ASSESSING THE IMPACTS OF CLIMATE CHANGE ON LIVELIHOODS IN RUJUMBURA RUKUNGIRI DISTRICT

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Declaration

The work presented in this dissertation is the results of my original research and for the different source of work in this report have been reference.

Name:

Sign	**Date**
……	……

Approval

The conducted research work in the dissertation was under my guidance and supervision

Name…….

Sign **Date**

…… **……**

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List of abbreviations

ECHO	European Commission Directorate-General for European Civil protection and Humanitarian Aid Operation
FAO	Food and Agriculture Organization
GOU	Government of Uganda
MWE	Ministry of Water and Environment
IPCC	Intergovernmental Panel on Climate Change
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United State Agency for International Development
USD	United State Dollar

Abstract

Globally climate change effects are increasing and it affects the whole globe. Sub-Saharan Africa is more vulnerable and the most exposed to these effects. In most African countries including Uganda, agriculture is the leading source of livelihood and is the most affected sector. This study explored the impacts of climate change on the livelihood sources, the people's perceptions and the adaptation and coping measures. The study was carried out in n the sub counties of Ruhinda, Buhunga, Nyakagyeme and Bugagari. In addition, the objectives of the study were: 1) to assess the impacts of climate change on peoples' livelihoods, to analyze the perception of farmers about climate change impacts on peoples' livelihoods, 3) to determine the adaptation measures used by people to reduce the climate change impacts on people's livelihoods. The data was collected using interview guides and questionnaires, the respondents reported that climate change was due to deforestation, wetland degradation, and bush burning.

The major livelihood sources of people in the areas were crop growing, livestock farming, trading activities and handcrafts like basket weaving. Drying of crops, water scarcity, increased crop pests, soil erosion and reduced yields are the most experienced impacts resulting from climate change.

The most affected crops were beans, cassava, maize, banana, potatoes, coffee and rice. On the climate change perceptions, there has been increase in drought conditions, variations in seasons, increase in temperatures, decrease in rainfall, erratic rains and increased flooding conditions. Adaptation measures used by respondents were; early planting, changing the planting dates, crop diversifications, change in the crop varieties, rainwater harvest, and watering crops during drought. Meanwhile, livestock farmers reported shift grazing and change of local varieties as their mitigation actions to the climate change conditions. These challenges were limited capital to purchase improved agriculture technologies, limited skills and lack of enough government support. Recommendations of the study are the following: training the locals on the mitigation measures and extending credit facilities to enable farmers to access improved agriculture technologies.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) article 1 (2) defined climate change as "*a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods*" (United Nations UN, 1994, p.7).

Different sectors have experienced climate change that is, agriculture, forestry and biodiversity and water resources. People and their communities have experienced climate change impacts on food supply, and security, water availabilities, infrastructure and agriculture income and the effects of climate change have threatened as a result human, social, natural, physical and economic assents of sustainable livelihoods (Shree, 2019).

Climate change impacts have challenged Uganda's efforts in become a middle-income country by 2040 as rising temperatures and variable rainfall patterns negatively affect important sources of livelihoods and economic activities in the country (Daniella, Anika and Alec, 2016). Rural households in Sub-Sahara Africa including rural areas in Uganda earn a substantial part of their living from rain fed smallholder agriculture, which are highly sensitive to climate change (Wichern, 2019).

Uganda is one of the most vulnerable countries to climate change as the changes affect crop production and livestock sectors that are the main sources of livelihoods of the rural population. (UN, 2017)

Uganda experienced a total production loss of 1034.7, 1126.5, 169.9 and 106.3 billion shillings (USD) in the sectors of crop, livestock, commerce and electricity respectively because of rainfall deficit in the year 2010-2011 reported by the Ministry of Water and environment (MWE, 2014)

UN (2017) Global information and early warning system on food and agriculture pointed out some impacts resulting from climate change and these impacts are affecting many districts in Uganda and Rukungiri district has not been made exceptional.

The impacts include:

- South western Uganda districts of Kibaale, Busheyi and Rukungiri recorded a below average crop harvests in the months of March-May because of a 30-40% reduction in the rainfall received compared to the long-term rainfall received.
- Food securities less than expected and Rukungiri Kisoro and Kabale district lived in the minimal level of consumption according to the report (UN, 2017).

This research assessed the impacts of climate change in Rujumbura, Rukungiri, the people's perceptions, the adaptation and coping strategies to reduce the negative impacts of climate change in the area. With hope, this study will help both local and international policy makes in implementing the better climate change action plans.

1.2 Problem Statement

Rukungiri district (where Rujumbura is a part) experiences climatologically and meteorological hazards such as floods, drought, strong winds and hailstorms, ecological and biological hazards such as crop pests and diseases, livestock pests and diseases as a result of the changing climate.

This had affected people's livelihood by affecting the key livelihood sectors of agriculture and livestock. This according to (GOU, 2015).

According to the literature review, conducted studies have been at the global, continental, regional, at national and district levels leaving out some of the rural areas. This study therefore assessed impacts of climate change at the local level.

1.4 Objectives

1.4.1 Main Objectives

Assess impacts of climate change on peoples' livelihoods in Rujumbura, Rukungiri district.

1.4.2 Specific objectives of the study

i. To assess the impacts of climate change on peoples' livelihoods

ii. To analyze the farmers' perceptions on climate change

iii. To determine the adaptation measures used by people to reduce the impacts on people's livelihoods

1.4.3 Research Questions

iv. What were the impacts of climate change on peoples' livelihoods?

v. What were the perceptions of farmers about climate change? vi. What were the adaptation measures used by people to reduce the climate change impacts on people's livelihoods?

1.5 Scope of the study

1.5.1 Conceptual scope of the study

The study assessed the impacts of climate change on the people's livelihood.

1.5.2 Geographical scope

The research study was conducted in selected sub counties of Ruhinda, Buhunga, Nyakagyeme, and Bugagari in Rujumbura, Rukungiri District south western Uganda.

1.5.3 Time scope

Writing research proposal, preparation and defence was done from 2019 to February, 2020 data collection was from March to October, 2020 and analysis and report submission in January 2021.

1.6 Rationale / contribution of the study

The study provides researchers and scholars of Environmental Science with information on impacts of climate change. It assessed adaptation options that the people used in adapting and copping with the impacts of climate change in Rukungiri district. The study provides information for farmers to learn from one another's experiences to help them adapt to climate change impacts.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

2.1 Climate change overview in Uganda

Extreme changes over Eastern Africa such as drought and heavy rainfall have been experienced more frequent in the last 30-60 years and risks are unevenly distributed and are generally greater for the disadvantageous people and communities in all developing countries

Temperatures have been increasing in Uganda by approximately 0.2 degrees over the last 30 years. Previous studies indicated a decrease in rainfall during the March-May rainy season (USAIDARCC, 2013).

