Community based climate change vulnerability assessment of the Sabeto Catchment:

Enhancing community adaptation to climate change

INTRODUCTION

The Sabeto catchment was selected for the implementation of the USAID funded climate change project: *Enhanced Climate Change Resilience of Food Production Systems for selected PICTs (Fiji, Kiribati, Samoa, Solomon Islands, Tonga and Vanuatu)* based on the following criteria:

- Ridge to reef approach;
- a range of farming systems and climate change, food security and land management issues exists;
- Upper catchment dominated by forestry, grazing;
- The mid catchment is where a lot of farming/agricultural activities are taking place so issues there on food security, climate change adaptation, land tenure, agriculture leases, land degradation;
- and the lower catchment which is actually being developed for tourism development and also the main outlet into the sea/reefs;
- also the need to establish the Landcare concept/landcare groups in this catchments;
- demonstration sites can be established in the upper, the mid and the lower catchments; and
- also a lot of work, baseline data already exists for this area such as soils, land use capability and land use baseline information.

A 20 member team consisting of 10 SPC staff and 10 MPI staff (see annex 1) were formed to undertake the 1st task of the project and that is the vulnerability analysis of the community at the Sabeto Catchment. Four villages were selected representative of the upper catchment, mid catchment and the lower catchment. The villages were Korobebe, Nagado, Nabuotini and Naiyaca and Narokorokoyawa Villages making up Sabeto Village.

The vulnerability analysis was conducted using 3 different methods:

1. Land use surveys
2. Participatory rural appraisals
3. Household income and expenditure surveys

These were conducted from the 4th to 10th November. These were followed by a mission to evaluate the vulnerability of the food production systems from the 17th to 24th November. The information collected from these missions was used to determine the vulnerability of the selected communities as well as their production environment.

LAND USE

The land use survey was conducted by the MPI Land Use staff and the SPC staff from the LRD policy support group. The field work carried out in the Sabeto catchment provided a description of the land resources, its availability, limitations and potentials.

Objective

The main objective of the land use assessment was to collect biophysical and baseline data for the catchment such as soils, land use capability, land tenure and current land uses. More precisely:

- Collection and preparation of soil maps, land use capability maps for the catchment
- Preparation of land use maps for the catchment

Methodology

- 1:10,000 satellite images were used to identify land use types
- Field survey were carried out to clarify land use types
- Field findings were integrated into Geographic Information System (GIS)
- GIS were used to prepare soil, land capability, land tenure and land use maps

Area description

Sabeto catchment covers 13819 ha and is located halfway between Nadi and Lautoka. The Sabeto road turnoff is about 10 minutes north of the Nadi international Airport. The catchment is located in the Ba Province in the Western division of Viti Levu and comprises of Sabeto, Nalotawa, Nadi, Vuda and Vaturu districts.

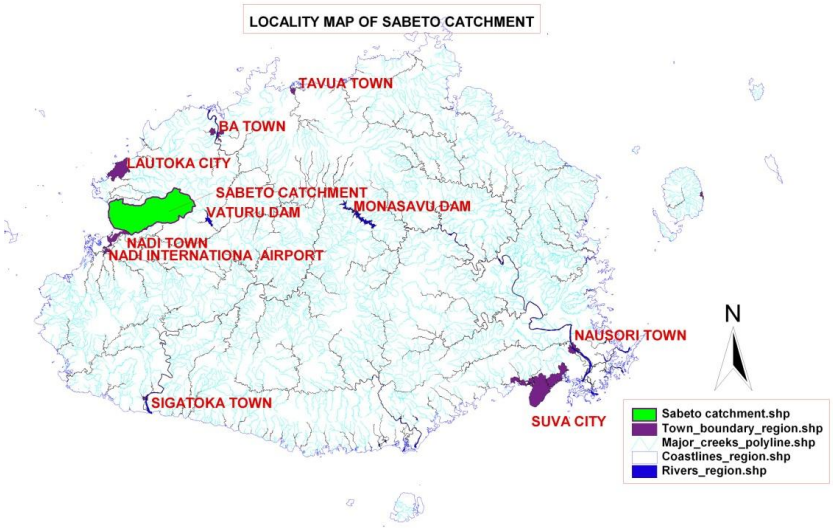


Fig 1: Sabeto catchment on Western Viti Levu

Landscape features

A prominent feature of the landscape is the Land of the Sleeping Giant which lies north-west. The two mountain ranges Sabeto range leads into the Mt Evans range and includes the peaks Drelaga (618m a.s.l) and Koroyanitu (1195m a.s.l). Prominent also in this catchment is the massive rounded landscape with very steep slopes stretching down to the main Sabeto river.

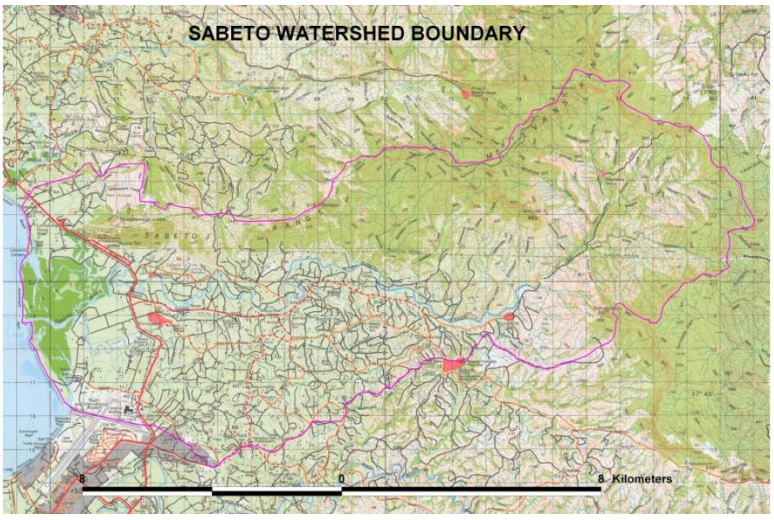


Fig 2: Sabeto watershed boundary

The Sabeto river is sourced from the Koroyanitu peak and flows through the hills of Naivilawa down to Korobebe, Naboutini, Natalau, Koroiyaca and out into Naisoso island and Lomolomo beach.

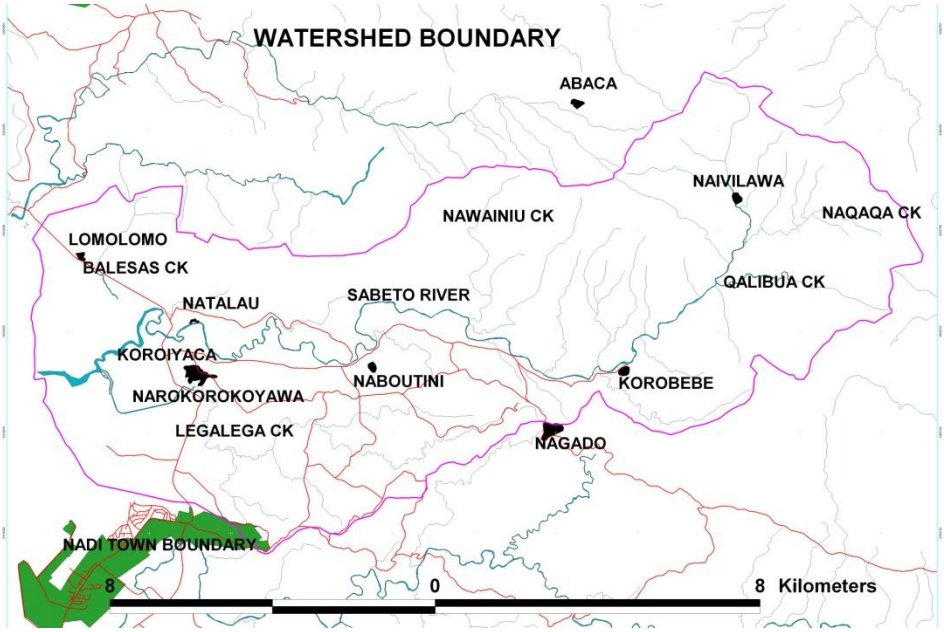


Fig 3: Sabeto River and river tributaries

Soils

The catchment is covered mostly (36%) with Nigrescent soils. These are dark soils (black or dark grey), moderately fertile to fertile. They are frequently cultivated and support a diverse range of crops. The soil types occur mostly on the foothills of the sabeto range, Naboutini, Keolaiya and Nadele.

Red yellow podzolic occurs mostly on rolling and hilly lands of Naivilawa and Korobebe and Votualevu and covers 17% of the area. These are yellow brown sandy soils and are covered mainly with shrubs and grassland.

Humic latosols (red soils) occur mostly on forested areas in Naivilawa and the foothills of Keolaiya, Votualevu, Naboutini and Legalega. This soil type covers 26% of the catchment. These are highly leached, acidic and not very fertile soils.

Soils of the flats make up 18% of the catchment. These are saline soils of the marine marsh which occurs at the Sabeto river mouth supporting mangroves or reclaimed for hotel development. Soils of the floodplains (alluvial) are soils of the river flats. These are deep well drained and fertile soils and are used mainly for vegetable and sugarcane farming. The gley soils are soils with high clay content and poorly drained.

Ferruginous latosols or Talasiga soils covers only 1% of the area. These are degraded humic latosols and occur mostly in Korobebe area. They are highly weathered and low in cation exchange capacity and shows evidence of erosion.

