AN ASSESSMENT OF LANDSLIDES OCCURENCE AND ITS IMPLICATIONS ON LOCAL COMMUNITY IN IBANDA SUB COUNTY KASESE DISTRICT, UGANDA

BY

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A RESEARCH REPORT SUBMITTED TO THE l<'ACULTY OF t!:DUCATlON !N PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE A WARD OF A BACHELOR DEGREE OF EDUCATION OF KABALE {JNIVERSITY

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DECLARATION

I hereby declare that this research report titled ··An assessment of landslides Occurrence and its implications on Local Community in Ibanda Sub County K.asese District, Uganda" is entirely my own work and does not contain any unacknowledged work from other sources.

Signature ……..Date:27/01/2021

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11.

APPROVAL

This research proposal titled "An assessment of landslides Occurrence and its implications on Local Community in lbanda Sub County Kasese District, Uganda" has been submitted for examination with my approval as supervisor.

Signature:  **Date:** 27/01/2021

MR. AINOMUGISHA JEREMIAH

UNIVERSITY SUPERVISOR

DEDICATION

This research proposal is dedicated to the people who provided me with endless support during the period of my study both financially and guidance as well as through prayers. These are: The Almighty God, my parents Mrs. Muhindo Doing and Miss Kabugho Zaituni.

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l wish to extend my happiness to all the people who have contributed to the successful complication of this research report. My greatest thanks go to my dear supervisor Mr. Jeremiah Ainomugisha whose kindness, guidance and encouragement are important for the successful completion of this proposal.

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I also extend my heartfelt thanks to the community of Ibanda Sub-County Kasese District for all the contributions they made especially in filling the questionnaires. You really did commendable work.

Finally, I extend my thanks to my friends especially Salumu. and Sulait for their tireless support during my studies.

May God Bless you!!

LIST OF ACRONYMS/ABBREVIATIONS Soil

SOM	Organic Matter
NEMA	National Environment Authoritv
LDD	Land Development Department

TABLE OF CONTENTS

SUMMARY

This study was about landslides occurrence and its implication on local community in Ibanda Sub County, Kasese District. Thus the general objective of this study was to examine landslides occurrence and its implication on local community in Ibanda Sub County, Kasese District, Uganda. The specific objectives of the study are: to determine the main factors responsible for causing landslides; to assess the effects of landslide threat on the local community; and examine the control measures employed by farmers in landslide prone areas. This study has examined the factors causing landslides in Ibanda sub county Location targeting 120 households. A total sample of 92 farmers representing 92 households was selected. Data was presented using frequency distributed tables, bar graphs, photographs and maps from various sources. Also content analysis was analyzed using qualitative techniques. From the study findings it was established that the main factors responsible for causing landslides in Ibanda sub county Kasese district were steep gradient of slope, climate change and lack of cover vegetation. The findings revealed that, first, human activities that caused landslides include deforestation in general and removal of vegetation on slopes, specifically excavation of the toe slope, loading of the slope, defective maintenance of drainage systems, water leakages from water supply and terracing on the slopes. Second, heavy rainfall, geology, soil thickness, deep weathering, fluvial erosion of slope toe are the geomorphological factors that causes landslide in the area. Thirdly is that the socio-economic losses due to slope failures are great, ranging from destruction of infrastructure, displacement of residence, loss of property and siltation of rivers. Fourthly, the study established that farmers have adopted some responses in regard to landslides such as afforestation programmers, and adhering to warnings given by local government to re-locate to a safer ground. From the findings, the study recommends that there should be sustainable communication and education to farmers on effective ways to mitigate landslides, implementation of policies on settlements, and penalties curbing deforestation. Future researchers should investigate the influence government policies have on human activities in landslides prone areas.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Globally, Land slide occurrence is on the increase worldwide and the consequences of which can be loss of life loss of livestock, damaging or destroying residential and industrial developments, villages or even entire towns, destroying agricultural and forest land and negatively influencing the qua! ity of water in rivers and streams (Ki tutu, 201 0)

Landsides are a complex natural phenomenon that constitutes natural hazard in many countries (Brabb and Harrod, 2009). Landslides belong to a group of processes referred to as mass wasting. The term mass wasting is the downhill movement of weathered materials due to influence of gravity or the creeping/flowing/sliding of rock and weathered materials or Debris clown the slope under the influence of gravity, (Fleming, & Taylor. 2010). Types of landslides include deep-seated slides, rock slides, debris slide soil creeps. rock creep, rock slump (UNESCO/UNEP. 2008). Landslides are commonly associated with a trigger such an intense rainfall; a rapid snow melt or earth caves

The worldwide increased population and economic pressures in mountainous areas h,wc !orced human activities to shift to practices such as deforestation, urban development and agriculture into potentially hazardous region in Uganda it is reported that all mountainous areas arc either vulnerable to or currently facing serious soil erosion (Mohammad, Buttler, & Adam, 2010). It was also reported that farmer's not have incentives to undertake conservation in mountains areas of Uganda (Jakob, 2012). Due to these short-comings mountain disasters such as landsides have had significant impacts but limited interventions exist to minimize them. Landslides are caused by a combination of both natural and human related causes (Claessens. Knapen. Ki tutu. Poesen. & Seppe. 2007). Slopes north east of Puerto Rico were cleared for Agriculture resulting in gullies and landslides (Wendy, 2003). Further still Kitutu, (2010) reported that many landslides that Occurred in Nyeri district in central Kenya were caused by human activities and terracing of steep slopes. They further reported that the soils also have clay content and probably the swelling clays are another important factor in triggering landslides. In addition. Jakob, (2003). in the assessment of mass movements in Rukiga area South-Western Uganda observed that landslides

occur during peak rainy seasons of March and A pri l. Geological factors have also been found to cause mass movements on slopes and these include shallow soils over hard impermeable rocks. Landslides occur when the average shear stress of the hill slope materials becomes greater that the average shear resistance (Ki tutu, 2010)

In Uganda, degradation of slopes through soil loss clue to landslides in Bududa District which lies in eastern Uganda is a problem with fatalities, environmental consequences and food shortages in the future. During the period 1997 to 1999. landslides killed 48 people and displaced 10,000 (Ki tutu, 2004). Farmlands and infrastructure such as bridges and roads were also destroyed. The causes of landslides were in the early days dominated by speculations and myths of some mysterious animal. These myths seem to be fading away as farmers understand their surroundings better. Developing countries such as Uganda have a difficulty in spatial and temporal prediction of landslide disasters because of the high costs and technicalities involved. Therefore, the use of Indigenous Knowledge captured through farmer participatory methods could be of use if found to be in line with the scientific explanations. Tim in 2005 concluded that greater understanding of the utilisation of appropriate indigenous knowledge would improve the success of future agricultural interventions. However. despite recognition in principle that local knowledge is a valuable source, its contribution is often limited due to a general lack of understanding of what local knowledge actually is and how it can be explored.

There is a growing interest in involving the local population in technology development. Farmers' participation has been used to identify improved rice varieties in South- East Tanzania Kafiriti (2003). Similarly, these approaches can be used to involve farmers in landslide hazard assessment and management. Farmers' observations on land characteristics, climate patterns and landslide hazard areas can lead to cheaper evaluation and reduce risks especially in situations of limited financial support. According to Kirsten et al., (1982) there was close connection between farmer's assessment of landslide hazard and their land use decisions in Ibanda Valley in Kasese. Farmers are often good observers and integration of their knowledge may be essential in sustainable development. Farmers were also asked to give the impacts and losses from landslides since no official records exist. There has also been a big debate in government on whether landslides are the main cause of land scarcity or there are other causes which would guide decisions on what the best intervention would be.

Unfortunately, Landslide research efforts around the world are small relative to the economic costs of landslide damage, so the scientific and mitigation challenges are great (Crozier, 1994). The main goal for of this research is to assess the landslide occurrence and its implications on the local community in Ibanda Sub-County Kasese District.