Uganda experienced oscillating wet and dry periods reflected in the variability of its climate. MWE (2014) indicated that a statically significant decrease in the annual rainfall has been observed since 1960 and as well as variation in the rainy season of March to May. The annual rainfall has decreased at average rate of 3.4mm per month per decade, while the amount of rainfall in March to May has decreased by 6.0mm per month (McSweeney, 2011).

Uganda vulnerability assessment report on climate change pointed out the following climate change projections:

Rainfall

- The onset rain seasons will shift by 15 to 30 days (earlier or late), while the length of the rainy season can change by 20 to 40 days from year to year.
- Increase in rainfall in December, January, and February.
- Potential increase in the frequency of extremes like heavy rainstorms, floods.

Temperatures

- There is an increase in the average annual temperatures between 1951-1980 and 1981-2010 by approximately 0.5-1.2 degree for the minimum temperatures and 0.6-0.9 degrees for the maximum temperatures and an expected increase of 2 degrees by 2030. This will have a strong impact on agriculture, livestock, increasing the risks of disease and pest infestation.

Climate change extreme events have increased manifesting in Uganda, for example, the flash floods a cross Nakasongora District that happened on 06 July, 2020, heavy rains that happened in Arua District and killed 8 people on 27 August, 2020. Bindibugyo floods (western Uganda) 26 August, 2020 and the raising water levels on lake Albert and Lake Kyoga that displaced many in the northern central and western Uganda regions as reported by the European Commission Directorate-General for European Civil protection and Humanitarian Aid Operation (EHCO, 2020).

Rukungiri district has experience different weather extremes (for example heavy rain characterized by strong wind and hail storms that destroyed houses farm crops and acres of gardens on 11 march 2020 (Kabanza, 2020).

2.3 Livelihood patterns and climate change

Like in other districts in Uganda Rukungiri District derives its livelihood from agriculture which is the main economic activity in the district employing over 90% of the working population, majority of farmers are small holders using tradition farming techniques

The population in the area either directly or indirectly depend on primary production in agriculture, cattle keeping, hand craft, timber harvesting and small-scale surface mining of sad, clay and gravel. The urban population is engaged in small activities such as trading of agriculture products, food processing and construction works for livelihood (GOU, 2015).

Climate change has posed a threat to all livelihood source sectors and its impacts go beyond national borders. The economy and the livelihood sector are highly vulnerable to climate change due to impacts on the key sectors that is agriculture, fisheries, water resources forestry, health and energy and infrastructure. The effects of climate change on the key sectors hinder effort to eradicate poverty, household income and improve on the wellbeing. This has resulted in to a need for the government and the affected communities to come up, combine efforts and build climate change resistance through climate change adaptation and mitigation in order to promote economic and social development (MWE, 2018).

Changing climate has affected the livelihood sources directly and indirectly, warmer temperatures have diminished soil moistures, soil erosion and reduced the extent of agriculture land while warm conditions have increased the occurrence and prevalence of pests that harm and ruin many crops and livestock. For instance, the 1990s epidemic of cassava mosaic virus resulted into yearly losses of thousands of tons of cassava. Increases in extreme drought and floods have increased stress on crops and livestock as the conditions decrease the crop and animal yields, diseases in the quality and quantity of grazing area and water resources because of drought conditions. This can result in the loss of livestock as occurred during the 2004-2005 droughts (McSweeney, 2011).

2.4 Adaptation of climate change

Climate change actions have often relied on one of the following strategies. Mitigation efforts to lower the greenhouse gas emissions and adaptation to adjust the system and societies to with stand the impacts of climate change. This includes protection of wetlands like the salt marshes, mangroves and sea grasses that are unique coastal ecosystems (mangrove forests hold the equivalent of more than two years of global emissions which would be released to the atmosphere), promoting sustainable agro forests, securing indigenous people land rights and improving mass transit which accounts for 72% global transport-related emissions (Suarez, 2020).

Climate has varied and negatively affected communities in the past and these affected communities have developed coping mechanisms to climate changes. In Uganda, most of coping strategies pass from generation to generation and are not in any book of record (not documented). Uganda uses the following adaptation and mitigation strategies; 1) food preservations (for example grain drying), 2) alternative livelihood resources (like switching to motorcycle riding), 3) water harvesting, 4) bush burning 5) shifting cultivation, 6) migration, encroachment to wetland areas, 7) famine marriage and hunting of wild animals and birds (common in the districts of Pallisa, Lira, and Soroti) (GOU, 2007).

2.5 What makes people fail to adapt to climate change

Public and private sectors are involved in the implementation of adaptation measures; however, the decision-making barriers have reduced the desired level of adaptation. The assessment report

of the international panel on climate change (IPCC, 2014) provides a comprehensive literature survey identifying the barriers to adaptation and decision-making.

These are transaction costs (the information requiring costs and the long-lived capital for adaptation), behavior and obstacles to adaptation (including social norms and culture factors), uncertainties (this has presented the greatest challenge in adapting to climate change in different dimensions, inability to have improved technologies by the time of uncertainties and economic support) (IPCC, 2013).

2.6 Research Gap

In Rukungiri which is in western Uganda, there has been little or no study that has focused on the impacts caused by climate changes and as a result this has created a gap and hence a need to carry out this study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study area

The study was conducted in the selected sub counties in Rujumbura County, Rukungiri District that is in the south western part of Uganda. The District borders with the districts of Bushenyi in the North, Ntungamo in the East, Kabale in the South and Kanungu in the West. It is about 400 km from Kampala the capital city of Uganda.

3.2 Target population

Rujumbura has a total population of 123,175 people. Ruhinda with 25803, Buhunga has 22088 people, Bugangari has 299424 people and Nyakagyeme has 16467 people with a total number of households of 24,652 (GOU, 2015).

To get the sample size' the Glenn's formula (1992) was used to get the sample size of the population.

$$\text{WHERE: } n = \frac{N}{1+N(e)_2}$$

n = Sample size

N= Population size

1 = constant

e = Level of precession 10%

Therefore

N=123175 1= constant e= 10%

$$n = \frac{123175}{1+123175\ (0.1)^2}$$

n= 100

3.3 Study Design

The research used qualitative and quantitative research approach.

3.4 Sampling design

During the study, the researcher applied stratified and simple random sampling whereby he stratified the population in such a way that the population within a stratum is homogeneous with respect to the characteristic based on which it is being stratified and selected randomly respondents from the stratum.

