retreat.

### **Kabisi Village**

Gravel extraction destroys the habitats and creatures in the river. Water level continues to decrease hence the disappearance of big fish. The loss of river ecosystem leads to the loss of food and income sources. For example, fish and prawns. Cultural obligations are affected as traditional foods that are expected to be presented are no longer in abundance for traditional gatherings.

Fishing techniques is affecting the marine resources. Ladies no longer use traditional fishing methods. Nowadays, they use fishing nets as a more efficient and effective method. They are able

to catch in abundance different varieties of species and sizes. Long term implications are the reduction in fish population particularly the loss of native fish. Food scarcity and low income sources will be the result.

Key informants highlighted the loss of boulders and rocks from the river. They are habitats that protect fish and other living creatures in the river. Rivers and ponds have become murky due to logging and introduced fish species have suppressed endemic gobies.

Farming on floodplains and buffer zones contributes to river bank erosion and the constant widening of the river. Mangrove snappers are now found in the river and are killing the native fish species. Pollution continues to affect the river ecosystem. It doesn't only affect the survival and existence of marine resources but the health and safety of human life who consume them for a living. Native fish (saweni), freshwater eels and prawns have disappeared from the streams and river system.

### **Ciri Settlement**

The creek mouth is over grown with mangroves which cause a lot of flooding during heavy rainfall. Farms are always flooded and food sources are either completely destroyed or partially damaged. Pollution poses risk to human health and marine resources as a whole. River bank erosion continues to widen the river channel. Narrow estuary because of development causes flooding. The presence of elephant grass dominates portions of farmlands along the river banks. Furthermore, the removal of vertiver grass for building traditional Fijian bures causes a lot of erosion along floodplains.

### **Navisabasaba Village**

Waters are becoming shallower because of landslides. This causes a lot of flooding which affects farms. Food sources are affected. Shallow waters cause fish population to migrate to the deeper waters. Their absence affects food sources for the people. Narrow channel of the waterways has led to increase in water levels during floods and have had adverse impacts on farms. Sharks are seen at the river mouth during high tide. This poses great risk to the residing community.

Lots of deforestation along the river banks destroys the river ecosystem and the habitats of various living species. Before there used to be trevally accompanying sardine but now there is no

more. Trevally is a major source of food for the people. Their disappearance indicates the destruction of their habitats. Presentation of trevallies will no longer be a tradition as they are no longer seen in the river. Food source is affected especially the consumption of fish.

Fishing along the river takes longer compared to before. There is less fish population existing in the river today. The use of Jet skis for tourist activities disturbs the marine ecosystem and causes river bank erosion and land retreat. The use of boats generates huge waves that are destructive to the river banks

### **Batiri Village**

Tourist boats using the river travel at high speeds hence cause soil erosion, river bank erosion and overtime leads to land retreat. Waters are getting shallower due to continuous landslides along the river banks. River channel is getting wider and wider due to river bank erosion. Farmlands are lost due to land retreat. This cause more flooding on low lying areas and food sources household livelihoods are affected.

Key informants shared that before villagers were not allowed to swim across the river because of shark attacks. During that time, the river was deep and sharks were found in the upper river but now the river is shallow and sharks are hardly seen.

### **Vusama Village**

The shallow river leads to the disappearance of various fish species. Before, villagers used to fish for cod and there was a particular bird that gives a signal indicating the presence of cod in the water. This no longer occurs nowadays which indicates the absence of cod in the river. Cod used to be sold for income.

Riverbank erosion and land retreat occur as a result of hotel boats traveling at maximum speeds. Landslides cause the falling of mangrove trees into the river system. Various fish species may disappear forever if no precautionary measures are taken. It is very hard nowadays to look for fish as they do not exist in abundance as before. Villagers have to look elsewhere. Fishing nowadays takes longer. People passing by tend to pollute the river and sea. This rubbish thrown into the upper river is washed out into the ocean. Habitats and food sources are affected.

Sugar cane farmers along the river plains use chemicals that can easily be washed into the sea during heavy rainfall and bank erosion. The river system along the mangrove forest is banned from any fishing activities until further notice. Whenever there is a village function then it is traditionally lifted for the villagers to get fish for the occasion. The ban is reactivated afterwards.