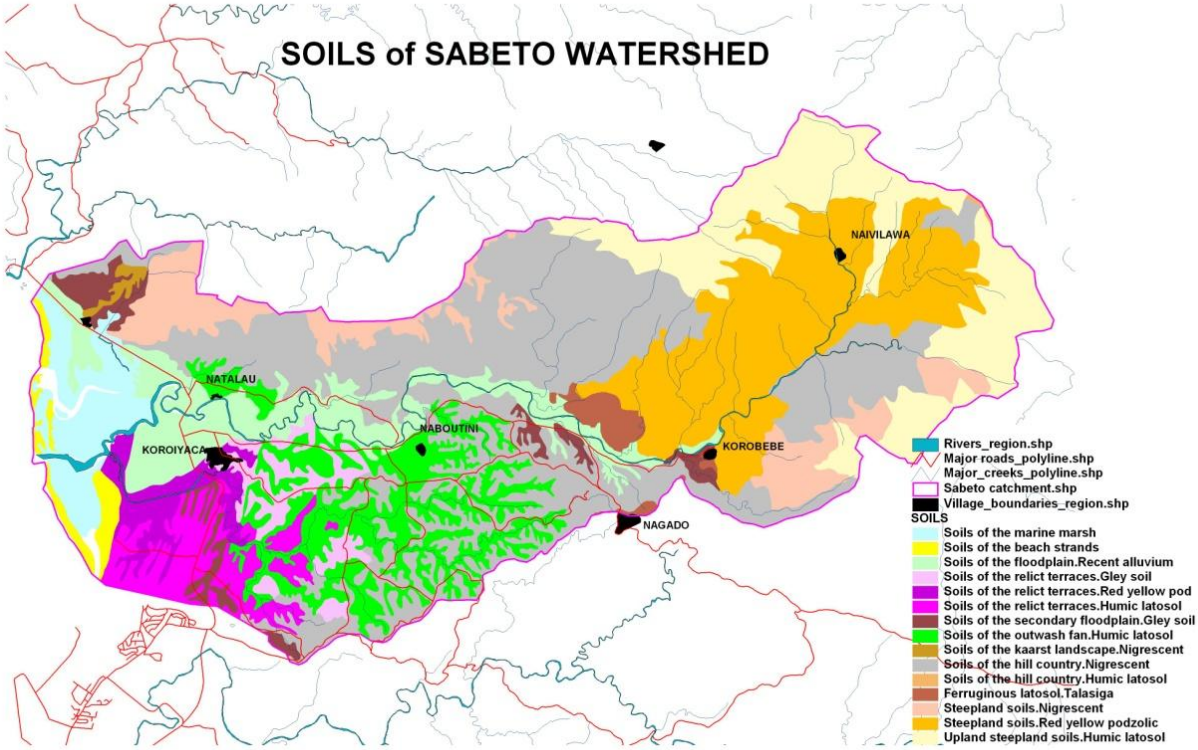


Fig 4: Soils of Sabeto catchment

Major Soil type in the area	Area(ha)	%
Nigrescent	5010.81	36.26
Red yellow- podzolic	2456.13	17.77
Humic latosol	3624.09	26.23
Ferruginous latosol -Talasiga	161.59	1.17
Gley soils	679.26	4.92
Marine marsh	571.10	4.13
Recent alluvium	1146.20	8.29
Beach strands	169.96	1.23

Land Use Capability

Land use capability (LUC) classification is the systematic arrangement of different kinds of land according to those properties that determine its capacity for sustained production, where capability is used in the sense of suitability for productive use.

Land class II covers 22% of the catchment. This is good arable land (0-7degrees), well drained to moderately drained, deep to slightly shallow and fertile to moderately fertile. Class II land is confined mainly to alluvial areas and on flood plains. The land can be used for arable cultivation.

Land class III (10%) is fair arable land with moderate limitation which restricts the choice of crops grown. The land is gently sloping, and subject to frequent flooding. Class III land occurs mainly in areas of gley soils, secondary floodplains and relict terraces. The land maybe used for arable cultivation, pasture or forestry.

Land class IV (7%) is marginal arable land with severe limitations which restrict the choice of crops grown, or necessitate intensive conservation treatment and very careful management.

Majority of the land is Land class VI (33%) and occurs in areas of fans and outwash surfaces, boulder, infertile and soils with very low moisture holding capacity. This is marginal pastoral land with moderate to severe limitations. Pasture should be suitable on this land class but its management will require special attention.

Land class VII (23%) occurs mainly on soils on the hill country, nigrescent, humic latosols and ferruginous latosols. This land class is generally unsuitable for pastoral use, but suitable for forestry. It comprises land that is either very steep or highly susceptible to erosion. The major hazard on this land class is erosion, steepness and stoniness and commercial forestry or protection forestry maybe practiced, or otherwise the land is best left untouched in its natural state.

Class VIII land (4%) is generally unsuitable for productive use in both agriculture and forestry is very steep mountainous land and also peat and mangrove swamps. Class VIII land is therefore best protected and or reserved for watershed and wildlife protection purposes, or left in its natural state.

The catchment has some good (40%) arable land (classes II-IV) with slope ranging from 4-15 degrees (flat- rolling slopes). These classes comprise land suitable for arable cultivation. Majority of the land 56% or 7775 ha is land classes V – VII with slope ranging from 16-35 degrees (strongly rolling slopes-steep –very steep slopes). This is land not suitable for arable cultivation but suitable for pastoral or forestry use; and class VIII with slope more than 35 degrees (extremely steep slopes) and peat land is land suitable only for protective purposes.

The LUC map shows that much of the land classes in the catchment relate to the physiographic characteristics and the terrain. Flat land is very scarce in the catchment and most available flat land has been used mainly for residential purposes, hotel development, and recreation purposes.

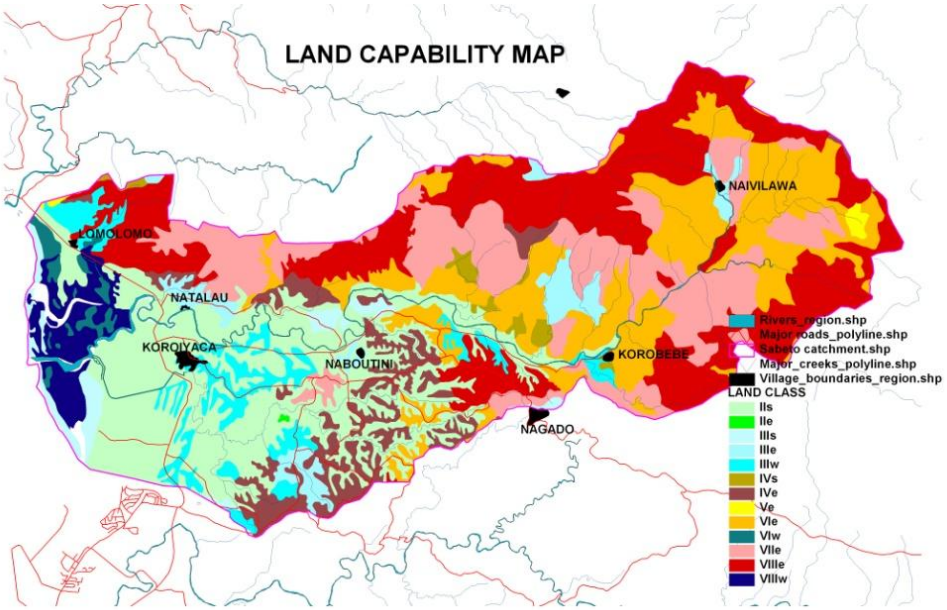


Fig 5: Land capability of Sabeto catchment

Land tenure

Almost 96% of the catchment is native land and 4% freehold. Land ownership in the catchment shows that landowners' consultation is vital before any development takes place in the catchment.

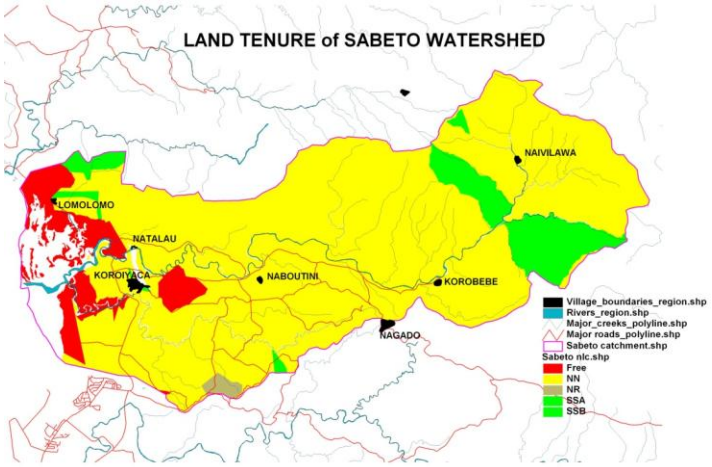
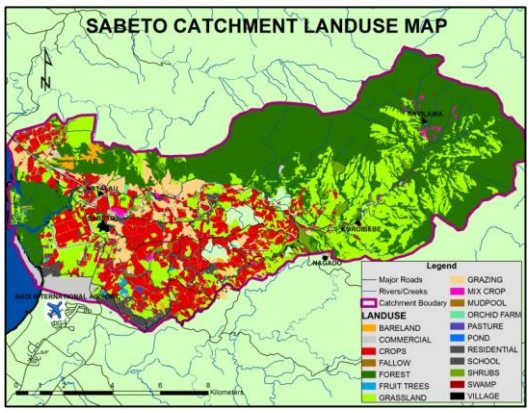


Fig 6: Land ownership in the catchment

Land class	Area(ha)	%
II	3103	22
III	1422	10
IV	948	7
V	42	0.31
VI	4584	33
VII	3149	23
VIII	571	4

Land Use

Generally the catchment is mostly under forest (40%). Grassland and shrubs is 26% of the total catchment area. Lower and middle reaches of the catchment are cultivated with sugarcane (15%) and other crops and vegetables (2%). Cropland is located mainly on the gentle slopes but there are few croplands located on steeper slopes. Uncultivated lands make up only 1% of the catchment area. Urban uses (residential, commercial, hotels and recreation) occupy 7% of the catchment.



Major land use	Area (ha)	%
Forest	5549.96	40.16
Grassland, shrubs	3628.39	26.26
pasture, grazing	718.50	5.20
cultivated land	2339.17	16.93
Unused land	142.07	1.03
school, residential, ponds	1034.55	7.49
Mangroves	406.35	2.94

Figure 7: Land use type in the catchment

CONCEPTUAL ASPECTS OF CLIMATE CHANGE VULNERABILITY ASSESSMENT

Community-based Climate Change Vulnerability Assessment is based on the following theoretical bases
"Vulnerability is a function of character, magnitude and rate of ***climate variation*** *to which a system is exposed, its* ***sensitivity****, and its* ***adaptive capacity***"
This definition is articulated in the following equation for simplicity

$$V=ExS/A$$

Where

V = Vulnerability: The degree to which a system is susceptible to, or unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character,

magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity. (IPCC, 2001)

E = Exposure: The nature and degree to which a system is exposed to significant climatic variations (IPCC). The climate variation includes average climate change and the extreme climate variabilities. Exposure, in this document, is the character, magnitude and rate of climate variation at local level

The more the local climate has changed or deviated from its historical condition or trend, the more the value of exposure (E) will be; the more the value of E means the more the system is exposed to new climate leading to high vulnerability. "E" is assessed through assessment of change in elements of climate over time – temperature, precipitation, etc and the hazards induced by such changes through community participation.

S = Sensitivity: Degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct e.g. a change in crop yield in response to a change in the mean, range or variability of temperature or indirect e.g. damages caused by an increase in the frequency of coastal flooding due to sea-level rise (IPCC) or floods, landslides, etc. Sensitivity in this document is the effect of local climate change and related hazards on local system – biophysical and socioeconomic.