3.5 Methods of data collection and analysis

3.5.1 Methods of data collection

During the study, the researcher used only two (2) data collection methods the interview guide and questionnaire.

3.5.1.1Interview Method

The researcher met respondents face to face where it was possible and interacted with them as they gave their views and response on the interview, questions. However due to the COVID-19 pandemics restrictions on movement, the researcher also used phone interviews especially to respondents who were in the far areas that couldn't be reached and the researcher was able to note down the respondent views and answers to the question.

3.5.1.2 Observation Method

The researcher used different senses in order to collect information like feeling, seeing and hearing.

3.5.1.3 Questionnaire Method

For the respondent who could read and write, the researcher could read questionnaires for them, capture their responses and filled on spot on their behalf for the respondent who could read and

write the researcher administered the questionnaires and collected the on spot after they were filled.

3.5.2.1 Qualitative data analysis

This technique aimed at ensuring that the collected data is of the right detail and contains the whole amount of information required. It involved an in-depth interview with key informants after the field visit, reviewing statements made on each of the general and specific topics in order to determine if there was disagreement on issues.

3.5.2.2 Quantitative data analysis

Here data was analyzed during and after data collection. This means reviewing of collected data was done immediately in order to identify any missing information and ensure it was correct before leaving the field (Data cleaning). Data was analyzed and assessed according to questionnaires, interview and observation.

CHAPTER FOUR: PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS

4.0 Introduction

This chapter presents findings according to the data collected, the findings are analyzed, interpreted and presented according to the objective of the study and research question.

4.1 Effects of climate change on the livelihoods in Rujumbura

4.1.1 Demographic study

The sample size being 100, sub counties were divided into strata whereby 25 households were sampled from each sub county. All the respondents were above the age of 18 because people below 18 are considered as minors, it was unethical to talk to people who are below 18 years.

In the study 20% were youth (18 to 30 years), 45% were adults between the age of (31 to 45) and 35 were the elderly with 46 years and above.

4.1.2 Awareness of climate change by the people of Rujumbura

The study shows that all the respondents were aware of climate change. They thought that climate change is real and it is the major factor affecting livelihood sources. Climate change awareness was through personal experience and observation, media that was through radio and television.

According to respondent 71% were able to access the information for at least 1 to 2 years.

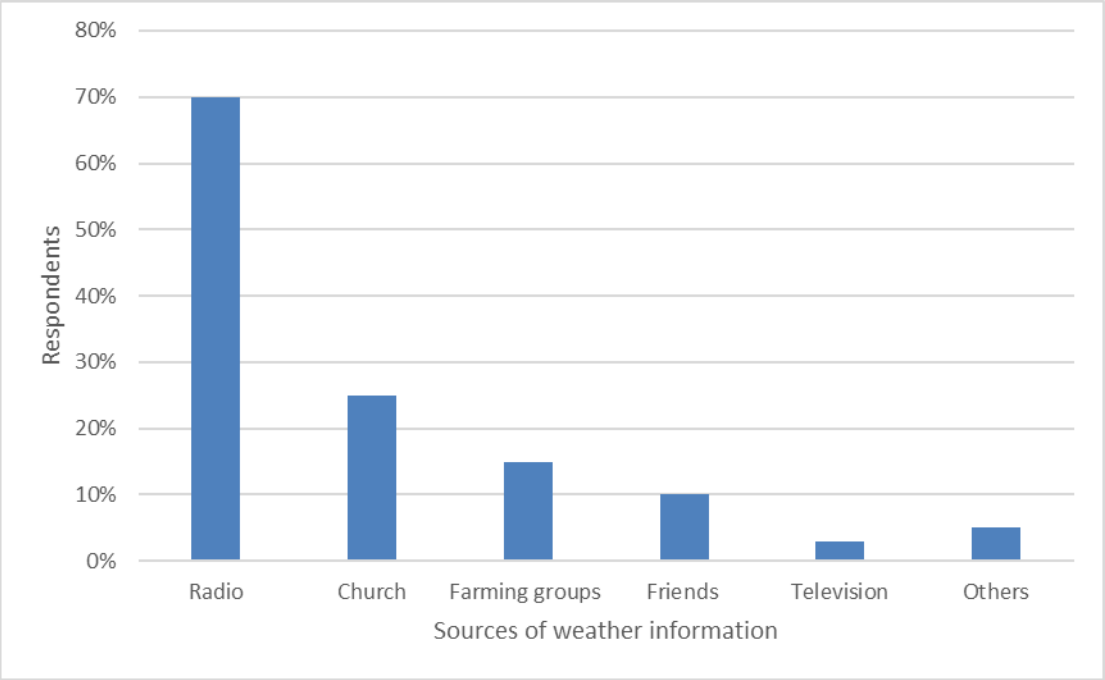

Figure 1: *Source of climate change information*

4.1.3 Causes of climate change

According to the study, 67% of the respondents said deforestation was cause of climate change, while 60% of them said it was wetland degradation. 48% of them said it was bush burning while 3% of the respondents did not know what could have caused climate change and others believed that climate change is by Gods will.