### **Emuri Village**

Major threats include gravel extraction, waste disposal (*solid waste and liquid waste*), overfishing, use of indiscriminate fishing methods, riverbank landslides, logging of riparian vegetation, flash floods, use of dynamite, nets and debris plant (*duva*).

The above threats lead to the decline in freshwater resources. This affects their source of income and food supply. Communities find it hard to look for freshwater resources as the river is highly polluted. Most times villagers have to buy freshwater resources or pay for transport if they want to eat freshwater fish, prawns, and mussels. This affects community (*vanua and church*) obligations. When there is a vanua gathering, they have to feed the vanua with these resources but they are unable to do so as the resources have been depleted. The main social issues or problems are the depletion of freshwater resources that generate income and food security.

### **Nawaqadamu Village**

The major threats are overfishing due to commercial pressure or population pressure, use of indiscriminate fishing methods, riverbank landslides, riverbank landslides, logging of riparian vegetation, and flash floods. The use of indiscriminate fishing methods impacts most fishes and crustaceans. Logging causes streams and creeks to dry up which are a major source of livelihood for the community. Flash floods tend to increase since most of the streams and pools have become shallow due to sedimentation from logged areas.

## **15.3 Threats to the Grassland**

### **Vunamoli Village**

Vast areas of grasslands of the past are now taken over by Pine forests.

### **Vusama Village**

Land pollution through excessive dumping of rubbish becomes an eyesore and a terrible breeding place for cockroaches and rats. It creates sickening smell that affects human health. Polluted land is no longer ideal for any agricultural activity due to high levels of concentration of toxic waste. There is consistent burning of sugarcane farms and farmers will spend more to get this growing again.

### **Emuri Village**

Burning destroys traditional medicinal plants in the area. This affects villagers financially because without those traditional medicinal plants they have to travel to the Sigatoka hospital which is more expensive (*approximately \$15 fare*).

### **Nawaqadamu Village, Ba.**

Burning is a major threat to the grasslands. Cattle farmers burn grasslands to control weeds for their pastoral land. Pig hunters also burn grasslands to capture wild boars.

## **15.4 Threats to the Farmland**

### **Vunamoli Village**

Wild animals (*especially pigs, horses, and cattle*) destroy village farms, hence, source of livelihood is affected. Cultural obligations for traditional village occasions or ceremonies are affected. Sometimes arguments and disagreements occur between farm owners and animal owners.

Cyclones are the major threat to the farmlands. Crops and vegetables are destroyed by strong winds and flying branches. Sources of income and cultural and traditional obligations are greatly affected. People have to clear debris and replough and replant for a new farm cycle again. Short term crops (kumala) and vegetables are usually grown. Villagers put in a lot of hard work and sacrifice in order to ensure sustainable livelihood outcomes.

Forest fire/burning spread into farming areas hence destroy crops and vegetation. Family income and food supply is greatly affected. Various diseases are affecting the growth of certain produce

(for example, *plantains*). Leaves wilt and die while fruits shrink in size. They cannot be eaten or sold due to their diminishing quantity and poor quality. Families who depend on plantain as their major food source particularly due to medical reasons are affected.

### **Vagadra Village**

Invasive species (*African Tulip*) is a major threat occupying large potential areas vacant for farm land and existing farmlands. They grow enormously and scattered over large areas of land. This reduces farming efficiency, productivity, yield, and income. Flooding naturally affects vulnerable areas. According to key informants, plantations are normally flooded and filled with water during flooding hence affects yield and quality of production. In addition, villagers are not able to meet cultural obligations for village functions or occasions due to scarce food supply.

Soil erosion affects the physical landscapes of farmlands. Soil nutrients are lost through erosion. Crops and vegetation are destroyed. Burning destroys food sources and therefore leads to shortage of food supply to be sold at the markets. Excessive burning may lead to extensive damages that may possibly affect cultural obligations in the village. Burning also causes excessive loss of native plants and trees. Furthermore, various diseases affect crops and vegetables. For example, fungi on cassava stems affect crop life and productivity. Quality and quantity of yield is affected. Furthermore, drought or long dry spells leads to lack of adequate water supply for proper plant growth. Stress caused on plants exposes them to potential insects and disease attacks. This increases the severity of impacts on poor crop life, productivity, yield and income.

