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BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

ASSESSING THE IMPACTS OF LAND USE CHANGES ON STREAMFLOWS:

CASE STUDY: RIVER MALABA SUB-CATCHMENT

BY

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ABSTRACT

The hydrology of most tropical catchments is largely influenced by variations in land use. River Malaba sub catchment is experiencing significant changes in land use, this is adversely impacting the river hydrological flow regimes. The catchment is a transboundary with a total drainage area of about 3500 km² shared between Uganda and Kenya. Hydrological Engineering Center Hydraulic Modelling Service (HEC-HMS) model was used to assess the impact of land use changes on stream flows in the catchment. Changes in land use on the streamflow were evaluated using land change detection analysis. The highest change in the gain of land were mainly experienced from the agricultural land use (23.61%) and Settlement (2.64%); while the highest loss in land use change were experienced from the Grassland (15.79%) and forests (9.02%) land cover types respectively. Data collected included: - DEM, discharge flow data, land use/land cover data, rainfall data and soil data. These datasets were conditioned and processed in the GIS environment using the ArcGIS software. Land use and soil data were used to generate Curve number grid and later geo.hms was used to set up a project which involved basin characteristics and processing and exported into HEC-HMS to generate hydrograph (peak discharges). The Depth Duration Curves (DDC) were generated for a return period of 50 years that gave peak discharge of 235.0m³/s. In addition to modeling the current land use condition, two land use changes were simulated and the outflow result showed that land use changes can affect streamflow. The results also show that a land management program like reforestation could decrease the risk of high flows in the watershed.

DECLARATION

I **MWIRU BRANDON** declare that this final year project report is a result of my own efforts and tremendous work done during the research period and it has never been submitted to Busitema University or any other institution of higher learning for any academic award.

NAME: MWIRU BRANDON

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APPROVAL

This is to certify that this *final* year project report was written under the guidance of my supervisors on the topic “*Assessing the impact of land use changes on stream flows in the river Malaba sub-catchment*,” and is now ready for submission to the department of water resources Engineering, Busitema University.

MAIN SUPERVISOR: **MR. OKETCHO YORONIMO**

Signature.......... Date.....

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Signature.......... Date.....

DEDICATION

I dedicate this project report to my mother Mrs. Auma Zeulia, brothers, sisters, friends and Uncles for the parental love, financial support and guidance. The almighty God richly bless you.

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First and foremost, I would like to thank Almighty God for his protection and guidance up to this stage in my life.

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TABLE OF CONTENTS

Contents

ABSTRACT.....	i
DECLARATION	ii
APPROVAL	iii
DEDICATION.....	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS.....	vi
LIST OF ACRONYMS	x
LIST OF FIGURES	xi
LIST OF TABLES	xii
CHAPTER 1: INTRODUCTION.....	1
1.1 Background of the study	1
1.2 Statement of the problem	2
1.3 Objectives of the Study.....	3
1.3.1 Main objective	3
1.3.2 Specific Objectives	3
1.4 Justification.....	3
1.5 Scope of the Study	4
CHAPTER 2: LITERATURE REVIEW	5
2.1 Land use and landcover changes.....	5
2.2 Thematic maps	6
2.2.1 Introduction.....	6
2.2.2 Slope maps.....	7
2.2.3 Soil maps.....	7

2.2.4 Land use maps.....	7
2.2.4 Change Detection.....	7
2.3 Hydrological Modelling.....	7
2.3.1 Classification of Hydrological Models	8
2.4 Hydrologic Engineering Centre’s (HEC) Hydrologic Modelling System (HMS).....	8
2.4.1 Definition and Introduction to HEC-HMS	8
2.4.2 HEC-Geo-HMS.....	10
2.4.3 Preprocessing	11
2.4.4 Model Component Calibration Methods	11
2.5 Geographical Information System (GIS)	12
2.5.1 GIS applications.....	12
2.5.2 Remote sensing	13
2.5.3 Digital Elevation Model.....	13
2.6 Soil Classification System (SCS) Runoff Method.....	14
2.6.1 SCS Curve Number.....	14
CHAPTER 3: METHODOLOGY	15
3.1 Study Area Description.....	15
3.2 Sources of data and methods of data collection.....	16
3.2.1 Reasons for using HEC-HMS.....	17
3.3 Developing relevant thematic map for the catchment.	17
3.3.1 Land use change analysis.....	18
3.3.2 Land cover data processing.....	18
3.3.3 Land-Use and Land-Cover Change Detection Analysis	19
3.4 Hydrological modeling for the River Malaba Sub-Catchment.	20
3.4.1 Data processing tools used.....	20

