

**ASSESSMENT OF THE EFFECT OF FLOODING ON AGRICULTURAL LANDS
IN KAHARO SUB COUNTY OF KABALE DISTRICT SOUTH WESTERN
UGANDA**

BY

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**A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT
OF ENVIRONMENTAL SCIENCES IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR'S
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UNIVERSITY**

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DECLARATION

I, **Nyakiti Dorcas Awino**, declare to the best of my knowledge this Research Report is my original work and has never been presented by anyone in any university or any other institution for an academic award.

Sign

Date

.....

.....

NYAKITI DORCAS AWINO REG: 2018/KES/1843/F

APPROVAL

This Research Report titled “*the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.*” has been done under my supervision and is now ready to be submitted to the Faculty of Agriculture and Environmental Sciences of Kabale University.

Sign

Date

.....

.....

Dr. TURYATEMBE JENNIFER

DEDICATION

This piece of work is dedicated to my parents Mr. Argwings Nyakiti and Mrs. Emily Nyakiti who have supported me socially, economically, spiritually and cognitively.

ACKNOWLEDGEMENT

I thank the Almighty God for His love and protection. In regard therefore, I acknowledge the assistance both material and other support received from the individuals who contributed towards the completion of this proposal.

Sincere gratitude goes to my supervisor Dr. Turyatamba Jennifer for her guidance throughout this research season. May the Lord reward her abundantly.

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Appreciation goes to all administrators, and the entire community of Kabale University for allowing and cooperating with me in giving me all the necessary information during my study.

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ABBREVIATIONS

NEEMA:	National Environment Management Authority
MEA:	Millennium Ecosystem Assessment
UNEP:	United Nations Environment Programme
USEPA:	United States Environmental Protection Agency
DFID:	Department for International Development
FTF:	Feed the Future
GDP:	Growth Domestic Product
IPCC:	Intergovernmental Panel on Climate Change
MDGs:	Millennium Development Goal
NMSA:	National Mission for Sustainable Agriculture
UBOS:	Uganda Bureau of Statistics

ABSTRACT

In the last three decades, the impacts of flooding have increasingly assumed from significant to threatening proportions in Kaharo sub-county villages like Kitare, Nyakigugwe, Nkumbura, Kizinga, Karehe resulting in loss of lives and destroying farm lands. The purpose of this study was therefore assessment of the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda. The study was guided by the specific objectives which include investigating the causes of flooding on agricultural lands in Kaharo sub county, establishing the effects of flooding on agricultural lands in Kaharo sub county, and assessing the possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda. The study employed descriptive survey design utilizing both qualitative and quantitative data collection and analyses methods. Using simple random and purposive sampling techniques, a total of 84 respondents were selected to participate in the study. Focused group discussion and interviewing methods of data collection were used in this study. Rapid urbanization, population growth and high Rainfall Intensities were the causes of flooding on agricultural lands in Kaharo sub county Kabale district reported by 49%, 56% and 32%), respectively (Table 4.1). Other causes of flooding were location of settlement on flood plain (48%), lack of awareness and information (2%), poverty (7%), unprotected flood areas, standing crops and livestock (30%) and lastly transition in cultural practices (24%). Loss of life (52) was the major effect of flooding on agricultural lands in Kaharo sub county Kabale district (Table 4.2), 49% of the respondents recorded that damage to crops and food supplies were the effects of flooding in an area whereas 46% of the respondents mentioned that Famine was also an effect of flooding due to destruction of crops and other agricultural lands. It was also concluded that 60% of the respondents suggested that there should be wetland restoration in the area, the need for community based natural resource management which helps in the conservation of wetlands (44%), 38% of the respondents suggested that early warning systems should be put in place to find out different mitigation measures for conservation of agricultural lands whereas 30% of the respondents suggested that there was need for massive education (Table 4.3). The study also recommended areas for further studies like assessment of the effects of flooding on agricultural production in Kaharo sub-county and assessing Vulnerability of Peri-Urban Areas to Floods.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Globally, changes of combined climate and land use induce significant alterations in climate and hydrological regimes in urban areas, producing flash floods with significant impacts in terms of damage to farm lands and loss of human life. This will force people to relocate in search of a less-risk location. These flash floods occur mainly in small-urbanized areas where climate change is likely to aggravate the impacts. The impact of the change on extreme rainfall events is still not well understood (Bicknell et al., 2009).

The effects of climate change are shown to have immensely affected the changing weather conditions in many parts of the world. There is a global concern about global warming. Global warming is leading to climate change as noted in the third assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2001). Global warming has caused incidences of tsunamis, melting of icebergs, washing away of shorelines, flooding and drowning of islands (IPCC, 2001). Consequently, flooding has become of great interest to humanity (Oppong, 2011). Floods claim approximately 20,000 lives annually, leaving people homeless in the process and have negative implications on at least 20 million people all over the world (Smith, 2011).

Natural disasters are common nowadays in Africa. They are result of sudden change in state of natural elements due to natural forces. Most of the natural disasters are beyond control of human beings and cannot be predicted accurately when it occurs. Major natural disaster like floods, earthquakes, landslides and droughts when they happen, it results in threat of human life, loss of property; affect infrastructure, agriculture and environment. The impact of disaster is different due to its intensity and coverage area (Bronen, 2015).

In East Africa Uganda not exclusive, urbanization leads to sharper and faster changes on land use and on the climate like increasing flash flood risk which affects farm lands especially due to the impacts of flooding. The green environment with associated natural resource components are under threat from urbanization; and this threat is manifested in form destruction of vital environmental components such as wetlands, forests, water resources and the natural landscape problems with management of urban rainfall have their root in the concentration of population in relatively small areas. Flooding in urban areas is not only as a result of heavy rains; it is also a result of changes in the built-up areas. This makes even

moderate storms produce quite high flows because of surface runoff and poor drainage (Bronen, 2015).

Uganda, like the rest of the world, there are changes in the frequency or severity of extreme climate events, such as droughts, floods (Lwasa, 2010). Kabale is observed to be in a region with extreme events where rainfall varies greatly exceeding 300mm per month in region (Lwasa, et. al 2009). Such rates of increase unprecedented and will be felt in fast-growing urban areas of in Uganda (Lwasa, 2010). Further environmental degradation and urbanization to a city level especially in Kabale municipality in Kabale District is largely characterized by reclaiming of wetlands, clearing vegetation for business like in Kabale town and dumping rubbish in water channels like river Ruhuraa that passes Kirigime ward all of which interfere with water flow and make neighboring communities vulnerable to both flash flooding and waterlogging. Each year there are climatic events that present risks to residents and the urban sectors (Ian *et al.*, 2008). Floods are natural phenomena, though the damages and losses from floods are the consequences of human action especially in Kaharo sub-county of Kabale District (Lwasa, et al. 2009).