### **Semo Village**

Excessive use of soil over the years has led to the decrease in soil fertility. This is evident in the yield and production output during harvest. The quantity and quality of yield for either financial or cultural obligations has decreased dramatically. Farmers have to produce more in order to harvest large yields and meet demands. A common issue is the excessive use of fertilizers and chemicals. People are at risk of NCDs due to excess purchase and mismanagement of farm chemicals and fertilizers.

Farming near river banks pose high risk of river bank erosion. Traditional farming techniques are no longer used as people prefer modern farming methods (*use of machinery for land preparation*).



However, soil structure and soil health is a concern as ploughing or tillage may occur on the same piece of land several times in a planting season.

A fungi bacterium affects the growth of cassava. Market value and food security is affected. Farms are badly affected by drought. Crop life, yield and market value is compromised hence peoples' livelihood outcomes are affected. This leads to the increased consumption of more processed food. The excessive use of farming chemicals will have long term effect on soil texture and structure. It will take years for the soil to regain its original fertility status.

### **Kabisi Village**

Loss of soil nutrients affects the growth of crops. Crop quality plays a vital role in determining the price of products sold at the markets. Low crop quality leads to low yield, sales and less income. Therefore, food supply for income, cultural obligations and subsistence use is affected. Invasive species have taken up large portions of farmlands. Bush fallow system is difficult as invasive species tend to occupy vacant areas of land very quickly. Farmers are experiencing symptoms of climate change impacts. Drought has been a major setback for farmers. Crop quality, yield and production are greatly affected. Villagers are not able to consistently meet cultural obligations and family needs.

Burning/forest fire is a major threat as it normally destroys everything in its path. Farmers lose everything planted and have to start all over again. Long term effect of the use of chemicals is visible in soils. Growth and quality of crops harvested is affected. Human life is also at risk consuming food grown on land excessively concentrated with chemicals. This may contribute to various sicknesses (NCDs) and diseases. Change of farming methods and techniques from traditional to modern equipment and machineries is going at a faster rate. Farmers utilize modern mechanisms to speed up planting to harvesting periods, increase production and earn maximum profits from it. However, this only leads to over exploitation and long term implications on the soil structure.

Soil erosion is a major threat as loss of soil nutrients affects crop life and quality. Low food production leads to low food sales at the market hence less income. Cultural obligations in the village are also affected. Less consumption of fresh and healthy food will possibly lead to the increase of NCDs.

### **Ciri Settlement**

Flooding causes the drowning of animals, cattle in particular. Villagers who rely on rearing animals as a source of income are greatly affected financially when such incidents occur. Cows are the main food source for traditional ceremonies. Cultural obligations are affected due to their loss. Domestic pigs either partially damage or completely destroy farms which affect income sources for families. Food shortage may occur due to the extensiveness of the damages caused.

Drought kills crops and vegetables and grass for the animals. There is insufficient water supply for rearing livestock. Crop produce does not yield much and earnings decrease. Food availability is a problem and people resort to buying processed food. Farmers are being threatened by FSC to plant sugarcane despite the low financial return. Sugarcane farming is very tiring and time consuming with very low income. Farmers resort to rearing cattle and goats as additional means of income and livelihood for their families. Another setback experienced are wild dogs who are killing farmed goats.

### **Navisabasaba Village**

Animals damage farms. Crops are either partially damaged or completely destroyed. Income and traditional obligations are affected. Theft of farm produce causes conflicts. Daily food ration is affected. Drought causes extensive damages to crop life and yield. Very little is produced and sold for income. There is shortage of food supply for subsistence use. Flooding damages cassava plantations on low lying areas. Income and subsistence use is affected. There is shortage of cassava due to widespread damages.

Pests and diseases damage taro leaves (rourou) and bele leaves. A particular virus affects banana leaves which continue to shrink in size and affects the fruit as well. Fire destroys farms. Produce planned to be harvested and sold are destroyed hence affects daily livelihoods and income sources. Flood deposits debris and all sorts of rubbish when water recedes. Crops are washed away or get scorched by the sun after a big flood.

### **Batiri Village**

Drought causes less or no water supply at all and farm produce are destroyed. Income and subsistence supplies of food are affected. Climate change continues to affect food production.

Lack of rainfall and long periods of dry weather causes adverse effects on food sources. Household livelihoods face major challenge coping with these stresses and vulnerabilities.

Sugarcane farmers face difficulty with the purchase of fertilizers for sugarcane as they are very expensive. More money is spent on planting and maintaining rather than harvesting. Weedicides have long term effects on soil structure, texture and overall soil health and quality. Crop quality and yield will decrease hence affect market value.