1.2 Statement of the problem

Although it is clear that landslide have caused damage 111 the mountainous areas of Kasese District, (NEMA, 2008) their factors that influence them in the Kasese areas are still not well understood. The challenge of some of the hilly areas not affected as compared to others heavily devastated lea, es more questions to be answered on what the actual causes are. Prone areas such as Ibanda Sub County it is important for farmers to be equipped with knowledge about the natural and human factors causing landslides, the social- economic effects of landslides and mitigating responses. Government had proposed resettlement of some of the affected people to safer areas in Kamwenge District. The situation is likely to become worse because the sediment from landslide will cause siltation of river channels and lakes downstream resulting into floods and affecting more communities. This study will seek to assess the effect of landslides occurrence and its implications on local community in Ibanda Sub County Kasese district.

1.3 General objective

The general objective of the study is to determine the relationship between Landslides Occurrence and its implications on Local Community in Ibanda Sub County Kasese District, Uganda.

1.3.1 Specific objectives

1. To determine the factors responsible for causing landslides in Ibanda Sub county Kasese District Uganda
12. To establish the effects of Landslides on local community of lbanda Sub-county Kasese District in Uganda

iii. To examine the control measures employed by farmers in landslide prone areas of lbanda Sub county Kasese district Uganda.

1.4 Research Questions.

1. What are the factors responsible for landslide occurrences in Ibanda Sub county Kasese District?
11. What are the effects of land slide occurrence to the local community of Ibanda sub county Kasese district Uganda?
m. What are the measures employed to control landslide in prone areas of Ibanda sub-county Kasese district?

1.5 Scope of the Study

1.5.1 Content Scope

The study was limited to the relationship between Landslides Occurrence and its implications on Local Community in Ibanda Sub County Kasese District. Particularly, the study looked at the factors responsible for causing landslides, effects of Landslides on local community, and control measures employed by farmers in landslide prone areas of Ibanda Sub county Kasese district, Uganda.

1.5.2 Geographical Scope

The study was conducted in Ibanda Sub County in Kasese District. lbanda Sub County is located in Busongora North constituency of Kasese district. Kasese is located in the western part of Uganda being bordered by Lubirizi and Kamwenge districts in the south. DRC in the North and west and Bunyangabu district in the East. The researcher therefore intends to carry out a study in this area to establish whether there is a relationship between Landslides Occurrence and its implications on Local Community in Ibanda Sub County Kasese District, Uganda.

1.5.3 Time Scope

The study was for a period of five months that is from January to May 2020 following the relationship between Landslides Occurrence and its implications on Local Community in Ibanda Sub County Kasese District, Uganda.

1.6 Significance of the study

Landslides are very common disaster in Ibanda Sub County and other wildly areas of Uganda like Rubanda district, Bududa district, Kasese District, and Rukiga District. The devastating and

loss of lives have been well documented but not investigated to reduce the risk. Therefore. this study will avail strategies of reducing risks caused by landslide occurrence

The research will assess how landslides affect the local community. Thus the research will guide National Environment Authority (NEMA), and other interested parties to carry out appropriate actions to halt degradation of soils and develop more efficient soils conservation programmes.

The study findings will stipulate ways through which landslides can be reduced and increase productivity. This is to help farmers to harvest much from agriculture

The study findings will contribute to the available reading materials in the library for creating awareness among the users

The findings further help the district administrators like district environment officers to prepare action plans to improve local soil management and mobilize community efforts to participate in soil conservation.

The information is to help lbanda Sub County planners in practicing sustainable development that is beneficial to the people especially farmers. It will provide knowledge to the local community on the effects of landslides.

1.7 Definition of Operational Terms

Landslide refers to the movement of weathered materials, such as rocks, debris, and soil, along a downward slope clue to gravity (Hungr, 2001).

A community has been defined as a group of interacting people living in a common location. The word is often used to refer to a group that is organized around common values and is attributed with social cohesion within a shared geographical location, generally in social units larger than a household (Krhoda, 2013)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, the definition and technology given for landslides classification system, landslide Hazard, knowledge types used in production of lands! ide hazard and basic concepts and previous investigations and evaluation of the potential for debris, flows and related sediment-flows, are reviewed. Besides use of the remote sensing and geographic information system (Gis) techniques in landslide Hazard assessment are also briefly mentioned.

2.2 Factors that influence landslides in Uganda

Causes of landslides may be considered to be factors that made the slope vulnerable to failure, that predispose the slope to becoming unstable

Influence of Soil Properties: Two soil series occur in Bududa District as described Krhoda, (2013) and these are the Bududa Series which consists or red clay loams originating from the Elgon volcanics and Basement Complex colluvium with a high to medium productivity. The other is the Bubutu Series which consists of non-lateralizecl brown sanely clay loams originating from the Basement Complex granites with a medium productivity. A third series, the Bubulo Series is located in Manafwa District and consists of non-lateralized red loams and clay loams originating from the Basement Complex granites and amphibolites with a medium productivity (Krhoda, 2013).

According to Wendy, (2003), two basic types of residual soil occur at Butiriku carbonatite in Bududa. These are light grey sandy soils which are rarely more than Sm thick and the fenite complex gave rise to much finer grained, red brown soils, with a very thin A-horizon, which grades imperceptibly into an extremely thick and uniform B-horizon. The influence of soil in mass movements cannot be underestimated. Soils play a dual role because it is a by-product of the landslide process and at the same time it is an important causal factor. The most important properties in soil stability are those that influence the rate of water movement in the soils and the capacity of the soil to hold water (Wendy, 2003). These include particle size and pore distribution of the soil matrix.

Influence of Slope Steepness Relief: is a principal factor in the determination of the intensity **and** character of landslides. It has direct as well as indirect influences. Direct influences encompass slope, steepness, river valley morphology and thalweg gradients. The most important relief characteristic is the steepness, which affects the mechanism as well as the intensity of the landslides. The greater the height, steepness and convexity of slopes, the greater the volumes or **the** landslides. The stability of the slope against sliding is defined by the relationship between the shear forces and the resistance to shear. The main force responsible for mass wasting is gravity (UNESCO/UNEP, 2008). Gravity is the force that aets everywhere on the earth's surface, pulling everything in a direction toward the center of the earth. On a flat 20 surface the force of gravity acts downward and so long as the material remains on the flat surface it will not move under the force of gravity. On a slope, the force of gravity can be resolved into two components. one acting perpendicular to the slope and acting tangential to the slope.

Influence of Undercutting of Slopes: Rockslides resulting from human activities such as undercutting by roads or railroad excavations are more widespread than rockslides resulting from natural causes (Scharpe, 2008). Human activities such as construction of roads. building developments, mines and quarries, dams and reservoirs, canals, increase of groundwater levels. changes in vegetative cover, tunnels and communication systems have a great impact on the stability of the area and are seen as the major factors causing slope failures in the twentieth century (UNESCO/UNEP, 2008). These human modifications fundamentally alter hill slope stability (Larsen and Torres-Sanchez. 2008). Slope undercutting due to house construction and also foot paths cause concentrated flows which trigger landslides mostly in the western part of Bududa (Knapen, 2006).

Influence of the Geological Factors: It is believed that Mount Elgon may have been higher than Mount Kilimanjaro but the summit of Elgon collapsed into the chamber from which volcanic material had been expelled resulting in a caldera of 8 Km in diameter. It differs from the other Rift Valley volcanoes by its age, which is estimated to be at least 24 million years (Davies. 2016). In Bududa District three main lithology's can be distinguished and these are the Butiriku carbonate covering the central part which corresponds with the sub county of Bukigai. a zone of fenitised basement rocks of Precambrian age surrounding this central carbonate outcrop and the third zone with Mount Elgon agglomerates and tufls situated in the north east of Bududa District

and falling within the borders of Mount Elgon National Park. These highly weathered rocks are composed of extremely fine pyroclasts of potash feldspar and are referred to as potash ultrafenites (Reedman, 2013). There are many associations of mass movements with certain rock types (Sidle et al., 2005, UNESCO/UNEP, 2008). Hard intact rocks have strengths controlled by their internal cohesive and frictional properties. Existence of areas of weakness such as faults and joints may lead to rock failures and these are more common in granites and sandstone

Selby, 2013).

