

BUSITEMA UNIVERSITY

Faculty of Natural Resources and Environmental sciences

Department of Natural Resource Economics

**Economic and Livelihood Impacts and Coping Mechanisms to Landslides
that Previously Occurred in Nametesi Parish, Bukalasi Sub-county,
Bududa District, Eastern of Uganda**

By

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**A research dissertation report submitted in the partial fulfilment of the
requirement of the award of the degree of Bachelor of Science in Natural
Resource Economics of Busitema University**

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DECLARATION

I, **WAKALANGA SULAYI** do hereby declare that this research work has been through my own efforts and never has it been submitted to Busitema University or any other Institution of higher learning for the award of a degree or any other qualification.


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APPROVAL

This serves to certify that KAKALANGA SUWAYI-----
did research that I had the pleasure to supervise. I confirm that this report is a true
representation of the findings in it.

I am therefore recommending that the report be submitted to the Faculty of Natural
Resources and Environmental Sciences of Busitema University.



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DEDICATION

I dedicate this research report to my dear parents, Mr. Busiku Rashid and Mrs Busiku Aisha for their support in educating, guiding and encouraging me throughout my education career. To my beloved Uncle Mr Musimbi Richard, my grandmother Mrs watenga Iren and finally to my course mates who also worked tirelessly to ensure that I attain academic excellence in Busitema University

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TABLE OF CONTENTS

DECLARATION	i
APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
ABSTRACT	xi
ACRONYMS AND ABBREVIATIONS	xiii
CHAPTER ONE: GENERAL INTRODUCTION	14
1.2. Background	16
1.3. Problem statement	18
1.4 Objectives of research.....	18
1.4.1 General objective	18
1.4.2 Specific objective.....	19
1.5. Hypotheses.....	19
1.6, Research questions	19
1.7. Significance or importance of the study	19
1.8. Justification	20
1.9. Scope.....	20
1.9.1. Time of the scope.....	21
1.10. Limitation of the study	21
CHAPTER-II: LITERATURE REVIEW	22
2.1. Introduction	22
2.2. Causes of landslides.....	23
2.2.1. Rain fall as factor.....	24
2.2.2. Soil type.....	24
2.2.4. Human activities.....	24
2.3. Losses caused by landslides	25
2.3.1. Loss of farm lands and crops.....	26
2.3.2. Loss of human life	27
2.3.3 Displacement of people	28
2.3.4. Destruction of infrastructure	28

2.4 Estimation of the losses	29
CHAPTER-III: MATERIALS AND METHODS	31
3.1. Introduction	31
3.2. Research designs.....	31
3.3. Study area	31
3.4. Sample size and sampling techniques.....	33
3.4.1. Study population.....	33
3.4.2. Sample size.....	33
3.4.3. Sampling techniques.....	33
3.5. Methods of data collection.....	33
3.5.1. Data collection	33
3.5.2 Individual observation.....	34
3.5.3. In depth interviews	34
3.5.4 Secondary Data collection.....	34
3.6. Data collection tools.....	35
3.7. Data processing and analysis.....	35
3.8. Ethical considerations	35
CHAPTER FOUR: RESULTS.....	36
4.1. Introduction	36
4.2. Socio-economic professional and demographic characteristics of the respondents.....	36
4.2.1. Gender of respondents	40
4.2.2. Age and Time of stay of the respondents.....	40
4.2.3. Marital status of the respondents.....	40
4.2.4. Educational level.....	40
4.2.5 Activities of the respondents.....	41
4.2.6. Occupation level.....	48
4.2.7. Monthly income of the respondents	49
4.2.8. Amount from agriculture	49
4.2.9. Source of income	49
4.2.10. Map land uses by the respondents.....	50
4.2.11. Did landslides occur and the common village.....	50
4.2.12. Distance from the previous landslides.....	50
4.3. Causes of landslides.....	52
4.3.1. Rain fall.....	52