### **Vusama Village**

Traditional farming technique is no longer practiced. The elders used traditional farming techniques to produce varieties of crops according to their specific seasons and there used to be abundance of food supply. When there is food surplus, it is sold to assist with family needs. Nowadays, villagers grow just enough for subsistence use. Not many variety of food is available. For example, there is no yam farming in the village today. People grow and eat one variety of crop (cassava) all year and when it does not grow well there is nothing to substitute it. This results in food shortage.

Climate Change (CC) has brought about many changes to farming. It dictates how farmers grow and harvest their produce. Farmers are no longer able to predict the weather in a farming cycle or season due to the unexpected changes experienced daily. For example, the Kuta plant no longer exists due to CC. Drought is also experienced and affects crop life, yield, cultural or traditional obligations and income. Cassava diseases tend to destroy cassava plants. Food rationing is important in such circumstances. Flooding occurs during heavy rainfall and destroys farms hence causing food shortage. River bank erosion caused by hotel boats affects farms along low lying areas. Invasive species namely African tulips and raintrees occupy farmlands and take over native trees.

### **Emuri Village**

Burning, land development, soil erosion, invasive pests, flooding, and drought are the major threats to the farmland. They either directly or indirectly destroy food and income sources which are the basic needs for sustainable livelihoods. These threats affect villagers financially. For example farmers have to buy weedicides or insecticides to get rid of potential harmful pests and diseases. Prices vary and can be very costly. Otherwise, if they are not treated in time, production

yields during harvest may decrease due to high mortality rate of crops and vegetables. When crops and vegetation are destroyed and there is lack of food supply, cultural obligations is affected.

### **Nawaqadamu Village**

Uncontrolled burning of grasslands affects farm lands. Invasion species known as African tulip trees affect farmlands by preoccupying and dominating majority of the land areas. Wild boars have had major impacts on cassava farms while cattles invade and damage farm areas. The use of machineries and bullocks has led to the loss of soil fertility overtime. Farmers experience a decline in crop productivity due to excessive cultivation and planting of the same crop on the same piece of land. Soil erosion washes away rich top soil and damages existing crops and vegetation while droughts causes short life span for crops thus affecting productivity and yield.

## **15.5 Threats to the Marine Environment including Mangroves**

### **Navisabasaba Village**

Flooding leads to the deposition of all forms of rubbish via the river channels and washed down to the sea. Exploitation of marine resources and selling of undersize crabs creates an unstable future for the crab population. There is no freedom granted for reproduction and multiply for the future. Theft or illegal cutting of mangroves leads to the loss of mangroves, habitats and ecosystem. If uncontrolled mangrove cutting continues, habitats will be permanently destroyed and living creatures extinct.

Mangroves stems are used to build traditional bures in resorts/hotels. People cutting and selling mangrove stems are compensated. However, biodiversity and food chain is greatly implicated in such activity. This would lead to the loss of fish, crabs and native birds. The use of duva kills every reef fish of all sizes. The greater risk and concern is the permanent loss of various fish species due to the constant use of duva.

The use of horses to catch fish out in the sea damages the corals. These coral reefs are very special as they provide habitats for unique fish species. Continued activity as such causes stress and vulnerability. Use of sunscreen along the beach can be very destructive to coral reefs as certain species can be intoxicated. Uprooted trees floating out at sea damages the reef and spoils the white sandy beaches.

Certain areas that used to be white sand are now filled with mud making it swampy. Different forms of rubbish washed down to the sea during floods pollute the ocean. The reef system, habitats and living creatures are all at risk. Human life is also at risk as they depend on marine life as traditional food sources. Climate change- strong current nowadays compared to before. Coastal birds are disappearing. If unplanned development and pollution continues then it may chase all those coastal birds away.

### **Batiri Village**

Mangrove roots strain waste from inland before they reach the sea. Mangroves are habitats to different species of birds, reptiles, insects, prawns, fish, etc. If mangroves are destroyed the above species die as well. If fish, crabs and other food sources are not conserved, they are likely to diminish and disappear. This affects livelihoods and sources of income.

Most fish will disappear due to the extensive shallow waters evident in the river systems. When habitats are destroyed there is high possibility of creatures that depend on them for survival will disappear as well. The use of fishing nets will dramatically decrease the fish population. Food supply in the near future will be affected due to unethical fishing practices. Speed boats travelling at maximum speeds along the coast cause river bank erosion and changing landscapes due to land retreat.