Triggering Factors: A triggering factor is an external stimulus that triggers the movement and one of the renowned triggering factors is rainfall. Rainfall is an important factor in triggering landslides. Precipitation conditions determine infiltration and run-off. Prolonged rains with a lower intensity result in a higher and deeper infiltration and lower run-off in sloping areas. On the other hand. in these regions, torrential rains increase run-off and result in a lower amount of infiltration. Nevertheless, they promote the wetting of soil along fissures which serve as natural rainwater collectors (UNESCO/UNEP, 2008; Smeclerna et al., 2003). The amount of rainfall has a considerable influence on the moisture content and the pore pressure in the soils (Ayalew. 2009). Higher moisture content can increase the specific mass of rocks by 20 to 30% and at the same time lower their shear resistance by 50% and even more, clue to increased pore-water pressure (UNESCO/UNEP, 1988). This greatly reduces shear strength and hence slope failure.

Influence of Rainfall: The climate of Mount Elgon varies a lot from its surroundings in view of geomorphologic settings. The climate is determined by the alternating moist south-westerly and dry north-easterly airstrearns. The mountain area experiences a bimodal rainfall pattern (Figure 5). The wettest period of the year is from March till October, while the dry season occurs from November till February with a short dry period around July. Rainfall is higher at the southern and western slopes (1500-2000 mm/yr) than at the eastern and northern slopes (1000-1500 mm/yr). Information from old rainfall data reveals that Bududa receives an average rainfall of 1588 mm while Bulucheke receives 1615 mm which indicates local variations. In the year 2001 six rain gauges were installed in various schools throughout the district with the aim of collecting rainfall at various locations in Bududa. However four of 24 them were vandalized and only two at Bududa S.S and Bulucheke were successful which shows the limitation of data collection in this area. The rainfall peaks for rainfall data collected by farmers compare with that from the

Department of meteorology. Information from farmers reveals that rainfall showers mostly occur in the afternoon hours while the mornings are clearer with no rains apart from some seasons of higher rainfall when it rains throughout the day. No temperature extremes exist in this region due to its location near the equator and altitudinal variations. Average maximum temperature ranges from 27 to 32C, the minimum temperature from I5 to 17%C. High cloud cover, relatively low temperatures, high rainfall and high relative humidity (76% in the morning and 57% during afternoon) contribute to low evapotranspiration (NEMA, 2007)

1.3 Effects of landslides on local community in Uganda

Landslides have an impact over the landscape have an impact over the landscape of the islands, affecting human population distribution, vegetation or stream network. Glade, (2008) although the human activity may produce landslides caused by deforestation or urban expansion (Kitutu. et..al, 2010) also, there is a relation between the revolution of the landscape and the landslides caused by the erosion of human activity and natural (Krhoda. 2013)

Fleming, (2010) explain that in Europe the contribution of the landsides m the landscape has been important in the actual relief. In the Alps different types of landslides such as rock and deboris falls and avocadoes, debris and earth flow and slides have created important slopes and a singular mountain relief. Landslides triggering factors have been affecting this area [Climate, rain events, erosion]. In calaabria [Italy] slope, extreme meteorology and geological materials on the one hand, and type and size of the landslides in the other hand have created a singular relief as well.

In Spain, there are two important areas where landslides have relevant role in the landscape: the cantebriaan cordillera and the canary, Islands. In cantabrian cordillera, the climate and geological materials are the most important factors in landslides while in canary Islands volcanic activity is in some cases, the main factors of the origin of lanclslides which produce land scope evolution ancl relief degradation. Tenerife, Lapalme and El Hierro have large valleys and slopes created during the quaternary which have created a new landscape. These geomortphological elements affect the vegetation distribution and the land occupation in these areas (Kitutu, et,,al, 2009).

Landslides affect crop production and yields in multiple ways. Physical loss of soil through erosion, leading to a decline in land productivity, this is the most visible form of degradation; its

effect is both long-term and cumulative. Critics of the concept of soil loss note that nearly 75% **of** the "eroded (detached and transported) soil is eventually deposited on another site and thus is **not** truly "lost, as it moves from one part of the landscape to another (Larson et al: 2003). This research therefore provided ways on to reduce soil erosion so as to increase crop production in

the area. **It** is the nutrient rich organic and clay particles that tend to be the soil pnrticles dislodged and carried away by erosion. This loss of soil organic matter (SOM), nutrients, and water-holding capacity causes significant qualitative changes in soils (National Agricultural Lands Study. 2009). Therefore, it may not be the decrease in depth of topsoil or sol um or to a root-restrictive layer per say that impacts yields, but rather the changes the loss of soil brings about in other soil factors, such as nutrient levels, pH, water-holding capacity, texture, infiltration rates. and SOM over time, possibly rendering agriculture unprofitable or even impossible. For example, changes in soil texture and tilt due to erosion may necessitate heavier machinery to work the soil or more passes to prepare a suitable seed bed, incrensing the risk of compnction and the formation of plow and traffic pans (Frye, 2009). This can cause delays in planting in spring as the soils remain too cold and wet to enable seedbed preparation and planting. Other effects of erosion include losses of crop stand and loss of arable land area to gully formation and landslides and crop burial by sediment deposition (Lal, 2012)

However, even if soils become less productive for one crop, they may remain highly productive for others better able to exploit adverse or resource-limiting conditions. Although erosion is the most frequently studied type of degradation affecting crop yields, the precise relationship between erosion and productivity remains unclear and difficult to quantify (Littleboy et al: 2006; Sanders, 2003). Erosion and productivity are also not independent; both are influenced by other factors (Ponzi. 2003). Moreover, the loss in productivity set in notion by accelerated cos+04 may be a self-sustaining process: Loss of production on eroded soil may further degrade its productivity (through loss of crop cover, poor stands, and reduced amount of residues returned to the soil) which, in turn, may accelerate erosion (Ponzi, 1993).

In a majority of studies that aimed at quantifying the relationship between soil erosion and productivity, yield declines were related to a loss in soil. Hoag (2008), however, concluded that soil erosion is not generally an adequate measure of productivity. The most profitable

management of a soil will depend on the quality and distribution of soil layers in the overall rooting zone. Soil substitution and mixing, as well as depth, can affecl productivity. Because soil layers are not uniform, productivity may even increase or be affected by erosion." In addition to **the** on-site effects of erosion on soil quality, the export of soil, nutrients, and pesticides may have adverse off-site effects through siltation of streams and reservoirs and damage to water quality (Loch et al; 2007).

Human activities can either aggravate or mitigate soil degradation. Mostly, though, human activities accelerate the natural derivative processes, so that the rate of soil formation is greatly outweighed by soil loss as a result of degradation.

The effects of degradation on soil resources can be grouped into two categories: those that are reversible (e.g., nutrient levels, pH, organic matter, and biological activity) and those that are irreversible given present technological and economic resources (rooting depth, water holding capacity, structure, and texture). The reversibility or irreversibility of a specific type of soil degradation depends not only on available technology. but also in most cases on economic costs and returns. For example, irrigation can mitigate a decline in water-holding capacity, but may not be economically viable in all circumstances. Results from field studies and simulation models indicate that there is a large variation in the way soil degradation affects its quality (Maetzold

and Alt, 2003).

Some soils experience consistent productivity reductions with degradation. while others suffer no loss until some critical point in one (or more) yield-determining factor(s) is reached, at which time significant yield losses occur with further degradation (Hoag, 2007). The effects *of* degradation may also vary from year to year, so that long-term degradative effects are not easily apparent. For example, eroded soils with reduced plant-available water-holding capacities and/or infiltration rates often show greater yield losses in drought years compared with un eroded soils (Shaffer, 2010: Swan et al: 2013). During years with normal or above-average rainfall. however. yields on eroded and un eroded soils may be identical.

Productivity can reflect soil erosion if yields decline with progressive erosion or if input use increases to compensate for declines in soil quality due to erosion (ERS, 2008). However, soils of poor physical quality (as measured by erosion and changes in texture and organic matter) can sometimes produce very high yields without large increases in input use (Vesterby and Krupa,

2009). Because of the emphasis on a soil's capacity to produce plants or biomass (see Section **I),** productivity is usually expressed in terms of crop yield or output per unit area over a given time period (NSE-SPRPC, 2007). Yield data are the way that farmers, policy makers, and the public typically consider agricultural production data, and they are also a basic measure of productivity **in** agricultural experiments (Tomlin and Umphrey. 2006). Crop yields are. therefore. used as the measure of productivity.