Flooding in Kabale District has affected many agricultural farm lands and lives of people for example in Kaharo Sub County the rains destroyed Kitare, Nyakigugwe, Nkumbura, Kizinga, Karehe, Omukazi bridges and the major bridge that connects the sub county headquarters to the Kabale Mbarara road Kabale District (Anthony Kushaba, 2015).

1.2 Statement of the Problem

In the last three decades, the impacts of flooding have increasingly assumed from significant to threatening proportions in Kaharo sub-county villages like Kitare, Nyakigugwe, Nkumbura, Kizinga, Karehe resulting in loss of lives and destroying farm lands. Though detailed statistics are not available regarding the losses sustained by the urban dwellers and flood victims, it is obvious from the available record that irreparable havocs have been sustained by the citizen of Kabale municipality southern division due to what has become perennial natural disaster in Agriculture lands Khandlhela, (2006). Apart from houses that collapse by flooding, school's buildings and bridges sometimes collapse as well. Markets places and farmlands are submerged for weeks and sometimes are washed away. Hence flooding in Kaharo sub county of Kabale district south western Uganda needs to be assessed.

1.3 Justification of the study

There is a public outcry that agricultural farm lands in Kaharo sub-county is used by people for their domestic and agricultural gains and a lot remains desired to investigate the causes of flooding and their effects on agricultural lands. The study benefited the communities around Kaharo sub-county in Kabale, District Natural Resources, scholars, researchers, academicians, organizations and other Stakeholders with useful and dependable information about the status of Kaharo agricultural farm lands to ease conservation and management of the biodiversity.

1.4 Research Questions

The study answered the following questions

- i. What are the causes of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?
- ii. What are the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?
- iii. What are the possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?

1.5. General Objective

To assess the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

1.5.1 Specific Objectives

The study was guided by the following objectives

- i. To investigate the causes of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.
- ii. To establish the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.
- iii. To assess the possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

1.6 Significance of the Study

This study presented the causes and effects of flooding on agricultural farm lands in Kaharo sub-county. The information was used to carry out assessment of the effects of flooding on farm lands that require detailed knowledge about the flood management in respective parts of the villages affected in Kaharo sub-county, Kabale district and it also provided a basis for the development of flood risk management plans that was used by decision makers, emergency response units, and the general public as a measure to reduce flood effects on agricultural farm lands. The study presented information on the effects of floods on communities and

document the possible copying mechanism that communities adopt to combat the effects of floods on them. By finishing this research, the researcher had fulfilled one of the essential requirements for the award of Bachelor's Degree in Environmental Science of Kabale University.

1.7 Scope of the Study

1.7.1 Geographical Scope

The study was carried out in Kaharo sub county of Kabale district 7.4 km via Kabale Mbarara Road to Kabale headquarters.

1.7.2 Content Scopes

The study focused mainly on assessing the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda. The study investigated the causes of flooding on agricultural lands, effects of flooding on agricultural lands and the possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

1.7.3 Time scope

The study was carried out in a period of one year from November, 2019 to November, 2020. This involved proposal writing, data collection, data presentation and discussion of results. Conclusion and recommendations of this study was presented basing on the results of the study.

1.8 Definition of Operational Terms

The following terms were used in the study.

Natural hazards, these are defined as geophysical events that can potentially cause large-scale economic damage and physical injury or death (Johnson *et al.*, 2000).

Agricultural land, this is land devoted to agriculture, the systematic and controlled use of other life particularly the rearing of livestock and production of crops to produce food for humans. Lauren (2008)

A flood is an over flow of an expense of water that submerges land. The EU floods directives defines a flood as a temporary covering by water of land not normally covered by water in the sense of flowing water (Mhonda, 2013).

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter described and related what other scholars have noted down about the topic. The researcher got information from different and related sources or scholars, magazines, journals, websites that all point and relate to the study.

2.1The Causes of Flooding on Agricultural Lands

Urbanization, the number of people migrating from the rural to urban areas tends to be increasing greatly on daily basis. As urbanization increases, the need for construction of buildings and structures for shelter and other activities increases. There is an increase in risk of flooding specifically where there is an intertwining in inappropriate, or inadequately maintained infrastructure, low-quality shelters and lower resilience of the urban poor for example the expansion of trading centers in Kabale due to becoming of a city (World Bank, 2008).

According to Sam (2009), the construction of buildings and structures has in some cases come into close proximity to streams and other primary drainage facilities. These drainage channels have subsequently been rendered incapable of coping with the high volume of runoff water during rainfall, which invariably carries large amounts of silt and this is common in Kaharo.

Due to ignorance and sheer disregard of building regulations many people build haphazardly putting them at risk to the dangers of erosion and flooding. Paved roads and setting up of these buildings/shelters increases the imperviousness of the catchment areas. The catchment areas easily respond to rainfall and subsequently increase runoff (Ly, 2020).

Building in Flood Plains and swampy areas, several buildings and structures have been constructed in flood plains and swamps. Some structures are ignorantly and dangerously built some few meters from the stream channel or even across natural watercourses. With the onset of an inundation these places are at high risk of flooding Asaph, 2019). Some resident's particularly in Kaharo sub-county constructed in wetland areas where flooding is a big problem. Agricultural lands especially in Ahamuremere village in Kaharo are being affected by flooding due to swamp reclamation and clearing trees for agricultural purposes hence flooding (Action Aid, 2006).

High Rainfall Intensities, the incidence of heavy rainfall is generally the cause of flooding in the Kabale Community. The river and drainage network system in Kaharo usually cannot

carry all the water in its channels after a heavy downpour thereby causing flooding. It is worth mentioning that this situation is worsened by human induced activities like bush burning and deforestation. Also with the portions of land unbarred, the ground becomes saturated after a heavy downpour and the soil is rendered incapable of storing water after saturation point has been attained leading to increased surface runoff hence causing flooding on farm lands in Kaharo village of Kabale District (Adebayo, 2012).

Nature of Terrain, flooding is rampant in low lying areas/lowlands. Since rivers flow more slowly in such areas, if the water volume increases abruptly or suddenly, floods occur (Oppong, 2011). There is a reduction in the amount of infiltration of water into the ground on steep slopes. This means water can easily flow down to rivers as overland flow. Steep slopes also make it easier for more through flow within the soil. These two situations can both raise river levels easily. Relatively gentle slopes or flat land also allows easy penetration of water into the soil and increase lag times (Jackson, 2012).

Absence and Inadequate Capacity of Drains and Culverts, this contributes to the problem of flooding in Kaharo sub-county due to the absence of drainage systems and the inadequate capacities of the already existing drainage facilities. Drainage system is a process of removing and controlling excess surface water with in right of way. Drainage is an important feature in determining the ability of given pavement to withstand the effects of traffic and environment.

Adequate drainage is very essential in the design of highways since it affects the highway's serviceability and usable life. Reconnaissance and field survey works carried out during the same research showed that quite a number of drains and culverts in local areas are inadequate hence causing flooding (Flaherty, 2002).