### **Vusama Village**

There is a decline in the species of crabs, fish, eels available now compared to before. There is concern that the numbers will keep decreasing if nothing is done about it. The fish, crabs and eels etc. signify the village totem which is a traditional and cultural identity and of utmost importance. Logging of mangroves for hotel purposes will lead to the loss of habitats and living creatures. Mangroves are of cultural and traditional importance to the people. Dumping of rubbish in mangrove areas pollutes and harms habitats and living organisms.

## **15.6 Land Use Management (Agriculture and Forestry)**

### **Vunamoli Village**

There are no land use management plans or practices currently effective. Bush fallow system was used before but is no longer practiced.

### **Vagadra Village**

Mixed farming and intercropping is practiced to enable continuous production for farmers. Contour farming is done to prevent soil erosion and allow nutrient restoration in the soil. Pineapple and bele are commonly grown on contour slopes. In the past, random visitation and update of farm production was done for each farmer. The number of crops or vegetables grown would be recorded for all farmers. In addition, the bush fallow system is no longer practiced today.

### **Semo Village**

Agricultural land is thoroughly ploughed with the use of either bullocks or tractors. Dried grass is ploughed with the soils to add nutrients into the soil. Ploughed land is then left for a while before planting takes place. Mixed cropping (*cassava, bindhi, tobacco and water melon*) and crop rotation is practiced. Contour farming is also done particularly by farmers on hilly slopes. Farmers have been thoroughly assisted with the providence of seedlings and farming implements via Government's Farm Care initiative.

### **Kabisi Village**

There is no land management practice in place. Traditional farming practices are no longer practiced. There are no livelihood projects to be initiated by any agency or government. Fundraising activities are held to cater for the *solu ni yasana* (province money collection). Village development plans exist but there are no funds to support it. Majority of the households have pit toilets but plans are underway to have flush toilets.

### **Ciri Settlement**

The Agriculture Department has visited Ciri Settlement regarding a project on Guava planting.

*Additional comments regarding issues in Ciri:*

Mangroves along the mouth of the creek are something that is new to the community because there were no mangroves before. In addition, every farmer has a vehicle because of the distance to the main road. There were promises made that the road will be upgraded but it has been 7 years and no development has eventuated. Furthermore, the settlement still does not have access to electricity.

### **Navisabasaba Village**

There are no land management plans or practices currently in place.

### **Batiri Village**

The land management plan currently effective is either to ban tourist boats from using the river or completely reduce speed. The other alternative is for all tourists and hotel staff to board the boat from Natadola rather than using the river.

### **Vusama Village**

There is a plan in place to have a natural water processing plant. Another proposal is to have a hydroelectric plant to be constructed near the river on village land. Nowadays farmers are no longer using forks but ploughs. At the moment there is no good farming management.

### **Emuri Village**

Intercropping or model farming whereby more plants are planted in one place to make use of the land rather than planting one type of plant in one place which will leave more gaps. When there is an extreme weather condition, you have the chance to get food from that model farm. Some of those plants will be destroyed while some can withstand the extreme weather conditions. Villagers plan to plant drought resistant crops to maintain food and income supply. In addition, they plan to seek assistance from government and other funding agencies.

## **16.0 CONCLUSION AND RECOMMENDATIONS**

The following recommendations are based on key findings and discussions with key Informants for the Tuva Catchment region.

- I. More thorough consultations and awareness workshops are to be conducted on proper farm management practices. Workshops to outline specific information and solutions to loss of soil productivity, declining crop yield, pests and diseases, recommended chemicals and uses, land degradation and desertification, reduced water quality and supply, change in cropping season, and loss of cultural identity.