4.3.2. Over Cultivation	52
4.3.3. Soil type and the Nature of the area	53
4.3.4. Deforestation	53
4.4. Losses from landslides	55
4.4.1. Losses to humans	55
4.4.2. Losses to households	58
4.5. Estimation of the loses from landslides	63
4.5.1. Estimated loss of human lives	63
4.5.2. Estimated households loss	63
4.5.3. Estimated community losses	67
4.6 Climate change perception due to landslides occurrence	69
4.6.1. Respondent's views about landslides impact on the climate	70
4.6.2. Respondent's views about how landslides have impacted on the climate	70
4.6.3. Respondent's perception about the season when landslides happen	71
4.6. Respondent's perception about the causes of landslides	73
4.7. Respondent's perception about the mitigation mechanisms	74
4.8. Correlations	75
4.9. Determinants of knowledge of landslide causes: Econometric models	76
4.9.1. Knowledge of the respondents about the causes of landslides	76
4.9.2. Knowledge of proposed mitigation measures	77
CHAPTER-V: DISCUSSION	85
5.1. Introduction	85
5.2. General discussion	85
5.2.1. Socio-economic professional and demographic characteristics of the respondents	85
From the study, the majority of the people were male and the female were few with 69.8% than the female that were 31.2%. The village with the highest percentage of the male was Namansaya with 90.9% and that with the lowest percentage was Kubewo with 33.33%, the village with the highest female was Kubewo with 66.7% and that with the lowest percentage was Namasaya with 9.1%	85
This is because most of the male are born and inherit the property of their parents like land where they build their houses and start up their life there which is not the case to their female counter parts. This influences them to stay in those areas for their life span than the women who get married in other areas. In the parish they are more males than women because they males can get adapted to situation easily than female counter parts that fear.	85
5.2.2. Causes of landslides	89
5.2.2.1. Rain fall	89

5.2.2.2. Over Cultivation	90
5.2.2.3. Soil type and the Nature of the area.....	91
4.3.4. Deforestation	91
5.2.3. Losses from landslides	92
5.2.3.1. Losses to humans.....	92
5.2.3.1. Losses to households.....	94
5.2.3.2. Community losses	97
5.2.4. Estimation of the loses from landslides	99
5.2.4.1. Estimated loss of human lives.....	99
5.2.4.2. Estimated households loss.....	100
5.2.4.3. Estimated community losses	102
5.2.5 Respondent's perception about climate change due to landslides occurrence.....	103
5.2.5.1 Respondent's views about landslides impact on the climate	103
5.2.5.2 Respondent's views about how landslides have impacted on the climate	104
5.2.5.3 Respondent's perception about the season when landslides happen	104
5.2.6 Farmers perception about the landslides	105
5.2.6. Mitigation measures	107
5.3 Conclusion	108
5.4. Recommendations	109
5.5. Areas of future research	109
REFERENCES	110
APPENDIX 1: Questionnaire	113
APPENDIX 2: Survey photos	117
APPENDIX 3: Matrices of Correlation.....	118

