



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

**APPLICATION OF GIS IN ASSESSMENT OF IRRIGATION POTENTIAL BASED ON
SURFACE WATER AVAILABILITY**

(Case Study: Busitema Sub-County)

By

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ABSTRACT

Assessing available land and water resources for irrigation is important for planning their use. This study was initiated with the objective of assessing the water and land resources potential of Busitema Sub county for irrigation development and generating geo-referenced map of these resources by using Geographic Information System.

Geospatial maps preparation, identification of potential irrigable land, and estimation of irrigation water requirement and surface water resources of Busitema Sub County were the steps followed to assess this irrigation potential. Results of Geospatial maps preparation led to identification of potential irrigable land, irrigation suitability factors such as soil type, slope, land cover/use, and distance from water supply (source) were taken into account.

The irrigation suitability analysis of these factors indicate that 63.6% of the soil and 97.2% of the slope in the study area are in the range of highly suitable to suitable for sprinkler irrigation system. In terms of land cover/use, 69.1% of land cover/use is highly suitable where as 7.9% is restricted from irrigation development. Weighted overlay analysis of these factors (land, slope, land cover) gave potential of 86.8% of the area in the range of highly suitable to suitable for sprinkler irrigation system. Finally when Euclidean distance was considered an area of 50.3km² was obtained in the range of highly suitable to suitable for sprinkler irrigation system.

DECLARATION

I **AZIRA ROGERS PATRICK** hereby declare that the report and work presented in it are my work and has been generated by my efforts and the work of my supervisors. This report has not been submitted in any form to any institute of higher learning.

SIGNATURE: Azy.....

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APPROVAL

This report has been submitted in partial fulfillment of Bachelor of Science in Water Resources Engineering under the persistent and constant efforts of my supervisors.

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DEDICATION

I hereby dedicate this report to my Supervisors Mr. Mugisha Moses and Mr. Wangi Mario, my parents, my brothers, my sisters and friends who were there by my side to guide me and give me the courage that I can do best so long as I took a path to try a task.

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LIST OF ACRONYMS

AHP	Analytical hierarchy process
AWC	Available Water Content
DEM	Digital Elevation Model
DWRM	Directorate of Water Resources Management
ESRI	Environmental Systems Research Institute
ETcCrop Evapo-transpiration
ETo	Reference Crop Evapo-transpiration
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GPS	Global Positioning System
ILWIS	Integrated Land and Water Software
IWR	Irrigation Water Requirement
KARI	Kawanda Agricultural Research Institute
LUCC	Land Use Classification Code
MWE	Ministry of Water and Environment
NFA	National Forestry Authority
QGIS	Quantum Geographic Information System
UBOS	Uganda Bureau of Statistics
UNMA	Uganda National Meteorological Authority

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CHAPTER ONE

1.0: Introduction

This chapter briefly gives the general information relevant to the research of irrigation potential of an area. It shows how the research has reduced the problem through achieving of the different objectives.

1.1: Background of the study

Small-scale informal irrigation has been practiced in Uganda since the 1940s. The majority of farms are located not too far from lakes, rivers and fringes of swamps which makes them suitable for irrigation. Formal irrigation development in the country commenced in the 1960s with the following schemes: Mubuku irrigation settlement scheme in the Kasese IN 1998, Kiige scheme in the Kamuli District in 1998 etc.

Uganda has a water withdraw of 0.259km³ in Agriculture, 0.328km³ for municipal, 0.05km³ for industrial and a total area equipped for irrigation, as a percentage of cultivated area is 0.1217% and as a percentage of area equipped for irrigation 94.9% .([FAO,AQUASTAT country fact sheet](#))

Surface water resources include rivers and lakes. Uganda has major water bodies that include lakes Victoria (the world's second largest freshwater lake), Kyoga, Albert, George and Edward while major rivers include the Nile (the world's longest river), Ruizi, Malaba, Katonga, Kafu, Mpologoma and Aswa covering up to 15% of the total land area. Surface water is unevenly distributed, especially in the dry (cattle) corridor that stretches from the southwest to the northeast. Uganda has eight major catchments which drain to major water receiving bodies within and outside the country. These vary in size from the very large catchment discharging into Lake Victoria with an area of 59,858 km², including the Ugandan part of Lake Victoria to the very small Kidepo Basin at the extreme north-eastern part of the country with an area of 3,129 km². The country is divided into eight sub-basins all of which drain into different reaches of the Nile inside Uganda or the Equatorial Lakes. These are: 1-L.Victoria, 2-L. Kyoga, 3-Victoria Nile, 4-L.Edward, 5-L. Albert, 6-Aswa, 7-Albert Nile and 8-Kidepo. (Anon., 2005)([Uganda National Water Development Report, 2005](#)).

3.3: Development of relevant geospatial maps.

1. Land cover map

The land cover map was derived using the following processes;



2. Soil map

The soil map of Busitema Sub County was clipped from the Uganda soil map using the clip tool under the geo-processing tools in ArcGIS 10.1. Soil PH, texture, organic matter content and soil drainage maps were extracted from the map through the category of the value field of the clipped map.

3. Slope map

The steps taken were as follows;

Using spatial analyst tools the DEM of the area was clipped out from from the Uganda DEM and slope map generated in the following ways;



3.4: Land suitability analysis for irrigation

Identification of suitable sites for irrigation was carried out by considering the slope, soil, and land cover/use factors. The individual suitability of each factors were first analyzed and finally weighted to get potential irrigable sites. This procedure is discussed as follows.