Highly sensitive (S) systems will be more impacted compared to low sensitive systems even with a same level of climate change or hazards. Therefore the more the system is sensitive to climate change and related hazards, the more the system is vulnerable to climate change. Sensitivity of a system is assessed through assessment of effects or impacts or damages of the system from climate change and related hazards.

A = Adaptive Capacity: The ability of a system (in this case the "community") to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC).

Adaptive capacity (A) of a system helps the system to adjust to climate change and moderate the impacts of climate change. The more a community (system) is endowed with resources, has access to and control over resources, the more the community has the capacity to adjust to climate change and moderate the impacts of climate change. Community or individual resources are assessed through assessment of livelihood assets.

Five villages in the Sabeto Catchment were selected for the vulnerability analysis. Annex 2 has lists of participants taking part in the PRA exercises.

In order to enhance adaptation, the variables of Vulnerability were assessed
- Climate change at local level
- Effects of climate change at local level for sensitivity assessment and
- Adaptive capacity of the community based on their livelihood assets

CBVA assesses community vulnerability and its variables based on the community perception and evidences. The Variables (E, S and A) of Vulnerability and the Vulnerability (V) are categorised at 4 levels based on community perception and the numerical values are used in the equation.
- Low or 1
- Medium or 2
- High or 3 and
- Very High or 4

The numerical values also provide basis for comparison of the vulnerability (V) and its variables (E, S and A) between the communities.

Elements of Exposure, Sensitivity, and Adaptive Capacity

Exposure (local climate change and variability)

Temperature	Precipitation	Plants/Animal behaviour as proxy indicators	Hazards	Livelihood activities	Physical information

Sensitivity (effects of changes at local level)

Agriculture and food security	Forest and biodiversity	Settlement and infrastructure	Water and energy	Human health

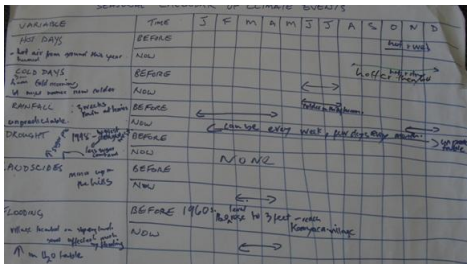
Adaptive capacity (livelihood assets)

Human Resources	Natural Asset	Social asset	Financial asset	Physical asset

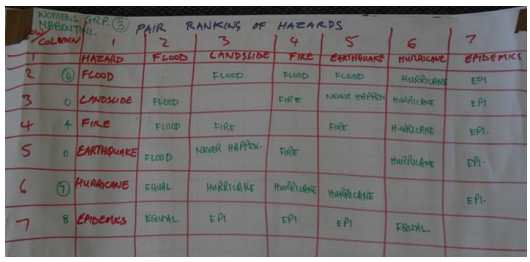
Participatory Tools for CBVA

CBVA uses Participatory Appraisal Tools to assess the Variables of Vulnerability to get information on changes. Some of the relevant and appropriate tools are:

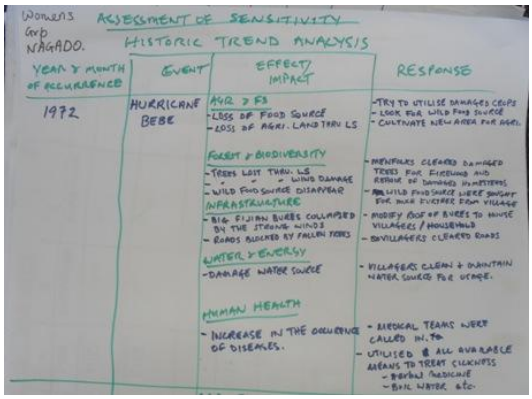
- Seasonal calendar
- Hazard prioritization
- Cause and effect analysis
- Historic time line assessment
- Hazard mapping
- Resources mapping
- Livelihood assessment
- Institutional assessment



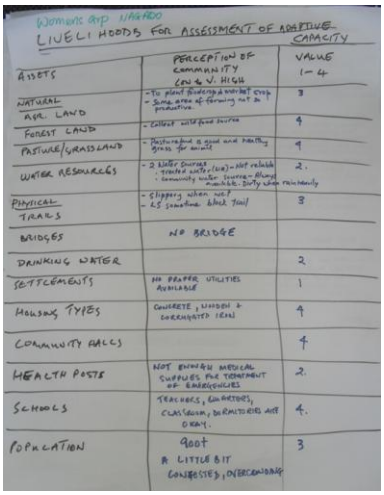
Seasonal calendar of local climate change



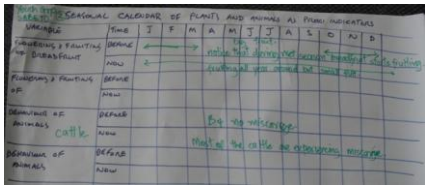
Paired ranking of hazards



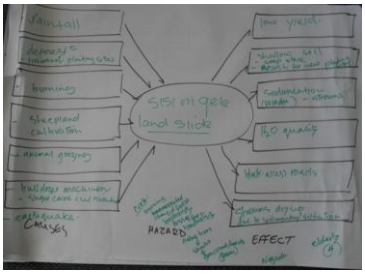
Historical trend analysis



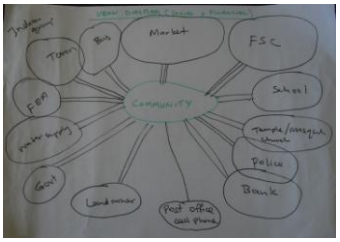
Livelihood assessment



Seasonal calendar of proxy indicators



Causal analysis



Venn diagram

Some of the tools are multipurpose which can be used to derive information for all 3 variables of vulnerability.

In combination with the PRA tools, a household income and expenditure survey was also conducted in all villages on about 10% of households to assess socio-economic characteristics (annex 3) as well as food consumption. From the food consumption data analysis of the contribution of local and imported foods (energy and protein) to the diet of the villages were calculated.

The climate change presentation

Climate change being the driving reason for the project, it was agreed that a context-setting presentation be made to the community participants during the evening PRA sessions. This presentation was given by Mr. Dean Solofa and Mr. Viliame Mainawalala (latter providing the vernacular translation).

The presentations were focused on the science of climate change and the focus developed in three areas.

(i.) ***Explaining the scientific understanding of the mechanics of climate change science*****.** This was done via a simple, standard illustration of the 'greenhouse effect' mechanism and the feedback principle leading to global surface warming. The climate change component was introduced in a brief discussion of the role of additional greenhouse gases that are being emitted into the atmosphere and the enhanced feedback mechanism leading to the current warming situation. Also discussed in brief were the sources of greenhouse gases and their emission sources (transportation, agriculture etc.). The main objective in this component is to provide this overarching view that climate change is a global issue with hints that it will have some impacts at the local level (next component).

(*ii.*) ***Explaining evidence of CC via trends and current observations.*** This was done by a simple illustration of historical records of temperature data showing globally and locally that surface temperature is indeed rising, and that current observations are important to keep track and understand better the implications of future extreme events such as more frequent flooding rainfall events and more extreme tropical cyclones. Also discussed was the issue of sea-level rise and the contribution made by melting glaciers and polar ice sheets by illustration. In these discussions, a point was made that although science has made some prediction of the sea-level rise to be expected, that newer findings in the last 2 years have shown that the estimated sea-level rise might be far less than the actual sea-level rise to occur, and at a possibly faster rate also. Observations of the surrounding environment was discussed at length also to impart that current climate change may already be causing some biophysical impacts on the surrounding environment of the local area, and what these could possibly look like or have some impact on (e.g. breadfruit seasons and size of breadfruit, citrus, livestock etc.). This discussion is included to begin to take the presentation from the science component to a relatable understanding and evidence based appreciation of the CC issue.

(iii.) ***Explaining the projections of climate change and possible impacts.*** The projections component is often a science heavy component, however this was reduced to simply discussing the key projected changes for the meteorological parameters of rainfall, temperature, and sea-level, and their impacts including tropical cyclones, and discussing the projection outputs of these for Fiji (as recently published by the Australian funded PCCSP project). The message in this component was to relate the observed trends in recent years to expectations of more of the same albeit in higher frequency and intensity where relevant. As a final message and food for thought ahead of the discussions that were to follow immediately, some examples of extreme adverse impacts (disrupted fruit seasons, diminished harvest sizes, fewer fish catch) were given with the open question of asking participants to keep in mind and to think about what sorts of such biophysical and environmental changes they may link to these changes in temperature, rainfall, and their impacts of drought, flash floods, landslides etc.

The feedback from the participants varied in the communities but questions and discussion that were in common were about seasonality of crops (in particular breadfruit), and behaviour of some animals, along with changes in landscapes via landslides and flooding. Overall, the reception to the presentation was positive with many indicating that this was their first time to have heard and learned about climate change.

There is obviously a lot of scope for more climate change education and awareness of the associated issues in these communities. While the presentation provided context to the following discussions, it was clear that some awareness would be a positive benefit for the communities, if just for awareness particularly for school children of the communities. Suggested outputs like climate change posters, a copy of the presentation made, could be given to the communities for display in community halls. Such awareness materials and items need to be provided in the vernacular of the respective communities.

The challenge of explaining climate change science directly depends on the target audience. Community based audiences understandably provide the most challenging audience (at least in discussion of topics such as modelling requirements, consideration of uncertainty and error levels etc.), and the Sabeto communities fall into this category. However the success of the presentations made, were based on avoiding an in-depth science discussion on the issue but focused more on CC impacts discussion and visual aids for illustration of the few core scientific points included. It was noted that the majority of the participants were of a median mid-fifties age group, and that only a few youth participated. Though the latter low number wasn't clearly explained, it is obvious that the number of youth involved directly with their surrounding environment by way of farming etc., is a low number which is consistent with observed trends around the region (of youth in agriculture). How this will pan out in future management of village and family unit based food security in the face of climate change is a question for consideration.