LIST OF TABLES

Table 1: The Socio-economic professional and demographic characteristics of the respondents in Nametsi parish, Bududa district, Eastern Uganda.....	37
Table 2: Numbers of livestock owned, food crop produced each year per household.....	41
Table 3: The time of stay, age (years), monthly income (USD (\$), how far (km) of the respondents..	51
Table 4: Community perception (Knowledge) about the causes of landslides in Nametsi parish.....	54
Table 5: Respondent's views about the human loses (Numbers, quantity).....	56
Table 6: Community perception about the losses of forests (ha), agricultural land (ha), food crops (kgs), cash crops (kgs), livestock (nbr), house (nbr), pulping machine, batteries, solar panels, sewing machine.....	60
Table 7: Respondent's estimates of house hold losses (loss of forests lost (ha), agricultural land lost (ha), food crops (kgs), cash crops (kgs), livestock (nbr), poultry (nbr), sewing machine, pulping machine, solar panels and maize milling machine, batteries).....	64
Table 8: Respondent's views about the climate change due to landslides, how the climate has changed and the season when the landslides happen.....	69
Table 9: Respondent's perception about the causes and Mitigation of the causes of landslides in Nametsi parish.....	72
Table 10: Generalised Linear Model (GLM: Gaussian linear Model) to investigate the factors likely determining the causes of landslides that occurred in Nametsi parish in the previous years.....	79
Table 11: Generalised Linear Model (GLM: Gaussian Log Model) to investigate the factors determining the causes of landslides in Nametsi parish.....	80
Table 12: Generalised Linear Model (GLM: Gaussian Identity Model) to investigate the factors determining the mitigation measures against prevention of landslides occurrence in Nametsi parish.....	81
Table 13: Generalised Linear Model (GLM: Gaussian log Model) to investigate the factors determining the mitigation measures against prevention of landslides occurrence in Nametsi parish.....	82
Table 14: Generalised Linear Model (GLM: Gaussian Poisson Identity Model) to investigate the factors determining the mitigation measures against prevention of landslides occurrence in Nametsi parish.....	83
Table 15: Generalised Linear Model (GLM: Gaussian Poisson log Model) to investigate the factors determining the mitigation measures against prevention of landslides occurrence in Nametsi parish.....	84

ABSTRACT

Landslides are the most frequent and diffuse natural hazards and, as a result of earth quakes causing the highest number of fatalities and damage to both rural and urban areas. Nametsi parish having experienced major landslides in previous years which caused many losses and injuries, affecting the livelihood activities like the destruction of farm lands and infrastructure such as roads and bridges, this study therefore is set to assess the socio economic impacts of landslides on livelihood of the people in Nametsi parish, Bukalasi sub county, Bududa district. A sample of 7 villages; Kubewo, Nametsi, Mabale, Monyi, Ukha, and Namansaya was considered as the sample area using the simple random sampling method. Open and closed ended questionnaire and interview approaches were used to obtain primary data and Econometric models were used to test the significance of the relationships between different variables. Rain fall (100%) was found to be the major triggering factor of landslides. Besides rainfall, the other factors were deforestation, nature of the area and soil type. Among the house hold losses, loss of lives and the displacement of the people with the children with a mean of 143.17 being the majority was a major loss faced though it was difficult to estimate since it could not be valued in monetary terms as also expressed by Kitutu et al. 2010. Loss of farm land agricultural fields with a mean of 7.69 hectares was another impact suffered. In monetary terms, the loss value of bananas was 301 and 633 USD and coffee was 978 and 1756 USD crops was the highest in Kubewo and Ukha villages respectively. The loss of the community hospital (Nametsi health centre II) was the major community loss suffered. The people didn't individually identify the damage to environment and infrastructure such as roads as a problem. Using the Gaussian linear models, the Gaussian identical model and Gaussian log model were used to test for the significance of the a person's knowledge about the causes and the mitigation measures of the landslides and it was found that independent variables as; village of stay, time of stay in that village, distance a person stays to the landslides event and house hold loss suffered to be significant ($P < 0.05$). Correlations between livelihood activities with demographic, environmental and health variables of communities living near by the landslides events were tested and it was found that Number of people in the house hold was negatively correlated to estimated losses (%) of properties due to landslides ($r = -0.245$, $P < 0.05$) and land owned is positively correlated to the number of people in the house hold ($r = 0.444$, $P < 0.001$). Therefore, I recommend planting of trees and resettlement schemes in the flatter areas within the vicinity of Bududa district which permits easy access of the affected to their agricultural land. Additionally, the people should be acutely sensitized

about the causes of landslides and how effectively they can adapt to them so that they can have in addition to the local ideas scientific familiarity to the event.

Key words: Causes of landslides, Landslide losses, Estimation of Losses, Namesti Parish.

