PERCEPTION OF FARMERS TO CLIMATE VARIABILITY AND COPING STRATEGIES AMONG FARMING COMMUNITIES OF BUFUNDI SUB-CATCHMENT, KABALE DISTRICT, SOUTH WESTERN UGANDA

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APRIL, 2015
DECLARATION

This thesis is my original work and has not been presented for a degree or any other award in any other University.

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DEDICATION

I dedicate this thesis to my dear mother, Mrs Flora Tugumisirize, my sister Viola Musiimenta, my aunties Prof Joy Kwesiga and Dr Grace Kalimugogo; my supervisors Prof Joy Obando and Prof Majaliwa Mwanjalolo.
My heartfelt thanks go to God, who by His grace has brought me this far through all challenging and difficult times. I really thank him for giving me the wisdom, knowledge and all the support I needed to complete this study. I indeed wish to convey my profound gratefulness to the German Academic Exchange Services (DAAD) for the support. Thank you for believing in me and financing my Master’s studies.

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ACRONYMS AND ABBREVIATIONS

CBO: Community Based Organization
CDO: Community Development Officer
DAAD: German Academic Exchange Services
DFID: Department for International Development
DRC: Democratic Republic of Congo
DENIVA: Development Network of Indigenous Voluntary Organizations
ECA: Enhanced Capital Allowance
EEA: European Environment Agency
FAO: Food and Agriculture Organization of the United Nations
FARA: Forum for Agricultural Research in Africa
GDP: Gross Domestic Product
IDRL: International Disaster Response Law
IPCC: Intergovernmental Panel on Climate Change
KDLG: Kabale District Local Government
MAAIF: Ministry of Agriculture Animal Industry and Fisheries
MDGs: Millennium Development Goals
NAADS: National Agriculture Advisory Services
NAPA: National Adaptation Programme of Action
NEMA: National Environment Management Authority
PEAP: Poverty Eradication Action Plan
SSA: Sub Saharan Africa
UBOS: Uganda Bureau of Statistics
UNEP: United Nations Environment Programme
UNFCC: United Nations Framework Convention on Climate Change
URCS: Uganda Red Cross Society

WHO: World Health Organization
ABSTRACT

Global climate variability is one of the greatest environmental challenges facing the world today. Due to inadequacy in infrastructure and over dependency on natural resources, developing countries are more vulnerable to climate variability effects. The main objective of the study was to assess perception of farmers to climate variability effects and coping strategies among farming communities in Bufundi Sub-catchment. The specific objectives of the study were to (i) evaluate climate trends in Bufundi sub-catchment from 1991 to 2011, (ii) assess Bufundi farmers perceptions on effects of climate variability, (iii) establish coping and adaptation strategies adopted by farmers in response to climate variability effects, and (iv) evaluate mechanisms in enhancing community resilience to climate variability effect in Bufundi sub-catchment, Kabale district south western Uganda. Rainfall and temperature data covering the period from 1991-2011 were acquired from the Department of Meteorology and analyzed. Semi-structured questionnaires were administered to 95 respondents, and three focus group discussions conducted using guiding questions. Key informant interviews and field observations were also conducted. Annual rainfall and temperature were subjected to regression analysis for temporal trends, and to ANOVA for testing variability. Semi-structured questionnaire were subjected to descriptive statistics to establish household perceptions on climate variability and how it has affected availability of resources, coping strategies adopted by farmers in response to climate variability effects. Chi-square ($\chi^2$) test was used to test association between different household coping strategies among different households. Qualitative data was transcribed and organized under different themes and coded for analysis. Annual rainfall amount and average maximum temperature did not follow any significant linear trend; while minimum temperature increased gradually with time ($R^2=0.476$). Respondents experienced floods (83.2%) and landslides (92.6%) as the major hazards linked to extreme climatic events in the micro-catchment. They also perceived a moderate increase in temperature of which 38.9% of respondents ranked it moderate. Farmers in Bufundi sub-catchment have adopted different coping strategies to climate variability which include: rainwater harvesting, improved crop varieties, soil and water conservation measures, alternative sources of livelihoods such as brick lying and extensive farming. The study recommended that the existing legal and institutional framework should be strengthened, land management options, irrigation, and awareness creation.
CHAPTER 1: INTRODUCTION

1.1 Background to the study

Global climate change and variability are one of the greatest environmental challenges facing the world today (World Bank, 2009). Due to inadequacies in infrastructure, over dependency on natural resources especially rain fed agriculture, Africa is most vulnerable and least prepared to deal with climate variability effects (World Bank, 2010). About 25% of the contemporary African population experiences water stress, while 69% live under conditions of relative water abundance (Vörösmarty et al., 2005). Sub-Saharan Africa (SSA) is predicted to be particularly hard hit by global warming because it already experiences high temperatures and low and highly variable precipitation (Kurukulasuriya et al., 2006).

About 80% of rural households in Uganda depend directly or indirectly on rain fed agriculture for their livelihoods (UBOS, 2007). According to National Environment Management Authority (NEMA) state of environment report (2007), 92.3% of Uganda’s population depends on biomass for their energy needs mainly firewood, charcoal and crop residues. However, degradation of these resources coupled with climate variability is beginning to have serious negative impacts on Uganda’s socio-economic development and the livelihoods of millions of her people including attainment of development targets such as Millennium Development Goals (Republic of Uganda, 2010). A recent study in both Uganda and Eastern DRC showed that streams are highly loaded by sediments and most especially during the rainy season (Majaliwa et al., 2010). This was attributed to high population pressure that has
resulted into pressure on land which has led to cultivation and settlement on marginal land including hill slopes and wetlands.

According to reports by Uganda Red Cross Society (2011) it is estimated that 31% of the total population in Uganda lives in mountainous areas. Uganda’s highland areas are the most densely populated. Kabale is one of the most densely populated districts with an estimate population density of 318 people per km\(^2\) (UBOS, 2007). Kabale district has the highest rate of land degradation of which 90% of its land is degraded due to population pressure and poor farming practices in the area (NEMA, 2008). Due to land degradation, Kabale highlands are more vulnerable to climate variability effects such as intensive rainfall which triggers soil erosion and landslides. This has led to increase in sediment load in streams in the district, which affects water availability especially in rainy season. Temperatures in the Kabale district have been increasing dramatically by 2\(^\circ\)C in the last three decades (Wamukonya et al., 2008). Temperature increase in highland areas of about 3 degrees has favoured the growth of vectors like mosquitoes which has increased malaria rates in many parts of Kabale district (Bagoora, 2011). Malaria trend in the district has been on the rise with more than 100 malaria cases being recorded per 1000 people (WHO, 2009).

According to Uganda Red Cross Society (URCS) report on International Disaster Response Law (IDRL) in Uganda, the torrential rains of March 2010 linked to climate change and variability which led to weakening of the soils in Kabale resulted into mudslides and flooding. This displaced hundreds and cut off roads connecting different communities including Bufundi sub-catchment.
1.2 Statement of the problem

Climate variability has affected community livelihoods world over especially natural resource dependent livelihood in the developing world. Over dependency on rain fed agriculture has led to increased vulnerability to climate vulnerability among the farming communities in the sub-catchment. Highly variable precipitation and increase in temperature in the sub-catchment greatly affect the livelihood of farming communities. The government of Uganda has put in efforts in addressing climate variability and change effects through establishment of National Adaptation Programme of Action (NAPA) in 2007. However the measures put in place by the above programs are still at national level and not yet implemented by local communities. Hence this study was aimed at assessing the perceived effects of climate variability and how the farmers are coping with climate variability effects. This will help in the development of well-targeted adaptation measures that will increase community resilience to climate variability effects and improve on existing land and water management options in the catchment.

1.3 Justification

Bufundi is a sub-catchment of Lake Bunyonyi, it is mountainous, remote and a marginal area. This makes it inaccessible to other communities, to infrastructure such as hospitals, and water supply which makes the communities in the sub-catchment more vulnerable to climate variability. The farming community of Bufundi sub-catchment depends on rain-fed agriculture which is highly affected by highly variable precipitation. The sub-catchment has currently been experiencing frequent landslides, as a result of torrential rains that have led to displacement of households in the community and has affected their livelihood through destruction of farms. Results from this study will be useful in the identification of climate
change and variability adaptation gaps, understanding and supporting coping strategies of local farmers will be useful in designing appropriate adaptation mechanisms by decision makers. They can also be used by other researchers as reference and identification of study gaps for further research and for more innovative coping and adaptation strategies and enhancement of resilience among farming communities.

1.4 Research questions

i. What is the trend of rainfall and temperature trends from 1991 to 2011?

ii. How do different farmers perceive climate variability effects?

iii. What are the coping strategies adopted by households to cope with effects of climate variability?

iv. What are the existing mechanisms in enhancing community resilience to climate variability effects?

1.5 Hypotheses

i. There is no statistically significant variation in rainfall and temperature trends from 1991 to 2011.

ii. There is no statistically significant difference between coping strategies adopted by farmers in response to effects of climate variability.
1.6 Objectives of the study

1.6.1 General Objective

The aim of this study was to assess perception of farmers to climate variability effects and coping strategies among farming communities in Bufundi Sub-catchment.