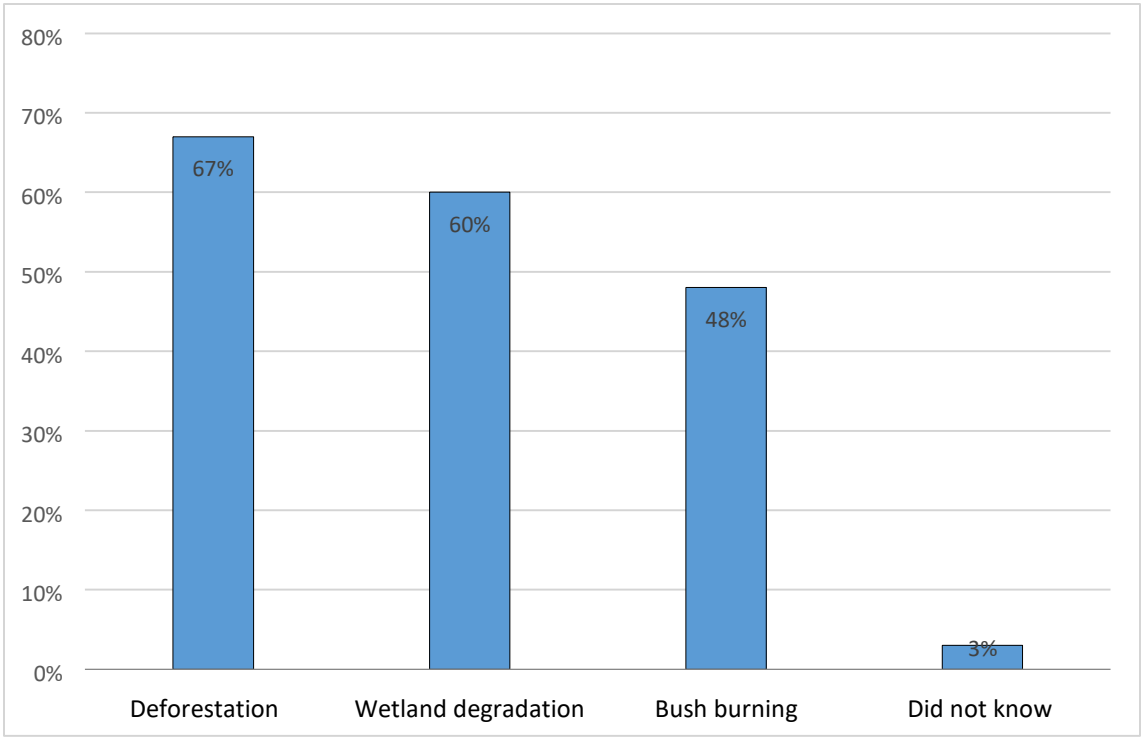

Figure 2: *Causes of climate change*

4.1.4 Effects of climate change on livelihoods sources

A greater percentage (90%) of the respondents reported that climate change equally affected men, women and children while 7% reported that children were the most affected due to nutritional requirements and 3% did not know about the impacts of climate change.

4.1.5 Major livelihood sources

From the study most respondents said that 90% crop growing was the major source of livelihood, 56% said it was livestock, 22% earnings from trading 10% from formal sources (salary earners), and 3% from hand craft. The house holds 50% had solar energy and 95% had improved house roofed with iron sheet and 45% had students in tertiary institutions.

4.1.6 Effects on major livelihood sources

Climate change according to the respondent caused the following impacts on the livelihood sources 99% that were the negative impacts.

On crop production, 100% reported drying of farm crops, 60% reported water scarcity, 98% reported crop pests, 20% reported loss of soil fertility and 60% reported soil erosion. On livestock sector, 100% reported decline in the livestock yield, 100% reported water scarcity, 83% reported decline in the pasture quality, 80% reported disease and parasite outbreak.

Table 1: Showing climate change impacts on crop growing

Climate change impact	**Respondent frequency**	**Percentage**
Drying crops	100	100%
Water scarcity	60	60%
Increased crop pests	98	98%
Loss of soil fertility	20	20%
Soil erosion	60	60%

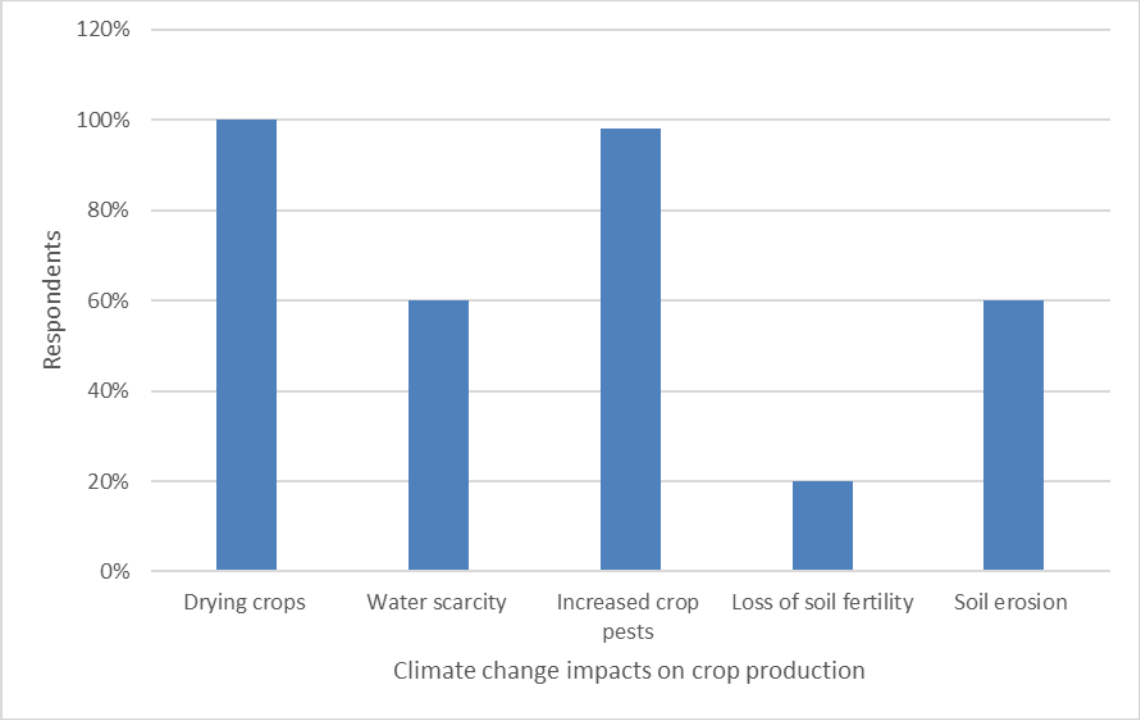

Figure 3: *Climate change impacts on crop production*

4.1.7 Most affected crops in Rujumbura

Table 2: Most affected crops and decline cause due to climate change

Most affected crops	**Percentage of the effect**	**Percentage decline as a result of climate change**
Beans	40%	20%
Cassava	10%	10%
Maize	12%	15%
Banana	10%	20%
Potatoes	5%	07%
Coffee	12%	15%
Rice	11%	20%