VULNERABILITY ANALYSIS FOR KOROBEBE VILLAGE

Assessment of climate variables (Elements of Exposure 'E')

Parameters	**Indicators**	**Perceived changes/remarks**	**Score index/remarks**
Temperature	• Numbers of hot days increased • Number of cold days decreased	High (4) Medium (2)	3 (high)
Precipitation	• Rainfall has become increasingly unpredictable	Very high (4)	4 (very high)
Plant and animal indicators	• Flowering and fruiting of some of the fruit trees like breadfruit and mango • Animal behaviour like chicken egg laying is changing	High (3) High (3)	3 (high)
Climate induced disasters	• Landslide • Drought • Fire • Hurricanes	Very High (4) Medium (2) Medium (2) High (3)	2.75 (high)
	Average Exposure index	**High**	**3.18**

Sensitivity Assessment (elements of Sensitivity 'S')

Parameters	**Hazards**	**Indicators**	**Perceived changes/ remarks**	**Score index/ remarks**
Agriculture and food security	Landslides	Loss of productive lands	High (3)	**2.33 (high)**
	Drought	Loss of crop production	Medium (2)	
	Outbreak of diseases	Production decline	Medium (2)	
Forest and biodiversity	Landslides	Loss of forest cover	High (3)	**2.5 (high)**
	Fire	Loss of biodiversity	Medium (2)	
Infrastructure	Landslides	Trails and roads damaged	Medium (2)	**2 (medium)**
Water resources and energy	Landslides	Loss of fresh water (buried)	High (3)	**2.5 (high)**
	Drought	Reduction of freshwater	Medium (2)	
Human health	Landslides	Emergence of waterborne diseases	High (3)	**3 (high)**
Average Sensitivity Score			**High**	**2.47**

Adaptive Capacity (elements of Adaptive Capacity 'A')

Parameters	**Indicators**	**Criteria**	**Perceived changes/ remarks**	**Score index/ remarks**
Human assets	Demography	Old age and children	High (3)	**2 (medium)**
	Education	Secondary education and awareness of climate change	Medium (2)	
	Skill labour	Trained workers	Low (1)	
Natural assets	Land	Land ownership and productivity	High (3)	**2.66 (high)**
	Forest	Availability of product and services	Medium (2)	
	Water	Availability of drinking water	High (3)	
Financial assets	Financial institutions	Banks, cooperatives,	Medium (2)	**2 (medium)**

	Household incomes	Sufficiency for household needs	Medium (2)	
Social assets	Social institutions	Community affiliations to formal and non-formal institutions	Medium (2)	**1.5 (Low)**
	Service providers	Engagements of NGOs and GOs with community	Low (1)	
Physical assets	Infrastructure for services	Access to school, house, bridge, road, electricity, health posts, vehicle availability	Medium (2)	**2 (medium)**
	Information and communication sources	Access to mobile phones, radio, TVs, papers, and internet	Medium (2)	
Average Adaptive Capacity Score			**Medium**	**2.03**

Vulnerability = E x S/A
= 3.18x2.47/2.03
= 3.87
Vulnerability is high

FOOD SECURITY
Food Availability

Local Energy Sources				**Imported Energy Sources**	
Taro	***Cassava***	***Banana***	***Breadfruit***	***Rice***	***Flour***
120[1]	500	90	210	112	127
103[2]	545	54	126	402.2	462.3
828				**865.5**	

[1] g/person/day [2] kcal/person/day

Percentage of imported energy source = 865.5/1693.5 = 51.1 %

Protein

Local		**Imported**			
Fish	**pork**	**Canned Fish**	**Corned Beef**	**Chicken**	**Dhal**
102	35	60	16.7	98	32
13.1	4.7	12.5	4.2	12.1	7.0

[1] g/person/day [2] g protein/person/day

Total protein per person per day = 53.6g (66.8% Imported)

VULNERABILITY ANALYSIS FOR NAGADO VILLAGE

Assessment of climate variables (Elements of Exposure 'E')

Parameters	**Indicators**	**Perceived changes/remarks**	**Score index/remarks**
Temperature	• Numbers of hot days increased • Number of cold days decreased	High (4) Medium (2)	3 (high)
Precipitation	• Rainfall has become increasingly	Very high (4)	4 (very high)

	unpredictable		
Plant and animal indicators	• Flowering and fruiting of some of the fruit trees like breadfruit and mango • Animal behaviour like chicken egg laying is changing	High (3) High (3)	3 (high)
Climate induced disasters	• Landslide • Drought • Fire • Hurricanes	Very High (4) Medium (2) Medium (2) High (3)	2.75 (high)
	Average Exposure index	**High**	**3.18**

Sensitivity Assessment (elements of Sensitivity 'S')

Parameters	**Hazards**	**Indicators**	**Perceived changes/ remarks**	**Score index/ remarks**
Agriculture and food security	Landslides	Loss of productive lands	High (3)	**2.5 (high)**
	Drought	Loss of crop production	Medium (2)	
	Outbreak of diseases	Production decline	Medium (2)	
	Cyclone	Damage crops	High (3)	
Forest and biodiversity	Landslides	Loss of forest cover	High (3)	**2.33 (high)**
	Fire	Loss of biodiversity	Medium (2)	
	Cyclone	Damage trees	Medium (2)	
Infrastructure	Landslides	Trails and roads damaged	Medium (2)	**2 (medium)**
Water resources and energy	Landslides	Loss of fresh water (buried)	High (3)	**2.33 (high)**
	Drought	Reduction of freshwater	Medium (2)	
	Cyclone	Damage infrastructures	Medium (2)	
Human health	Landslides	Emergence of waterborne diseases	High (3)	**3 (high)**
Average Sensitivity Score			**High**	**2.43**

Adaptive Capacity (elements of Adaptive Capacity 'A')

Parameters	**Indicators**	**Criteria**	**Perceived changes/ remarks**	**Score index/ remarks**
Human assets	Demography	Old age and children	High (3)	**2 (medium)**
	Education	Secondary education and awareness of climate change	Medium (2)	
	Skill labour	Trained workers	Low (1)	
Natural assets	Land	Land ownership and productivity	High (3)	**2.33 (high)**
	Forest	Availability of product and services	Medium (2)	
	Water	Availability of drinking water	Medium (2)	
Financial assets	Financial institutions	Banks, cooperatives,	Medium (2)	**2 (medium)**
	Household incomes	Sufficiency for household needs	Medium (2)	
Social assets	Social institutions	Community affiliations to formal and non-formal institutions	Medium (2)	**2 (medium)**
	Service providers	Engagements of NGOs and GOs with community	Medium (2)	

Physical assets	Infrastructure for services	Access to school, house, bridge, road, electricity, health posts, vehicle availability	Medium (2)	**2 (medium)**
	Information and communication sources	Access to mobile phones, radio, TVs, papers, and internet	Medium (2)	
Average Adaptive Capacity Score			**Medium**	**2.06**

Vulnerability = E x S/A
= 3.18x2.43/2.06
= 3.75
Vulnerability is high

FOOD SECURITY
Food Availability

Imported Energy Sources				**Local Energy Sources**		
Taro	Cassava	Banana	Breadfruit	Rice	Flour	Ramen
68[1]	549	128	149	102	103	27
58.4[2]	589.4	76.8	89.4	367.2	374.9	99.1
814				**841.2**		

[1] g/person/day [2] kcal/person/day

Percentage of imported energy source = 841.2/1655.2 = 51%

Protein

Local		**Imported**			
Fish	**pork**	**Canned Fish**	**Corned Beef**	**Chicken**	**Dhal**
115	75	52	15	94	20
14.5	10.1	12	3.8	11.6	4.4

[1] g/person/day [2] g protein/person/day

Total protein per person per day = 56.4g (56.4% imported)

VULNERABILITY ANALYSIS FOR NABOUTINI VILLAGE

Assessment of climate variables (Elements of Exposure 'E')

Parameters	**Indicators**	**Perceived changes/remarks**	**Score index/remarks**
Temperature	• Numbers of hot days increased • Number of cold days decreased	High (4) Medium (2)	3 (high)
Precipitation	• Rainfall has become increasingly unpredictable	High (3)	3 (high)
Plant and animal indicators	• Flowering and fruiting of some of the fruit trees like breadfruit and mango • Animal behaviour like chicken egg laying is changing	High (3) Medium (2)	2.5 (high)

Climate induced disasters	• Flood • Fire • Hurricanes	Very High (4) Medium (2) Very High (4)	3.33(high)
	Average Exposure index	**High**	**2.96**

Sensitivity Assessment (elements of Sensitivity 'S')

Parameters	**Hazards**	**Indicators**	**Perceived changes/ remarks**	**Score index/ remarks**
Agriculture and food security	Floods	Loss of productive lands and farm animals	High (4)	**3 (high)**
	Outbreak of diseases	Production decline	Medium (2)	
	Hurricanes	Loss of crops	High (3)	
Forest and biodiversity	Floods	Loss of forest cover	High (3)	**2.5 (high)**
	Fire	Loss of biodiversity	Medium (2)	
Infrastructure	Flood	Trails, roads and settlements are damaged	High (3)	**3 (high)**
	Hurricanes	Damages to buildings and public utility	High (3)	
Water resources and energy	Flood	Loss of fresh water (contaminated)	High (3)	**3(high)**
	Hurricanes	Damage water infrastructure	Medium (3)	
Human health	Floods	Emergence of waterborne diseases	High (3)	**3 (high)**
Average Sensitivity Score			**High**	**2.9**

Adaptive Capacity (elements of Adaptive Capacity 'A')

Parameters	**Indicators**	**Criteria**	**Perceived changes/ remarks**	**Score index/ remarks**
Human assets	Demography	Old age and children	High (3)	**2 (medium)**
	Education	Secondary education and awareness of climate change	Medium (2)	
	Skill labour	Trained workers	Low (1)	
Natural assets	Land	Land ownership and productivity	Medium (2)	**2.33(high)**
	Forest	Availability of product and services	Medium (2)	
	Water	Availability of drinking water	High (3)	
Financial assets	Financial institutions	Banks, cooperatives,	Medium (2)	**1.5 (medium)**
	Household incomes	Sufficiency for household needs	Low (1)	
Social assets	Social institutions	Community affiliations to formal and non-formal institutions	Medium (2)	**2 (medium)**
	Service providers	Engagements of NGOs and GOs with community	Medium (2)	
Physical assets	Infrastructure for services	Access to school, house, bridge, road, electricity, vehicle availability	High (2)	**2 (high)**
	Information and communication sources	Access to mobile phones, radio, TVs, papers, and internet	Medium (2)	
Average Adaptive Capacity Score			**Medium**	**1.97**

Vulnerability = E x S/A
= 2.96x2.9/1.97
= 4.35
Vulnerability is very high

FOOD SECURITY
Food Availability

Imported Energy Sources				**Local Energy Sources**		
Taro	Cassava	Banana	Breadfruit	Rice	Flour	Ramen
40[1]	566	60	109	104	120	27
43.6[2]	616.9	36	65.4	374.4	436.8	99.1
761.9				**910.3**		

[1] g/person/day [2] kcal/person/day
Percentage of imported energy source = 910.3/1672.2= 54.4%

Protein

Local			**Imported**			
Fish	**Pork**	**Mutton**	**Canned Fish**	**Corned Beef**	**Chicken**	**Dhal**
36.3	33.7	63.7	61	14	81	34
4.6	4.5	8.9	8.5	3.5	9.9	7.5

[1] g/person/day [2] g protein/person/day

Total protein per person per day = 47.4g (62% imported)