*2.4*low to reduce Landslides and increase land use productivity

More fertilizer and lime would be required to raise and maintain the soil test when erosion is allowed to occur. The greater the erosion, the more fertility that would be lost

2.4.1 Using organic manure. Soil organic matter is very important in soil fertility and productivity. Organic matter is important in physical soil structure thereby improving drainage of water, infiltration of the water into the soil, aeration and water holding capacity. Organic manure also develops much nutrients in the soil to increase fertility in the soil that promotes much attachments in the soil that makes the soil not being washed away so easily (Follet, 2009)

2.4.2 No-till farming. This can also be referred to as conservation agriculture. Madison, (2008). It leaves the soil undisturbed, allows residues on the surface of the ground to naturally decompose and build more top soil to minimize erosion. ft also makes it easier to manage weeds.

2.4.3 Planting cover crops. Mohammad. (2010) Cover crops while maintaining soil moisture also helps prevent soil erosion and puts nutrients back into the soil, keeping it fertile. more sustainable thus contributing to better harvests. These also help to reduce the high rate flow of floods especially in areas which are mountainous

2.4.4 Precision agriculture. Precision agriculture is whereby real-time data on the conditions of the crops, soil. air as well as other local weather predictions are obtained using information technology (IT). Runnels, (2005), Farmers can use mobile software applications to monitor their fields and maximize their harvests.

2.4.5 Adopting improved methods of tillage. These while including conservation tillage methods such as reduced/minimum/no tillage also include direct drilling and strip cropping.

Swan, (2013), these methods are widely recommended to protect against soil erosion and degradation of structure, creating greater aggregate stability and increasing soil organic matter.

2.4.6 Promoting agro-forestry. Agro-forestry involves the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic and social benefits. Agro-forestry reduces the need to use soil nutrients and fertilizers by improving soil quality and maintaining good nutritional balance and fertility. Zhongming. (2012).

2.4.7 Developing and applying suitable crop rotations. Bista, (2013). Crop rotation involves growing different types of crops in the same area. This is done to replenish and balance the nutrients in the soil. This helps also to reduce soil erosion, increasing soil fertility and crop

vields.

CHAPTER THREE RESEARCH METHODOLOGY

3..U Introduction

This chapter discussed the different aspects of methodology applied in this study. These duded research design, area of study, study population, sampling methods, data collection methods and instruments, data quality control data analysis and presentation, ethical issues and limitations of the study.

3.1 Research design

A research design is an arrangement of conditions for the collection and analysis of data in a format that combines their relationship with the purpose of the study to the economy of procedures (Chandran, 2004). It works as the master plan for the collection and analysis of data that aids in the answering of the research questions.

Cooper and Scheduler (2003), States that, a research design ensures that the study is relevant and applicable to the problem and its economic procedure for acquiring information. This research adopted a descriptive study design. It gathered information from Ibanda Sub-county Kasese district. The information obtained was provided in details about the natural and human factors associated with landslides and their effect in Ibanda Sub-County Kasese district Uganda.

3.2. Reconnaissance Survey

This study examined the factors associated with landslides in Ibanda Sub County, determine the impacts of landslides, and assess the adaptation strategies employed by farmers to mitigate the effects of landslides. The survey was made within the study area.

The objectives of the study was to determine the causes of landslides m Ibanda Sub County Kasese district Uganda to establish the extent of landslides threat on social economic and physical environment, and to examine adaptive responses employed by farmers in landslides prove areas;

The field reconnaissance was established to visit the area and familiarize with the geomorphology of the Sub County, take photographs, draw illustration of the observed land disturbances. The depth, length, width and slope angle of the individual landslides was measured.

3.3 Study population and sample size.

Borg and Gall, (1996) defines a sample as a small proportion of a target population selected l'or analysis. Ibanda Sub County has an area of 120 square Kilometers a target population for the study is 246 thus a population density has equal number of males and females. The number of households in the location is 120 households. The sampling frame included all farmers that constitute inhabitants of the location. In addition. the Agricultural officer, water resources management and environment Officer serving in the Sub-County will be part of the study population purposive sampling was employed, whereby first representative parishes was sampled, after which farmers was selected. Sampling in which decisions concerning the individuals to be included in the sample are taken by a researcher, based upon a variety of criteria which may include specialist-knowledge of the research issue or capacity and willingness to participate in the research

3.4 Sample Size Determination

There are several approaches to determine the sample size. These include using a census for small populations, imitating a sample size of similar studies, using published tables and applying formulas to calculate a sample size. This study applied a simplified formula provided by Yamane (1967) in order to determine the required sample size at 95% confidence level, degree of variability of= 0.5 and 5% will be considered as the margin of error

The Yamane formula for determining the sample size is given by:

$n=N/I+N(e)2$

Where

n corrected sample size, N = population size, and e = Margin of error (MoE), e = 0.05 based on the research condition.

$n=N/l+N(e)2$

$120/1 +120(0.05)2$

$120/1 + 120(0.0025)$

$120./1+0.3$

120/1.3

92.3076923076 =92 Respondents

Where n is sample size, N is the population size, and e, is the level of precision. According to the above formula, the sample size was a minimum of 92 respondents. And this research paper surveyed all the 92 respondents.

3.5 Collection of primary Data

Slopes were measured to determine angles from field visits sample of soils and rocks were collected.

3.6. Data analysis

Qualitative and quantitative data analysis techniques were used to facilitate interpretation of data.

Both secondary as well as primary data was collected and analyzed. The Secondary data was gathered from published literature was collaborated by triangulation and further interviews of key informers. The primary data on the other land was gathered from survey carried using questionnaires to establish house hold characteristics and knowledge and frequency of landslides occurrences, land use, original angle of hill slopes before landslides incidence and estimates of land slide damage.

3.7. Data collection methods

The following data collection methods were used. **3.7.1**

Questionnaire method

This is a method which was used to collect information from the field that involves drafting questions related to the study. The structure is intended to reduce bias. Questionnaires allow reducing a wider range and distribution of the sample, provide an opportunity to give frank anonymous answers and allowed greater economy of effort Amin (2005)

3.7.2 Observation method

The observation method is a research technique that involves a researcher using his/her naked eyes to see physical and man-made features plus geographical relationships related to the study and objective in the field. Activities observed include methods of farming. the nature of relief and nature of vegetation. This method aims at investigating the environment within which the respondent s operating in and to confirm data obtained through questionnaires. The researcher

referred to be non- participate where we observed the farmers from the distance to let them do **eir** work freely. It was used because it provides firsthand information to the researcher without relying on informants (Amin, 2005)

3.7.3 Interviewing method

Interviews are usually conducted face-to-face and involve one interviewer and one participant. interviewing is one of the major methods of data collection that the researcher used during data collection. Interviewing method helps in collecting data directly through face-to-face mteractions. Furthermore, an interview guide was developed in advance and in a sequence that make sense to interviewees. This was used to interact with respondents like some of the farmers who may not be in position to fill the questionnaire possibly because some may be illiterate and have no time to seat for the questionnaire. The researcher used this method to design the interview guide according to the study objectives whereby the researcher invited respondents especially those farmers to provide information to him depending on the question asked and

according to the questions in the interview guide.

3.8 Data collection instruments

The researcher obtained responses from farmers, leaders, and Ibanda agricultural Oflicer by use of various instruments as shown below.

3.8.1 Self-Administered Questionnaires (SADS)

Self-administered questionnaires (SAQs) are to obtain information from the respondents. The questionnaires are to be administered to farmers because farmers are to be many. By using the SAQs, the researcher will cover a big population in a short time.

3.8.2 Interview guide

An unstructured interview schedule which contains open-ended questions was used as a guide to obtain qualitative data from farmers who are part of household heads. The interview schedule was used because they have a high completion rate compared to other methods. Interviews also guarantee an immediate feedback. Orodho (2005) asserts that interview guides have the ability to collect a *large* amount of information in a reasonable quick space of time. Besides. the participants respond to items freely without the influence from others. This therefore encourages anonymity, honesty and frankness. This is the reason why this study used the instrument as its major instrument to collect data.

3.8.3 Observation

This is where the researcher physically observes the nature of vegetation, farming methods, **nature** of relief. Observation methods was used by the researcher to identify the causes of lane! slides

3.9 Procedures of Data Collection

An introductory letter was obtained from the Dean under graduate studies the Kabale University after approval of the proposal, copies of the letters was presented to selected villages in Ibanda Sub-county Kasese district alongside questionnaires. The researcher holder briefly discussions with respondent's end explain to them the major objectives of the research as being purely for study. The respondents filled Questionnaires on request for cooperation. Afterwards the researcher gathered one filled questionnaires and take them for analysis.