1.6.2 Specific Objectives

The specific objectives were to:-

i. Determine rainfall and temperature trends in Bufundi sub-catchment from 1991 to 2011.

ii. Assess Bufundi farmers’ perceptions on effects of climate variability.

iii. Establish coping and adaptation strategies adopted by farmers in response to climate variability effects.

iv. Determine existing mechanisms that enhance community resilience to climate variability effects.

1.7 Significance of the study

The results of this study will be essential in contributing to development of well targeted adaptation policies that will enable communities to adopt sustainable watershed management options to enhance their resilience to climate variability effects. This calls upon decision makers to put in more effort especially agricultural research for example improved crop and animal variety, dissemination of climate information to communities such weather forecast informing farmers of seasonal changes. This will contribute to the realization of government programmes such as Millennium Development Goals (MDGs) since climate variability has
serious negative impacts to Uganda’s socio-economic development and the livelihoods of many people. Establishment and improvement of the already existing soil and water conservation measures also contributes to natural resources management and reduction of the effects of climate variability. The outcome of this study may be used as a planning and management tool for policy makers for sustainable utilization of watershed resources.

1.8 Scope and limitation

The study was conducted in Bufundi Sub-catchment of Lake Bunyonyi Kabale District, south western Uganda. The study analyzed rainfall and temperature data to observe any variation in the past 20 years, farmers’ perception to climate variability effects and how they cope with perceived changes. The limitation of the study was access to and gaps in rainfall and temperature data. However, data from National Meteorology Department was acquired to fill in the gaps.

1.9 Operational definitions

Adaptation: Adaptation to climate variability is a response that seeks to reduce the extent to which the system or community is affected by climate variability. In relation to water availability adaptation involves putting in place sustainable water and land management options to adjust with the highly variable climate.

Adaptive capacity: Adaptive capacity refers to the ability of any system or community to respond to change and return to a normal state. Adaptive capacity is shaped by available resources, institutions, skills and knowledge, among others. When communities’ adaptive capacity is low it means it will be adversely affected.
Climate Variability: Climate variability refers to shorter term, that is daily, seasonal, annual, inter-annual, or several years’ fluctuations in climate

Climate change: Climate change refers to long-term, that is decades or longer trends in climate averages that have been observed over decades or the past century, and long-term changes in variability for example the frequency, severity and duration of extreme weather events.

Coping strategies: Coping strategies are short-term actions opted by households or communities to reduce risk of extreme weather events.

Resilience: Resilience is the ability of a social or ecological system to absorb disturbances without losing its structure and productivity.

Vulnerability: Vulnerability is an extent to which climate variability will affect or damage the community well being mostly being influenced by socio-economic and biophysical factors.

Exposure: It is defined as the degree of climate or extreme weather event stress upon communities in terms of magnitude and frequencies of extreme events.
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This section reviews empirical works done by other scholars in the field of climate variability and coping strategies. It dealt with areas such as overview of climate variability from global to local level, effects of climate variability on access and availability of resources such as water resources, agriculture production, energy and health. It also looked at perception to climate variability and adaptation strategies. An outline of related research and gaps that were filled in order to answer the questions on effects of climate variability and coping strategies were also discussed.

2.2 Overview of Climate change and climate variability

East Africa’s climate is naturally dynamic with high temporal and spatial rainfall variability, some of which can be explained by large scale oscillations in atmospheric and ocean circulation including El-Nino, Southern Oscillation and less well known events such as the Indian Ocean Dipole reversal (Brooks, 2008). Climate change indicators show that mean annual temperature has increased by 1.3°C since 1960, an average rate of 0.28°C per decade (IPCC, 2011). Climate change and variability is rapidly emerging as one of the most serious global problems affecting many sectors in the world and is considered to be one of the most serious threats to sustainable development with adverse impact on environment, human health, food security, economic activities, natural resources and physical infrastructure (IPCC, 2007).
2.3 Rainfall variability and Temperature variability

Inter annual rainfall variations in equatorial East Africa are tightly linked to the El Niño Southern Oscillation (ENSO), with more rain and flooding during El Niño and droughts in La Niña years, both having severe impacts on human habitation and food security (Wolff et al., 2011). A study by Boko et al. (2007) predict that Africa is likely to warm across all seasons during this century with annual mean surface air temperatures expected to increase between 3°C and 4°C by 2099, roughly 1.5 times average global temperatures. Dello et al. (2008) goes further to show that a 10°C increase in temperature in developing economies leads to approximately 2.37 percent loss in the growth of agricultural output.

2.5 Water resources

Climate change poses a grave threat to the availability of freshwater around the world, about 25% of the contemporary African population experiences water stress, while 69% live under conditions of relative water abundance (Vörösmarty et al., 2005). Climate change adds pressure to existing threats to the sustainability of freshwater resources; population growth, socio-economic and technological changes and the resulting rising demand for water (Kristensen, 2006). Lack of water hampers population and economic growth in some areas of the world, but even in such areas, it is common to think of water as a resource that is renewable within the bounds imposed by a stationary regional climate (Welle, 2010). Unexpected, prolonged, and widespread shortages of water resulting from climatic change could have an unsettling and depressing effect on regional and possibly even on the national economy (Till et al., 2011).
Higher intensity and frequency of floods and more frequent extreme precipitation events will give increased surface runoff and erosion, increasing the nutrient load to the surface water (Jeppesen et al., 2009). Higher temperature increases the release of phosphorus from bottom sediments (Feuchtmayr et al., 2009). Increased intensity of rainfall will also pose a problem for drainage and sewerage disposal in urban and peri-urban areas. It is likely to those low-capacity systems, or those that are in poor repair, will be overcome, leading to increased contamination (Hunter, 2003).

Increased precipitation and increased extreme precipitation events (also in areas with decreased precipitation) increase concentrations of waterborne pathogens in the water in three ways. First of all, increased extreme precipitation increases the risk of sewer overflows. Secondly, subsurface runoff of manure faeces will increase by increased precipitation and more extreme precipitation events, thirdly, increased precipitation and more extreme precipitation events increase turbulence and this allows for re-suspension of pathogens from sediment. A study by Hofstra (2011) shows that there is a relationship between precipitation, runoff or discharge; and the concentration of faecal indicator organisms, or waterborne pathogens in surface water.

Climate variability will negatively impact on the quality of water in many parts of the world, increasing water temperatures, higher or lower groundwater levels. Floods and droughts raise the threat of heightened micro-organisms, chemical substances and radiological hazards in drinking water (Van der et al., 2009). Floods and droughts will exacerbate many forms of water pollution such as sediments, nutrients, organic carbon, pathogens and pesticides, and may distribute human excreta and its attendant health risks across entire neighbourhoods and
communities (Howard et al., 2003). Rain-generated floods and landslides will deteriorate existing water and sanitation infrastructure, especially where these are not located within the house.

With increased intensity and irregularity of rainfall, the inter-annular variability of river flows is likely to increase, such that rivers will become increasingly ‘flashy’ and seasonal. A study by Boko et al. (2007) shows that as a result, flood events will be more common, and an increased proportion of the available surface water will be lost in peak discharges, reducing the quantity of accessible water. With higher temperatures, the water-holding capacity of the atmosphere increases and evaporative demand is projected to increase almost everywhere (Solomon et al., 2007). The overall availability of water will be seriously impacted by climate change mainly through drought, the decline in water supplies stored in glaciers and snow cover, and flooding (Parry et al., 2007). Increased water scarcity will result in increased competition between sectors such as domestic, agricultural and industrial water use. Groundwater levels of many aquifers around the world are in decline due to groundwater pumping surpassing groundwater recharge rates (Howard et al., 2003). The Department for International Development DFID (2009) reports that drought also present serious risks, causing water wells and dams to dry up, contributing to water shortages in rural areas.

2.6 Agricultural productivity and food security

Uganda’s agricultural sector is largely rain-fed agriculture. Overall, 96% of the farmers in Uganda depend on rain as their main source of water while 3% farmers were reported using swamps/wetlands as their main water source (2.9%) and only 1% using irrigation as their main source of water (UBOS, 2007).
According to IPCC (2007) increased temperatures are expected to reduce crop yields and increase levels of food insecurity even in the moist tropics with predictions that during the next decade millions of people particularly in developing countries will face major changes in rainfall patterns and temperature variability regimes.

A study by Food and Agriculture organization (FAO) (2008) indicates that the effects of climate change on food availability and the stability of the food system are already being felt, especially in rural locations where crops fail or yields decline, and in areas where supply chains are disrupted, market prices increase, and livelihoods are lost. Climate change and climate variability are among the biggest contemporary threats to agricultural productivity in the Sub Saharan Africa (SSA) region (IPCC, 2007). The agricultural sector is a critical mainstay of local livelihoods and national Gross Domestic Product (GDP) in some countries in Africa.