2.2 The Effects of Flooding on Agricultural Lands

The main aspect of the agricultural impact is the crop losses. Harvesting time for grapes, which is one of the largest crops in the area, occurs annually in the end of January. As the flood in 2011 struck during harvesting time the agricultural sector was especially vulnerable. Inaccessibility to farm lands due to obstructed transportation and submerged crops effectively led to substantial crop losses that year. Officials at DoA also observed that the main issue for commercial farmers was flooded lands, while a bigger issue for emerging farmers was access to their lands (DoA 2012b).

Agriculture is the mainstay of the study area's economy. Almost 85% people in Kaharo subcounty directly depend on agriculture for their livelihood (NEMA 2012). For majority of the people, there is hardly any surplus land since the size of the landholding is very small. Very few well-off farmers have switched from domestic to commercial farming as a large area of agriculture land is being swept away or made unproductive by the flood through river erosion, sedimentation and inundation where crops maize, wheat and vegetable are reported to be damaged by the flood.

The majority of irrigation areas in the Lower Orange River area bordering the river are protected by flood diversion walls (COGHSTA, 2011). Many of these walls were severely damaged and failed to keep water from the areas they were supposed to protect (ibid.). Especially walls in low lying areas were damaged by the flood (Koms Consulting, 2012). One reason given for their failure was lack of maintenance (COGHSTA 2011:14). Farmers from both community meetings held on the Northern Islands stated that the communal flood emergency walls for their islands had neither been inspected nor maintained for a very long time. After the flood in 1988 there were substantial repairs to damaged walls in the area, however these walls have in general received no maintenance since then (ORLU, 2012). Some large scale commercial farmers however reported that they have conducted regular maintenance on their private emergency walls. This is also a common problem in Kaharo villages due to over population and limited land for agriculture hence flooding and its associated problems.

Some qualitative studies mention possible impacts of flooding on agricultural activities that do not actually take place in the flood plain area (Brémond et al., 2008). For instance, farmers who are not directly impacted may suffer disruption in their supply of inputs (including stored fodder) if these activities have been impacted. Closely related economic sectors may also be disrupted even if they are not directly impacted by the flood if harvests have been destroyed, the food industry may suffer from a shortage depending on their capacity to find substitutes to lost harvest on markets also if a lot of farms go to bankruptcy, the food industry may have to reorganized to adapt to this new situation. Kabale District is a swampy flood plain with fertile soils which fertilizes crop growing hence farmers end up affecting its ecosystems exposing it to erosion as there is heavy rains in Kabale areas (Bauduceau, 2004)

Direct induced damage to agriculture that can be considered depends on the scale at which agricultural activities are studied. When agriculture is studied only through land use (i.e.

parcels and farm buildings separately), little direct induced damage can be taken into account. Bauduceau, (2001) points to future loss of yield that would continue for a number of years after flooding when perennial plant material is destroyed. Specifically with respect to livestock, Posthumus *et al.*, (2009) mention direct induced damage such as reduced milk production, due to loss of grass yield and feed value, or an increase in costs of veterinary treatment due to the consequences of stress for animals. Bauduceau, (2001) also mentions possible increases in production costs (additional inputs to limit losses). When some direct damage is not entirely repaired (soil erosion, soil contamination, for example), it may also lead to restrictions in land use, for instance in disallowing certain crops like maize and sorghum in Kaharo sub-county of Kabale District Southwestern Uganda.

Brewin, (2013) mention that the reduction in agricultural yield due to flooding may cause some variations in production costs: savings due to a decrease in yield like reduction in the time dedicated to some tasks. These savings occur after the flood and may continue until the end of the production cycle. However, as they can be anticipated depending on the loss of yield, they are usually taken into consideration to calculate direct damage to crops. This is seen in many parts of Kigezi region due to ignorance about flood control and poor government support hence affecting agricultural lands in Kabale District (Morris, 2013).

Close to a billion people around the globe live in abject poverty characterized by serious hunger (Lobell & Burke, 2010) and majority of this number lies within Africa which is heightened by the conflicts, degradation of resources and poor adaptive skills (IPPC, 2007). With Nigeria being the most populous nation on the African continent and 70% of this population living in poverty, any unrest or disasters such as flooding will have a huge impact (Agwu, 2009).

2.3 The possible solutions to the effects of flooding on agricultural land

Restore, maintain and enhance the ecological process essential for the functioning of the biosphere to preserve biological diversity and the principal of optimum sustainable yield in the use of living natural resource and ecosystem (Nathwani, 2008).

Tackle climate change, Climate change has contributed to a rise in extreme weather events, scientists believe. Earlier this month the leader of the Green Party, Natalie Bennett, welcomed the landmark Paris Agreement, whereby governments from 195 countries pledged to “pursue efforts” to limit the increase in global average temperatures to 1.5°C above pre-industrial

levels. “It is now crucial that world leaders deliver on the promise of Paris,” Ms. Bennett said. “The pressure is now on the British government to reverse its disastrous environmental policy making.” And this is an important tool to reduce on the effects of flooding in Kigezi region particularly Kabale district (Dixit, 2003).

Protect wetlands and introduce plant trees strategically which can act as sponges, soaking up moisture and wooded areas can slow down waters when rivers overflow. These areas are often destroyed to make room for agriculture and development, the WWF said. Halting deforestation and wetland drainage, reforesting upstream areas and restoring damaged wetlands could significantly reduce the impact of climate change on flooding, according to the conservation charity (Khandlhela, 2006).

Restore rivers to their natural courses like river Ruhuraa in Kabale Municipality. Many river channels have been historically straightened to improve navigability. Remaindering straightened rivers by introducing their bends once more increases their length and can delay the flood flow and reduce the impact of the flooding downstream (Dodman, 2009).

Raise public awareness and promote understanding of essential linkages between the environment, resources and development and encourage individual and community participation in environmental improvement efforts; and the Government should draw up a more comprehensive flood prevention plan, paying particular attention to prone areas and integrated into master plans for all cities, local government and villages (Bartlett, 2008).

Public enlightenment should be emphasized on the dangers associated with erecting buildings on flood prone areas and other practices that will affect the environment and create risk to individuals. Climate change lectures should be given to farmers, community members, talks on radio, and primary school will help in enlightening people on the risk and consequently their compliance with policies and future warnings (Duncan, 2000).

Early Warning Systems, they can be implemented with knowledge of flood risk management and support decision-making by involving the Municipal Assembly and the Community in participatory flood risk management analysis and in gathering all necessary information to inform planning and other courses of action for example emergency action plans should be put in place for unforeseen future events, even if it seems insignificant Balabanova, (2010). The common sayings ‘Prevention is better than cure’ and ‘Better safe than sorry’ can be used

as phrases for strategic planning hence reduction of the effects of flooding on agricultural lands in Kabale District (Odufuwa, 2012).