3.10 Ethical Consideration

The researcher asked for informed consent to carry out the study from all the respondents. As a primary goal of ethics in research, the researcher ensured that no one is harmed or face adverse consequences from research activities.

The ethical problem in this study was privacy and confidentiality of the respondents information. Given the role that research plays in shaping the community, the researcher was make every effort to ensure that issues are truthfully presented, and handled meticulously throughout the research process, while maintaining objectivity. The researcher from time to time was guided from the academic supervisor. Every effort was made to acknowledge sources of information that were consulted or utilized in the course of the research.

3.11 Limitations of the Study

The researcher was faced with methodological problems as in interviewing respondents, who in any case were suspicious of ill motives by the researcher. An honest, intimate relationship was then developed to overcome this by requesting respondents to advise accordingly on how he/she can be questioned.

Questionnaire retrieval, leave alone filling it, took a lot of time which delayed the who!rs-r! process. The benefits of such an exercise were explained to the respondents for easy cooperation. There was limited local literature on the phenomenon under study. The researcher utilized locc1l sources, research reports, internet, and published document in order to gather enough literature for the study.

During interviews, some respondents did not easily disclose some information which limited the amount of data collected. However, this was minimized by explaining to the respondents the purpose of the study so that they could avail enough information.

Furthermore, since the respondents were skeptical that the researcher is a student, they saw him as a government agent to assess their agricultural productivity. This skepticism is apparently based on levying different taxes and investigations. This was solved by creating a rapport between the researcher and the respondents

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter gives a detailed presentation of data as it was collected, interpretation and discussion, edited and tabulated of findings. The purpose of the study was to establish the relationship between landslides occurrences and its implications on local communities in Ibanda sub county Kasese District. The findings have been derived from the respondents obtained by the use of both primary and secondary methods of data collection through interview, questionnaire and observation. Data analysis was based on the study objectives; to determine the factors responsible for causing landslides in Ibanda Sub County Kasese District Uganda. to establish the effects of Landslides on local community of Ibanda Sub-County Kasese District in Uganda and **to** examine the control measures employed by farmers to reduce landslide in prone areas of lbanda Sub county Kasese District Uganda.

-t.2 Background information about the respondents

A number of variables pertaining to the respondent's background were considered during the study. Respondent's age, sex and level of education, status of respondents were the key variables that were explored.

4.3 Demographic characteristics

92 respondents were reached and therefore was the actual number in the field that was attended too. The researcher considered the age, sex, marital status and education levels of respondents. The biographic data was very essential for the researcher and the study in order to describe the best respondents selected for the study as presented in the table l

4.3.1 Age

Table I: Age of respondents

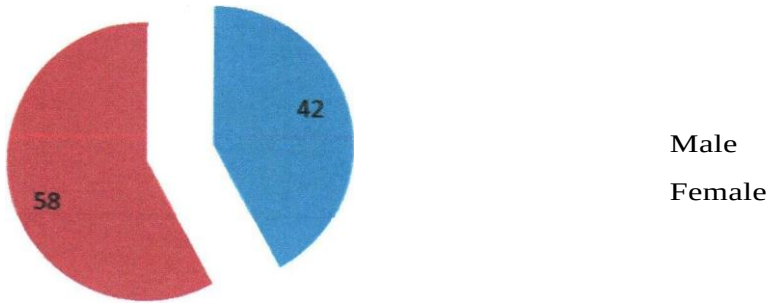
Age of respondents	Frequency	Percentage
2-29	22	24
~ - -39	26	28
-1-49	21	32
- -59	12	13
>60	11	12
Total	92	100

Source: Field research, (2020)

According to the findings in table 1 above, the researcher considered the age of respondents and the results are shown in the table 1 above which indicates that 28% was the biggest number or respondents who were between 30-39 years of age while the smallest numbers of respondents were 12% who were above 60 years of age. Other respondents included 24% who were between *20-29* years. 23% were for years between 40-49 years while 13% of respondents were for ages between 50-59 years of respondents. The above age differences gave the researcher a chance to explore the views of respondents with varying age ranges and this broad experiences on the context of the study is vivid. Household analysis revealed that most of interviewed households are headed by mature category of people implying that the respondents had enough experience on landslide related events in their localities and in relation to how landslide can influence soil productivity in the area.

4.2 Sex of respondents Figure

1: Sex of respondents



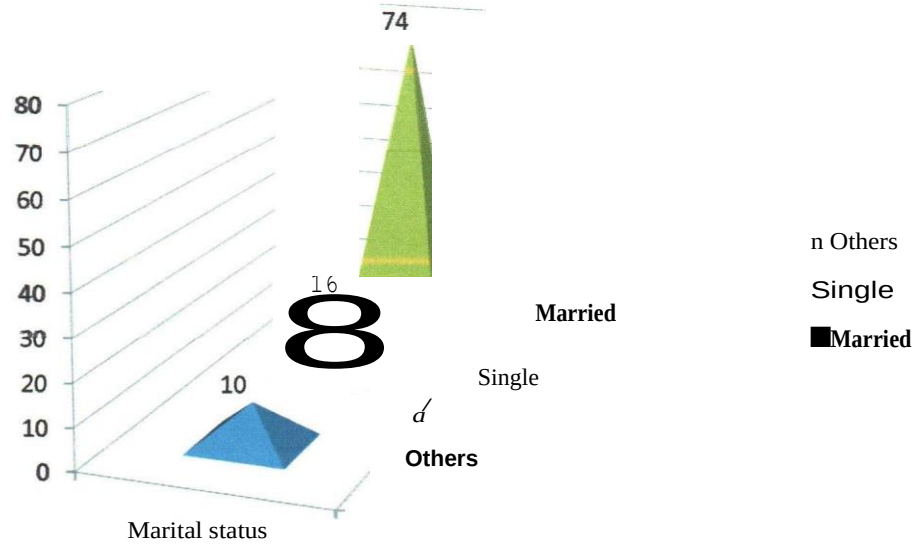
Source: Field research, (2020)

Basing on the data presented in the table above, it was found out that most respondents were females with a percentage of 58% of respondents, and males were found to have contributed by 42.4%. The researcher considered sex to ensure that there is gender balance among the respondents. Females were many compared to males because the males were not found at their homes during the time of study and in most cases in lbanda sub county, men are always found at bars than females who are always found at their homes or in garden since it was rainy season

4.3.3 Marital status of respondents

Figure 2: Marital status of respondents

13.



Source: Field research, (2020)

Basing on the results presented figure 2 above, shows that the highest number of respondents were married with 74%, the least status being the others with 10%, while single were presented with 16%. This implies that the researcher got different views from these different statuses depending on how they understand soi] erosion and land use productivity in Ibanda Kasese district, south western Uganda. Married people will understand differently the influence that landslides have on land use productivity than those who are single or separated, widowed.

4.3.4 Level of education of respondents

Table 2: Level of education of respondents

Level of education	Frequency	Percentage
Primary	**18**	20
Secondary	36	39
Tertiary	25	27
None	13	**14**
Total	**92**	100

Source: Field research, (2020)

As regards to the results presented in table 2 above, most respondents had attended to secondary schools with 39% of respondents, there were respondents who had never acquired any certificate

, ard of academic (none) with 14% of respondents, respondents who had attended to tertiary institutions were presented with 27% of respondents while 20% of respondents had completed primary level as their highest level of education. Srivastava and Jaffe, (1992), noted that access to weather information is significant for the planning of farmers' agricultural activities and improvement of their adaptive capacity. Those engaged in secondary and college education employed in parastatals, community based organizations. public works and church works. Low education level contributes largely to poverty in Kasese district due to lack of alternative ways of making their living and hence depended entirely on using natural resources. That has implications for resource use and management. According to (Van de Poe! *et al*.. 2008). in all regions of the developing world, lower income households experience drastically higher rates of pre-scholar stunting than better-off families.