The growth in human population has increased the demand for food pressure on natural ecosystems. Climate change puts additional pressure on the world food supply system. According to the 2008 report of the Africa Progress Panel, Climate change will affect Africa more severely than other regions of the world, and will have a devastating impact on food production and the livelihoods of the rural poor.

Impacts of climate variability and change on the agricultural sector are projected to steadily manifest directly from changes in land and water regimes, the likely primary conduits of change. Changes in the frequency and intensity of droughts, flooding, and storm damage are expected. The droughts which used to last for a period of 3 months have been extended to
about 4-6 months. This presents much stress to both food (banana, maize, beans, cassava, vegetables) and cash (coffee) crops and results in low productivity and at extreme there is complete death of the crops (Zake, 2012). Climate variability has led to changes in crop potential and an increase in pests and diseases depending on the changing weather patterns. Current temperatures and rainfall allow growing of coffee in most parts of Uganda, including Bududa District, where it has historically been an important cash crop. According to Ministry of Finance Planning and Economic Development (2004), climate change models indicate that an increase of 2 °C could have a significant negative impact on coffee-growing areas. Instability or a decrease in agricultural income will, then, have effects on food consumption (as share of production or income), depending on the subsistence nature of the agricultural activity or on the price of the purchased products (Lazzroni, 2010). Malnutrition effects on human capital are one of the most explored phenomena following lower food productivity through the food consumption effects of weather vagaries (de la Fuente and Dercon, 2008).

2.7 Health

It is estimated that average global temperatures will have risen by 1.0–3.5 °C by 2100, increasing the likelihood of many vector-borne diseases (Githeko et al., 2000). Highland malaria has returned to Kabale district after an absence of nearly 30 years when it was eradicated using DDT spray in 1961 (DENIVA, 2008). Local severity of the malaria epidemic was associated with changing microclimates associated with land use, the positive correlation between average minimum temperature and household densities of Anopheles mosquito shows that warmer seasons associated with El Niño and global warming pose a continuing threat (Lindblade et al., 2000). Githeko (2007) highlighted that people living in areas with low malaria transmission such as highlands are vulnerable because their immunity is low. This
increase in malaria incidence in Kabale has been attributed to changing climatic conditions, drug resistance and land use change (Kiwanuka 2003).

2.8 Perception to climate change and variability effects

Humans are now unequivocally implicated in triggering global climate change, and the impacts on human and natural systems will be severe, far reaching, and affect the most physically and economically vulnerable people around the world (Semenza et al., 2008). Interactions between individuals are complex and nonlinear, agent populations are heterogeneous and outcomes, based on decisions, can result in adaptations (Bonabeau, 2002). Elder cultures possess a deep knowledge base about the complex ecological systems with which they interact through the transmission of knowledge and wisdom from one generation to another (Berkes et al., 2000). The knowledge base has most commonly been termed Traditional Ecological Knowledge (TEK) (Kimmerer, 2002). As successive generations inherit natural resources, their perceptions rely on some measure of change based on a “before” and a “now.” (Ford et al., 2006). This difference in perception is not only related to the amount of time that a particular generation has experienced the natural resource, but also on transmission of information from others and on the quality of their experience (Davidson and Berkes, 2003).

2.9 Coping strategies

Goulden (2008) found that many of the actions that households take to adapt to the impacts of climate variability depend on diversifying their livelihoods - taking up different activities to earn income and obtain food - whilst others depended on social bonds. Variability and uncertainty in the climate is inherent, and human societies have often had to deal with, and
respond to, unforeseen variation in climate or weather extremes (Adger et al., 2003). However, the ways in which societies have coped to date, and the range of these coping mechanisms, may not be sufficient to deal with the new challenges brought about by climate change (van Aalst et al., 2008).

Coping strategies are short-term actions opted by households or communities to reduce risk of extreme weather events (Victor and Eriksen, 2005). Climate variability may not be limited to technical measures but can also incorporate elements of equitable resource access and use, good governance, participation in decision-making processes and gender equity. Strengthening institutions for land and water management is crucial to effective adaptation and must build on principles of participation of civil society, gender equality, subsidiary and decentralization. Successful adaptation requires public participation and interactions between multiple levels of government: regional, national, local and at the level of the transboundary basins, as adaptation at one level can strengthen or weaken, adaptive capacity and action at other levels. Coping is also a matter of interaction between local strategies to manage change and policies and decision making that may favour particular strategies and developments over others. The capacity to adapt is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology. Multiple stresses related to HIV/AIDS, land degradation, trends in economic globalization, and violent conflict affect exposure to climate risks and the capacity to adapt (Adger et al., 2007).
2.10 Conceptual framework for effects of climate variability and coping strategies

The conceptual framework was adopted and modified from DPSIR framework (Kristensen, 2004). The DPSIR framework was selected because the framework elements are related to the study which include climatic factors, non climatic factors, impact, responses and outcome. The framework components are defined as follows:

**Climatic factors**

Climate variability affects the well being and functionality of the farming community. The climatic factors include: rainfall variability, temperature increase and seasonal shift. These affect the availability of resources such as water, agricultural land and human health.

**Non climatic factors**

Farming communities have other stressors which affect their well being apart from climate variability. These factors include: population growth, topography, poor land use, inadequate infrastructure, poor governance, and pollution.

**Effects**

The changes in the physical, chemical or biological state of the environment determine the quality of ecosystems and the welfare of human beings. These changes are as a result of both climatic and non climatic factors. These include unhealthy ecosystems of certain species, diseases outbreaks as a result of invasion of vectors, increased demand and conflicts, food insecurity, poverty, water scarcity and landslides and erosion.

**Response**

A ‘response’ by society or policy makers is the result of an undesired impact and can affect any part of the climatic and non-climatic factors and effects (EEA, 2004). The responses...
include livelihood diversification, strengthening institutional and policy frameworks for effective management, Soil and water conservation for sustainable management land and water resources.

**Outcome**

The response by either society or policy makers leads to enhancement of resilience of communities to the effects of climate variability; and sustainable watershed management.

**Figure 2.1: Conceptual framework for effects climate Variability**

Source: Adopted and modified DPSIR framework (Kristensen, 2004).
CHAPTER 3: MATERIALS AND METHODS

3.1 Introduction

This chapter includes materials and methods which used in the study which include description of study area, sampling techniques, data collection methods, data analysis and ethical clearance.

3.1 Study area

Bufundi Sub-catchment is located in Kabale, South Western Uganda between 1014’S and 1026’S latitudes and 29048’E and 290 55’E longitudes and it covers an area of up to 20 square kilometers (Figure, 3.1). The terrain is dominated by hills and v-shaped valleys. Bufundi has a bimodal rainfall pattern that provides opportunity for two cropping seasons in a year. The long rains occur in mid-February and June while the short rains occur from mid-September to mid-December. The average annual rainfall in the catchment varies between 900 mm to 2200 mm with a mean annual temperature of 16.7ºc. Soils are volcanic andosols which are relatively fertile but susceptible to extreme soil erosion (FARA, 2009). Bufundi has a total population of 33,300 people and 6544 households (KDLG, 2011).
Figure 3.1: Map of Bufundi Sub-catchment

Source: FARA (2009)
3.1.2 Pilot survey

One month before the field survey, a pilot survey was conducted in the study area. The purpose of this survey was to pilot the questionnaire for reliability and accuracy. The pilot survey was also to obtain informed consent from local institutions, leaders, respondents, and in identification of research assistants and field guides. This was also an entry point to the community as well as the community members to appreciate the purpose of the study in their sub-catchment.

3.1.3 Selection and Training of Research Assistants

Two research assistants and one field guide were selected from the study area based on their ability to speak English and Rukiga languages fluently. The research assistants were given one day training by the researcher on how best to translate English questionnaire to Rukiga. The training also involved the relevance of each question in the questionnaire as far as the research was concerned, how best to introduce the topic to the respondent and its importance for the Bufundi sub-catchment, research ethics among others.

3.2 Sampling Procedure

Selection of sample size from a total of 6544 households was selected using a formula by Yamane in 1967 (Baartlett, 2001)

\[ n = \frac{N}{1 + N(e)^2} \]

………………………………………………………………equation I
Where \( n = \) sample size

\[ N = \text{total number of households} \]

\[ e = \text{margin of error set at 10\%} \]

By using the equation I with the confidence level of 95\% and marginal error of 10\%, a calculation from a population of 6544 households came up with 95 farmers as sample size for the survey. Key Informants (6) were purposively selected based on the key areas of the study. The key informants included local council Leader, community based organization, and government officials.

### 3.3 Data Collection

The study employed a combination of data collection methods: secondary data gathering, household survey, Focus Group Discussions, Key Informant Interviews, and direct field observation.