VULNERABILITY ANALYSIS FOR SABETO VILLAGE

Assessment of climate variables (Elements of Exposure 'E')

Parameters	**Indicators**	**Perceived changes/remarks**	**Score index/remarks**
Temperature	• Numbers of hot days increased • Number of cold days decreased	High (4) Medium (2)	3 (high)
Precipitation	• Rainfall has become increasingly unpredictable	Very high (4)	4 (very high)
Plant and animal indicators	• Flowering and fruiting of some of the fruit trees like breadfruit and mango • Animal behaviour like chicken egg laying is changing	High (3) Medium (2)	2.5 (high)
Climate induced disasters	• Flood • Drought • Fire • Hurricanes	Very High (4) Medium (2) Medium (2) High (4)	3(high)
	Average Exposure index	**High**	**3.12**

Sensitivity Assessment (elements of Sensitivity 'S')

Parameters	**Hazards**	**Indicators**	**Perceived changes/**	**Score index/ remarks**

			remarks	
Agriculture and food security	Floods	Loss of productive lands and farm animals	High (4)	**2.75 (high)**
	Drought	Loss of crop production	Medium (2)	
	Outbreak of diseases	Production decline	Medium (2)	
	Hurricanes	Loss of crops	High (3)	
Forest and biodiversity	Floods	Loss of forest cover	High (3)	**2.5 (high)**
	Fire	Loss of biodiversity	Medium (2)	
Infrastructure	Flood	Trails, roads and settlements are damaged	High (3)	**3 (high)**
	Hurricanes	Damages to buildings and public utility	High (3)	
Water resources and energy	Flood	Loss of fresh water (contaminated)	High (3)	**2.66 (high)**
	Drought	Reduction of freshwater	Medium (2)	
	Hurricanes	Damage water infrastructure	Medium (3)	
Human health	Floods	Emergence of waterborne diseases	High (3)	**3 (high)**
Average Sensitivity Score			**High**	**2.78**

Adaptive Capacity (elements of Adaptive Capacity 'A')

Parameters	**Indicators**	**Criteria**	**Perceived changes/ remarks**	**Score index/ remarks**
Human assets	Demography	Old age and children	High (3)	**2 (medium)**
	Education	Secondary education and awareness of climate change	Medium (2)	
	Skill labour	Trained workers	Low (1)	
Natural assets	Land	Land ownership and productivity	High (3)	**2.66 (high)**
	Forest	Availability of product and services	Medium (2)	
	Water	Availability of drinking water	High (3)	
Financial assets	Financial institutions	Banks, cooperatives,	Medium (2)	**1.5 (medium)**
	Household incomes	Sufficiency for household needs	Low (1)	
Social assets	Social institutions	Community affiliations to formal and non-formal institutions	Medium (2)	**2 (medium)**
	Service providers	Engagements of NGOs and GOs with community	Medium (2)	
Physical assets	Infrastructure for services	Access to school, house, bridge, road, electricity, vehicle availability	High (3)	**2.5 (high)**
	Information and communication sources	Access to mobile phones, radio, TVs, papers, and internet	Medium (2)	
Average Adaptive Capacity Score			**Medium**	**2.23**

Vulnerability = E x S/A
= 3.12x2.78/2.23
= 3.98
Vulnerability is high

FOOD SECURITY
Food Availability

Local Energy Sources	**Imported Energy Sources**

Taro	*Cassava*	*Banana*	*Breadfruit*	*Rice*	*Flour*	*Ramen*
115[1]	519	117	183	117	112	16
98.9[2]	565.7	70.2	109.8	421.2	407.7	58.7
844.6				**887.6**		

[1] g/person/day **[2] kcal/person/day**

Percentage of imported energy source = 887.6/1732.2= 51.2%

Protein

Local			**Imported**			
Fish	**Pork**	**Mutton**	**Canned fish**	**Corned beef**	**Chicken**	**Dhal**
115	7.5	15	57	17	87	27
14.5	1.0	2.2	11.8	4.3	10.7	6

[1] g/person/day **[2] g protein/person/day**

Total protein per person per day = 50.5g (64.9% imported)

Interpretation of the Results

The community perception of their vulnerability to climate change was high. The local climate changes and the exposures of the villages were high; their sensitivity was medium to high; and their adaptive capacity was medium. These indicated that we need to devise adaptation measures to reduce impacts of climate change due to increased temperatures, rainfall and frequency of disasters. They also need to improve their adaptive capacities by improving awareness to climate change impacts; improve income sources; improve relationship with government and non-government organizations (NGOs); and also improve some of the infrastructural services.

The food security of the four villages was also found to be quite vulnerable. When sources of energy and protein were analysed, it was found that around 50% of the average diet of an individual in the villages were imported sources (rice, flour and noodles) and more than 60% of their protein sources were imported (tinned fish, imported chicken, and dhal). The results indicated that the communities should promote production local and consumption of local foods, and improve household incomes from food production.

It was clear from the results of the community based vulnerability analysis that the communities, their production environment and their food security are all vulnerable. There was therefore a need to evaluate the food production systems and the food production environment before developing local adaptation program of actions. A team of five SPC - Siosiua Halavatau, Nichol Nonga, Dean Solofa, Viliame Mainwalala and Mr. Shalendra Prasad visited the villages again and evaluate the food production systems.

The Farmers in Korobebe and Nagado are cultivating some of the rather steep slopes that can be very vulnerable to high intense rainfall.


This sloping area in Korobebe can be very vulnerable to slipping during high rainfall. The soils in Korobebe and Nagado are also quite shallow sitting on soap stone. If these soils are saturated under high rainfall can slip.


The photo above left from Korobebe shows that farmers are encountering soil erosion and their solution to the problem is contour barrier constructed with bamboo (not the best solution). The photo above right is from Nagado showing that they also encountering soil erosion and solution they select is planting borders of corn (good live barrier).

Throughout the 4 villages we also saw nutrient deficiencies espeacially phosphorus and potassium deficiencies.


The cassava (top left) is showing phosphorus deficiency and the taro patch (top right) is showing potassium deficiencies.

The communities are also showing that they still rely on the wild for food security. Below is a wild yam being cultivated in one of the household in Naboutini.

All 4 villages for food security cultivate some wild yams but needed to be promoted more.

In terms of producing own protein – we saw few villagers raising chicken in the villages as well as pigs.

Free ranging chicken and chicken raised in confinement.


Photo of a piggery in the communities.

One of the key problems to livestock production in the villages is not having secure water supply.

It was very clear from the food production systems survey that the production environments are currently constrained both by non-climate as well as climate change factors.

Based on the results of the land use surveys, PRAs and house hold income and expenditure surveys – the issues and problems were used to develop a logical framework for improving resilience of food production systems in the villages.

Local Adaptation Program of Actions for Selected Communities at the Sabeto Catchment (Korobebe, Nagado, Naboutini, Nayaca, and Narokorokoyawa villages)

Intervention Logic	OVIs	Baseline	Target	MOVs	Assumptions
Goal: Improved resilience of selected communities in the Sabeto Catchment to impacts of CC on food security	Threat level to ecosystems, related to CC effects	Ecosystem vulnerability rated as high	By end of the project the vulnerability level in the project area will be rated as medium	Ecosystem impact assessment at the end of the project	CC measures are long term and the project may not capture all changes in ecosystem vulnerabilities
Component 1 objective: Increase adaptive capacity and reduce recurrent risks of climate variability at the community level.					Community workforce available to support adaptation initiatives Scientific and technical information availability in relation to CC for area is insufficient
Component 1 Outputs: 1. Improved productivity of food production systems	• Increase production and area of crops	Current acreage and yield/area	By end of the project there will be a 40% increase in area of crops and yield per area	Project M and E report	
	• Increase production and number of small livestock animals	Current number of animals	Animal numbers will increase by 40% by end of project	Project M and E report	
	• Conduct research in priority areas that will improve productivity	Currently no research	By end of the project research results will be generated to support adaptation strategies	Project reports	
2. Improved food security	• Increase consumption of locally produced foods	Currently around 50% or less local food contribution to diet	By end of the project contribution of local foods will be more than 70%	Project report	
3. Improved adaptive capacity of communities	• Improved knowledge on climate change risks	Limited knowledge by communities in adaptation measures to reduce food insecurity	At the end of the project at least one member from each household have knowledge of climate threats and adaptation measures	Project report	
	• Improved household incomes	Currently incomes not sufficient for most households	Household incomes of 60% households will be sufficient By end of project households will be accessible to information	Project report	
	• Improved access to information and communication sources	Limited access to information and communication sources		Project report	
Component 2 Objective: Capacity building and knowledge management on managing climate change risks affecting food security					Community structures need to be strengthened Community leaders will promote participation of communities
Component 2 Outputs: 1. Increased awareness of communities on climate change risks	Targeted communities trained in climate change threats and adaptation measures reducing vulnerability, in particular to food security	Limited knowledge by target communities in the adaptation measures to reduce food security	At the end of the project at least one member from each household have knowledge of climate threats and adaptation measures	Project report	
2. Secured ownership of adaptation plans in targeted communities	Adaptation plans developed with the communities	There are no adaptation plans developed with community	By end of the project communities and leaders have actively participated in the adaptation plan development	Project report	

3. Increased knowledge to manage climate change and risk, including climate variability affecting food security	Community early warning system designed, implemented and maintained with appropriate community level disaster risk management plan Community climate change training conducted, and awareness and education materials distributed	participation No community level early warning systems or formalised community level disaster risk management plan to cope with main disasters in place A number of primary and secondary schools are in the Sabeto area and offer an opportunity for climate change material to be added to their curriculum on arrangement. At community level, Sunday school classes as well can be targeted.	By end of the project communities have designed their early warning systems and a community level disaster risk management plan By end of project, climate change awareness training will have been completed targeting certain groups (e.g. primary and secondary teachers living in Sabeto area village, Sunday school teachers and community leaders in youth, women's and men's groups. The project will also have made available, and distributed, climate change awareness materials for schools, Sunday schools, and community centres.	Project report Project report	
Component 1 Activities: 1.1 Establish village coordination committees 1.2 Tree planting on the hillock caps 1.3 Establish contour barriers for crops grown on hill slopes 1.4 Promote planting of local staples – taro, cassava, sweet potato, yams 1.5 Promoting planting vegetables 1.6 Promote planting rice 1.7 Develop local chicken/ducks/ broilers in villages for egg and meat 1.8 Develop pig production in the villages 1.9 Develop honey bee production in the villages 1.10 Develop appropriate technologies to support adaptation strategies 1.11 Identify and record incremental benefits arising from the new technologies (CBA) 2.1 Promote utilization of locally produced foods 2.2 Conduct training on preparation of locally produced foods 3.1 Support development of household incomes for communities 3.2 Conduct agribusiness skills training 3.3 Make available information on appropriate technologies in a form					

suitable for the communities					
Component 2 Activities: 1.1 Establish and implement a training program on CC threats and adaptation measures related to food insecurity at community level. Ensure gender focus in all trainings. 1.2 Identify sources of climate risk information at local; disseminate information and ensure that vulnerable households and schools have access to relevant information 2.1 Design a participatory methods for developing community adaptation plans 2.2 Participatory development of adaptation plans. 3.1 Design and implement early warning systems to enable the dissemination of the main threats for the communities 3.2 Training for all the necessary personnel to operate and maintain the EWS. 3.3 Engage primary and secondary school authority in Sabeto area to agree on climate change input into appropriate curriculum 3.4 Develop and distribute awareness and education materials to Sabeto area schools and communities					

After the logframe was developed a team visited the villages to identify priority adaptation strategies both for crops and livestock. The team met with the Turaga ni Koro of each village and some of the village leaders and decide priority crop and livestock adaptation activities.