4.3.5 Occupation of respondents Table 3:

Occupation of respondents

Occupation	**Frequency**	**Percentage**
On farm	79	86
Off farm	09	10
Others	04	04
Total	**92**	**100**

Source: Field research, (2020)

According to the results in table 3 above, it was identified that most respondents were those on farm with 86% of respondents, those off farm where represented by 10% of the respondents while 4% of the respondents were belonging to others(teachers, councilors. business, civil servants etc). This implies that when many people are practicing agriculture, they put a lot of pressure on land because it is being used time again which can make it to lose its fertility and hence affecting land use productivity. Therefore more sensitization is needed to the people especially in rural areas as to reduce on the rate at which they are producing to reduce on the pressure that the high population is putting on land.

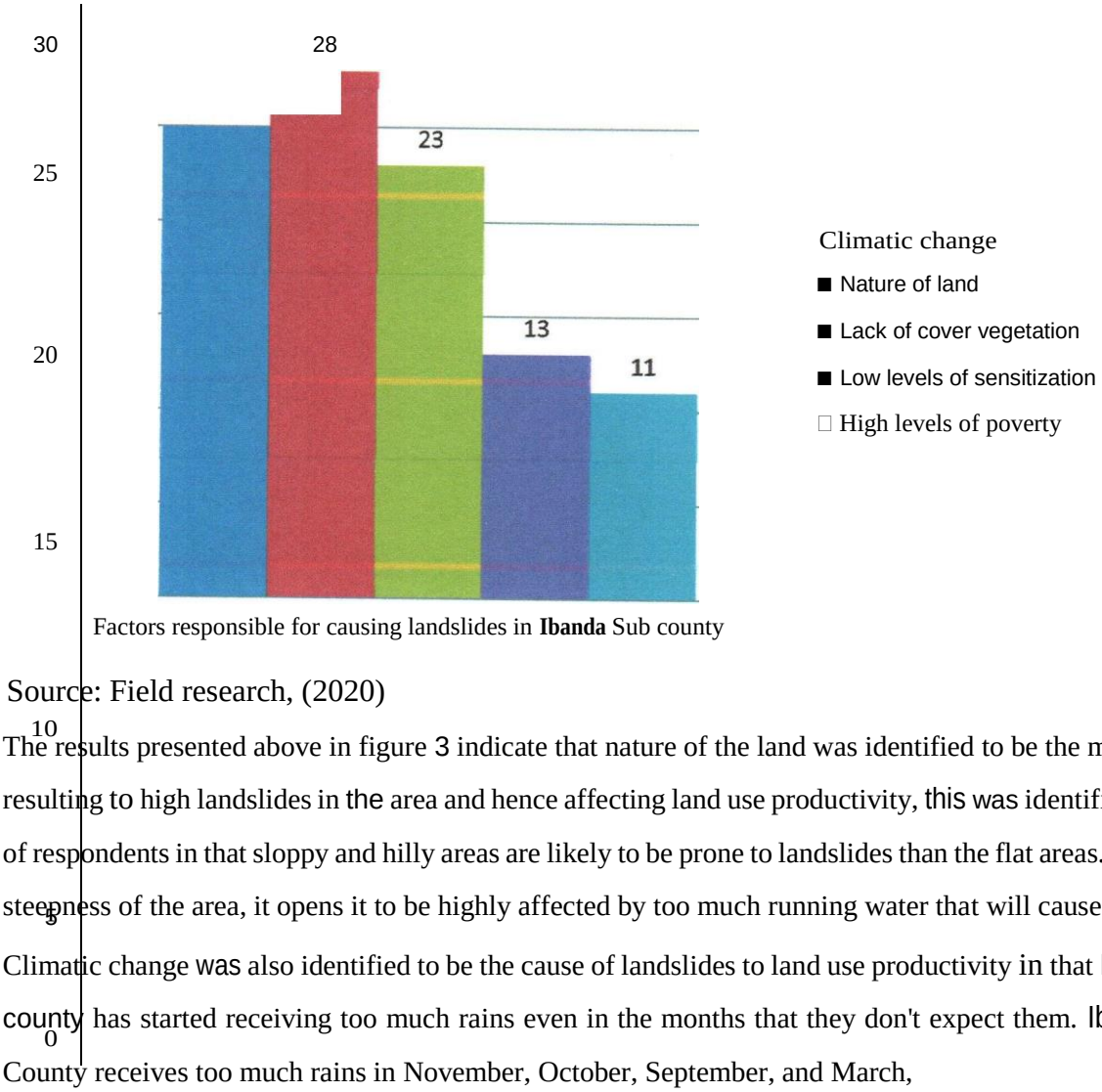
14.

4.4 Data presentation

4.4.1 Factors responsible for causing landslides in Ibanda Sub county Kasese District Uganda

To answer the objective number one of the study, the researcher sought from respondents to reveal some factors responsible for causing landslides in Ibanda Sub county Kasese District. The researcher went on to ask the respondents to some factors responsible for causing landslides in IbandaSub county Kasese District as shown in figure 3 below

Figure 3: Factors responsible for causing **landslides** in Ibanda Sub county Kasese District Uganda



Factors responsible for causing landslides in **Ibanda** Sub county

Source: Field research, (2020)

The results presented above in figure 3 indicate that nature of the land was identified to be the most factors resulting to high landslides in the area and hence affecting land use productivity, this was identified by 28% of respondents in that sloppy and hilly areas are likely to be prone to landslides than the flat areas. Due to the steepness of the area, it opens it to be highly affected by too much running water that will cause landslides Climatic change was also identified to be the cause of landslides to land use productivity in that Ibanda sub county has started receiving too much rains even in the months that they don't expect them. Ibanda Sub County receives too much rains in November, October, September, and March,

but they become surprised to receive too much rains in June and May which most farmers are not planned for this was supported by 25% of respondents

Lack of cover vegetation on the land, due to too much agriculture and other related activities like lumbering, bush burning and charcoal making has left the soil bear and making it to be affected by running water that breaks the rocks and stones hence causing landslides in Ibanda Sub County, this was supported by 23% of respondents

Low levels of sensitization in the area has contributed to landslides in the area, in that some people just cut trees because they don't know its value to the community apart from getting firewood from such trees which has led people to misuse even the hilly places hence making such areas letting to the cause of landslides. This was mentioned by 13% of respondents

High levels of poverty in Ibanda sub county has also caused landslides because most poor people are now living in hilly areas because the population has increased and therefore they have even to use the hilly areas plus the river banks hence causing too much of landslides in Butand a sub county this was also identified among the effects or soil erosion and it was supported by 11 % of respondents

4.4.2 The implications of Landslides on local community oflbanda Sub-county Kasese District in Uganda

To answer the objective number two of the study, the researcher sought from respondents to reveal some effects or implications of Landslides on local community of Ibancla Sub-county Kasese District. The researcher went on to ask the respondents to some effects of Landslides on local community of Ibanda Sub-county Kasese District in Uganda as shown in table 4

Table 4: Effects of the of Landslides on local community of Ibanda Sub-county Kasesc District in Uganda

Effects	Frequency	Percentage
Soil loss	19	21
Reduction in yields	31	34
Reduction in soil organic matter content	21	32
Changes in soil physical properties	12	13
Exposure of, and/or mixing of topsoil with, subsoil ol poorer *0)* physical, biological, and chemical properties	9	
Total	2	**100**

Source: Field research, (2020)

The results presented above in table 4 indicate that reduction in yields was identified to be the most affecting issue of landslides on land use productivity, this was identified by 34% of respondents in that after top soil have been washed away, the land production through agriculture becomes less because the soil that can support growth of plants and crops have been destroyed away due to heavy running water.