2. Waste management practices needs to be improved with clear regulations to be instituted along with enforcement officers to follow through, particularly with lifestyle changes that include dumping of household waste materials in the river. Relevant stakeholders need to conduct awareness workshops on proper waste management practices. Strict rules need to be implemented. TNK and TNY need to be engaged to enforce change.
3. All villages in the catchment need to improve sanitation facilities. The location and type of toilet facilities, drainage systems, and wastewater treatment systems needs to be improved. Health inspectors need to conduct frequent visits to villages. TNY and TNK need to enforce change in the villages.
4. Water is a basic necessity of life and for successful livelihood outcomes. Villages in the lower catchment namely Batiri, Vusama, Naveisabasaba, and Ciri settlement have been facing water problems for years. Financial, infrastructural and technical assistance is needed. This will help prevent or minimize waste pollution in the waterways.
5. Proactive Adaptation and proper resource use management needs to be addressed at village level. They need to discuss and implement 'taboo' for their traditional fishing grounds and ensure strict observation of these taboos. Exploitation of natural resources needs to be at minimal levels. A suggestion put forward during the talanoa session was the need to have forest and fish wardens in the catchment to monitor the forest and marine resources and to reduce uncontrolled harvesting and extraction of valuable resources for short term gain.
6. Mangrove reforestation program is vital for coastal villages to ensure that the coastlines are protected. Awareness is pivotal and strict enforcement of regulations needs to be consistent. Findings indicate high reliance on mangroves for firewood especially for the lower catchment.
7. Green and brown rubbish/waste such as tree branches, fallen leaves, food peelings and cuttings are normally thrown into the waterways or plantations and piled and left idle which over time attracts flies, becomes an eye sore and releases bad smell. Relevant stakeholders need to conduct awareness and training workshops on composting techniques. Villagers must



learn how to recycle waste through composting. This will be positively impact farming activities through the use of organic manure.

8. More awareness and consultation workshops need to be conducted on financial literacy and resource use management skills training. Villagers are to be educated on how to utilize their resources wisely and generate consistent income for positive and sustainable livelihood outcomes. Financial literacy is critical to prevent excessive spending and to encourage savings and investment.

## APPENDICES

### Appendix I: List of Villages and Settlement

No.	Vanua	Tikina	Villages/Settlement
1	Nasesevia	Rukuruku	Vunamoli
2	Nasesevia	Rukuruku	Nawaqadamu
3	Nasesevia	Waicoba	Vagadra
4	Yavahuga & Voua No.2	Tuva	Semo
5	Yavahuga & Voua No.2	Tuva	Kabisi
6	Yavahuga & Voua No.2	Tuva	Emuri
7	Nahoni (Tuva River Mouth)	Malomalo	Naveisabasaba
8	Nahoni (Tuva River Mouth)	Malomalo	Batiri
9	Nahoni (Tuva River Mouth)	Malomalo	Vusama
10	Nahoni (Tuva River Mouth)	Tuva	Ciri Settlement

## Appendix 2: Timeline of R2R Household Socioeconomic Survey

<b>Date</b>	<b>No. of Days (<i>field survey</i>)</b>	<b>Village / Settlement</b>
Sept 16	Day 1	Survey at Vunamoli village
Sept 17	Day 2	Survey at Nawaqadamu village
Sept 18	Day 3	Survey at Vagadra village
Sept 19	Day 4	Survey at Semo village
		Survey at Kabisi village
Sept 20	Day 5	Survey at Emuri village
Sept 23	Day 6	Survey at Ciri Settlement
Sept 24	Day 7	Survey at Naveisabasaba village
Sept 25	Day 8	Survey at Batiri village
Sept 26	Day 9	Survey at Vusama village
Sept 27	Day 10	

### Appendix 3: Consolidated Income, Expenses, and Surplus per year

<b>Villages / Settlement</b>	<b>Income</b>	<b>Expenses</b>	<b>Surplus or Savings</b>
Vunamoli	\$200,034	\$61,102.43	\$138,931.57
Nawaqadamu	\$178,610	\$89,728.20	\$88,881.80
Vagadra	\$313,988	\$311,809.31	\$2,178.69
Semo	\$391,916	\$149,955.56	\$241,960.44
Kabisi	\$295,192	\$53,955.44	241,236.56
Emuri	\$118,196	\$61,002.80	\$57,193.20
Ciri Settlement	\$95,870	\$51,899.80	\$43,970.20
Sugarcane growers	\$86,896	\$42,020.72	\$44,875.28
Batiri	\$386,628	\$175,365.07	211,262.93
Naveisabasaba	\$510,656	\$214,535.00	\$296,121
Yusama	\$840,044	\$355,461.86	\$484,582.14
<b>TOTAL:</b>	<b>\$3,418,030</b>	<b>\$1,566,836.19</b>	<b>\$1,851,193.81</b>