	Interventions	
Villages	**Crops/Agroforestry**	**Livestock**
Naboutini	• A community nursery to be established in the village • Vegetable/pulse demonstration in Ilisoni Galala's land • Root crop demonstration in Isaia Reaga Tora's land. This is supposed to be an intercropped/mix cropping systems that should also include trees as well as mucuna as cover crop/soil improver.	• Piggery demonstration in Deo Prasad's farm. • Chicken demonstration in Sri Ram's farm. Annex 4 gives details of costs for establishing chicken and piggery units. There was also discussion on raising cockerels. The issue of participating farmers being able to contribute something to the intervention was

		also discussed.
Nagado	• A community nursery to be established in the village. • Vegetables/root crops to be established in Amenio Naseyara's farm. • Root crops demonstration to be established in Aporosa Namaga's farm. Potential agroforestry system. • It was also agreed that project and MPI source planting materials such as wild yams and distributed among farmers.	• Establish chickens and vegetables in Vaturu Drumaru School • Apakuki T. An individual chicken farm demonstration will be established in Apakuki T's place. Andrew Tukana will decide on an option here.
Sabeto village consisting of two villages Koroyaca and Narokorokoyawa	• A community nursery to be established in each village • For crops, again traditional varieties need to be collected, established and distributed. Planting rosters and inspection	• One chicken and 1 piggery have been proposed to be operated by the coordination committee and villagers. Piggery will be a breeder farm. • Possibility of improving the pastor's existing piggery in addition and would be used as a demonstration farm as well.
Korobebe	• Vegetables demonstration in Mr Joe Tavutu's farm. • Root Crops demonstration in Mr Nacanieli's place (Turaga ni Koro) • Contour farming on the slopes that are being cultivated	• Chicken and Honey with Women's Group.

Each village will establish a coordination committee consisting of the Turaga ni Koro, farmer representative, women representative, youth and MPI (probably Viliame Mainawalala). The committee's role is to coordinate activities, set planting targets, livestock objectives and also monitoring and evaluation of the progress of activities. The 2 Sabeto villages have established their coordination committee but may need to include women representative.

Nursery Construction:

Construction of structure - $22,800

Construction of benches - $6,780

Total - $29,580

This will be for all the villages. The size of the nursery will be 10m x 4m with galvanized pipe structure and hardwood & 2 x2 mesh benches. The proposed structure will be strong and suitable for all weather. It will hold 96 trays producing 4,800 vegetable seedlings at one time.

The nurseries will be managed by women who will also grow vegetable and pulse backyard gardens in the villages.

Annex 1. The PRA team to the Sabeto Catchment

1. Mr. Siosiua Halavatau (Team Leader) Crop Production and Extension Coordinator, SPC LRD
2. Mr. Emil Adams, Information Officer, Information, Communication and Extension, SPC LRD
3. Mr. Dean Solofa, Climate Change Officer, SPC LRD
4. Ms. Maria Elder-Ratukarua, Agriculture & Forestry Policy Officer, SPC LRD
5. Mr. Joeli Savou, Land Use Technician, SPC LRD
6. Mr. Cenon Padalino, Forestry Genetic Resources Officer, SPC LRD
7. Mr. Takaniko Ruabete, Plant Pathology Technician, SPC LRD
8. Ms. Anna Fink, Land Resources Economist (ODI), SPC LRD
9. Mr. Tuvuki Ketedromo, GIS Technician, SPC LRD
10. Mr. Viliame Mainawalala, Principal Agriculture Officer (West), MPI
11. Mr. Shalendra Prasad, Senior Research Officer, MPI
12. Ms. Inise Sakoro, MPI Extension, Nadi
13. Ms. Atelini Vuinakelo, MPI Extension, Nadi
14. Mr. Adriano Tabualevu, MPI Extension, Singatoka
15. Mr. S. Ralulu, MPI Extension, Singatoka
16. Mr. Ulaiasi Lawavou, MPI Landuse
17. Mr. Apatia Nagalevu, MPI Landuse
18. Mr. Aporosa Tavuse, MPI Landuse
19. Mr. Apisai Yaranamua. MPI Landuse
20. Mr. Joeli Waradi, MPI Landuse

Annex 2. List of participants attending the PRA workshops in the villages

Korobebe Village

Women	Age
Luisa Naociovalu	56
Adi Ceva Ciriwai	39
Senimili Tiliko	44
Asenaca Lewaso	65
Livia Taliga	35
Luisa Lockwood	35
Roseana Naivalu	49
Imeri Neikere	64

Youth	Age
Saimoni Nalolawa	23
Ess Marana	27
Limairi	31
Inoke Neivue	29
Osea Ranuby	30
Joseva Neikere	23
Timoci Tiloko	

Men	Age
Semi Turuva	38
Vou	65
Loie	58
Eroni	47
Sikeli Dela	54
Jope Nacoivalu	67
Waisale Rokomatu	66
Luke Tamani	34
Nacanieli Tuiganu	60

Nagado Village

Women	Age
Amelia Ralune	53
Lusiana Tabusali	45
Veniana Naivaere	45
Anaseini Dakuwaqa	57
Leata Derenalagi	29

Youth	Age
Peniana Seniyautu	36
Penioua Tairoga	29

Saimere Liku	21
Bate Vutabere	20
Tarusila Volina	19
Epeli Kurulasela	21

Men	Age
Sakao Nailolo	46
Kitione Lotowa	38
Jona Lewere	72
Epeli Neidiri	43
Peniasi Dakuraga	63
Elomi Toutou	63
Epeli Solosolo	70

Naboutini Village

Women	Age
Anaseini Suvewa	72
Luse Rarawa	71
Jokaveti Vakavunivala	40
Adi Joana Galala	53
Veniana Niusama	59
Alivani Senigigia	48
Limiva Ravutu	47

Indian Farmers	Age
Habib Ali	50
Kasim	45
Shaan Ali	56
A Rahim	44
Anil	50
Chandra Prakash	68
Shri Ram	55

Youth	Age
Mehmood Ali	42
Lakshman Singh	50
Ledna Senuti	27
Aminiasi Qoro	52
Elia Nasa	42
Ilapote Vuniyawa	70

Men	Age
Epeli Waitui	75

Ilisoni Galala	56
Save Vasumaitoga	75

Sabeto Village

Women	Age
Adi Mere Turuva	56
Mere Tabulutu	62
Verenaisi Turuva	68
Loami Lewatu	43
Vilisi Bute	47
Merewalesi Sadrawu	60
Ana Dawai	42
Alivani Naroko	36

Youth	Age
Apisai Varo	
Sailasa Natalawaqa	
Poate Naivalurua	
Joeli Uqeuqe	
Vero Vu	
Josaia Qoro	
Kelemedi Dreu	
Pauliasi Niusama	
Akuila Lidi	
Eparama Nuika	
Sitiveni Vuniyayawa	
Peniona Qoro	
Joseva Varo	
Elaisa Mawa	
Sevuloni Vuniyayawa	
Mauori Nadoi	
Mataiasi Savura	
Jolomi Sengau	

Men	Age
Jonati Suka	50
Jone Boseiwasa	60
Kinivilame Moko	50
Viliame Rakiri	49
Sau Naquto	54
Mesake Galala	47

Annex 3. Household Income Expenditure Survey

Sabeto

2012

Vulnerability and Adaptation Survey

Section1: Background Information

1.1 Household No.: ☐	1.4 Interviewer name: ……
1.2 Village: ……..	1.5 Date: …… /……. / ……..
1.3 Respondent name: ……	1.6 Time: ……..

Section 2: Demographics

2.1 Household composition

Household Member No.	*Ethnicity*	*Relationship to H/ H*	*Sex*	*Age(Years)*	*Marital Status*	*Highest level of Education completed*

CODES

Ethnicity	R'ship to HH	Sex	Marital Status	Education
1.Fijian	1. Hhold head	1. Male	1. Never Married	0. None
2. Indian	2. Spouse	2. Female	2. Married	1. Kindergarton
3. Chinese	3. Child		3. Widowed	2. Elementary
4. Others	4. Parent		4. Separated	3. High School
	5. Grandchild		5. Divorced	4. College
	6. Other relation		6. Other	5.University
	7. Not related			6. Vocational
				7. Other

2.2 Migration

In the last 10 years, how many members in this household have moved out of the region?

- None (Go to Section 3) ☐
- One or more (Provide the relevant ages in the boxes below for each category)

a) Move out of the region but stay within the province ☐☐☐☐☐☐

b) Moved to other province ☐☐☐☐☐☐

c) Moved overseas ☐☐☐☐☐☐

Section 3: Household and Housing

3.1 – 3.9 Dwelling Structure and Amenities

3.1 MAIN type of living quarters

1-Independent
2-Shared building
3-Other

3.2 MAIN type of material for walls of the house

1-Concrete
2-Corrugated Iron/Tin
3-Timber/Wood
4- Thatch
5-Other
6-None

3.3 MAIN source of drinking water

1-Public utility water supply
2-Community water supply
3-Household tank
4-Protected well
5-Unprotected well
6-Other

3.4 MAIN source of washing water

1-Public utility water supply
2-Community water supply
3-Household tank
4-Protected well
5-Unprotected well
7-Spring, river, lake
8-Other

3.5 MAIN toilet facility

1-Flush toilet
2-Water seal
3-Outhouse, pit toilet
6-Other

3.6 MAIN form of sewage disposal

1-Connected to sewer line
2-Connected to septic tank
3-Use other means

3.7 MAIN source of power you have access to;

1-Public utility
2. Generator
2-Solar Panels
3-Other
4-None

3.8 MAIN source of lighting

1-Public utility
2-Generator
3-Solar panel
4-Kerosene lamp
5-Battery lamp
6-Other
7-None

3.9 MAIN cooking facility

1-Electric range
2-Gas stove
3-Portable electric stove
4-Kerosene stove
5-Microwave oven
6-Wood stove
7-Open fire
8-Other

3.10 Household Appliances

Do you have the following appliances in your households (in working order)?