#### 3.2.1 Secondary Data

Climatic data comprising of rainfall and temperature data recorded from 1991-2011 were used in the study. Rainfall and temperature data was collected from Kabale District Meteorological Station located at Kabale District head quarters. The data from 1991 was selected because the 1991–2000 decade alone (peak observation), Uganda experienced seven drought episodes. Extreme droughts had significant negative effects on water resources, hydropower production, agriculture and the overall economy. El Niño and La Niña episodes have been the principal causes of most severe climate change-related disasters (NEMA and UNEP, 2009). Other published and non-published study reports for example Journals and Government publications on the same subject were reviewed to enhance the study results.
3.2 Primary Data

3.2.1 Questionnaire

A household survey was conducted to assess effects of climate variability and coping strategies in response to the perceived changes using likert scale to determine the extent of effects of climate variability among different farmers. This was achieved by administering a structured Questionnaire (Appendix IV). It involved a set of predetermined set of questions mainly for collecting farmers’ general data on climate variability effects. The data included household socio-economic profile, climate variability experiences, and coping strategies in response to the effects of climate variability.

3.2.2 Key Informant Interviews

Key informant interviews were carried out based on the key areas in the study. An interview guide (Appendix V) was developed to help in carrying out these interviews. The key informants included Local council Leader, Community Based Organization (CBO), sub-county chief and Community Development Officer (CDO). The data included existing mechanisms in enhancing community resilience, policies and awareness creation.

3.2.3 Focus Group Discussion

A total of three (3) focus group discussions were conducted in each of the three (3) selected parishes to get more detailed information on how people regard climate variability experiences and how it affects water accessibility by households. A minimum of ten respondents were selected for each of focus group discussions. Each of the selected group had at least one representative from vulnerable group which included the youth, women, elderly
and people with disabilities. An interview guide (Appendix VI) was used to guide the discussion.

3.2.4 Field observations

Direct field observations were carried out with the help of observation checklist (Appendix VII) to validate information gathered through household survey and focus group discussions. High risk areas were identified by the participants and researcher, established on the ground and documented through photographs.

3.3 Data analysis

The study employed a combination of qualitative and quantitative approaches to analyze the information that was gathered through the above-mentioned methods.

3.3.1 Rainfall and temperature variability analysis

The climatic data that was used for analysis was from 1991-2011 and was collected from Kabale District Meteorological Station located at Kabale District headquarters. The researcher first attempted to capture the totality of inter-annual variability of climate with respect to monthly maximum temperature, monthly minimum temperature and monthly rainfall. Linear graphs based on actual records showing the actual variability in rainfall and temperatures from one year to the other were drawn. Linear Regression Analysis ($r^2$) was used to determine whether there are significant linear trends in rainfall and temperature.

A linear regression line has an equation of the form $Y = a + bX$………………equation II.

Where $X$ is the explanatory variable and $Y$ is the dependent variable. The slope of the line is $b$, and $a$ is the intercept. Results from trend analysis were compared with results from
household perception of climate variability to determine whether there is any relationship between household perception and empirical analysis of actual rainfall and temperature data.

### 3.3.2 Household data analysis

The data collected from household survey was first pre-processed. This essentially involved checking and cleaning errors of responses from the field survey to ensure accuracy and reliability. The data was assigned numeric and alphanumerical codes and was entered and displayed into SPSS version 19.0 for analysis. The data included household demographic and socioeconomic characteristics, household perception on climate variability experiences and the coping strategies adopted by households, views on non climatic factors that affect availability of resources and livelihood. The data was first subjected to descriptive statistics such as frequencies and percentages to establish farmers’ perception on climate variability and coping strategies adopted by farmers in response to climate variability effects. The data was then subjected to non parametric test. The chi-square ($\chi^2$) test was the non parametric test that was selected to determine if observed data deviate so it was used to determine significant difference between household coping strategies.

### 3.3.3 Qualitative data analysis

Qualitative data collected from focus group discussion and key informant interviews was audio tape recording, which was transcribed, cleaned and reviewed to check consistence and data quality. The data was analyzed using thematic content analysis where by themes which were developed from responses and coded for analysis. Quotes from respondents and narratives were used to illustrate and emphasize the voices and issues made by respondents.
3.4 Ethical clearance

An introductory letter was provided to every respondent and every questionnaire had an informed consent to inform the respondents about the study and its purpose in their community. Participation of respondents was voluntary meaning that every respondent participated in interviews and questionnaires on their own will. All data from completed surveys was de-identified and aggregated to ensure anonymity of participants.
CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discusses the findings of the study. The findings were presented in form of tables, graphs and pie charts. Photographs taken in the field also formed part of data presentation. Discussion of the results was done in reference to the stated study objectives.

4.1.1 Demographic characteristic of respondents

Demographic characteristics included age of respondents, marital status, household size, gender, and level of education.

4.1.2 Age of respondents

The age bracket of the respondents was of 15-75, with a mode in the age bracket of 26-35 (Figure 4.1) which is an indication that the population of Bufundi is mainly composed of the youth. This calls for increase in sensitization and projects which target the youth in the community.
4.1.3 Gender of respondents

The results indicate most of the respondents were Male (Figure 4.2) with 53.7% male and 46.3% female. This is because the study was targeting household heads.

Figure 4.1: Age of respondents

Figure 4.2: Gender of respondents
4.1.4: Marital status of the respondents

The highest percentages of respondents were married with 80% married, 13.7% single, 4.2% widowed and 2% divorced (Figure 4.3). This indicates that there is need for collective involvement of men and women in sensitization on mechanisms for coping with climate variability effects.

![Marital status of the respondents](image)

Figure 4.3: Marital status of the respondents

4.1.5 Education level of respondents

Majority of the respondents did not go to school (29.5%) or attained primary education (42.1%), only about third did secondary (15.8%) or tertiary (12.6%) education (Figure 4.4). The level education in the sub-catchment indicates that there is limitation in establishment of modern practices because this can lead to lack of compliance of communities to new technologies that can be used as coping strategies against climate variability. A good level of education increases available livelihood options and enhances adaptive capacity (Hari et al., 2010). It includes knowledge, skills, competencies and attributes embodied in people that
facilitate creation of personal, social and economic well-being; as well as motivation, behaviour, physical and emotional attributes and mental health (Sen, 1997).

“Many of the people in the sub-county have low education levels and this has hindered environmental management, new farming practices because people are not complying to the new mechanisms put in place and they still cling on unsustainable practices and methods which are not effective in this changing climate”. (Chairperson Local Council III, Bufundi, 15-05-2013)

Box 4.1: Respondent quotation on education level of people in Bufundi sub-catchment

This is in line with Kabale district local government report which indicates that Bufundi Sub-county is among the sub-counties in the district with the lowest enrolment levels in primary schools with a total enrolment of 6938 pupils (KDLG, 2011)

Figure 4.4: Education level of the respondents
4.1.6 Occupation

The majority (56.6%) of the respondents practice crop farming only 20.2% practice livestock farming followed by 12.9% business and the least 10.3% are civil servants (Figure 4.5). However, those doing off farm activities like business and teaching said as quoted below,

“we also practice farming to complement the salary and food for the family” (Bakyera Kashasha parish 30-04-2013)

Box 4.2: Respondent Quotation on Occupation

This means that all respondents are farmers. Household population of 82% depend on subsistence farming as source of their livelihoods (KDLG, 2011). This means that communities are small scale farmers with low production for home consumption.

Figure 4.5: Occupation of the respondents
4.1.7 Household size and land size

The results show that the average household size is approximately 5 persons. This slightly concurs with the district statistics where Bufundi has 4.8 persons as an average household size (Kabale District Planning unit, 2010). The average land size is approximately 1 acre. The per capita land holding is 0.3 acres and this land is seriously fragmented, the average household has 6-7 plots each plot measures 0.1-0.7 of an acre (KDLG, 2011). This shows that there is limited land in the sub-catchment. Farmers who own enough land are more likely to invest in coping strategies, including crop and livestock management practices and water conservation. The type of farming system also determines farmers’ use of adaptation strategies: those engaged in mixed crop and livestock farming, as well as those engaged in subsistence farming, are more likely to adapt to variation in climatic conditions than the farmers in specialized farming systems (Nhemachena, and Hassan, 2007). This implies that there is limited food production which can be consumed and stored for future crisis. This also puts pressure on land which can lead land degradation and opting for marginal lands like hill slopes which can trigger cases of erosion and landslides in the catchment.

4.1.8 Land ownership

The results show that the highest percentage of respondent that is 65.4% own land that is inherited from parents, then 32.6% freehold and 2.2% through donation especially marginalized pygmies (Batwa) acquired land through donation by African International Christian Ministries (AICM) (Figure 4.6).
Adaptation is a dynamic social process the ability of societies to adapt is determined, in part, by the ability to act collectively. The majority of respondents (74.7%) belong to social organization in their community and 25.3% do not belong to any social organization (Figure 4.7). These social organizations help the members to access credit; help in need especially sickness and death. Social organization can be useful in sensitization and establishing coping mechanisms. Informal networks within a village are central to the everyday system of dependence; ‘bonded ties’ are the reciprocal relationships between friends and family to exchange services and goods (Brouwer and Nhassengo, 2006). Robust and extensive networks assist in accessing resources and enable rapid response to adverse events/disasters. Strong
social connectivity facilitates well-being and co-operation for mutual benefit (Pomeroy, 2011). The networking and ‘caring for our neighbours’ enables solutions to be found that individuals could not reach on their own. All this contributes to community resilience (Reid, 1998). This indicates that Bufundi sub-catchment communities have strong bonds through social organization which improves their resilience to climate variability.