## Appendix 4: Categories of Expenditure per year

Villages	Agro chemical	Communication	Community	Education	Food	Leisure	Toiletries	Water supply
<b>Vunamoli</b>	\$3,124	\$3,764	\$12,640	\$6,604	\$15,521.36	\$9,834	\$6,856.68	\$3,028.39
<b>Nawaqadamu</b>	\$2,179	\$6,040	\$16,060	\$8,268	\$27,300.44	\$27,120	\$17,100.24	\$5,136.24
<b>Vagadra</b>	\$5,821	\$6,644	\$29,995	\$16,512	\$210,234.51	\$18,740	\$18,061.40	\$4,601.40
<b>Semo</b>	\$5,502	\$11,640	\$34,953	\$5,974	\$3,529.48	\$27,120	\$17,100.24	\$5,136.24
<b>Kabisi</b>	\$448	\$252	\$2,898	\$260	0	0	\$1,800	\$180
<b>Emuri</b>	\$1,795.80	\$5,964	\$13,527	\$3,952	\$19,334.96	\$8,446	\$5,576.08	\$2,407
<b>Ciri</b>	\$5,920	\$5,800	\$7,680	\$5,160	\$11,592.60	\$8,998	\$2,882.68	\$3,865.52
<b>Batiri</b>	\$6,517	\$8,768	\$38,035	\$12,299.20	\$53,768.24	\$28,988	\$17,649.44	\$9,340.20
<b>Navisabasaba</b>	\$11,390	\$15,808	\$53,100	\$18,612.80	\$62,201	\$24,430	\$18,404.90	\$10,222.60
<b>Vusama</b>	\$14,256	\$24,108	\$71,989.50	\$40,409.60	\$87,115.36	\$48,457	\$34,212.43	\$21,830
<b>Sugarcane Growers</b>	\$6,460	\$5,440	\$24,622	2944	\$14,409.30	\$4,004	\$7,052.90	\$13,851.41
<b>TOTAL</b>	<b>\$63,413</b>	<b>\$94,228</b>	<b>\$305,500</b>	<b>\$12,096</b>	<b>\$505,007.25</b>	<b>\$206,137</b>	<b>\$14,696.99</b>	<b>\$79,599</b>

## Appendix 5: Background Demographic Information

POPULATION															
Locality	0-12m		1-5yr		6-14yr		15-21yr		22-35yr		36-65yr		Over 66yr		TOTAL
	m	f	m	f	m	f	m	f	m	f	m	f	m	f	
Vagadra	6	2	13	12	22	15	20	15	26	14	27	45	9	11	237
Semo	5	5	13	11	27	18	17	24	33	22	40	42	7	7	271
Kabisi	0	2	4	6	9	4	4	2	8	10	7	2	1	1	60
Emuri	14	13	9	11	10	12	27	25	27	31	13	15	11	9	227
Navisabasaba	2	3	6	7	27	28	17	11	29	20	47	53	10	20	280
Batiri	2	4	9	8	14	18	10	5	18	14	31	22	6	6	167
Vusama	6	4	15	14	29	16	26	10	16	19	32	30	9	7	233