Engineering Solutions, this will include the planning design and construction of adequate drains in the Community to improve the carrying capacity of the drainage network system. Buildings and structures should be raised well above ground to prevent flood waters from gushing in and destroying properties in case of a flood event. Regulations concerning building should also be adhered to in new infrastructural developments. Also spatial planning and land use should establish and delineate areas in the community which are at risk to floods and should be avoided for residential development in areas of Nkumbura and Kizinga villages in Kaharo sub-county of Kabale District Balabanova, (2010).

Improved Waste Disposal and Sanitary Condition capacities of the drains and river channels that are frequently taken up by waste will be released for additional storage of surface runoff water. Public Attitude and Education is also important tool towards flood risk management is the education of residents in the community as well as the authorities involved on flood awareness, preparedness and safety especially in Kasharara Parish in Kaharo sub-county Kabale district (CRED, E. 2011).

Community based natural resource management. The local community is import and key since they are the ones who may wake up in the morning with a tiger or bear in their back yard. But they are also the people who can benefit the most from this. If people are empowered to manage their relationship with wild animals, these "unwanted" neighbors can become allies in bringing income and promoting a better quality of life for all (George *et al.*, 2009).

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This research methodology chapter contained the: study area, research design, study population, sample size and selection, data and information sources, data collection methods, research procedure, ethical considerations, data analysis and limitations of the study.

3.1 Study Area

Kabale district is a district in the south western region of Uganda. It lies between 29-45 and 30-15 east longitude and 1-00 and 1-29 south of latitude. Kabale hosts the district

headquarters. It was originally part of the districts of Kabale Kigezi, before the districts of Rukungiri, Kanungu, and Kisoro were excised to form separate districts. Kabale is bordered by Rukungiri district to the north, Ntungamo district to the north-east, Republic of Rwanda to the east and south, Kisoro district to the west, and Kanungu district to the north-west. Kabale is approximately 420 km (260mi), by road, south-west of Kampala, the capital city of Uganda. Kaharo Sub County is one of the sixteen sub counties of Kabale, located in the eastern part of the district. Kaharo Sub County is bordered by sub counties of Bukinda to the North West, Maziba to the west and south, Kyanamira to the east and Rwamucucu to the North. Kaharo is made up of six parishes Katenga, Kitohwa, Bugarama, kaharo, Nyakasharara and Burambira. Various farming activities are carried out in the area including animal husbandry for example cattle most especially indigenous breeds, goats, pigs, poultry for example chicken, ducks and turkeys as well as rabbits however horses, camels and donkeys are not reared there. Many kinds of crops are also grown including sweet potatoes, Irish potatoes, cassava, beans, cabbages, bananas, maize and pineapples as shown in the map below with specific parishes in agricultural farm lands.

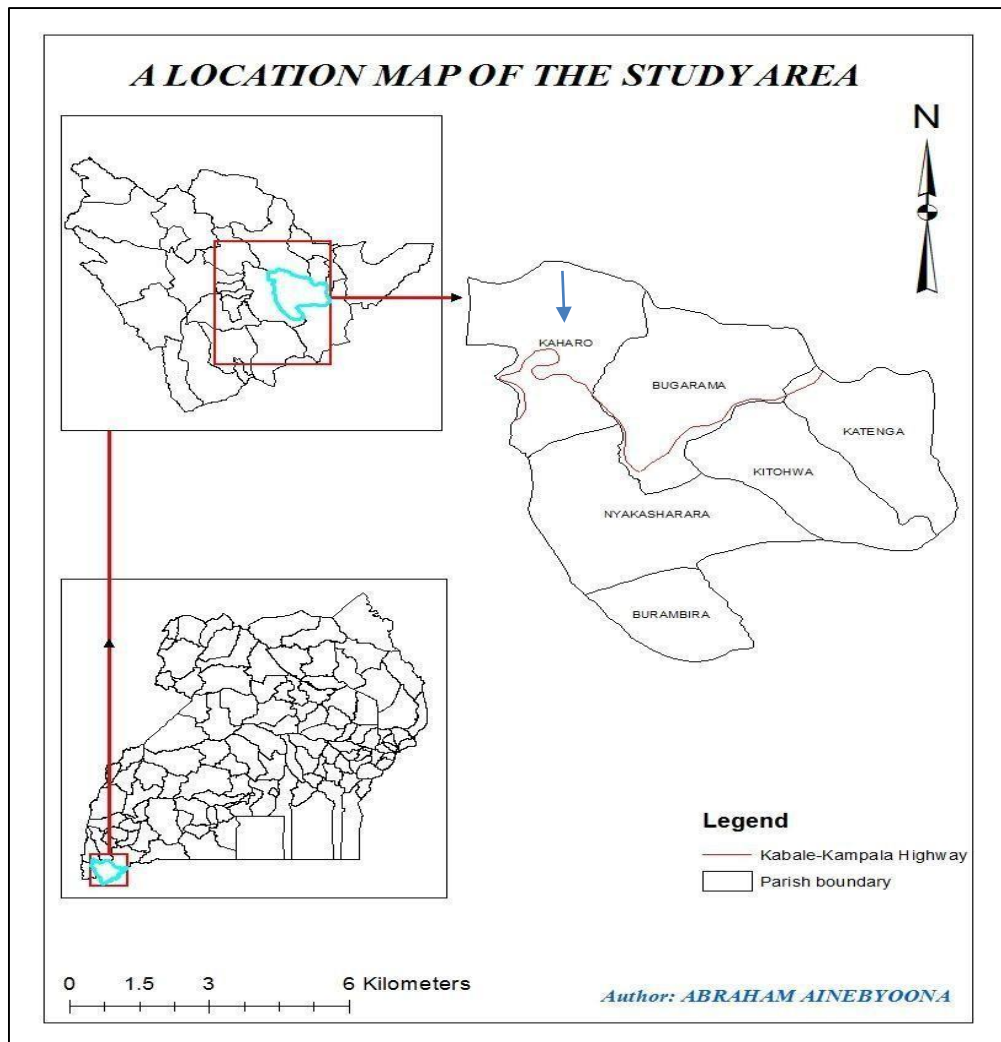


Figure 3.1: Map of the Study area

3.2 Research Design

The study employed descriptive survey design in gathering information about the effects of flooding on agricultural lands. Therefore, the research adapted to a quantitative research design since it focuses on analysis of numerical data (Hapkins, 2000).

3.3 Population and Sample Size determination

The study considered a population of 5,675 people in the study area (UBOS, 2014). The demographic characteristics evaluated in this study were age of respondents, sex, marital status, and educational level. To get the sample size, the Glenn formula 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 12%

Therefore

$N=5,675$

constant e=

12%

$n=5,675$

$1+5,675 (0.12)^2$

n= 69

Therefore, **69** respondents were selected using simple random sampling.