Refrigerator	Yes / No
Washing machine	Yes / No
Sewing machine	Yes / No
Radio	Yes / No
TV	Yes / No
Electric fan	Yes / No
Video player	Yes / No

Section 4: Health

4.1 Diabetes

Does anyone in your household have diabetes?

No (Go to q4.2)

Yes (Provide the number of cases below)

Males _____

#Females _____

4.2 Water Borne Diseases

Does anyone from your household suffer from any water borne diseases (e.g. diarrhea) and how many?

No (Go to Section 5)

Yes (Provide the number of cases below)

#Males _____

#Females _____

Section 5: Income

5.1 Income Sources

In the table below, please provide the average annual income of the household as a whole, for each of the categories provided below (Please leave the total as blank)

Sources of incomes	Av. income/week ($)
Selling farm produce	
Selling cooked foods	
Salary/wages	
Selling handicrafts	
Remittances	
Others (small business etc.)	
Total weekly income	

5.2 Income Sufficiency

Is the total weekly income sufficient for the household?

Yes (Go to q5.3)

No (Provide the MAIN method the household meets their basic needs)

1-Assisted by extended family members

2-Borrow from neighbors

3-Barter exchange

4-Other

5-None

5.3 Financial Impact

Please rank from 1 to 6 (1 being "most impact") the impact of the following obligations on the household's financial situation?

	Rank from 1 to 6 (1 most impact)
Traditional obligations	
Church obligations	
Food security (meals, preserved food, etc.)	
School fees	
Health care	
Shelter, clothing, etc.	

Section 6: Household Member's Time Use

(The following table should only be filled in for people aged 5 years and above)

In an average **WEEK** spent in the island how much time does each household member spend undertaking the following activities? Insert number of hours.

	ACTIVITIES										
Household Member No. (age 5 and above)	Farming staple food crops e.g. swamp taro	Tending backyard gardens e.g. vegetables	Collecting wild forest produce	Fishing (coastal & deep sea)	Work for income	Household chores e.g. washing, food processing, preservation, etc.	Community activities	Church activities	School activities	**Total Hrs**	Leisure (7days x 24hrs) – total hours

Section 7: Land Access/Use

7.1 Land Access

Do you have access to land?

Yes – my own land (Go to q7.3)
Yes – leasing from someone else
No (Go to Section 8)

7.2 – 7.9 Land Use

7.2 How much do you pay a year for the land? $_____

7.3 How much land do you have access to? _____m (length) x _____m (width)

7.4 Do you grow your own food on this land? Yes / No

7.5 How much do you pay a year for the land? $_____

7.6 How much land do you have access to? _____ ha

7.7 Do you grow your own food on this land? Yes / No; if yes what crops you grow_____

7.8 How would you describe the quality of land? 1-Good 2-Average 3-Poor

7.9 Do you use chemical fertilisers on your crops? Yes/No

7.10 Do you use chemical pesticides on your crops? Yes/No

7.11 Do you use any natural fertilisers like compost/chicken manure on your crops? Yes/No

7.12 Do you raise any livestock? Yes/No _____

Section 8: Food Availability

8.1 Crops

In a typical **WEEK** how much crops does your household consume, give away, sell, receive as gifts and purchase?

CROP	**Months in harvest in a given year**	**Total produced by the household Weight (lbs)**						**Received as gift** (lbs)	**Purchased from another household/ store**	
		Total =a+b+c+d	Household consumption (a)	Preserved (b)	Given Away (c)	Sold (d)	Sold ($ Value)		Amount (lbs)	$ Value
Taro (Colocasia)										
Cassava										
Banana										
Yams										
Taro (Xanthosoma)										
Coconut										
Sweet potato										
Breadfruit										
Other										
Total										

8.2 Wild harvest

In a typical **WEEK** how much wild harvest does your household consume, give away, sell, receive as gifts and purchase?

WILD PRODUCE	**Months in harvest in a given year**	**Total produced by the household Weight (lbs)**					**Received as gift** (lbs)	**Purchased from another household/ store**	
		Total =a+b+c	Household consumption (a)	Given Away (b)	Sold (c)	Sold ($ Value)		Amount (lbs)	$ Value
Other									
Total									

8.3 Livestock harvest

In a typical **MONTH** how much livestock does your household consume, give away, sell, receive as gifts and purchase?

LIVESTOCK	**Total produced by the household Weight (lbs)**					**Received as gift** (lbs)	**Purchased from another household/ store**	
	Total =a+b+c	Household consumption (a)	Given Away (b)	Sold (c)	Sold ($ Value)		Amount (lbs)	$ Value
Pigs								
Beef								
Mutton								
Chicken								
Ducks								
Wild birds								
Other								
Total								

8.4 Seafood harvest

In a typical **WEEK** how much sea food produce does your household consume, give away, sell, receive as gifts and purchase

SEAFOOD	**Total produced by the household Weight (lbs)**						**Received as gift** (lbs)	**Purchased from another household/ store**	
	Total =a+b+c+d	Household consumption (a)	Preserved (b)	Given Away (c)	Sold (d)	Sold ($ Value)		Amount	$ Value
Tuna and other deep sea fish									
Reef fish									
Shellfish									
Crab									
Lobsters									
Coconut crab									
Turtle									
Octopus									
Other									
Total									

8.5 Frequency of Consumption (Staple Foods)

How many days in a typical week does your household consume the following produce? Check (√)

Food Items	**Mostly (5+)**	**Sometimes (2-4)**	**Rare (once or less)**	**None**
taro				
cassava				
Banana				
yams				
Coconut				
Sweet potato				

Breadfruit				
Other				

Section 9: Imported Foods

9.1 Amount and Value of Imported Foods

In the following table, please provide details of the amount of each imported food item the household purchases in a typical MONTH. Also provide an estimate of the value of this food

Imported Food	**Quantity imported (quantity in numbers e.g. cases)**	**Total Costs ($ Value)**
Rice		
Flour		
Ramen Noodles		
Canned fish		
Canned meat		
Coffee/Tea		
Sugar		
Salt		
Soy sauce		
Milk & milk products		
Soft drinks		
Chicken/Turkey tails		

9.2 Frequency of Consumption (Imported Foods)

How many days in a typical week does your household consume the following produce? Check (√)

Food Items	**Mostly (>5)**	**Sometimes (2-4)**	**Rarely (once)**	**None**
Rice				
Flour				
Ramen Noodles				
Canned fish				
Canned meat				
Coffee				
Sugar				
Salt				
Soya sauce				
Milk & milk products				
Soft drinks				
Chicken/Turkey tails				

Section 10: Information, Communications and Extension

10.1 Rank the following media formats in their usefulness to receive information:

Format	**Most Useful**	**Useful**	**Not Useful**
Posters/leaflets			
Radio programme			
Newspaper			
Video programme			
Mobile phone			
Internet			

10.2 Do you own a mobile phone _____ yes _____ no

10.3 If you own a mobile phone, which service provider ___ Digicel ___ Vodafone __ Inkk

10.4 Do you own a smarthphone? Yes/No.

10.5 Do you know someone who owns a smartphone? Yes/No

10.6 Do you want to receive useful farming tips using text messages? Yes/No

If Yes, are you willing to pay for the text messages at 20cenets a message? Yes/No

10.7 Does your household have a computer? Yes/No

10.8 Do you have access to the Internet? Yes/No

10.9 Do you know your extension officer? Yes/No.

When did you last meet your extension officer? In the last six months? Yes/No.

10.10 Do you belong to a farmer network group? Yes/No. Name: _____

10.11 Do you belong to village group? Yes/No Name: _____

Annex 4. Costs for establishing different models of livestock interventions

1.0 Livestock unit establishment costs/selling price

Table 1: Meat chicken unit (establishment costs)

No.	Item	Unit cost ($-00)	Quantity	T/Cost ($-00) VIP
1.0	**Establishment costs**			
1.1	**Seed stock**			
	Purchase of meat day old chicks	1.93	100	193.00
1.2	**Feed**			
	Broiler starter (25kg bags)	45.05	6	270.30
	Broiler grower (25kg bags)	44.75	6	268.50
	Broiler finisher (25kg bags)	48.70	6	292.20
1.3	**Equipment**			
	Bell waterus	30.00	2	60.00
	Manual drinkers	25.00	2	50.00
	Plastic tube feeders	20.00	4	80.00
	Scratch trays	10.00	2	20.00
	Hurricane lantern (optional)	30.00	1	30.00
1.4	**Other items**			
	Wood shavings(bags)	5	10	50.00
	Old news papers (kg)	10	3	30.00
1.5	**Infrastructure**			
	“Lean-to” design building with dimensions of 3m x 3m.	1800.00	1	1800.00
1.6	**Training**			
	20 persons@$40, fuel@$200, MPI@$400	Na	1	1400

1.7	**Sub total**	Na	na	**4544**
1.8	**Contingency costs**			
	For price fluctuations and miscellaneous items (3.32%)	Na	na	156
1.9	**Total estimated establishment cost**			
	=1.1 + 1.2 + 1.3 + 1.4 + 1.5 + 1.6 +1.8	Na	na	**4700.00**
2.0	**Selling price calculation**			
2.1	**L/weight gain estimation**			
	=100 chickens x 0.90 (10% mort)			
	=90 chickens x 2.0kg L/wt			
	=180 kg L/wt gain			
2.2	**Breakeven point selling price**			
	=Prod. Costs/kg L/wt gain			
	=1.1+1.2+1.4/kg L/wt gain			
	=$1104.00/180kg			
	=$6.13/kg est. breakeven pt. sale price			
2.3	**Current market sale price**			
	=$8.00 per kg			
2.4	**Estimated net return per batch**			
	=Value mkt price less prod. Costs			
	=($8-x180kg)-($1104.00)			
	=$336.00 per batch			

(Source quotes; Crest chicken, Vinod Patel, 30th January 2013)

Table 2: Pig unit (establishment costs)