![Figure 4.7: Respondents belonging to any social organization](image)

**4.1.10 Access to credit**

The highest percentage of respondent (56.8%) access credit through the social organizations and Savings and Credit Cooperative Organizations (SACCO). Others access credit through community members (30.3%) while the least (12.9%) access it through commercial banks (Figure 4.8).
4.2.1 Rainfall variability analysis

The rainfall trend analysis was undertaken in order to evaluate the variability over 20 years. The years of 1991, 1992, 1998 and 2002 indicate relatively lowest rainfall totals and relatively highest rainfall peak occurred between 1995 and 1997 with rainfall totals of 1200 mm as shown in figure 4.9. However, linear regression analysis shows that rainfall remained uniform over the past 20 years (P>0.05 and R^2=0.008). This is related to a study by UNDP/NEMA/UNEP (2009) which shows that, 1997/1998 El Niño, the most severe weather phenomenon in Ugandan history, resulted in one of the worst widespread record floods witnessed by the country in over 50 years. According to Poverty Eradication Action Plan (PEAP) (2004) report, drought of 1991/1993 and 1999 affected communities due to lack of food, water, and inadequate pasture for livestock. Increased precipitation intensity and variability are projected to increase the risks of flooding and drought in many areas. The
frequency of heavy precipitation events are likely to increase over most areas during the 21st century, with consequences for the risk of rain-generated floods. At the same time, the proportion of land surface in extreme drought consequences for the risk of rain-generated floods. At the same time, the proportion of land surface in extreme drought at any one time is projected to increase (Kundzewicz et al., 2008).

![Annual rainfall totals for 20 years](image)

**Figure 4.9: Annual rainfall totals for 20 years**

4.2.2 Hypothesis testing that there is no significant variation in annual rainfall totals from 1991-2011

The Hypothesis was tested using ANOVA to establish significant variation in annual rainfall. The ANOVA of annual rainfall totals indicate there is no significance in variability in annual rainfall totals from 1991-2011 (p>0.05) (Appendix I). Highly variable rainfall can affect planting seasons which lowers agricultural production. It is also associated with extreme weather events like El Nino which can trigger floods, landslide which lead to destruction of infrastructures and misplacing households.
4.2.3 Mean Monthly rainfall

The analysis of mean monthly rainfall indicated in figure 4.10 shows that Kabale district has two rainy seasons with the highest peak in October with the average of 132 mm and the lowest in July with the average of 19 mm on average.

![Mean monthly rainfall from 1991 to 2011](image)

**Figure 4.10: Mean monthly rainfall from 1991 to 2011**

4.2.4 Seasonal rainfall trends

The results from analysis of seasonal rainfall trend (Figure 4:11) show that there is high variability in on set, cessation and intensity of rain from year to year. This conforms to the results from perception with majority of respondents perceiving delayed on set of rain, too much rain and early cessation of rains. Comparing these result with regression analysis results which showed no significant trend in rainfall indicate that there is change in annual
rainfall totals but changes in the seasonal distribution of rains. A study by Easterling et al. (2000) show that concentration of rainfall into a smaller number of rainy events with increases in the number of days with heavy rain, increasing erosion and flood risks a trend that is already apparent in the sub-catchment. This can also lower crop yields since the seasons are unpredictable.

![Seasonal Trends Graph](image)

**Figure 4.11: Seasonal trends**

### 4.3 Maximum temperature analysis

The temperature trend analysis was undertaken for over 20 years in order to understand the variability in the maximum temperature and its trend over the years. Maximum temperature varied from 23.7°C to 24.8°C peak (Figure 4:12). The linear regression analysis indicates that
there is slight increase in maximum temperature trends ($R^2=0.038$) for the past 20 years (Figure 4.12). It increases annually by $0.1^\circ$C on average.

![Figure 4.12: Mean maximum temperature trends from 1991-2011](image)

4.3.1 Hypothesis testing that there is no significant variation in maximum temperature

The hypothesis was tested using ANOVA to establish significance in variation of maximum temperature trends. The ANOVA of annual mean maximum temperatures indicates that there is significance variability in maximum temperatures over the past 20 years (p>0.05) (Appendix II).
4.3.2 Minimum temperature analysis

Minimum temperature analysis minimum temperature is significantly increasing for the last two decades (P<0.05 and R^2=0.476) (Figure 4.13). It increases annually by 0.2-0.3°C on average. This concurs with UNDP/NEMA/UNEP report (2009) that the minimum temperature is rising faster than the maximum temperature. The temperature changes have been more pronounced at the higher altitudes than in the lowlands with, for example, temperatures in the Kabale district of Uganda increasing dramatically by 2°C in the last three decades (Wamukonya, 2010). The temperature increases in the eastern African highlands have resulted in an increased range for malaria-carrying mosquitoes. There have been increasing malaria epidemics in the highland communities. In addition, Communities living at altitudes above 1100 m are more vulnerable to malaria epidemics due to lack of immunity (ECA, 2005). Furthermore, a study in Sudan (Rasha and Ayman, 2011) revealed that there is positive correlation between temperature and malaria infections. A study by Dunnington (2010) shows that increases in temperature and extreme rainfall events, can lead to spread of pests and pathogens, which may pressure farmers into heavier use of pesticides and herbicides, or, in the case of organic farms, more labor-intensive weed and pest control. This could be the cause of Banana bacterial wilt which has wiped most banana plantations in the district.
4.3.3 Hypothesis testing that there was no significant variation in minimum temperature from 1991-2011

The hypothesis was tested using ANOVA. The ANOVA of annual mean minimum temperatures indicates that there was significant variation in minimum temperatures over the past 20 years (a=0.05, df=1, Significance level= 0.00053) (Appendix II)

4.4 Farmers perception on climate variability effects

The results from perception are presented in this section indicating how different farmers in the sub-catchment perceive different climate variability and the extent to which the effects have been experienced. This was done through ranking of these effects using a Likert scale of levels very low, low, moderate, high and very high. The effects that were ranked by respondents include drought, landslides, floods, delayed onset of rain, too much rain, early cessation of rain, and temperature increase.
A better understanding of how farmers perceive climate change, current coping strategies, and the factors influencing the decision to adapt farming practices is needed to craft policies and programmes aimed at promoting successful adaptation in the agricultural sector (Bryan et al., 2009). For farmers to adapt effectively to climate change, they must have correct perceptions about the state of the climate and possible future trends. In practice, farmers take decisions in the context of their own environment, and differences may exist between perceived and real environments (Mather, 1992). People who live and work close to agriculture do experience these changes more since climate has a profound effect on production.

### 4.4.1 Perceptions on drought, floods and land slides

The majority of respondents ranked landslides as the most experienced, 92.6% of respondents ranking it very high, 2.1% high, 1.1% moderate, 3.2% low and 1.1% very low, followed by floods with 83.2% of respondents ranking it very high, 8.4% high, 4.2% moderate, 1.1% low, and 3.2% very low. The results in figure 4.14 indicates that floods and landslides have been highly experienced by farming communities compared to drought which was least ranked high with 26.5% of respondents ranking very high, 13.7% moderate, 26.3% low and 19% very low.
When the rains come they are very intense and unpredictable. Soil erosion has resulted into damming of our fertile land with polders from hill slope and soil exhaustion we now experience reduced crop harvest (Plate 4.1). We are in hilly areas and if the rain is too much we experience landslides that destroy our farms houses and roads (Plate 4.1). Death resulting from landslides has not been experienced in this parish but two years back death occurred in Kacerere parish and few days ago we were burying people in same family whose house was destroyed by landslides (Arineitwe, Kishanje parish, 29-04-2014)

Box 4.3: Respondent quotation on effects of landslides and erosion

Figure 4.14: Respondent ranking of drought flood and landslides
Plate 4.1: Productive land that was dammed by polders from flood and erosion

Environment office Kabale District (2012)

Plate 4.2: Road in the sub-catchment destroyed by landslides

Source: Author (2015)
4.4.2 Perception on delayed onset of rain, too much rain and early cessation of rain

The majority of respondents perceive to have experienced too much rain with 77.9% of respondents ranking it very high, 11.6% high, 6.3% moderate, 4.2% low and 0% very low. The ranking of delayed onset of rain show that 30.5% respondents rank it as very high, 32.6% high, 9.5% moderate and 6.3% very low. Early cessation of rain is ranked at 28.4% very high, 17.9% high 26.3% moderate, 20% low and 7.4% very low. The results in figure 4.6 shows that too much rain is experienced but rains usually delay or cease early which indicates unpredictable seasons which affect farming activities for example early cessation leads to drying of crops before harvest (Plate 4.3). This also concurs with result from analysis seasonal which shows unpredictable cessation and onset of rains from year to year meaning annual totals have not changed but the rainy seasons have shifted.