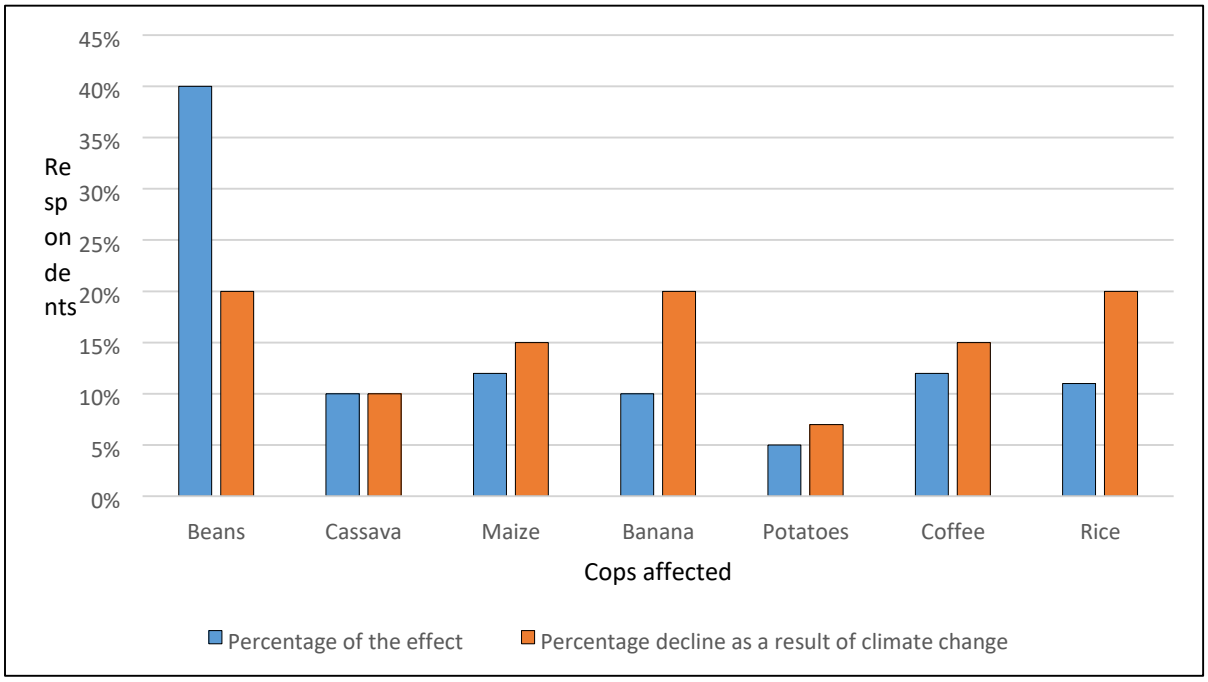

Figure 4: *Effect caused and the percentage decline in the crop production because of climate change*

4.1.8 Effects of climate change on livestock

From the study, 56 of the respondents were cattle keepers and they said that climate change impacts affecting livestock included reduction of the yields (eggs and milk), water scarcity, and decline of quality pasture and disease outbreak.

Table 3: Impacts of climate change on livestock

Climate change impact	**Frequency**	**%respondent**
Reduction of yield (milk and eggs)	56	100
Water scarcity	56	100
Decline of pasture quality	47	83
Disease and pest out break	45	80

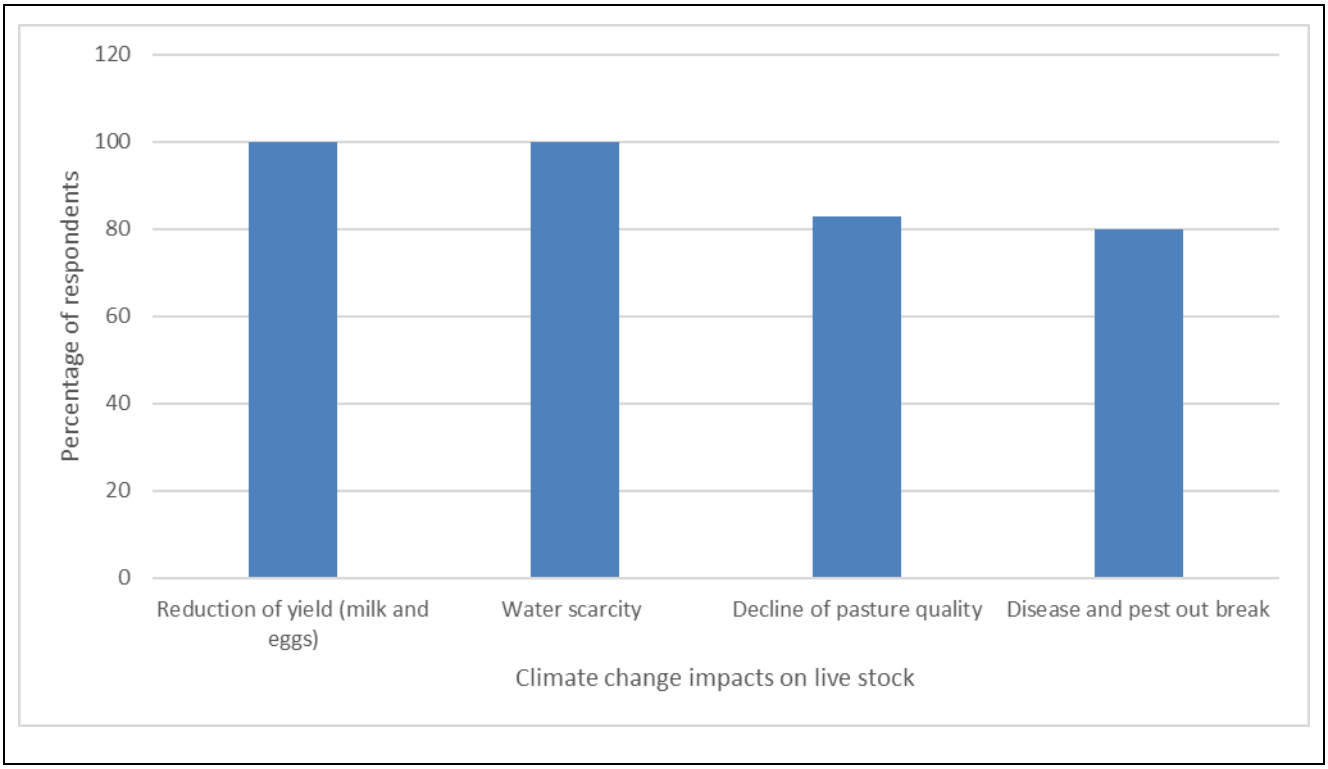

Figure5: *Climate change affects livestock*

4.2 People's perceptions on climate change in Rujumbura

4.2.1 Climate change aspects most experienced

Climate change to happen there must have passed a comparable period of 30 years therefore elders aged 45years and above were considered to respond to this part as the researcher considered them to have more experience about climate change. They reported that the recent climate and that of the 1970s has changed dramatically.