ACRONYMS AND ABBREVIATIONS

NEMA	: National Environmental Management Authority
UNEP	: United Nations Environmental Program
IAEG	: International Association for Engineering Geology and the Environment
CRED	: Centre for research on the Epidemiology of Disasters
NGOs	: None Government Organisations
CBOs	: Community Based Organisation
LCs	: Local council
e.g.	: For example
OPM	: Office of the Prime Minister
CRED	: Centre for research on the Epidemiology of Disasters
IAEG	: International Association for Engineering Geology and environment
USD	: United States Dollar
Nbr	: Number
Kgs	kilogram

CHAPTER ONE: GENERAL INTRODUCTION

The term 'landslides' includes all varieties of mass movements of hill slopes and can be defined as the downward and outward movement of slope forming materials composed of rocks, soils, artificial fills or combination of these materials along surfaces of separation by falling, sliding and flowing, either slowly or quickly from one place to another. Although the landslides are primarily associated with mountainous terrains, they can also occur in areas where activities such as surface excavations, buildings and open pit mines take place (Kato and Mutonyi 2011).

Landslide hazard refers to the natural conditions of an area potentially subject to slope movements. It is defined as the probability of occurrence of a landslide of a given magnitude, in pre-defined period of time, and a given area (varnes and IAEG 1984). The definition incorporates the concepts of spatial location ("where"), magnitude or intensity ("how large"), and frequency of occurrence ("when, or" how often").

Many factors contribute to landslides including geology, gravity, weather, groundwater, wave action, and human actions. In hilly and coastal areas of the world, landslides have been one of the major natural disasters that strike life and property almost perennially. It has brought untold misery to human settlements as well as serious damages to the transportation and communication infrastructures. Major landslides catastrophes in the 20th Century include the following: in 1919, Indonesia, Kalut volcano erupted sending volcanic mudflows over 185Km² destroying 104 villages and killing 5110 people; in 1920, China (Ningxia), earthquake caused 675 landslides that killed 100000 people and created 40 lakes, in 1967, Brazil (Serra das araras), heavy rains caused landslides killing 1,000 people and in 1998 in Honduras, Guatemala, Nicaragua and El Salvador, hurricane Mitch caused landslides, floods, debris-flows killing approximately 10,000 people (Martínez et al. 2001).

Although mass movements are recognized and well-studied geomorphic hazard due to their major role in the development of hill slope in mountainous areas and their considerable economic and social consequences (Sidel et al. 1985), information on the land slides in the East Africa highlands is rather limited (Ngecu and Mathu 1999). Never the less, mass movements have been report in few notable literature examples: Kenya (Ngecu and Ichang 1998, Ngecu and Mathu 1999, Inganga et al.2001). Uganda (Mwanga et al. 2001) Rwanda (Moeyersons 2003) and Tanzania (Rapp et al.1972, Christuansson & Westerbrg et al. 1999) East African highlands are noted as a very heterogeneous region but have high vulnerability

