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**FACULTY OF ENGINEERING**  
**DEPARTMENT OF WATER RESOURCES AND MINING**  
**ENGINEERING**  
**FINAL YEAR PROJECT REPORT**  
**APPLICATION OF GIS IN ASSESSMENT OF SOIL EROSION RISK**

(Case study: Mbale district)

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**BU/UP/2013/301**



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*A final year project report submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Water Resources Engineering.*

May 2017

**ABSTRACT**

Land degradation has already been treated as one of the most serious problem all around the world. Soil erosion is defined as the physical degradation of the landscape over time. The process is initiated when soil particles are detached from its original configuration by erosive forces such as rainfall. The soil particles may then be transported by overland flow into nearby rivers and oceans. Current developments in geographic information systems (GIS) make it possible to model complex spatial information. A GIS is used in this project to determine soil erosion rate and risk throughout a watershed. Hydrological data is also analyzed to give some understanding of the watershed response to the primary erosive input: rainfall. The goals of this research project is to obtain the erosion rate from the model and erosion risk area of the catchment. This study is a GIS-based to study which devotes to calculate annual soil loss value and erosion risk, seek for soil erosion trends linked with precipitation and land use in Mbale district, on Mount Elgon region, Uganda. Revised Universal Soil loss Equation (RUSLE) is implemented in the application to obtain the erosion risk in the catchment. The modeling is carried out for the years and is based on ASTER remotely sensed data, digital elevation models, precipitation data from the study area, as well as existing soil maps from DSMW. Over exploitation of land is probably compensated by improved agricultural management and no significant increase in precipitation. Even if there are reports of more intense and increasing amounts of rainfall in the area, this could not be verified, neither through analysis of climate data, nor by trends in estimated soil erosion risk and rate.

The predicted surface soil erosion in Mbale catchment mostly depends on the slope conditions and precipitation records while the major easily manageable factors are the conservation and cover management factors on the land.

**Key words: ArcGIS, RUSLE, and soil erosion**

## DEDICATION

This piece of work is dedicated God Almighty and those who supported me on my journey to complete this level of my education especially my brothers who have worked sacrificially and tirelessly to ensure I attain education.

**DECLARATION**

Except where otherwise stated, I hereby declare that this piece of work is my own original work and has never been submitted wholly or partially to any University or institution of higher learning for any award whatsoever.

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**APPROVAL**

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## ACKNOWLEDGMENT

First and foremost, I would like to extend my sincere gratitude to the Almighty God for His unlimited grace and love bestowed upon my life.

In a special way, I would like also to thank my supervisors Mr. Mugisha Moses and Eng. Badaza Mohammed for the advice, guidance and encouragement offered throughout the study.

I would like to thank the staff in the department of Mining and Water Resources Engineering and other lecturers for their guidance and assistance during the project research.

I owe sincere thanks to Staff of Mbale district who blessed me with the opportunity to carry out my research project from there place and also the help they accorded to me during times of need, May God bless you all.

I appreciate my brothers Adenga Jimmy and Okello Robert and others for their guidance and financial support they rendered to me. May the Almighty God bless the works of their hands!

Grate appreciation goes to Mr. Ojuka Alex MWE Lira, Maximó MWE Mbale and Faima DWRM Entabbe for their time and information on the required data and help on the GIS software and other tools.

Last but undoubtedly not least, I would also like to express my appreciation to my friends Steven, Allan, Consolate, Felister, Agatha, Shallon, Godwin, Obadiah and other colleagues for the moral and physical support given to me in my endeavors to complete this piece of work. May the good Lord bless and reward them with success.

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## List of acronyms

USLE	Universal Soil Loss Equation
RUSLE	Revised Universal Soil Loss Equation
MULE	Modified Universal Soil Loss Equation
GIS	Geographical Information Systems
DEM	Digital Elevation Model
TIN	Triangulated irregular Network
SWAT	Soil and Water Assessment Tool
MWE	Ministry of Water and Environment
DWRM	Directorate of Water Resource Management
NEMA	National Environmental Management Authority
UNMA	Uganda National Metrological Authority
FAO	Food and Agricultural Authority
DSMW	Digital Soil Map of the World
USGS	United States Geographical Survey
MOA	Ministry of Agriculture, Animal industry and Fishery
NRCS	National Research Conservation Service
CN	Curve Numbers
t ha-1 y-1	tons per hectares per year.
NFA	National Forest Authority
UTM	Universal Transverse Mercator
WGS	World Geographical System

LULC	land use and land cover
UBSO	Uganda Bureau of Statistics
WHO	World Health Organization
K factor	Soil erodibility factor
R factor	Rain fall erosivity factor
LS factor	Slope length and slope stiffness factors
C factor	Cover management factor
P factor	Conservation practice

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 BACKGROUND

As one of the most important basic natural resource, land relates to almost all human activities directly or indirectly, and is crucial for sustaining livelihoods. Rational utilization of the land resource has been treated as the key factor in the development pathways of many countries. However, land degradation is one of the major and widespread environmental threats both in the past and present years.

Soil erosion is regarded as the most serious form of land degradation around the world, especially in developing countries like Uganda, China, and India, as well as some developed countries like In order to meet their livelihoods, address the economic stress, and accelerate development, some people and development actors in the developing countries utilize land and soil resources in unsustainable and irrational ways as manifested by overgrazing, destruction of forest for urban extension, heavy intensity and unscientific agricultural activities, and land use changes in high As a result, soil erosion becomes a serious issue, which negatively impacts the soil quality reducing agricultural efficiency, worsening water quality, causing flooding and debris flow, and habitat.

Mountain ecosystems are considered as one of the most significant ecosystems, providing huge amount of benefits to humans both in natural and economic aspects via various ecosystem services and products. Nevertheless, unsustainable and unscientific land use practices and improper land management cause serious soil erosion in mountain regions. More and more studies are carried out focusing on mountainous areas in order to get better understanding of why the phenomenon happens and what could be done to solve the problems In recent years, governments started to pay attention to sustainable agriculture and development. As a result, many environment and land degradation assessment policies were announced and published, which pointed out that soil erosion and land degradation in mountain areas are being increasingly regarded as more serious than in other ecosystems. One of the major reasons for this is land use changes in high frequency, not only modifications but also conversion of the land cover, which has a negative impact on the environment, especially replacement of forest

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