Table 4: Strategies used in crop growing to adapt to climate change

Elderly perceptions on climate change (45 years and above)	**Percentage respondent**
Increased drought conditions	100%

Variations in rain seasons	70%
Increased temperatures	100%
Decrease in rainfall	80%
Erratic rainfall	20%
Increased flooding conditions	20%

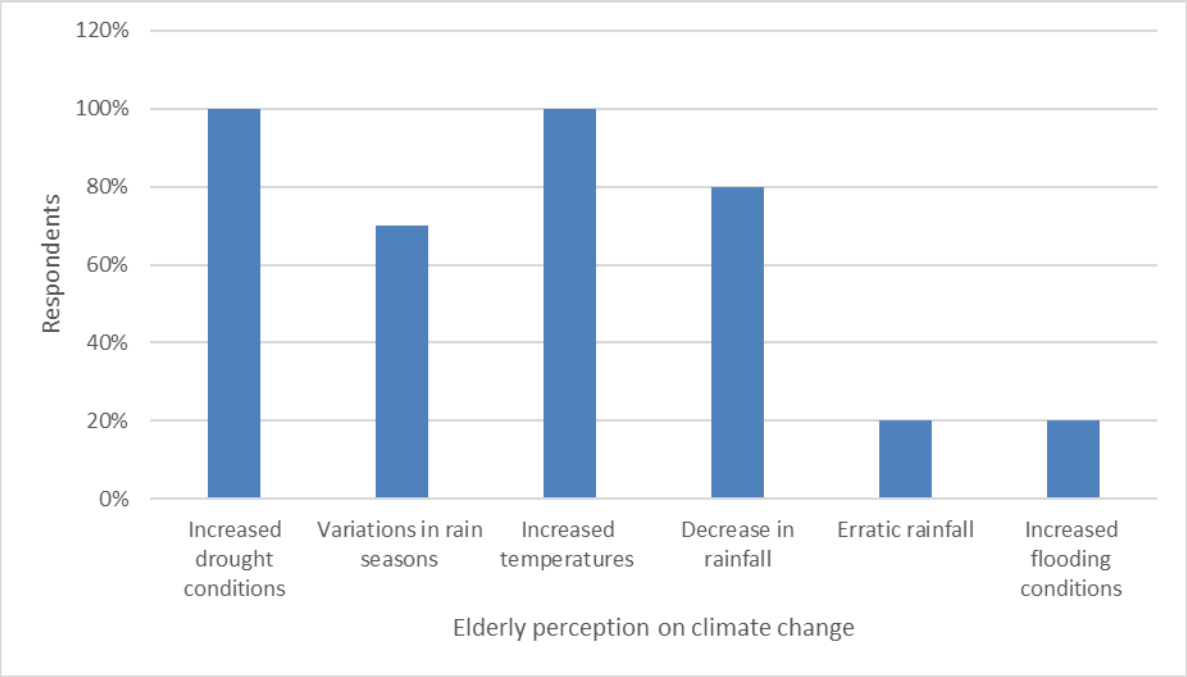

Figure 7: *Elderly perception on climate change*

4.2.2 Season variability

The elderly also said that there has been the following in the seasonal changes for the past ten years, long drought seasons (100%), late first rain in the first rain season (100%), early first rain in the rain season (45%), and early first rain in the second rain season (34%) late first rain in the second rain season (60%).

Table 5: Seasonal changes and variability

Season variations	Percentage respondent
Long drought conditions	100%
Early first rain in the first rain season	100%
Late first rain season in the first season	45%
Early first rain in the second rain season	34%
Late first rain in the second rain season	60%

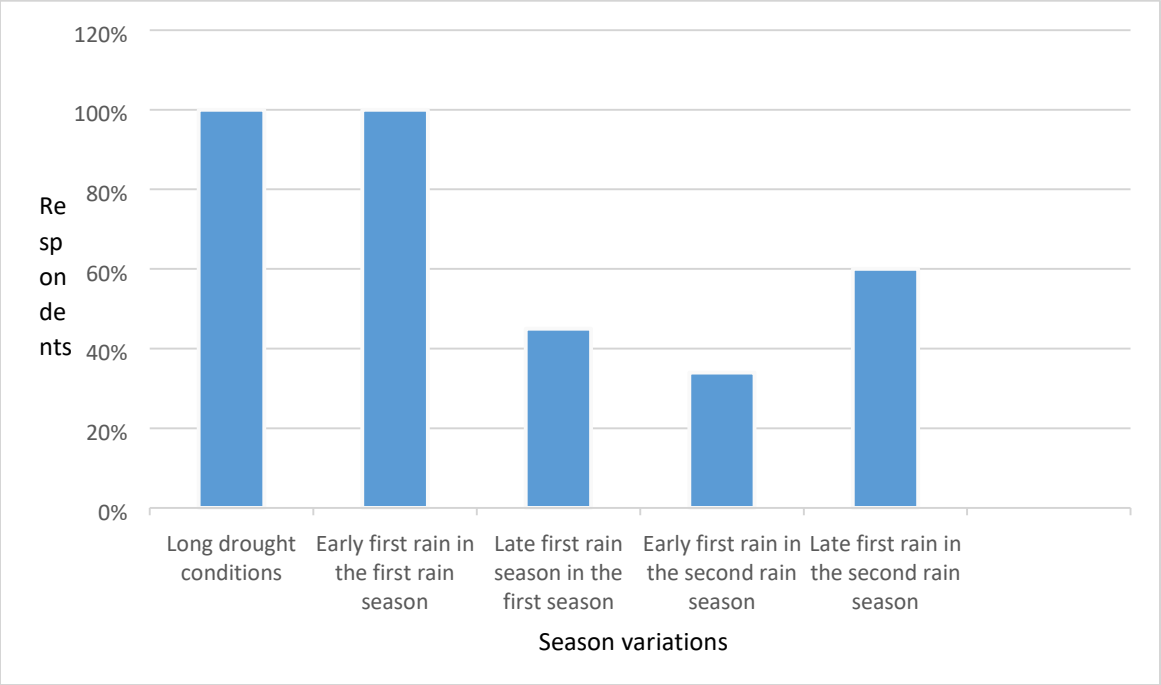

Figure 8: *Season variations in the past ten years*

4.3 Adaptation and mitigation measures

4.3.1 Strategies used by farmers to adapt to climate change effects in the crop sector

Respondents reported that they employed different methods to adapt to the impacts of climate change. Famers adapted: early planting of crops (58%), change in the planting date (55%), crop diversifying (44%), mixed farming (36%), watering crops during drought season (20%), rain

water harvest (14%) no adaptation (10%), and others believed in the rain makers (not scientifically proven).