Purposive sampling was used to select five (5) Kaharo local famers and (10) Local leaders of Kaharo sub-county. This sampling method was used to select respondents who are believed to be more informed and updated with the content of the study. Hence both sampling methods were limited to 84 respondents as explained in the table below.

Table 1: Study Population and Sample Size Determination and Selection

Category of Respondents	Population	Sample	Sampling Method
Population	5,675	69	Simple Random Sampling
Key informants			Purposive Sampling
a) Kaharo local famers	5	5	
b) Local leaders	10	10	
Total		84	Respondents

3.4 Data Sources

The study collected both primary and secondary data.

Primary data

According to Forshaw, (2000), Primary data is the data that you have collected for yourself for example data from Kaharo Sub-County.

Secondary data

This is the data collected by extensive review of government reports, newsletters, and publications from different libraries and from the websites (Creswell 2009).

3.5 Data Collection Methods

3.5.1 Focus Group Discussion

A total of 7 focus group discussions were conducted in the study. Arrangements were made to conduct the one and half hours long semi-formal discussions at Kaharo primary school, the Kitera village and in Nkumbura village. The discussion schedule was guided by the researcher and additional interesting and useful points will further be pursued.

3.5.2 Interview

The researcher uses this method because it collects information that cannot be directly observed or difficult to put down in writing. The researcher used interview guide to identify the causes of flooding on agricultural lands, effects and solutions from respondents in Kaharo subcounty. It allowed the researcher to obtain historical information whereby through intensive interviews the respondents can examine much about the flooding effects on agricultural lands (Filson, 2014).

3.6 Research procedure

The researcher requested an introductory letter from the Head of Department Agriculture and Environmental Sciences to conduct research on the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda. A copy of this letter was presented to respondents that were approached in data collection; interview check list field diaries were used and kept to record events that were important in interpretation and analysis of the results (Anderson, 2012).

3.7 Ethical Considerations

The researcher used privacy and confidentiality of the information that was given by the participant's obtaining a valid sample entailed gaining access to specific lists and files which is an infringement of the participant's information. However, the participants had the freedom to ignore items that they do not wish to respond to. For instance, the researcher didn't allow the participants to mention their names, avoid embarrassing questions to the participants and others.

3.8 Data Analysis

Data was collected processed and analyzed both quantitatively and qualitatively which includes editing, coding, proof reading tabulation of data to ensure clear and easy presentation of research findings. After thorough sorting, the data was entered into the computer for analysis using Microsoft Excel, a computer-based statistical application program.

3.9 Limitations to the Study

Costs including transport costs and other financial expenses while visiting the most affected villages with flooding like Kitare, Nyakigugwe and internet cafes to review the related literature about agricultural land conservation were hard to handle. However, the respondents were devised to borrow ideas about Kaharo flooding from friends all time to get real detailed information for the study.

Respondents withholding Information due to fear of being victimized as a result of confidentiality of the farm land data but this was overcome by assuring the respondents of utmost good faith by the researcher.

There was a problem of data inaccessibility which the researcher faced as a result of some respondents being hesitant to return the information sheet towards the research findings.

Some respondents were not co-operative and not willing to give the researcher the required information about Kaharo flooding especially in filling in the information sheets. However, the researcher got other information through observing agricultural lands affected by flooding due to heavy rains in Karehe and Kizinga villages respectively.

CHAPTER FOUR: RESULTS AND DISCUSSION OF THE FINDINGS

4.0 Introduction

This chapter gave a detailed presentation; interpretation and discussion of findings based in the order according to the objectives of the study.

4.1 Demographic Characteristics of Respondents

A total of eighty-four (84) respondents were selected for the study. The demographic characteristics evaluated in this study were age of respondents, sex, marital status, and educational level. These characteristics were selected because they influence effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

4.1.1 Sex of the Respondents

Out of 84 respondents that were selected to participate in the study, 47 % were male respondents and 37% were female respondents (Figure 4.1). The study findings indicated that the number of males was bigger than that of their female counterparts due to the fact that males participated more in the effects of flooding and conservation of agricultural lands in Kaharo Sub-County than their female counterparts. The sex of respondents was justified for this study because they helped in conservation of biodiversity and agricultural crops hence improved agricultural production and poverty reduction among households in an area.

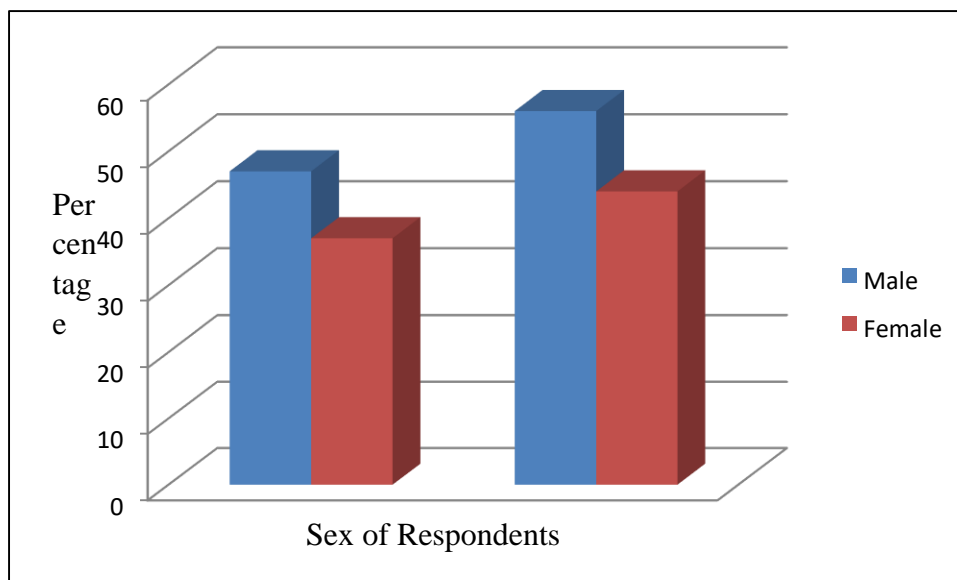


Figure 4.1: Bar graph showing the sex of the respondents

4.1.2 Age of the Respondents

As shown in figure 4.2, majority of the respondents (30%) of respondents were in the age bracket of 41-50 and 1% were aged <21 years. The researcher considered the age of respondents in order to acquire their knowledge based on their life time experience with the flooding effects on agricultural farm land at village level.