According to respondent ranking on experience of extreme events in the sub-catchment floods and landslide are the most experienced. Farmers have also experienced moderate increase in temperature. Ranking by respondents also indicates that the rainfall is too much but so variable because it either delays to come or ceases early but once it rains it comes in high totals which is an indication of high variability. In comparing results from perception and analysis of rainfall data for 20 years, they both show high rainfall variability with many extreme weather events like landslides, changes in seasons, floods.
Figure 4.15: Respondents’ rankings on delayed onset of rain, too much rain and early cessation of rain

Plate 4.3: Maize farm affected by drought

Source: Author (2015)
4.4.3 Temperature increase

The results in figure 4.16 indicate the farmers’ ranking of increase in temperature. Majority of the farmers have experienced moderate increase in temperature over the past 20 years with 38.9% ranking it moderate, 20% very low, 21.1% low, 17.9% very high and 2.1% high.

Figure 4.16: Respondents’ ranking of increase in temperature

4.5 Access and availability of resources in the Sub-catchment

This section presents results from access and availability of resources such as water, energy and agricultural production. It also includes changes in resources and factors that have led to their changes.
4.6.1 Source of water

As shown in figure 4.17, 56.8% depend on wells as their water sources, 35.8% depend on piped tap water, 3.2% stream, 2.1% on Borehole, 1% on rain water and 1% on lake (Plate 4.4). Total percentage coverage of safe water in the sub-catchment is at 80% (KDLG, 2011). This indicates that few people are making use of roof catchments and still depend on local sources of water such as wells.

![Water sources diagram]

Figure 4.17: Water sources
4.5.2 Source of energy for cooking

Majority of the respondents (99%) depend on wood as fuel for cooking (Table 4.1). This is an indication that there is pressure on trees for fuel which also contribute to climate change and emission of Carbon dioxide in the atmosphere. This excessive dependence on biomass has resulted in land degradation and has led to a decrease in forest and vegetation cover (Kayanja and Byarugaba, 2011), with impacts on climate regulation and on the carbon sequestration capacity. Contributing to these pressures is the very limited use of energy alternatives.
Table 4.1: Source of energy for cooking

<table>
<thead>
<tr>
<th>Source of energy for cooking</th>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>wood</td>
<td>88</td>
<td>99</td>
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4.5.3 Source of energy for lighting

The results (Figure 4.18) indicate that many of the respondents (64.2%) depend on kerosene, followed by fuel wood at 16.8%, candle at 9.2%, solar at 5.3% and batteries at 4.2% as a source of energy for lighting. This is an indication that there is limited use of renewable and clean energy that could be useful in combating climate change and variability.

Figure 4.18: Source of fuel for lighting
4.5.4 Changes in availability and access to natural resources

Figure 4.19 indicates that most of the respondents (88.4%) have observed changes in availability and access to resources. These resources include energy resources, water resources and agriculture production. This shows that there is limited and access to natural resources. This affects the natural resource dependent livelihood.

![Figure 4.19: Responses on Changes observed in resource availability](image)

4.5.5 How the resources have changed

Most respondents have observed decrease in agricultural production and energy resources with percentage of respondents at 80% and 67.4 % respectively, 28% of respondents have observed a decrease in water resource and 35.8% have observed an increase in water resources and another 35.8% have not observed any change (Figure 4.20). Reduction in agricultural production can lead to food insecurity which can lead to extreme hunger with this highly variable rainfall with extreme event like drought and El Nino.
Destruction of crops due to excessive wind and rain is going to reduce our harvest hence reduced income this season. Landslides affected the gravity water scheme. (Kabutaro Kashasha parish, 30-04-2014)

Box 4.1: Respondent quotation on extreme weather event

![Bar Chart]

Figure 4.10: Change in availability of resources

4.5.6 Factors influencing availability and access to resources

The main factors that have led to decrease in availability of natural resources are climate variability with 82.1% of respondents, inadequate infrastructure at 76.8%, and population growth at 75.8%, Poor land use practices at 74.5% and poor governance at 65.3% (Figure 4.21). Inadequate infrastructure affects the farming communities because of inadequate water supply, access to market due to poor roads and long distance to health facilities. Population
growth has led to competition for fire wood, reduced land that has led to poor farming practices and encroachment on marginalized land such as hill slopes (Plate 4.5) and encroachment on river banks and lake shores (Plate 4.5) that have soil erosion and sedimentation of water resources. This has further led to reduced soil fertility hence low crop production. The least mentioned factor was pollution with 49.5%. This pollution is as a result of local brewing of alcohol where by the fluid waste is directly disposed into streams in the sub-catchment without treatment.

Figure 4.11: Causes of decrease in resource availability and access
Plate 4.5: Over cultivation of hill slopes that has resulted into soil erosion

Source: Author (2015)

Plate 4.6: Encroachment on river banks and lakeshores of Lake Bunyonyi for farming

Source: Author (2015)
4.6 Disease infections

Diseases infection was analyzed as part of effects of climate variability on health among farming communities of Bufundi sub-catchment. The results indicated that majority of respondents (69.5%) have had a family member suffering with malaria in the past 6 months. Diarrheal diseases are less common among households with 29.5% respondents having had a member suffering from diarrheal diseases (Figure 4.22). It is estimated that climate change and variability currently contributes to 150,000 deaths and 5 million illnesses each year (WHO, 2003) and the majority of these deaths are in Africa. During the 1997/98 El Niño, malaria admission data indicated that the epidemic months corresponded with the onset of abnormally frequent short rains or that the El Niño years (DENIVA, 2008).

![Figure 4.22: Percentage of respondents on disease infections in past 6 months](image-url)
4.7 Awareness on climate variability and its effects

Awareness is important in increasing enthusiasm and support, stimulating self-mobilization and action, and mobilization of local knowledge and resources. Awareness is also important in overcoming individual barrier such as ignorance and behaviour. Most of the respondents 65.3% have received information concerning climate variability effects and adaptation strategies (Figure 4.23). Results from focus group discussions interviews showed that people do not know the causes of climate variability and change, one of the respondents said (Box 4.5):

"Because we have been told to plant more trees that’s why we are receiving intensive rains which have affected our livelihoods so I think we should reduce tree planting".

Box 4.2: Respondent quotation on awareness

This indicates that people lack information on climate change and variability which calls for more effort for awareness creation.

Figure 4.23: Percentage response on awareness creation on climate variability effects
4.8 Source of Awareness

Most of the respondents (32.6%) have received information about climate variability through media especially radio, 26% of respondents have hardly received any awareness on climate variability, 22% from Non Governmental Organizations, 11.6% Government and 7.4% Community member(Figure 4.24). The results indicate that the government has not put in more effort in creating awareness on climate variability and adaptation mechanisms which farming communities in Bufundi can put in place to enhance their resilience. A study on ICT access and poverty show that 70% of the population has access to Radio in Uganda (Kasumba, 2008). This is also an indicator that more radio talk shows should be done because many people access the information through radios.

Figure 4.24: Source of awareness
4.9 Institutional support

Institutional support involves activities or projects in the communities established by government and non-government institutions as adaptation mechanisms for enhancement of community resilience against the effects of climate variability. Local institutions have shaped how rural residents responded to environmental challenges in the past and they are also the mechanisms that will translate the impact of future external interventions to facilitate adaptation to climate change. Because adaptation to climate variability is local, it is critically important to understand better the role of local institutions in shaping adaptation and improving capacities of the most vulnerable social groups (Agrawal et al., 2009). Most of the respondents (67.4%) have not received food aid during extreme weather events such as floods, hailstorms, and landslides (Figure 4.25). However, those who have received food aid are given little amounts like 1kg of beans and maize which cannot sustain the household. Different NGOs have collaborated in construction of a warehouse for the community to store their foods in days of plenty to ensure food security though not yet in use (Plate 4.7). Another part component of institutional support which was analyzed was awareness with 53.7% of respondents have received awareness from government and nongovernmental organization especially on soil and water conservation practices from soil erosion project from Makerere University and nature Uganda and other adaptation mechanisms such as rainwater harvesting from the diocese of Kigezi. Majority of respondents (54.7%) have received improved crop varieties especially from National Agriculture Advisory Services (NAADS). Resettlement from high risk areas has been done on small scale with 9.5% response on resettlement especially the Batwa communities who have been resettled. Water supply has been put in place with 50.5% saying yes to water supply especially the
Diocese of Kigezi which has established gravity water scheme and water jars in the community.

The government of Uganda has also put in place a Disaster Management Policy to manage and give aid to people who are affected by disaster. In addition a disaster preparedness and management ministry has been put in place. The overall policy goal is to promote national vulnerability assessment, risk mitigation, disaster prevention, preparedness, effective response and recovery in a manner that integrates disaster risk management with development planning and programming (Republic of Uganda, 2010)

![Institutional support given to communities for resilience creation](image)

**Figure 4.25: Institutional support given to communities for resilience creation**
Plate 4.7: A warehouse constructed by NGOs to ensure food security in the communities in sub-catchment.