Table 6: Adaptation strategies used in the crop-growing sector

Adaptations strategies	**Percentage of the respondent who use of the strategy**
Early planting	58%
Change in the planting dates	55%
Crop diversification	44%
Change in the crop varieties	44%
Mixed cropping	36%
Watering during drought seasons	20%
Rain water harvest	14%
No adaptation	10%

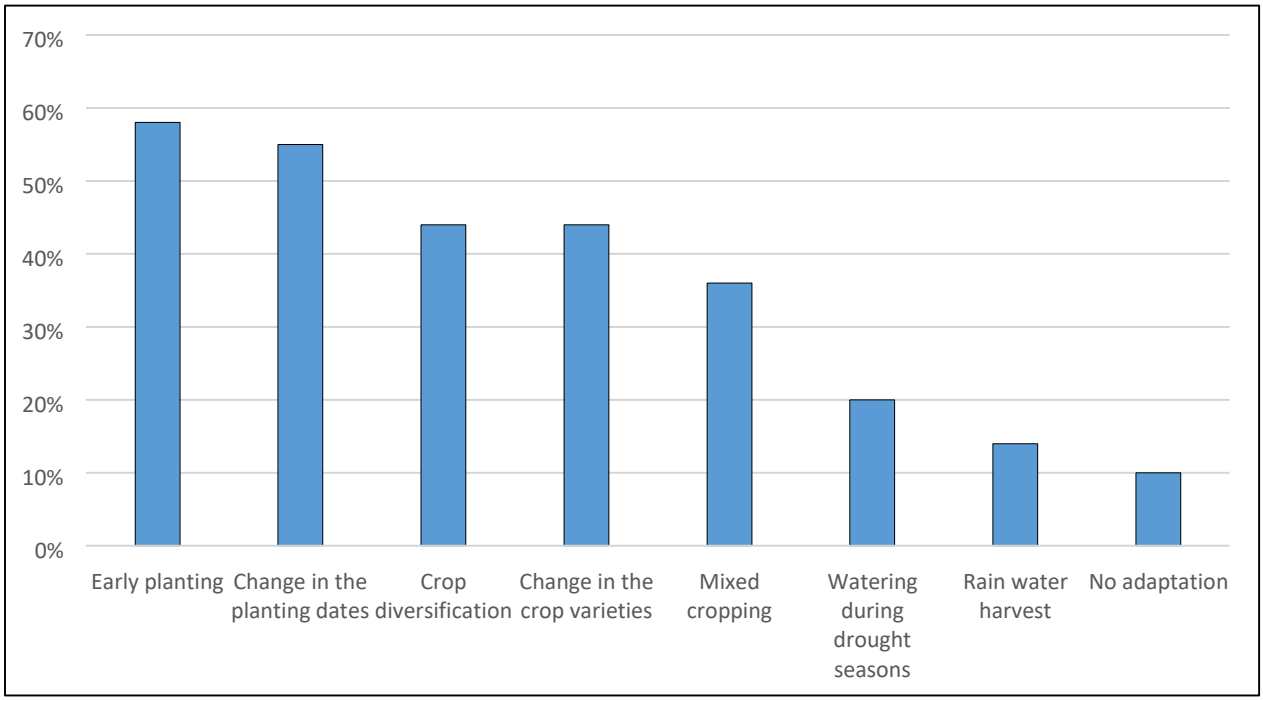

Figure 9: *Strategies used by farmers to adapt to climate change effects*

4.3.2 Strategies used by farmers to adapt to climate change effects in the livestock sector

From the study, 56% of the respondents were cattle keepers and suggested different coping strategies for climate change effects. These were changing to local animal breeds that were tolerant to drought conditions 22%, shifting grazing especially by the people with enough land (22%) and 10% said they are not applying and adaptation strategy.

Table 7: Strategies used in livestock sector to adapt to climate change

Adaptation strategies	Percentage of respondent
Change to local drought tolerant varieties	30%
Shift grazing	22%
No adaptation strategy used	10%

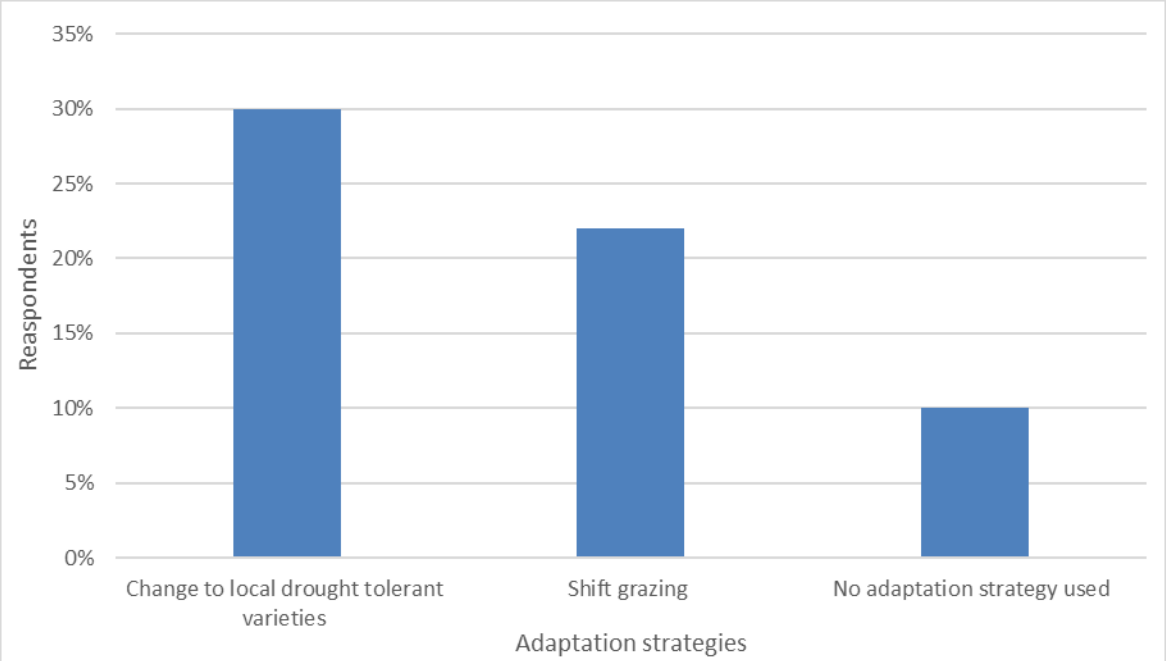

Figure 10: *Strategies used by farmers to adapt to climate change effects in the livestock sector*

4.3.3 Challenge in adapting to climate change effects

From study, 60% of the respondents suggested the following challenges limiting them from adapting to the climate change effects, limited capital to access improved agriculture technologies 78%, limited skills (22%), and limited government support 3%.

