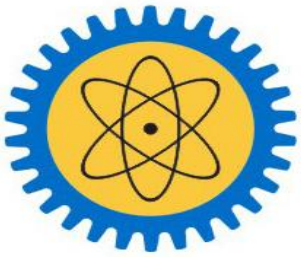

BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

APPLICATION OF GIS/RS FOR IDENTIFICATION OF SUITABLE SITES FOR RAINWATER HARVESTING STRUCTURES IN KAABONG DISTRICT.

BY

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A final year project Report submitted in partial fulfillment of the requirements for the award of a Bachelor of Water Resources Engineering Degree of Busitema University

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ABSTRACT

Arid and semi-arid areas such as Karamoja suffer not only from limited precipitation but also from poor management of rainwater for animal, human and agricultural use. One such solution is rainwater harvesting (RWH) (collect excess runoff water during the rainy season and store it during dry spells).

Identification of potential sites for rainwater harvesting (RWH) is an important step towards maximizing harvesting of this runoff using different RWH technologies. However, selection of appropriate sites for different RWH technologies on a large scale presents a great challenge.

The main objective of this study was to apply a geographic information system(GIS) that uses remote sensing (RS), to identify potential sites for RWH technologies. The input into the GIS include generated thematic maps of. The thematic layers such as (rainfall, slope, soil texture, drainage, runoff depth and land use/cover) were assigned suitable weights and then integrated in a GIS to generate an RWH potential map of the study area. Validation of the RWH potential map with existing RWH structures was carried out and finally sensitivity analysis was performed to determine the importance of a factor or group of factors in the site selection process for RWH.

The study area can be classified into five RWH potential zones; Not Suitable zone (102.23km^{2}or 1.4%), Marginally Suitable zone (1306.9km^2 or17.9%), Moderately Suitable zone (3696.3km^{2}or 50.6%) Suitable zone (1910.5km^2 or 26.1%) and Highly Suitable zone (291 km^2 or 4.0%).Validation test showed that out of 19 different existing RWH technologies, 0% fall within not suitable and marginally suitable zones and 32%, 53% and 16% fall within moderately suitable, suitable and highly suitable zones respectively. The integrated RS, GIS and MCDA techniques were found to be a cost-effective, faster and environmentally friendly method to select suitable RWH sites as compared to field surveys

Keywords: Rainwater harvesting, remote sensing and geographic information system, multi-criteria decision analysis, Thematic maps/layers.

DISCLAIMER

I, LOKAYE GABRIEL AKOPE, declare that this project report is my original work output apart from where acknowledged and has never been submitted for a ward of degree at the university and other universities.

Sign…….

Date……. /……... /……..

APPROVAL

I am presenting this final year project report titled: ***Application of Geographic Information System and Remote Sensing for identification of Suitable sites for rainwater harvesting Structures in Kaabong District*** to department of Water Resources and Mining Engineering of Busitema University. The undersigned certify that they have read and recommended for acceptance by the University.

……..

Mr. Oketcho Yoronimo

(Main supervisor)

……..

Mr. Baagala Brian Ssempijja

(Co-supervisor)

DEDICATION

I dedicate this report to my parents and my wife for their inevitable support.

ACKNOWLEDGEMENT

First of all, I thank the almighty God who by His grace kept me safe from all sicknesses and gave me knowledge used in the compilation of this important report. "……., for without me you're able to do nothing". (John 15:5).

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God bless you all.

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AHP	Analytical Hierarchy Process
ASARs	Arid and Semi-Arid Regions
CN	Curve Number
CR	Consistency Ratio
DEM	Digital Elevation Model
DSS	Decision Support System
FAO	Food and Agricultural Organization
GIS	Geographic Information System
HSG	Hydrological Soil Groups
IDW	Inverse Distance Weights
LULC	Land Use Land Cover
MCDA	Multi-Criteria Decision Analysis
MCE	Multi-Criteria Evaluation
NARO	National Agricultural Research Organization
NGOs	Non-Governmental Organizations
RS	Remote Sensing
RWH	Rainwater Harvesting
SCS-CN	Soil Conservation Service Curve Number
SRTM	Shuttle Radar Topography Mission
SWAT	Soil Water Assessment Tool
UNEP	United Nation Environmental Program
USDA	United States Department of Agriculture

CHAPTER ONE: INTRODUCTION

1.1 Background

Climate change and a growing demand for water for agricultural and urban development are increasing the pressure on water resources. Between 75 and 250 million people in Africa are projected to be exposed to increased water stress by 2020, yields from rain-fed agriculture could be reduced by up to 50% in some regions, and agricultural production, including access to food, may be severely compromised. The United Nations Environment Program (UNEP) estimates that more than two billion people will live under conditions of high water stress by 2050, which would be a limiting factor for development in many countries around the world (Arnell, Lindberg and Grimmond, 1999).

Arid and semi-arid regions (ASARs) around the world are already regularly facing problems of water scarcity, for drinking, crops and livestock. ASARs represent 35 percentage of Earth's land, about 50 million km^2 (Mwenge Kahinda *et al.*, 2007). Rain-fed agriculture is the predominant farming system in these areas, but aridity and climatic uncertainty are major challenges faced by local farmers who rely on rain-fed farming. Farmers are faced with low average annual rainfall and variable temporal and spatial rainfall distribution.

Karamoja region in particular, as a semi-arid area experiences periods of dry spells caused by low and unreliable rainfall which is unevenly distributed in space and time and faces challenges of recurrent droughts that jeopardizes the success of rain-fed agriculture, livestock production and general water availability in the area. Because of this, management of water resources is faced with serious problems of water scarcity, shortage and untapped full potential of water supply strategies.

The 2010/2011 drought has led to increased attention on resilience building in the region. Cyclical droughts and erratic rainfall, which are expected to intensify under progressive climate change, affects crop production and pasture for livestock in the sub-region, thereby having direct negative effects on the livelihoods of the population

Semi-arid to arid areas have unpredictable rainfall patterns, both in amount and time. This makes the ability to effectively manage the resulting effective runoff extremely vital. Rainwater harvesting (RWH) has been identified at a number of global platforms as one of the significant interventions necessary towards reaching the Millennium Development Goals in African

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