Source: Author (2015)

Plate 4.8: Community participation in construction of trenches (Fanya chini and Fanya jiuu) to control erosion

Source: Environment office Kabale district (2013)
4.10 Change in livelihood strategies

Majority of respondents (83.2%) have changed their livelihood strategies to cope with effects of climate variability (Figure 4.26)

![Percentage response on change in livelihood strategies](image)

**Figure 4.26: Percentage response on change in livelihood strategies**

4.11 Coping Strategies

Households in Bufundi Sub-catchment have resorted to different coping strategies which include: Rainwater harvesting, improved crop varieties, soil and water conservation measures, alternative sources of livelihoods such as brick laying and stone quarrying, planting sweet potatoes because they are resistant to drought, extensive farming. However some of these coping strategies are not effective and sustainable. Rain water harvesting is done on a small scale with majority of respondents (66.3%) are harvesting rain water with low storage capacity (Plate 4.10).
“When it rains we use the saucepans to harvest rainwater which we use only for a day”
(Baryasanga, Kishanje Parish, 15-04-2014).

Box 4. 3: Respondent quotation on rain water harvesting

Many households have also opted food storage to cater for food shortage days. However those not doing food storage (36.8%) complained that the harvest is very low so they do not have enough to eat and store. Improved crop varieties have been adopted by most farmers (61.1%) which have been introduced by NAADS. However many complained that they receive high production from the crops in first few seasons and the yields reduce with time. Soil and water conservation have also been practiced by majority of farmers (71.6%) such as digging of trenches, tree planting (Plate 4.11), and terracing with planting of Napier grass. Animal fodder planting is done by few farmers (29.5%) meaning that many farmers are still depending on natural vegetation which is not reliable during the dry season. Few farmers (18.9%) have opted for alternative sources of livelihoods such as brick laying and stone quarrying (Figure 4.27). These alternative sources of livelihoods are also not sustainable and more degrading to the environment.
Figure 4.27: Coping strategies among households

Plate 4.9: Tree Planting in the sub-catchment

Source: Author (2015)
Plate 4.10: Rain water harvesting
Source: Author (2015)

Plate 4.12: Napier grass planted as animal fodder
Source: Author (2015)
4.12 Hypothesis test for significance difference between coping strategies adopted by different house households

The Chi square test was used to study the significant difference between coping strategies adopted by households because, Yohe and Tol (2002) reported that adaptive capacity/strategies varies significantly from household to household, from system to system, sector to sector and region to region due to range of available technological options for adaptation, availability of resources and their distribution across the population and stock of human capital with respect to education and security among others. The results indicate that there is no statistical significant difference between coping strategies adopted by households in response to effects of climate variability ($a= 0.005$, $X^2=5.47$, df=7 and assumption significance= 0.000) (Table 4.2). This shows that many households are adopting similar coping strategies. Diversity in coping strategies is a key property of a resilient socio-ecological system which enables the system to experience disturbances but still continue functioning (Walkeret et al., 2003). This shows that farming communities in Bufundi are not resilient to effects of climate variability.
Table 4.2: Chi-Square results of household coping strategies to effects climate variability

<table>
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<th>Expected N</th>
<th>Residual</th>
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<td>11.1</td>
</tr>
<tr>
<td>food storage</td>
<td>15</td>
<td>11.9</td>
<td>3.1</td>
</tr>
<tr>
<td>planting improved crop varieties</td>
<td>25</td>
<td>11.9</td>
<td>13.1</td>
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<tr>
<td>planting animal fodder</td>
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CHAPTER 5: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter deals with summary of main findings, conclusion, the recommendations of this study and areas for further research. The general objective of the study was to assess perceived effects of climate variability and coping strategies among farming communities in Bufundi Sub-catchment. Tools for conducting study included use of secondary data that is rainfall and temperature data from 1991-2011 from Kabale District Department of Meteorology to evaluate variability and trend over 20 years, structured questionnaires, Key informant interviews, Focus Group discussion and field guide observation checklist. Analytical tools were mainly descriptive statistics (frequencies and percentages), non-parametric test involving the use of linear regression, ANOVA and chi-square.

5.2 Summary of findings

The study revealed that there was no significant trend in annual rainfall for the past 20 years but with variability in seasonal distribution of rainfall. Analysis of variability revealed that there was no significance variation in annual rainfall totals. The study also revealed that there is slight increase in maximum temperatures ($R^2=0.034$) and significance in variability (significance level=0.418) while there is significance increase in minimum temperature ($R^2=0.476$) and no significant variability was detected (significance level= 0.0005). Therefore the results from the study indicate that minimum temperatures are increasing more than maximum temperatures while maximum temperatures are highly variable than minimum temperatures.
Majority of respondents have observed and experienced changes in availability of resources which were grouped in form of energy, water resources and agriculture. Majority of respondents have observed decrease in agriculture production and energy sources while majority have not experienced changes in water resources. The major factor for decreasing availability of resources was climate variability (82.1% of respondents) and others included inadequate infrastructure, population growth, poor land use practices, pollution, and poor governance.

The study also assessed farmers’ perceptions on effects of climate variability. According to respondent ranking on experience of extreme events in the sub-catchment, floods and landslides are the most experienced. Farmers have also experienced moderate increase in temperature. The study also indentified coping strategies opted by farmers in enhancing their resilience to climate variability effects. Farmers in Bufundi Sub-catchment have resorted to different coping strategies which include: Rainwater harvesting, improved crop varieties, soil and water conservation measures, alternative sources of livelihoods such as brick laying and extensive farming. The study also revealed that there was no significant difference between coping strategies opted by household.

Institutional mechanisms were also indentified which included; food aid, awareness, water supply, improved crop and animal varieties, and resettlement. However the study also indentified that most of institutional mechanisms have not been effective and sustainable because of challenges which were identified by government officials and politicians. These included; corruption, lack of compliance, high illiteracy levels and limited land.
5.3 Conclusions

The findings of the study revealed that there is no significant trend in rainfall but it showed no variability in annual rainfall totals. Seasonal trend analysis showed variability year to year which shows unpredictable on set and cessation of rain. Minimum temperature trends are highly increasing than maximum temperature but maximum temperature analysis did not show significance variation compared to minimum temperature which showed significant variability.

Climate change and variability; and increasing population were the most reported by respondents to drive reduced resource availability in the sub-catchment which calls for approaches that can increase communities’ adaptation. The study also identified other drivers to reduced resource availability such poor land use practices, inadequate infrastructure poor governance and pollution.

The findings also indicate that most respondent have experienced extreme events of floods and landslides in the sub-catchment. Farmers have also experienced changes in rainy seasons in terms of onset, cessation and intensity. In addition farmers have also experienced moderate increase in temperature.

The study further indentified that there was inadequate awareness on climate variability, its effects and coping mechanisms. Those who had received awareness had got from radios. This indicates that the government, and civil society organisations have not put in more effort to create community awareness on how they can cope climate variability effects. This calls for more media platforms for wareness raising purposes.
In response to climate variability effects, different coping mechanisms have been adopted. They include: rainwater harvesting, food storage, improved animal and crop varieties, soil and water conservation, alternative sources of livelihood. However, the study identified that effectiveness and diversity of the coping mechanisms was limited and unsustainable. Therefore, this calls for more effort by the government, civil society organizations, and local communities in the sub-catchment to establish sustainable and effective adaptation strategies to enhance resilience among farming communities against climate variability and sustainable utilization and management of watershed resources in the sub-catchment and the entire district.

5.4 Recommendations

Based on the findings of this study, the following are the recommendations to the policy makers, NGOs, extension agents, households, and other environmental managers in the area to manage climate variability and sustainable management of watershed resources in Bufundi Sub-catchment.

From findings of objective one and two, the study recommends giving information to farming communities about the changing and highly variable rainfall and temperature, the causes and effects of these changes. There is a need to create communities’ awareness on climate variability and its effects and sustainable watershed management options to cope with reduced resource availability. This can be done by government, Non-governmental Organizations, community members. This is because the study identified that there was inadequate awareness creation to the community by the government NGOs. Use of media platforms
especially radios for awareness creation should be done since most people responded that they were receiving information through radios. Integrating indigenous knowledge and technology in weather forecasting should be done to enable early preparations by farmers against effects of future changes in climate. Land management options should be enhanced to reduce erosion, modify local climate such as tree planting, soil and water conservation practices. This can be done by authorized organizations such as (NEMA) to enforce the existing laws and creation of awareness. This is because the study noted there was a lot of encroachment on marginal areas such as hill slopes, wetlands and river banks for cultivation which leads to soil erosion, landslides and sediment loads which can be triggered by torrential rains hence affecting water quality in the sub-catchment. Enhancement of small scale irrigation in Bufundi sub-catchment should be done to reduce on the over dependency on rain fed agriculture which is associated with unpredictable rainy seasons.