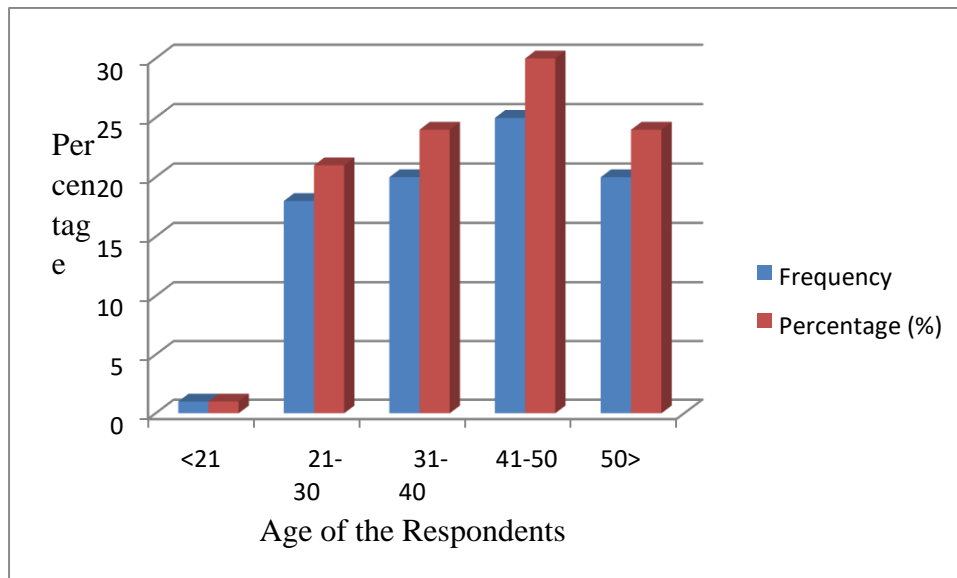


Figure 4.2: Bar graph showing Age of Respondents

4.1.3 Marital Status of the Respondents

As shown in Figure 4.3, 48% of the respondents were married whereas 7% were widows. The researcher considered the marital status of respondents in order to document justified information from categories of varying understanding in line with their day to day life time family duties and responsibilities in flooding management in the study area. The study considered the marital status of respondents due to the fact that the majority of respondents were energetic and was the ones that were involved in clearing ridges after flooding and agricultural land monitoring.

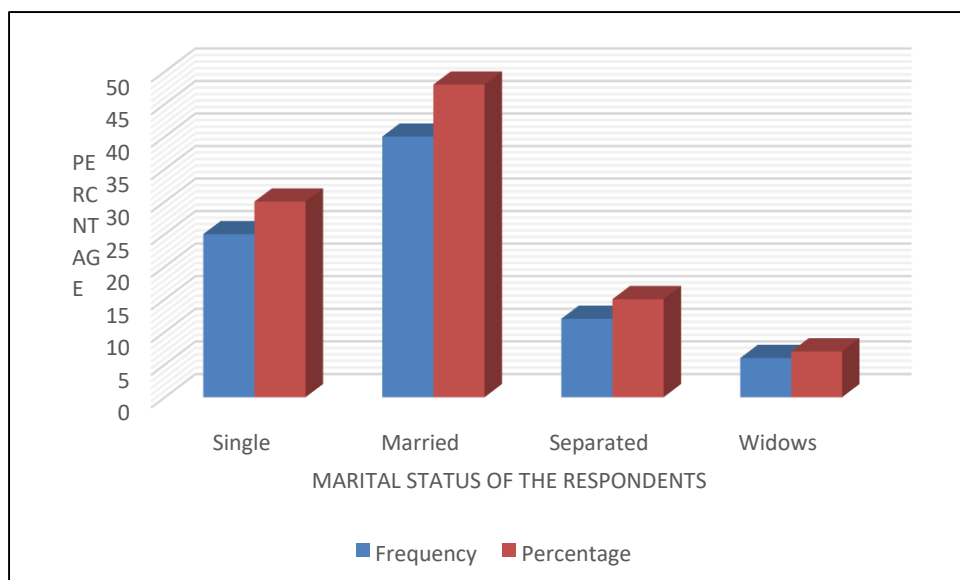


Figure 4.3: Bar graph showing the marital status of the respondents

4.1.4 Educational Levels of Respondents

As shown in Figure 4.4, 31% of the respondents had completed their ordinary level of education, followed by 26% with education level equivalent to a diploma. Only 6% of the respondents not attained formal education (Figure 4.4). The researcher main reason for considering the highest levels of education attained by respondents was to ensure that data collection tools were planned and used appropriately in reference to respondents' literacy levels. The majority of the respondents had completed secondary level. Due to this, they could adopt to better methods of farming and new technology techniques involved in wetland conservation.

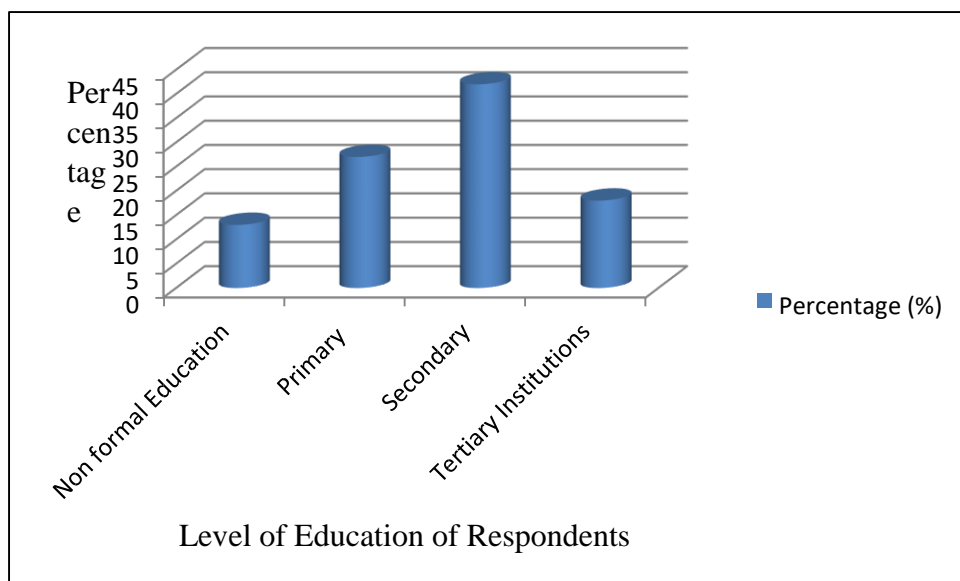


Figure 4.4: Bar Graph Showing Educational Levels of Respondents

4.2 The causes of flooding on agricultural lands in Kaharo sub county Kabale district

Table 4:1 Respondents views on the causes of flooding on agricultural lands in Kaharo sub county Kabale district

The causes of flooding on agricultural lands in Kaharo sub county Kabale district	Strongly agree		Agree		Not sure		Disagree		Strongly disagree	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Rapid urbanization	41	49	25	30	18	21	-	-	-	-
Population growth	31	37	47	56	6	7	-	-	-	-
High Rainfall Intensities	20	24	27	32	25	30	12	14	-	-
Location of settlement on flood plain	40	48	36	43	8	9	-	-	-	-
Lack of awareness and information	30	36	27	32	25	30	2	2	-	-
Poverty	32	38	28	33	18	22	6	7		
Unprotected flood areas, standing crops and livestock	31	37	23	27	30	36	-	-	-	-
Transition in cultural practices	24	28	20	24	40	48	-	-	-	-