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4.4 Discussions

4.4.1 Climate change and livelihood sources

The majority of the people derive their livelihood sources from land, which is from livestock, crop growing and trading activities dealing mainly in agriculture products. A few who derive their livelihoods sources from formal employment and so changes in climate have greatly affected their livelihood sources by affecting and causing a greater decline in crop and livestock production. According to the study, livelihood of people in Rujumbura mainly depends on agriculture that agrees with the literature about the livelihood source (GOU, 2015)

4.4.2 Effects of climate change on the livelihood sources

Climate change impacts have resulted into crops drying up, water scarcity, crop pests and soil erosions on the crop production and effects like decline in yields (eggs and milk), water scarcity again decline in the quality of pasture and disease out breaks on the side of livestock keeping in the area. Climate change has caused a greater decline in crop produce, this agrees with the information given in the literature by (McSweeney, 2011.)

4.4.3 Adaptation measures to climate change

The respondents had different adaptation strategies basing on one's expertise in coping and adapting to climate change effect in crop growing and livestock sector.

In crop growing sector farmers employed the following adaptation and coping strategies, 1) early planting, 2) changing in the planting dates, 3) changing to crop varieties which are tolerant to weather extremes, 4) watering during drought periods and 5) rain harvesting.

And for the livestock sector shift grazing and change to local livestock varieties which are tolerant to changing climatic events were being used, and this agrees with the information given in the government report about Uganda's climate change coping and adaptation strategies (GOU, 2007).

4.4.4 Failure to adapt to climate change

A greater percentage of respondent were unable to adopt to climate change due to limited capital, limited skills, lack of government support, others believed in cultural norms and traditional norms (like believing in the rain makers) and others believed in the religious teaching (whereby they believed that climate change is by Gods will and no one has control over it). This is in agreement with the report in formation of reported by the (IPCC, 2014) which indicated culture norms, religious beliefs uncertainties and economic factors hindering adaptations to climate change.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

This is the last chapter. It includes a brief summary of the research problem and method and interpretation of each result. It is a discussion of the study and the implications of the findings. Recommendations and suggested areas for further research are included in this chapter.

5.1 Conclusion

The following conclusion were drafted in line with study findings

In conclusion, this research has highlighted on the impacts of climate change and how it has affected the livelihoods, the coping and adaptation strategies used by the people in Rujumbura. Most affected livelihood sources were crop growing and livestock farming. According to the study that the area of study was exposed and vulnerable to climate change effects with low adaptive capacities.

5.3 Recommendation

The following are the recommendations of the study:

Engaging local communities to improve knowledge on how to mitigate and cope with the climate change effects.

Establish a community-wide campaign to impart knowledge about climate change.

Teams should be set in communities and trained to enable in informing and training their fellow community members on how to mitigate climate change.

The government should improve on the strategic planning for prevention and mitigation of climate change issues.

There should be increased collaboration of government and other organizations that are focusing on climate change prevention and mitigation to ensure knowledge sharing.

5.4 Areas for further study

Assess the government intervention on helping people living in rural areas to cope and adapt to climate changes impacts.

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Appendix I: Questionnaire for the Respondents

Dear respondent, my name is Niwagaba Alfred a student of environmental science Kabale University, doing my undergraduate research on the impacts of climate change on the livelihood sources of the people of Rujumbura Rukungiri District please I need your contribution towards this research, the responses will be confidential and used for only academic purposes.

Before we start, do you have any question for me?

Introductions

1.What is your name (optional)

2. Sex.

(a) Male

(b) Female

3. Village: ……

4. Sub county…….

Livelihood characteristics

5. what are the main source of livelihood

(a) crop growing

(b) livestock keeping

(c)trading activities

(d)formal sources (salary earners)

Others (specify)……

Climate change awareness

6. Have you ever heard about or experienced climate change?

(a) Yes

(b) No

7. If yes, how did you come to hear about climate change?

(a) Personal experience

(b) Media

(c) Churches

(d) Family

(e) Friends

(f) Televisions

(g) Radio

Causes of climate change

8.What do you think is causing climate change

(a) Deforestation

(b) Wetland degradation

(c) Bush burning

(d) Did not know

(e)others specify

9. Have you ever experienced climate change?

   (a) Yes

   (b) No

10. Have you ever experienced any change in the growing seasons?

   (a) Yes

   (b) No

11. If yes, what changes have been experienced?

   (a) Late rain seasons

   (b) Early rains

   (c) No changes

   (d) Dot know

12. Have you observed the following climate change impacts?

   (a) Decline in crop yields

   b) Increase in crop yields

   c) Increase in livestock production

   d) Decrease in livestock yields

   e) Food insecurities

   f) Water scarcities disease and parasites

   g) Others specify

13. Whom do you think mostly is affected by climate change?

(a) Men

(b) Women

(c) Elderly

(d) Don't know

(e) All

14. How has climate change manifested in your area?

(a) Prolonged drought

(b) Flood

(c) Erratic rain

(d) Land slides

(e) Others specify

15. What are the farmer's perceptions on climate change?

(a) Increased drought conditions

(b) Variations in rainfall seasons

(c) Increase in temperatures

(d) Decrease in rainfall

(e) Erratic rains

(f) Flooding conditions

On crop production

16. Do you crop growing?

(a)yes

(b) no

If yes, what types of crops are mainly grown?

(a) Beans

(b) Cassava

(c) Maize

(d) Banana potatoes

(e) Coffee

(f) Potatoes

(g) Rice

17.Main crops affected

18. Decline causes in the produce of the stated crop above 19.
what are the adaptation measure being take

On live stock

20. Do you keep animals or poultry?

21 How has climate change affected livestock production

22. What are the adaptations measures adopted to reduce the impacts of climate change in livestock production?

Appendix II: The key research questions

Do you know what climate change is, have you ever heard about climate change?

If yes, how did you know about climate change?

How has climate change affected your livelihood sources?

If yes, which sector has been mostly affected?

Which change climate change aspect has been mostly affected?

Have you experienced any change in growing seasons?

Which other climate change related impacts have you observed in your area?

Do you agree that there are climate change affects crops?

If yes, which change in climate affects crops mostly and which crop has been mostly affected?

If no, please explain

For how long have you noticed these changes in climate change?

Did you adapt to climate change?

If yes, what are your perceived adaptations options?

If no, what made you not adopt adaptation measures?

What would you consider the most important message in a joint campaign on climate in your area?

Appendix II1: Work plan of the study

ACTIVITY	**TIME FRAME (MONTHLY)**	
	Start	End
Proposal writing, presentation and defence	September, 2019	February, 2020
Data collection	March, 2020	August, 2020
Data analysis, presentation and report submission.	October, 2020	January, 2021

Appendix 1v: Study Budget

ITEM	**AMOUNT (SHS)**
Transport	100,000
Stationary	40,000
Typing, printing and binding	50,000
Stapling machine and wires	10,000
Grand total	**200,000**