Soil loss was also identified to be the effect of landslides to land use productivity in that the top soils are washed way in rivers and the valleys which encl up being nitrous in valleys leaving the top areas with no good soil that will support of growth of crops. this was supported by 21% of respondents

Reduction in soil organic matter content that supports the growth of crops. Land use activities will not be productive if the land is lacking the organic matter that acts as fertilizers for crops this was supported by 23% of respondents

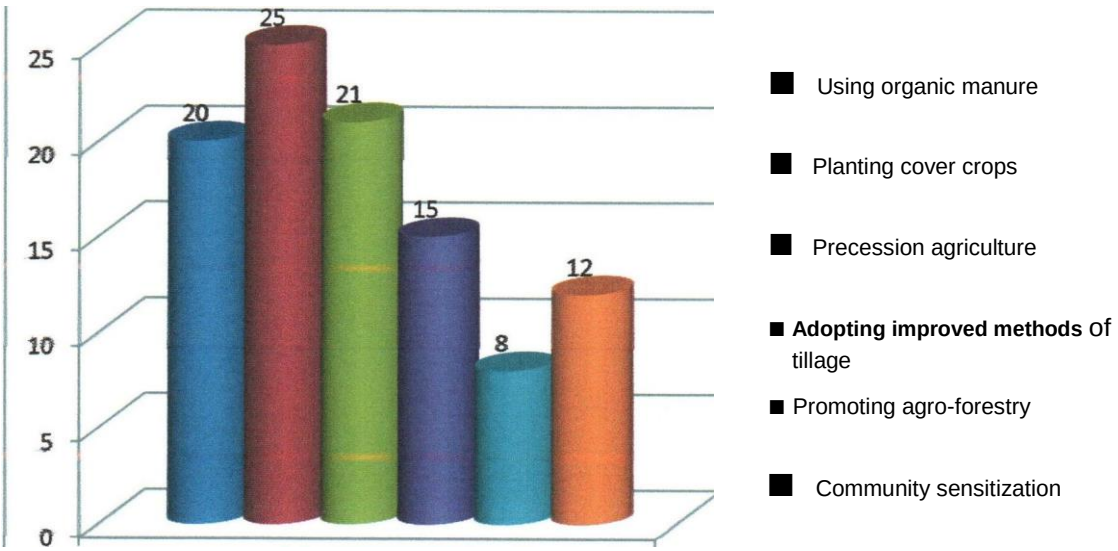
Changes in soil physical properties like creation of hills where it was not before landslides and this affects land use productivity because farmers will not use such places that are hilly and will destroy their crops when it rains again from in Ibanda in the areas of Kyanya farmers are no longer using the whole of their land because it has lost its shape and it becomes for farmers to is for agriculture. This was mentioned by 13%0f respondents

Exposure of, and/or mixing of topsoil with, subsoil of poorer physical, biological, and chemical properties this was also identified among the effects of soil erosion and it was supported by 9% of respondents

4.4.3 Measures to reduce landslides and its implication in Ibanda Sub County Kasese district

To answer the objective number three of the study, the researcher sought from respondents to reveal some remedies to reduce landslides and increasing land use productivity in Ibanda Sub County. According to this study the following was revealed to be the remedies to reduce landslides and increasing land use productivity in lbanda Sub County. The researcher went on to ask the respondents to some remedies to reduce landslides and increasing land use productivity in Ibanda Sub County as shown in the figure 4

Figure 4: Reducing landslides and increasing land use productivity in lbanda Sub County



Source: Field research, (2020)

From figure 4 above, the issue of cover crops while maintaining soil moisture also helps prevent landslides and puts nutrients back into the soil, keeping it fertile, more sustainable thus contributing to better harvests. These also help to reduce the high rate flow of floods especially in areas which are mountainous. This was reported by 25% of respondents

Some respondents of 20% of supported the issue of soil organic matter is very important in soil fertility and productivity. Organic matter is important in physical soil structure thereby

improving drainage of water, infiltration of the water into the soil, aeration and waler holding capacity. Organic manure also develops much nutrient in the soil to increase fertility in the soil that promotes much attachment in the soil that makes the soil not being washed away so easily

Precision agriculture, soil, air as well as other local weather predictions is obtained using information technology (IT). Farmers can use mobile software applications to monitor their fields and maximize their harvests, 21 % of respondents

These while including conservation tillage methods such as reduced/minimum/no tillage also include direct drilling and strip cropping. These methods are widely recommended to protect against soil erosion and degradation of structure, creating greater aggregate stability and increasing soil organic matter, 15% of respondents supported the tillage methods of soi l conservation

Agro-forestry involves the intentional integration of trees and shrubs into crop and animal farming systems to create environmental. economic and social benefits. Agro-forestry reduces the need to use soil nutrients and fertilizers by improving soil quality and maintaining good nutritional balance and fertility, 8% of respondents also supported the agro-forestry that will help in reducing the rate of soil erosion

Some respondents of 12% of also supported the issue of massive sensitization to local people on the dangers of living in hilly and mountainous s areas of Ibanda and what happen when many people are involved in cutting of trees and bushes that can cover the hilly areas so as to reduce to the rate of landslides in Ibanda sub county Kasese district.

4.5 DISCUSSJON OF FINDINGS

4.5.1 Effects of landslides on agricultural production in Ibanda Sub County Kasese District

From the results, Reduction in yields was identified to be the most affecting issue of landslides on land use productivity in that after top soil have been washed away the land production through agriculture becomes less because the soil that can support growth of plants and crops have been destroyed away due to heavy running water. These findings agree with the findings of (Littleboy et al; 2006); Sanders, (2003), although erosion is the most frequently studied type of degradation affecting crop yields, the precise relationship between landslides and productivity

remains unclear and difficult to quantify. Landslides and productivity are also not independent; both are influenced by other factors (Ponzi, 2003). Moreover, the loss in productivity set in motion by accelerated erosion may be a self-sustaining process: Loss of production on eroded soil may further degrade its productivity (through loss of crop cover, poor stands, and reduced amount of residues returned to the soil) which, in turn, may accelerate erosion (Ponzi, 1993).

From the results with some farmers, Soil loss was also identified to be the effect or soil erosion to land use productivity in that the top soils are washed way in rivers and the valleve which end up being nitrous in valleys leaving the top areas with no good soil that will support of growth of crops. These results support the results of (Larson et al; 2003), Physical loss of soil through erosion, leading to a decline in land productivity, this is the most visible form of degradation; its effect is both long-term and cumulative. Soil is eventually deposited on another site and thus is not truly "lost." as it moves from one part of the landscape to another. This research therefore will provide ways on to reduce soil erosion so as to increase crop production in the area. It is the nutrient rich organic and clay particles that tend to be the soil particles dislodged and carried away by erosion. This loss of soil organic matter (SOM) nutrients. and water-holding capacity causes significant qualitative changes in soils (National Agricultural Lands Study, 2009)

4.5.2 Reducing landslides and increasing land usc productivity in Ibanda Sub County

Soil organic matter is very important in soil fertility and productivity. Organic matter 1s important in physical soil structure thereby improving drainage of water, infiltration or the water into the soil, aeration and water holding capacity. Organic manure also develops much nutrient in the soil to increase fertility in the soil that promotes much attachment in the soil that makes the soil not being washed away so easily. Land management strategies for water in the three zones included; water conservation. Water conservation was clone through water harvesting across the three zones. The middle zone led in water conservation strategies most likely clue to availability of rocks in the zone which acted as water catchment during rains. The area also had trees and presence of stone lines which reduced surface runoff thereby increasing water infiltration. This zone was characterized by steep terrain and streams hence less use of micro-dams as water conservation strategy; these findings are in consistent with those Blanco, (2003). The lower zone had limited water conservation strategies. This was most probably because the zone was suitable for water catchment because most of the runoff from the upper zones concentrated at this zone

probably forming gullies and streams hence need for gabions to conserve water at the lower zone. This observation agreed with the findings by Johansson and Svensson, (2002). These also help to reduce the high rate flow of floods especially in areas which are mountainous

Agro-forestry involves the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic and social benefits. Agro-forestry reduces the need to use soil nutrients and fertilizers by improving soil quality and maintaining good nutritional balance and fertility. Forestry farming was mostly practiced in steep slopes across the three zones but majorly in upper zone. This implied that upper zone farmers could have high experience in reducing soil erosion and maintaining the soil structure hence being clear that their environment was well maintained. The mid-zone recorded the lowest forest cover hence was most likely suitable for crop product and other activities. Which could be attributed to low availability of water and increased land degradation clue to steep terrain hence hindering tree growth; this findings are similar to those arrived at by Morgan, (1995). Trees are commonly planted on steep slopes because of challenging terrain.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides conclusions and recommendations of the study findings. The discussion and interpretation has been presented according to research questions and in line with the study objectives. It is on the basis of the discussion and interpretation or field study findings that conclusions and recommendations are made.