From findings of objective three the study recommends improving the already existing coping strategies among farmers for effective adaptation and coping strategies for example expanding rain water harvesting, food storage, more research on and providing improved crop and animal varieties which can cope with the changing climate. Strengthening the social organizations in the sub catchment and encouraging farmers to work together because in areas with limited resource there is need for co-operation in mobilizing resources.

From results of objective four, the study recommends that, institutional and legal frameworks need to be strengthened by government and local authorities so as to establish effective and sustainable adaptation and coping strategies that would enhance communities’ resilience to climate variability effects. This can be for example, in form of capacity building of the
technical staff (including extension officers at sub-county level). Policies and development programs should aim at empowering the local communities to broaden their range of choices of appropriate adaptation strategies rather than making them dependent on external support. Therefore this calls for bottom-up assessment and planning to address vulnerability and enhance adaptive livelihood at the local level through participatory action and research that engages the different stakeholders, particularly the local communities. This can be done by empowering the local communities to broaden their range of choices of appropriate adaptation strategies rather than making them dependent on external support. Building on already existing strategies and implementing them for effective adaptation is very important, for example the ware house should be put in use by farmers for enhancing food security in the sub catchment.

5.5 Areas for further research

This study was mainly based on perceived assessing perception of farmers to climate variability and coping strategies among farming communities in Bufundi Sub-catchment, Kabale District, South Western Uganda. The study can be replicated in other areas of related or unrelated situations in Uganda and beyond.

Further research should be done on the following:

i. Potentials of rain water harvesting in creating communities resilience

ii. Assessing government mechanisms in fighting climate variability

iii. Potentials of Soil and water conservation strategies in adapting with climate change and variability.

iv. Examining potentials of improved cooking stoves in enhancing community resilience to effects of climate variability.
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APPENDIX I: ANOVA ANALYSIS FOR ANNUAL RAINFALL VARIABILITY

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## APPENDIX II: ANOVA ANALYSIS FOR ANNUAL TEMPERATURE VARIABILITY

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APPENDIX III: CHI SQUARE TEST FOR SIGNIFICANT DIFFERENCES IN COPING STRATEGIES ADOPTED BY DIFFERENT HOUSEHOLDS

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APPENDIX IV: QUESTIONNAIRE

Preamble

Hello, my name is Susan Kangume. I am a student at Kenyatta University, Kenya pursuing Master of Science Degree in Integrated Watershed Management. I am currently conducting a study on effects of climate variability and coping strategies of farming communities of Bufundi Sub-catchment Kabale District South western Uganda. The main Purpose of conducting this study is to come up with comprehensive finding on issues concerning climate variability and water availability in your community. The information provided in this study will be kept strictly anonymous and confidential.

Name of respondent……………………………………………………………………………………………………

Parish……………………………………Village…………………………………………………………

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<td></td>
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<td></td>
</tr>
<tr>
<td>7. 76-85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. &gt;85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td>Household Size</td>
<td>Farm Size</td>
<td>Housing Material</td>
<td>Land ownership</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------</td>
<td>-----------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>1. On Farm</td>
<td></td>
<td></td>
<td>1. Iron Roof</td>
<td>1. Customary</td>
</tr>
<tr>
<td>2. Off farm</td>
<td></td>
<td></td>
<td>2. Grass</td>
<td>2. Lease hold</td>
</tr>
<tr>
<td>3. Others</td>
<td></td>
<td></td>
<td>Thatched</td>
<td>3. Free hold</td>
</tr>
<tr>
<td>(Specify)</td>
<td></td>
<td></td>
<td></td>
<td>4. Others (specify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of water</th>
<th>Source of fuel</th>
<th>Access to credit</th>
<th>Belonging to any social organization</th>
<th>Land title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Well</td>
<td>4. Others,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Rain water</td>
<td>(Specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Section two: Perception on climate change effects**

<table>
<thead>
<tr>
<th>Effects</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landslides</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>-----------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Delayed onset of Rain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too much Rain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early cessations of rain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature increase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1). Has the availability and abundance of any resources which you depend on changed?

1. Yes [ ] 2. No [ ]

(2). If yes how have they changed?

<table>
<thead>
<tr>
<th>Changes in resources</th>
<th>Increased</th>
<th>Decreased</th>
<th>Not Changed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy resources</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3). If they have decreased, name the factors leading to declining availability of these resources in your area?

<table>
<thead>
<tr>
<th>Factors for decreased resources</th>
<th>1. Yes</th>
<th>2. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change and variability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(4). During the past year, have you heard about any conflicts over resources in your community?
1. Yes ☐ 2. No ☐


Section four: Coping mechanisms

(6). Have you received any Awareness about climate variability and its effect?
1. Yes ☐ 2. No ☐

(7). If YES who has created your awareness about climate variability effects and coping mechanisms?
1. Government ☐ 2. NGOs/ CBO ☐ 3. Community member ☐
4. Media (Radio, Television, Newspapers) ☐

Others (specify) ________________________________________________________________

(8). What type of institutional support have you received from organizations and government?
### Institutional Support

<table>
<thead>
<tr>
<th></th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food aid</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Improved crop and animal variety</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Awareness</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Resettlement</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Water Supply</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Others Specify</td>
<td></td>
</tr>
</tbody>
</table>

(9). Has the community changed their livelihood strategies in the last 20/40 years?

1. Yes □ 2. No □

(10). If yes, which new livelihood options have been adopted?

<table>
<thead>
<tr>
<th>Coping mechanism</th>
<th>Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain water harvesting and storage</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Food storage</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Planting improved crop varieties</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Storage of animal fodder</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>Tree planting</td>
<td>1. Yes 2. No</td>
</tr>
</tbody>
</table>

THANK YOU
APPENDIX V: KEY INFORMANT INTERVIEW GUIDE

Preamble

Hello, my name is Susan Kangume. I am a student at Kenyatta University, Kenya pursuing Master of Science Degree in Integrated Watershed Management. I am currently conducting a study on effects of climate variability and coping strategies of farming communities of Bufundi Sub-catchment Kabale District South western Uganda. The main Purpose of conducting this study is to come up with comprehensive finding on issues concerning climate variability and coping strategies in your community. The information provided in this study will be kept strictly anonymous and confidential will be used only for research on finding solutions to common problems.

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution</td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td></td>
</tr>
</tbody>
</table>

1. What are the major climate variability effects that are affecting water availability in the Sub-catchment?

2. How do these effects affect livelihood of communities in the sub-catchment?

3. Do you think the communities have appropriate coping strategies to manage effects of climate variability?

4. Is the community aware of appropriate mechanisms to address adverse effects of climate variability?
5. What institutional support have you rendered to communities in enhancement of their resilience to effects of climate variability?

6. As implementers what challenges do you face in running the programs related to climate variability?

7. What advice do you give the communities and government in combating effects of climate variability?

THANK YOU
APPENDIX VI: FOCUS GROUP DISCUSSION INTERVIEW GUIDE

Preamble

Hello, my name is Susan Kangume. I am a student at Kenyatta University, Kenya pursuing Master of Science Degree in Integrated Watershed Management. I am currently conducting study on effects of climate variability and coping strategies of farming communities of Bufundi Sub-catchment Kabale District South western Uganda. The main Purpose of conducting this study is to come up with comprehensive finding on issues concerning climate variability and coping strategies in your community. The information provided in this study will be kept strictly anonymous and confidential will be used only for research on finding solutions to common problems.

1. What are the major climate variability effects do you experience?
2. How do these effects affect well being in this community?
3. What measures have you put in place to cope with these effects?
4. Have you received any awareness on climate variability, its effects and appropriate coping strategies?
5. If yes who has created you awareness?
6. What type of institutional support have you received from private organizations, and government institution in addressing climate variability?

THANK YOU
### APPENDIX VII: OBSERVATION CHECK LIST

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roof of the house</strong></td>
<td>Iron sheet</td>
</tr>
<tr>
<td></td>
<td>Grass thatched</td>
</tr>
<tr>
<td><strong>Location of the house</strong></td>
<td>Flood, landslide prone area</td>
</tr>
<tr>
<td></td>
<td>Near garbage and pit latrine</td>
</tr>
<tr>
<td><strong>Food storage facilities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Land use practices that threaten water resources</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Agriculture practices for soil and water conservation</strong></td>
<td>Fallowing</td>
</tr>
<tr>
<td></td>
<td>Tree planting</td>
</tr>
<tr>
<td></td>
<td>Contouring</td>
</tr>
<tr>
<td></td>
<td>Terracing</td>
</tr>
<tr>
<td></td>
<td>Others</td>
</tr>
<tr>
<td><strong>Rain water harvesting</strong></td>
<td>Roof catchment</td>
</tr>
<tr>
<td><strong>Energy Saving options</strong></td>
<td>Rain water dams</td>
</tr>
<tr>
<td><strong>Areas in Sub-catchment hint by extreme events</strong></td>
<td>Landslides, Erosion, Flooding</td>
</tr>
</tbody>
</table>