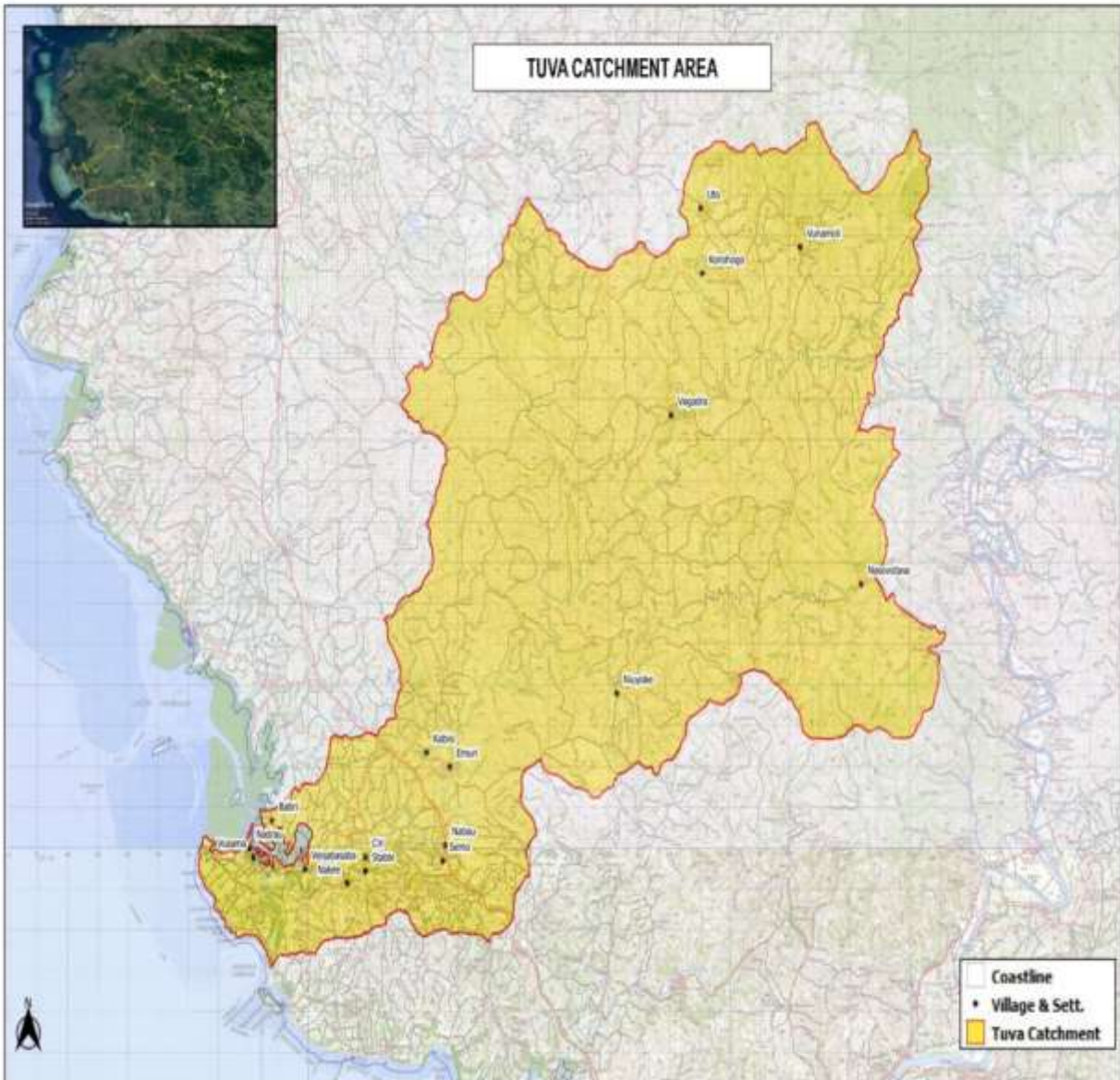
Source: Nadroga Navosa Provincial Office, Village Profiling Dataset 2017

Locality	0 - 4 yr.		5 - 9 yr.		10 - 14 yrs.		15 - 19 yrs.		20 - 24 yrs.		25 - 29 yrs.		30 - 34yr	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Nawaqadamu Village	7	8	9	6	10	5	9	2	2	4	4	2	5	3
Vunamoli Village	10	15	5	2	1	1	2	3	6	7	12	4	6	6
Ciri Settlement	7	5	6	1	2	8	2	6	3	3	4	6	8	3

Locality	35 - 39 yrs.		40 - 44yr		45 - 49yr		50 - 54yr		55 - 59yr		60 - 64yr		Over 69yr	
	M	F	M	F	M	F	M	F	M	F	M	F	F	M
Nawaqadamu Village	2	4	2	4	2	5	6	5	4	0	1	2	11	0
Vunamoli Village	2	4	5	5	7	2	3	5	4	4	1	2	7	4
Ciri Settlement	4	2	6	6	5	2	6	1	2	4	4	2	12	3

Source: Fiji Bureau of Statistics

## Appendix 6: Map of the Tuva Catchment



**Source:** Institute of Applied Science, University of the South Pacific

## Appendix 7: Pictures of villages and settlement surveyed at the Tuva Catchment

### Vunamoli Village (Upper Catchment)



### Nawaqadamu Village



### Vagadra Village (Middle Catchment)





### Semo Village (Lower Catchment)



### Kabisi Village



### Emuri Village



### Ciri Settlement



### Batiri Village



### Navisabasaba Village



## Vusama Village



Newly dug Waste treatment Pit



Mini home garden



Waterway polluted



Exposed Landfill