5.2 Summary of findings

A total of 92 respondents were reached and therefore was the actual number in the field that was attended too. According to the findings in table l above. the researcher considered the age of respondents and the results are shown in the table 1 above which indicates that 28% was the biggest number of respondents who were between 30-39 years of age while the smallest numbers of respondents were 12% who were above 60 years of age. Other respondents included 24% who were between 20-29 years, 23% were for years between 40-49 years while 13% of respondents were for ages between 50-59 years of respondents. Basing on the data presented in the table above, it was found out that most respondents were females with a percentage of 58% of respondents, and males were found to have contributed by 42.4%. Basing on the results presented figure 2 above, shows that the highest number of respondents were married with 74%. the least status being the others with 10%, while single were presented with 16%. As regards to the results presented in table 2 above, most respondents had attended to secondary schools with 39% 0f respondents, there were respondents who had never acquired any certificate award of academic (none) with 14% of respondents, respondents who had attended to tertiary institutions were presented with 27% of respondents while 20% of respondents had completed primary level as their highest level of education. According to the results in table 3 above, it was identified that most respondents were those on farm with 86% of respondents, those off farm where represented by 10% of the respondents while 4% of the respondents were belonging to others(teachers, councilors, business, civil servants etc).

5.2.2 Factors responsible for causing landslides in lbanda Sub county Kasese District Uganda

The results presented above in figure 3 indicate that nature of the land was identified to be the most factors resulting to high landslides in the area and hence affecting land use productivity, this was identified by 28% of respondents in that sloppy and hilly areas are likely to be prone to landslides than the flat areas. Due to the steepness of the area, it opens it to be highly affected by too much running water that will cause landslides

Climatic change was also identified to be the cause of landslides to land use productivity in that Ibanda sub county has started receiving too much rains even in the months that they don't expect them. Ibanda Sub County receives too much rains in November, October, September, and March. but they become surprised to receive too much rains in lune and May which most farmers are not planned for this was supported by 25% of respondents

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5.3 CONCLUSION

From the study findings it was concluded that heavy rainfall, geology, soil thickness, weathering. steep slopes, fluvial erosion of slope toe and loading of the slope or its crest arc geomorphological factors that causes landslide in lbanda location.

The study also concluded that human activities such as excavation of the slope through road cuts, loading of the slope or its crest through establishment of settlement, water leakages from broken water pipes, terracing, and increased agricultural activities have greatly contributed to the occurrence of landslides

Further, it was concluded that landslides in Ibanda have adversely affected physical and social-economic environment through the loss of property. land degradation. destruction of infrastructure, and displacement of residents, boundary conflicts. and siltation of rivers.

The study concluded that trees have some effect on stability of slope. The trees have root systems that reduce soil moisture and lower the water table in the underground level while tree vegetation causes increased infiltration and shear stress causes root wedging. After clearing the sources are deprived of the tree roots through decomposition.

Landslides are hence commonly attributed to the loss of support from a root system. An increase in population is the continuing high rate of deforestation clue to logging, burning and development, a factor that increases landslide activity on the worlds slopes.

The findings of this paper from discussion with respondents suggest that households lose a significant percentage of their income from agriculture in the year that they are affected by a landslide. An average loss of 20% is measured for income from agriculture, while an average loss of 15% is measured for total income. These are high numbers implying that landslides have a significant impact on the livelihoods of the affected households. This is particularly relevant because most households in our sample live in a precarious situation, with 90% of the households being multidimensional poor. It should therefore not come as a surprise therefore that 64% of the affected households mention that they faced hunger after the landslide. The severity of the impact on household income is highly dependent on the percentage of the land affected by a landslide. It is therefore likely that households with more land or with many plots are more resilient towards landslides than households which have less land.

Providing more attractive and sustainable jobs outside agriculture could therefore be a way to increase the resilience towards landslides in the region. We do not find indications of increasing transfers or remittances after a landslide, suggesting that no formal or informal insurance mechanisms are present for landslides in the region. As the burden of landslides is significant and the coping strategies adopted by the households do not seem sufficient to avoid severe income losses, the development of local risk-sharing mechanisms could therefore be promoted.

5.4 RECOMMENDATIONS

Basing on the findings of the study, the research supports the following recommendations:

Encourage farmers to plant trees as means of reducing soil erosion, sediment load detachment and position as well as increasing ground water recharge.

High population in Uganda is the main driver to land pressure which consequently results in the environmental disasters and encroachment on the fragile ecosystems. Therefore, population

control should be taken as a critical intervention if the proposed restoration activities are to succeed.

To strengthen programmes that target education of the youth and enhance their vocational skills so that they can get alternative solutions when such disasters happen. This will reduce the money spent on governments and foreign experts and spend it in protecting vulnerable regions Vegetation and trees cover on landslide occurrences, several researches have shown that landslides are likely to reduce when trees are planted. Roots from trees reinforce the soil through growing across failure planes, root columns acting as piles, and through limiting surface erosion. Farmers should avoid settling in areas of high hazard. The landslide hazard map if developed should guide the resettlement plan.

The study also recommends that sustainable communication through educating the residents of Ibanda location should be the most effective way to mitigate landslides in the area.

The study also recommends that deforestation to have penalties that are answerable to the law because the trees and vegetation protect the land against soil erosion and avoid too much water accumulating underground forming water tables that weaken the ground makes it prone to landslides hence extensive a forestation programs should be practiced. In addition, engineering methods should be involved such as changes in slope geometry, control of ground pore pressure, and stabilization by building retention walls or anchoring.

Local governments should promote integrated watershed management.

Areas for further research

Farmers mentioned losses from landslides which require a detailed study on the socio-economic impacts and also the downstream impacts on the communities downstream and also the impacts on the siltation of wetlands which may lead to flooding. Rainfall induced soil erosion and shallow landslides are the main sources of sediment supply in hilly catchments.

Population has been identified as one of the main drivers to land pressure which results in settlements in areas of high hazard. There is need to carry out in-depth studies to understand the main factors that contribute to this increased population growth

The researcher recommends that policies should be developed m landslides prone areas in the protection of lives and livelihoods in Uganda.

Finally the researcher recommends that future researchers should investigate on the influence government policies has on human activities causing landslides in prone areas.

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APPENDICES

Appendix I: QUESTIONNAIRE FOR FARMERS

Dear sir/madam

Im Agaba Chris a student of Kabale University carrying out a research on an assessment of landslides Occurrence and its implications on Local Community in Ibanda Sub County Kasese District, Uganda. The research is a partial fulfillment of a Bachelors degree with Education. You have been chosen randomly and your participation is entirely voluntary. I request you to answer the following questions as honestly as possible. There is no need of disclosing your name, all information given will be treated with utmost confidentiality and only used for purposes of this study. The exercise should last for two hours and 1 shall collect the selfadministered questionnaires myself.

Thank you.

Section A: demographic data

l. a. Male () b. Female ()

2. Age/ Years a. 20-29 () b. 30-39 0c. 40-49)d. 50-59)e. Over 60)

3. Marital status: a. Single () b. Married ( ) c. others ( )

4. **Level of education:** Primary school () Secondary () Tertiary college () bachelor degree () Post graduate degree ( ) No education ()

5. Occupation activities you are involved

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6. List down the natural causes of landslides in Ibanda Sub-county

.....

.....

7. List down the factors associated with lands I ides.

.....

.....

8. What are the impacts of landslides to the local community?

……

……

9. What are the strategies employed by the farmers to mitigate the effects of landslides in Ibanda Sub County

……

……

Thank you so very Much

APPENDIX HI: OBSERVATION CHECK LIST

1. Activities involved in the area
2. List down the natural causes of landslides in lbanda Sub-county
3. List down the factors associated with landslides.
4. What are the impacts of landslides to the local community?
5. What are the strategies employed by the farmers to mitigate the effects of landslides.

Appendix IHI: INTERVIEW GUIDE FOR SOME HOUSEHOLD HEADS Section

A: demographic data

1. a. Male () b. Female ()
2. Age/ Years a. 20-29() b. 30-39 () c. 40-49() d. 50-59)e. Over 60()
3. Marital status: a. Single () b. Married () c. others ()
4. **Level of education:**

Primary school () Secondary () Tertiary college () bachelor degree () Post graduate degree () No education ()

5. Occupation activities you are involved
6. List down the natural causes of landslides in Ibanda Sub-county
7. List down the factors associated with landslides.
8. What are the impacts of landslides to the local community?
9. What are the strategies employed by the farmers to mitigate the effects of landslides.

Thank you so very Much