Source: Field data

From the table 4.1 above, the study findings indicated that 41% of respondents strongly agreed with rapid urbanization in Kaharo Sub-County as the need for construction of buildings and structures for shelter and other activities as this is in line with World Bank (2008), who said that there is an increase in risk of flooding specifically where there is an intertwining in inappropriate, or inadequately maintained infrastructure, low-quality shelters and lower resilience of the urban poor, 30% agreed, 21% were not sure,

The study findings from table 4.1 above revealed that 37% of the respondents strongly agreed with population growth, 56% agreed, 7% were not sure. This means that majority of the

respondents were in agreement with statement as Kaharo Sub-County has fertile soils which supports crop growth hence increased number of people in an area. This is in line with one of the farmers from Kaharo community who said that” *the area is very populated as the soils are fertile, and with rainfall to support plant growth.*” Hence people have encroached wetlands that would act as water catchment areas causing flooding and associated problems.

The study findings revealed that 24% of the respondents strongly agreed, 32% agreed as in line with Adebayo (2012), who said that it is worth mentioning that this situation is worsened by human induced activities like bush burning and deforestation, the ground becomes saturated after a heavy downpour and the soil is rendered incapable of storing water after saturation point has been attained leading to increased surface runoff hence causing flooding on farm lands in Kaharo village Kabale District, 30% were not sure and 14 disagreed.

From study finding, 48% of the respondents strongly agree and 43% were in agreement as in line with A MMA (2014), who asserted that due to ignorance and sheer disregard of building regulations many people build haphazardly putting them at risk to the dangers of erosion and flooding. Paved roads and setting up of these buildings/shelters increases the imperviousness of the catchment areas. The catchment areas easily respond to rainfall and subsequently increase runoff.

The study findings from table 4.1 above revealed that 36% of the respondents strongly agreed with lack of awareness and information in Kabale district, 32% agreed, 30% were not sure and 2% disagreed.

From field survey conducted, results revealed that 38% of the respondents strongly agreed, 33% agreed, and 22% were not sure and 7% disagree. This implies that majority of the respondents were in agreement with the statement where one of the respondents said that” *agricultural lands especially in Ahamuremere village in Kaharo are being affected by flooding due to swamp reclamation and clearing trees for agricultural purposes hence flooding which leads to famine as people don’t have any source of income after their agricultural lands being affected by heavy rainfall.*”

From the table 4.1 above, the study results revealed that 37% of the respondents strongly agreed, 27% agreed, and 36% were not sure and none disagree. This implies that 87% of the respondents were in agreement with the statement. This is in agreement with Action Aid, (2006) which said that several buildings and structures have been constructed in flood plains

and swamps and some structures are ignorantly and dangerously built some few meters from the stream channel or even across natural watercourses hence these places are at high risk of flooding.

The study findings indicated that 28% of participants strongly agreed, 24% agreed, 48% were not sure.

4.3. The effects of flooding on agricultural lands in Kaharo sub county of Kabale district

Table 4.2: The effects of flooding on agricultural lands in Kaharo sub county of Kabale district

The effects of flooding on agricultural lands in Kaharo sub county Kabale district.	Strongly agree		Agree		Not sure		Disagree		Strongly disagree	
	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%	Freq uency	%
Damage of physical structures	45	54	39	46	-	-	-	-	-	-
Damage to crops and food supplies	41	49	37	44	6	7	-	-	-	-
Contamination of water supplies	20	24	27	32	25	30	12	14	-	-
Causalities and Loss of life	40	48	44	52	-	-	-	-	-	-
Famine	39	46	20	24	10	12	15	18	-	-

Source: Field data

The study findings indicated that 51% of participants strongly agreed with damage of physical structures, 46% agreed as in line with NEMA (2012), which said that flood disasters also have impacts, washing away, farmlands and destroyed livestock, which is an integral part of agriculture in Kabale District where agricultural lands have been washed off by the floods due to swamp reclaiming and over population.

The study results revealed that 49% of the respondents strongly agreed that flooding in Kabale district damage crops and food supplies in Kaharo Sub-County, 44% agreed as in line with Bauduceau (2004), who said that Closely related economic sectors may also be disrupted even if they are not directly impacted by the floods if harvests have been destroyed, the food

industry may suffer from a shortage depending on their capacity to find substitutes to lost harvest on markets also if a lot of farms go to bankruptcy, the food industry may have to reorganized to adapt to this new situation.

The study findings revealed that 24% of the respondents strongly agreed with contamination of water supplies, 32% agreed for example one of the local community said that “flooding contaminate river Nyabitabo and Nyakigugwe which act as source of water for domestic use and agricultural activities in are causing diseases to local residents like ring warms and death of plants in an area, 30% were not sure and 14% disagreed. This means that majority of the respondents 57 % were in agreement with contamination of water supplies.

From study finding 48% of the respondents strongly agree, 52% agree with causalities and loss of life. The researcher found out that flooding in areas of Kitare, Nyakigugwe, Nkumbura, Kizinga, and Karehe led to loss of lives and destroying farm lands.

It was also found out that 46% of the respondents strongly agreed that flooding leads to famine as it destroys all crops and farm lands in an area, 24% agreed as in line with Agwu (2009), who said that population living in poverty, any unrest or disasters such as flooding will have a huge impact especially on food security which is vulnerable to extreme events as Uganda is also very poor due to flooding problems especially in Bududa areas and Kigezi region, 12% were not sure and 18% disagreed.

4.4 The possible solutions to the effects of flooding on agricultural land in Kaharo sub county Kabale district

The researcher further asked respondents to suggest possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district. The results presented below in table 4.3 were recorded.

Table 4.3: The possible solutions to the effects of flooding on agricultural land in Kaharo sub county Kabale district

The possible solutions to the effects of flooding on agricultural land in Kaharo sub county Kabale district	Strongly agree		Agree		Not sure		Disagree		Strongly disagree	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%

Engineering Solutions	25	30	35	42	24	28	-	-	-	-
Community based natural resource management	27	32	37	44	20	24	-	-	-	-
Mass education on flooding and conservation	32	38	27	32	25	30	-	-	-	-
Wetland restoration	50	60	34	40	-	-	-	-	-	-
Early Warning Systems	32	38	22	26	30	36	-	-	-	-

Source: Field data

From the table 4.3 above, the study results revealed that 30% of participants strongly agreed with engineering Solutions, 42% agreed as in line with Duan (2009), who said that spatial planning and land use should establish and delineate areas in the community which are at risk to floods and should be avoided for residential development in areas of Nkumbura and Kizinga villages in Kaharo sub-county of Kabale District, 28% were not sure.