No.	Item	Unit cost ($-00)	Quantity	T/Cost ($-00) VIP
1.0	**Establishment costs**			
1.1	**Seed stock**			
	Purchase of weaner pigs	150.00	3	450.00
	Purchase of conceived gilt	500.00	1	500.00
1.2	**Feed**			
	Pig weaner feed 150g/p/d (25kg bag)	38.09	10	380.90
	Pig grower feed 200g/p/d (25kg bag)	30.10	15	451.50
	Pig breeder feed@500g/day (25kg bag)	29.03	15	435.45
1.3	**Equipment**			
	Drink nipples @$13.60 each	13.60	2	27.20
	Galvanise ½" pipe @$30.00 each	30.00	2	60.00
1.4	**Other items**			
	Wood shavings (bags)	5	10	50.00
	Iron injectable (100mls)	65.00	1	65.00
1.5	**Infrastructure**			
	"Lean-to" design building with dimensions of 3m x 3m x 2 rooms	Na	1	3000.00
1.6	**Training**			
	20 persons@$40, fuel@$200, MPI@$400	Na	1	1400.00

1.7	**Sub total**			**6820.05**
1.8	**Contingency**			
	For price fluctuations and miscellaneous items (2.57%)			179.95
1.9	**Total estimated establishment costs**			
	=1.1+1.2+1.3+1.4+1.5+1.6+1.8			**7000.00**

(Source quotes; Crest chicken, Vinod Patel, 30th January 2013)

Table 3: Honey bee (establishment costs)

No.	Item	Unit cost ($-00)	Quantity	T/Cost ($-00) VIP
1.0	**Establishment costs**			
1.1	**Seed stock**			
	Purchase of Queen bees	30.00	3	90.00
	Purchase of 4 frame brood and bees	130.00	3	390.00
1.2	**Bee capital items**			
	Purchase of foundation wax	2.00	60	120.00
	Purchase of bee wooden frames	1.50	60	90.00
	Purchase of bee frame wire	15.00	3	45.00

1.3	**Training**			
	20 persons@$40, fuel@$200, MPI@$400	Na	1	1400.00
1.4	**Sub total**			**2135.00**
1.5	**Contingency**			
	For price fluctuations and miscellaneous items (7.17%)			165.00
1.6	**Total estimated establishment costs**			
	=1.1+1.2+1.3+1.5			**2300.00**

(Source quotes; Crest chicken, Vinod Patel, 30th January 2013)

Table 3: Infrastructure material list, chicken unit

No.	**Item**	**Unit**	**Unit price $-00**	**Quantity**	**Total cost $-00**
1	Concrete blocks 6”	Pc	1.81	40	72.40
2	Shed-Pine post 4” dia, (2.4m) 8’	Lth	36.00	4	144
3	Tank platform-Pine post 4” dia, (2.4m) 8’	Lth	36.00	4	144
4	Roof Iron (Zincalum)x 12’ 86cm width(80cm, 2 corrugation o/lap)	Feet	3.08	5	184.80
5	Welded wire netting 3’ width x 10m Lth	coil	42.00	3	126.00
6	Bottom plate, 4x2” timber, 3m Lths, R/treated	Pc	4.90/m	4	58.80

7	Top plate, 4x2” timber, 3m Lths, R/treated	Pc	4.90/m	2	29.40
8	Rafter 4x2” timber, 3.6m Lths, R/treated	Pc	4.90/m	5	88.20
9	Platform timber 4x2” 1.8m Lths	Pc	4.90/m	6	52.92
10	Purlin 3x2” timber, 3.6m Lths, R/treated	Pc	3.6/m	5	77.76
11	Roof nails and washers	Kg	6.30/kg	2	12.6
12	6” nails	Kg	4.80/kg	2	9.60
13	5” nails	Kg	5.39/kg	2	10.78
14	4” nails	Kg	4.38/kg	2	8.76
15	2” nails	Kg	4.50/kg	2	9.00
16	Clout nails	kg	7.8/kg	2	15.60
17	Cyclone strapping, 30m	Coil	24.00	1	24.00
18	River gravel	load	220.00	1	220
19	Cement powder	Bag	14.60/bag	3	43.80
20	Plastic water tank 500 ltr	Pc	247.70	1	247.70
21	PVC ½” pipe lth and fittings	Pc	10.00	1	10.00
22	PVC glue 200 ml	Can	2.00	1	2.00
23	**Sub total**	na	na	na	1592.12
24	Contingency costs (11.55%) for price fluctuations and miscellaneous items	na	na	na	207.88
25	**Grand total**	na	na	na	**1800**

(Source quote; Vinod Patel, 30th January 2013)

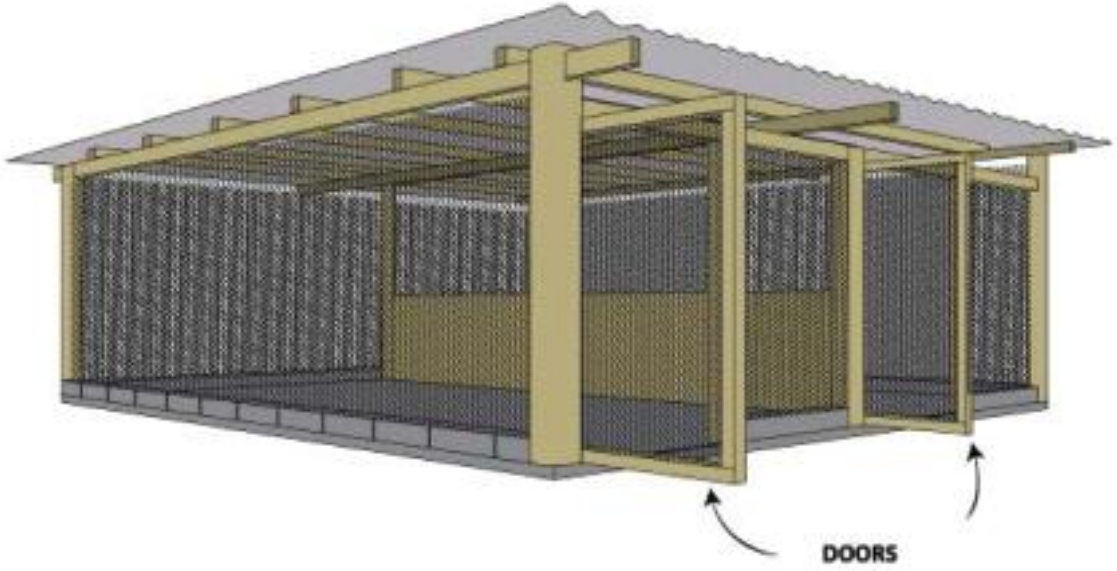
Table 4: Infrastructure material list, pig unit

No.	Item	Unit	Unit price $-00	Quantity	Total cost $-00
1	Concrete blocks 6”	Pc	1.81	320	579.20
2	Shed-Pine post 4” dia, (2.4m) 8’	Lth	36.00	4	144
3	Tank platform-Pine post 4” dia, (2.4m) 8’	lth	36.00	4	144
4	Roof Iron (Zincalum)x 12’ 86cm width(80cm, 2 corrugation o/lap)	Feet	3.08	10	369.60
5	Bottom plate, 4x2” timber, 6m Lths, R/treated	Pc	4.90/m	3	88.20
6	Top plate, 4x2” timber, 6m Lths, R/treated	Pc	4.90/m	2	58.80
7	Rafter 4x2” timber, 3.6m Lths, R/treated	Pc	4.90/m	10	176.40
8	Platform timber 4x2” 1.8m Lths	Pc	4.90/m	6	52.92
9	Purlin 3x2” timber, 3.6m Lths, R/treated	Pc	3.60/m	10	129.60
10	Roof nails and washers	Kg	6.30/kg	5	31.50
11	6” nails	Kg	4.80/kg	4	19.20
12	5” nails	Kg	5.39/kg	4	21.56
13	4” nails	Kg	4.38/kg	4	17.52
14	2” nails	Kg	4.50/kg	4	18.00

15	Clout nails	kg	7.8/kg	3	23.40
16	Cyclone strapping, 30m	Coil	24.00	1	24.00
17	River gravel	load	220.00	1	220.00
18	Sand	load	220.00	1	220.00
19	Cement powder	Bag	14.60/bag	6	87.60
20	Plastic water tank 500 ltr	Pc	247.70	1	247.70
21	PVC ½” pipe lth and fittings	Pc	10.00	1	10.00
22	PVC glue 200 ml	Can	2.00	1	2.00
23	**Sub total**	na	na	na	2685.2
24	Contingency costs (10.49%) for price fluctuations and miscellaneous costs.	na	na	na	314.80
25	**Grand total**	na	na	na	**3000**

(Source quote; Vinod Patel, 30th January 2013)

Figure 1: Poultry shed "Lean-to" design



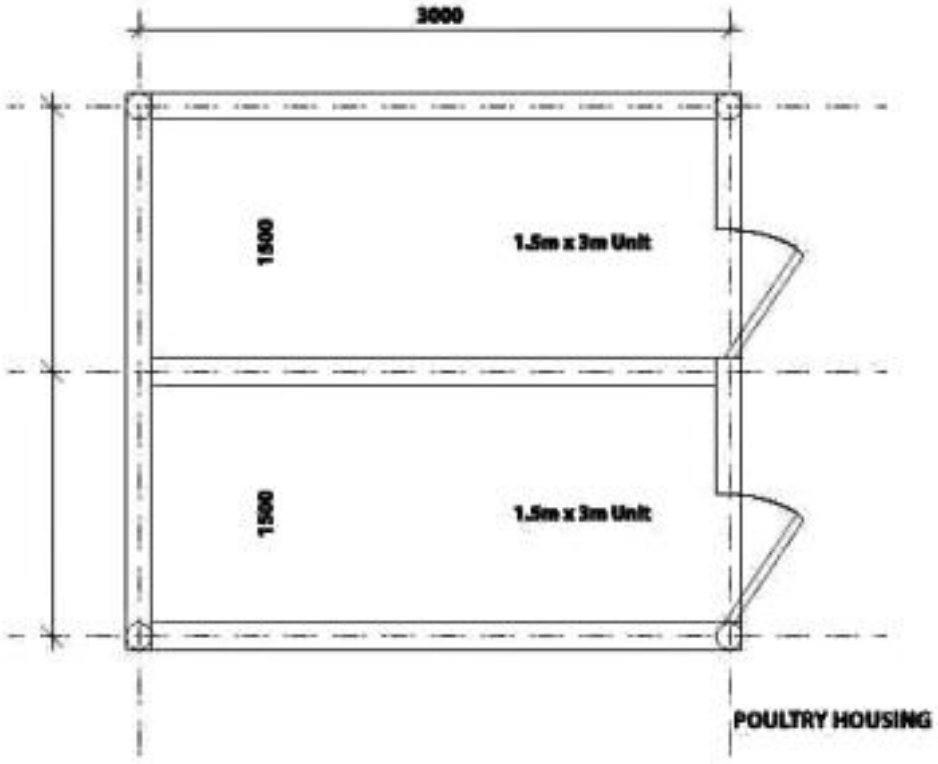


Figure 2: **Piggery Pen "Lean-to" design**