REFERENCES

- Kitutu M G , Muwanga A, Poesen J, Deckers JA(2011) Farmers perception on landslide occurrences in Bududa District, Eastern Uganda. *Africa journal of Agricultural Research* 6 (1):7-18.
- Varnes DJ, The international Association of Engineering Geology (IAEG) commission on landslides and other mass movements on slopes (1984), landslide hazard zonation: A review of principles and practice, 2, 108, PP:45
- NEMA (2008) State of Environment Report for Uganda 2008. National Environment Management Authority (NEMA), Kampala. The National Policy for Disaster preparedness and Management for Uganda (2010) , PP:121-145.
- Knapen A, Kitutu MG, Poesen J, Breuelmans W, Deckers J, Muwanga A (2006) Landslides in densely populated county at the foot slopes of Mount Elgon (Uganda): characteristics and causal factors. *Geomorphology* 73: 149-165.
- Kato and Mutonyi (2011) The challenges of managing increasing landslides vulnerability in Mount Elgon ecosystem: A case of human interactions with its Environment on the verge of collapsing. PP: 32-38
- Martinez C, Jorge E, Montero (2001). Proceedings of the Third Panamerican symposium on landslides, July29 to august 3, 2001, Cartagena Colombia , pp: 45-55
- Glade T, Crozier MJ (2004) The nature of landslide hazard impact. In glade, T., Anderson, M., Cozier, M. (Eds.) *Landslide hazard and risk*, pp:43-74
- Claessens, Knapen, Kitutu, Poesen , Deckers (2007) Modelling landslide hazard, soil redistribution and sediment yield of landslides on the Ugandan foot slopes of Mount Elgon, *Geomorphology* 90:23-35.
- Ngeeu WM, Nyamai CM, Erima G (2004) The extent and significance of mass movements in Eastern Africa: case studies of major landslides in Uganda and Kenya. 40, P15
- Schuster RL, Highland LM (2001) Socio Economic and environmental impacts of landslides in western hemisphere. P36

- Mugagga F, Kakembo V, Buyinza M (2012)** Land use changes on the slopes of Mount Elgon and the implications for the occurrence of landslides,
- Fausto Guzzetti, Alberto Carrara, Mauro Cardinali, Paola Reichenbach (1999)** Landslide hazard evaluation: a review of current techniques and their application in multi-scale study, Central Italy.
- NEMA (2010) State of Environment report for Uganda 2010. National Environment Management Authority (NEMA) Kampala., P34
- O. petrucchi and Gulla (2009)**, A support Analysis framework for mass movement damage assessment: applications to case studies in Calabria (Italy)
- DM Policy revised, MIDIMAR 2012.
- NEMA (2010, landslides in Bududa District, their causes and consequence
- Mugagga F, Kakembo V, Buyinza M (2012)**, Land use changes on the slopes of Mount Elgon and the implications for the occurrence of landslides. Climate data – Field Reports : like weather stations of Mbale and Bulambuli then rain fall: predicted data from AMIST. P35-50
- Yukni Arifianti, Sukahar Eka Adi Saputra, Arne Hoffman –rothe, and Bianca Pischke (2011)** Landslide Risk assessment in Earthquake prone Area at kabupaten Ende, Indonesia.
- Aryamanya-Mugisha H (2001)** State of the environment report for Uganda 2000/2001, Technical Report, National Environment Management Authority Uganda, Kampala, Uganda
- Westerberg LO, Christiansson C (1998)** Landslides in East African Highlands. Slope instability and its interrelations with landscape characteristics and land use. *Advances in GeoEcology* 31: 317–325.
- Christiansson C, Westerberg LO (1999)** Highlands in East Africa: unstable slopes, unstable environments. *Ambio* 18: 419–429.
- Westerberg L (1996)** Landslide as a consequence of natural conditions and human activities. Case studies in Nyandaura Ranges, Central Kenya, EDSU Working paper 34, Department of Physical geography, Stockholm University, p. 23.
- Kitutu KMG (2004)** Local perception of landslide problems in Manjiya County, Mbale District, Eastern Uganda, Mountain Ecosystems, Resources and Development in

Uganda, a publication of Mountain Resource Centre, Department of Geography, Makerere University, (2004), ISBN 9970-05-017-6, 187 p. 94-98

Ayalew L (1999) The effect of seasonal rainfall on landslides in the highlands of Ethiopia. *Bull. Eng. Geol. Env.* **58**: 9-19.

Claudio Campobasso, Giuseppe Delmonacco, Barbara Dessi, Pierluigi Gallozi, Domenico Ligato, Benedetto Porfida, Daniele Spizzichino, Francesco Traversa, and Giorgio Vizzini (2011), (WLF2- Risk management in Multi-hazard environment L28) long term strategies and policies for landslide risk mitigation in Italy: the ReNDiS project Bulambuli District landslide report by NEMA, 30TH August 2011.