From the table 4.3 above, the study results revealed that 32% of the respondents strongly agreed with community based natural resource management, 44% agreed as in line with George *et al.* (2009), who mentioned that the local community is import and key since they are the ones who may wake up in the morning with a tiger or bear in their back yard. But they are also the people who can benefit the most from this, and 24% were not sure.

The study findings from table 4.3 above revealed that 36% of the respondents strongly agreed with mass education on flooding and conservation, 32% agreed as in line with Duncan (2000), who stated that climate change lectures should be given to farmers, community members, talks on radio, and primary school in educating people on the risk and consequently their compliance with policies and future warnings, 32% were not sure.

From study finding 60% of the respondents strongly agree, 40% agree with wetland restoration as in line with Khandlhela (2006), who confirmed that Halting deforestation and wetland drainage, reforesting upstream areas and restoring damaged wetlands could significantly reduce the impact of climate change on flooding, according to the conservation charity.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter contains summary, conclusions and recommendations based on analysis of the results and in the same order according to the study objectives in Kaharo Sub-county, Kabale District.

5.1 Summary of Findings

The study findings on demographic characteristics of respondents revealed that 47% of the respondents were males (Figure 4.1), 30% were aged between 41-50 years (Figure 4.2), and 69% married (Figure 4.3). Majority of respondents (31%) had completed their ordinary level of education (Figure 4.4).

Rapid urbanization, population growth and high Rainfall Intensities were the causes of flooding on agricultural lands in Kaharo sub county Kabale district reported by 49%, 56% and 32%), respectively (Table 4.1). Other causes of flooding were location of settlement on flood plain (48%), lack of awareness and information (2%), poverty (7%), unprotected flood areas, standing crops and livestock (30%) and lastly transition in cultural practices (24%).

The study findings presented revealed that 52% of the respondents noted that casualties and loss of life was the major effects of flooding on agricultural lands in Kaharo sub county Kabale district (Table 4.2), 49% of the respondents recorded that damage to crops and food supplies were the effects of flooding in an area whereas 46% of the respondents mentioned that Famine was also an effect of flooding due to destruction of crops and other agricultural lands.

The study findings presented in (Table 4.3) indicated that 60% of the respondents suggested that there should be wetland restoration in the area, the need for community based natural resource management which helps in the conservation of wetlands (44%), 38% of the respondents suggested that early warning systems should be put in place to find out different mitigation measures for conservation of agricultural lands whereas 30% of the respondents suggested that there was need for massive education.

5.2 Conclusion

Majority of respondents (56%) reported that population growth was the major causes of flooding on agricultural lands in Kaharo sub county Kabale district. Respondents revealed that high Rainfall Intensities was also the cause of flooding in Kaharo Sub-county Kabale district (Table 4.1).

It was concluded that the majority of respondents (52%) of the respondents that casualties and loss of life was the major effects of flooding on agricultural lands in Kaharo sub county Kabale district (Table 4.2).

It was also concluded that 60% of the respondents suggested that there should be wetland restoration in the area and need for community based natural resource management which helps in the conservation of wetlands (44%). (Table 4.3)

5.3 Recommendations

The following recommendations were drafted in line with study findings and objectives.

The entire community members should be given detailed information on sustainable agricultural land management since there is a need to distinguish between desire, ability and the need to relocate. This should be done by local leaders in Kaharo sub-county to make people aware of effects of flooding and control measures to ease conservation.

There should be wetland restoration in the area and community based natural resource management which helps in the conservation of wetlands. This should be done in the degraded areas and in most affected agricultural lands to ease conservation.

The government of Uganda should provide people from Kaharo sub-county with early warning systems to act as mitigation measures for conservation of agricultural lands.

5.4 Areas for further study

The study recommends the following areas for further study:

- Assessment of the effects of flooding on agricultural production in Kaharo subcounty.
- Assessing Vulnerability of Peri-Urban Areas to Floods.
- Community insurance to and property security in flood prone areas.

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Appendices

Appendix I: Questionnaire for respondents

I am **Nyakiti Dorcas Awino**; a student of Kabale University. I am doing this study as a partial fulfillment for the award of a Bachelor of Environmental science. This questionnaire

will be drafted by the researcher in exploring the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

Please answer all the questions with honesty. The information you will give is purely academic and it will be treated with a lot of confidentiality. I am requesting you to kindly participate in this study by responding to the following questions about flooding.

SECTION A: BIO DATA OF RESPONDENTS

1. Age

- a. < 20 c) 31-40
b) 21-30 d) 41-50 e) 51 >

2. Sex

- a) Female
b) Male

3. Marital Status

3. Single

4. Married

5. Separated

6. Widows

7. Highest level of Education attained

- a) Non formal Education
b) Primary
c) Secondary
d) Tertiary institutions

8. Section B: The causes of flooding on agricultural lands in Kaharo sub county of Kabale district. Please respond to the following statements on the scale provided Tick appropriately using SA- Strongly agree, A- Agree, N- Not sure, D- Disagree and SD- Strongly disagree the boxes that most closely fit your opinion

The causes of flooding on agricultural lands in Kaharo sub county of Kabale district.	SA	A	N	D	SD
Rapid urbanization					
Population growth					
High Rainfall Intensities					
Location of settlement on flood plain					
Lack of awareness and information					
Poverty					
Unprotected flood areas, standing crops and livestock					
Transition in cultural practices					

Section C: The effects of flooding on agricultural lands in Kaharo sub county of Kabale district

9. Tick appropriately using SA- Strongly agree, A- Agree, N- Not sure, D- Disagree and SD- Strongly disagree.

The effects of flooding on agricultural lands in Kaharo sub county of Kabale district	SA	A	N	D	SD
Damage of physical structures					
Damage to crops and food supplies					
Contamination of water supplies					
Causalities and Loss of life					

Famine					
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9. Section D: Possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale

	SA	A	N	D	SD
Possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale					
Engineering Solutions					
Community based natural resource management					
Mass education					
Wetland restoration					
Early Warning Systems					

Thank you for your cooperation

Appendix II Interview guide for key informants

I am **Nyakiti Dorcas Awino**; a student of Kabale University. I am doing this study as a partial fulfillment for the award of a Bachelor of Environmental science. This questionnaire will be drafted by the researcher in exploring the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda.

1. What are the causes of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?

2. What are the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?
3. What are the possible solutions to the effects of flooding on agricultural lands in Kaharo sub county of Kabale district south western Uganda?

Thank you for your cooperation

APPENDIX III: Work plan of the study

ACTIVITIES					PERIOD (2020)				
		January-March	April- May	June	July				
Proposal Writing									

Data collection and Analysis				
Dissertation compilation				
Submission				

APPENDIX IV: Study Budget

ITEM	AMOUNT (SHS)
Transport	50,000
Stationary	40,000
Typing, printing and binding	70,000
Grand total	160,000

APPENDIX V: Field Photos