3.4.2 Terrain processing steps.....	20
3.4.3 Developing depth duration curves (Weibull method).....	22
3.4.4 Meteorological data	24
3.4.6 Curve number grid.	26
3.4.7 Hydrological modeling and simulation.....	27
3.4.8 Model calibration	28
3.4.9 Calibration outputs.....	29
3.4.10 Evaluation of the model	29
3.5 Assessing the Impacts of Scenario-Based Land Use Changes on the River Stream Flow Response.	30
3.5.1 Scenario 1: Considering the Current land use of 2016	31
3.5.2 Scenario 2: Considering the land use changes of 2000.....	31
3.5.3 Scenario 3: Reforestation.....	31
CHAPTER 4: RESULTS AND DISCUSSION.....	33
4.1 Thematic maps.....	33
4.2 To generate and simulate the hydrological model for River Malaba Sub-Catchment.....	41
4.2.1 Model set-up	41
4.2.2 Curve number map.....	42
4.2.3 Catchment area map.....	43
4.2.4 Simulation of the model.....	44
4.2.5 RMSC HEC-HMS sensitivity analysis	45
4.2.6 RMSC HEC HMS model calibration results	46
4.2.7 Evaluation of the HEC-HMS model	47
4.3. Scenario based land use types on streamflow	48
4.3.3. Possible solutions to the problem	51

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS	52
5.1 CONCLUSION.....	52
5.2 RECOMMENDATIONS	52
REFERENCES	53

LIST OF ACRONYMS

CCN	composite curve number
CN	Curve Number
DEM	Digital Elevation Model
GIS	Geographical Information System
HEC-HMS	Hydrological Engineering Center Hydrological Modelling Service
HRU	Hydrologic Response Units
LULC	Land Use and Land Cover
ENVI	Environment for Visualizing Image
SWAT	Soil and Water Assessment Tool
SCS-CN	Soil Conservation Service Curve Number
USDA	United States Department of Agriculture
NWSC	National Water and Sewage Cooperation
RMSC	River Malaba Sub-Catchment
UNMA	Uganda National Meteorological Authority
SRTM	Shuttle Radar Topography Mission
USGS	United States Geological Survey
SDG	Sustainable Development Goal

LIST OF FIGURES

Figure 1 showing the location of the study area	16
Figure 2 showing the methodology for objective one	19
Figure 3 showing maximum rainfall depth and return periods.....	24
Figure 4. Depth duration curves.....	26
Figure 5. Showing methodology for objective two	30
Figure 6. Shows the methodology for objective three	32
Figure 7. Showing the DEM map	33
Figure 8. Showing the soil map in the RMSC	34
Figure 9. Showing the River Malaba sub catchment slope map.....	35
Figure 10. Showing land use map before reclassification	35
Figure 11. Showing reclassified land use map of 2000	36
Figure 12. Showing land use map of 2016 before reclassification	37
Figure 13. Showing reclassified land use map of 2016	37
Figure 14 Showing land use distribution between 2000 and 2016	39
Figure 15 Showing percentage change in the land area coverage	40
Figure 16. Showing reclassified land use percentage of 2000.....	40
Figure 17 Showing reclassified land use percentage for 2016	41
Figure 18 Shows the Delineated Watershed for the River Malaba Sub Catchment	41
Figure 19. Shows the Curve number map.....	42
Figure 20. Shows the Catchment area map.....	43
Figure 21. Shows the graph for the simulation run.....	44
Figure 22. Shows the time- series table for the simulation run	45
Figure 23. Shows the graph for the calibration.....	46
Figure 24. Shows the Objective Function Results for the calibration	47
Figure 25. Shows the optimized parameter Results for the calibration	47
Figure 26. Shows the summary result at the outlet for the simulation run	48
Figure 27. Shows the graph for the percent flow of land use scenarios at the outlet	50

LIST OF TABLES

Table 1 showing the various datasets and their sources	17
Table 2 showing the tools used and their functions	17
Table 3 showing various annual daily max rainfall and their return periods.....	22
Table 4 showing maximum rainfall intensity	24
Table 5 : Design precipitation depths as a function of return periods	25
Table 6 showing soil hydrology groups.....	26
Table 7.showing a union of soil and land use (curve numbers).....	27
Table 8 showing performance evaluation	29
Table 9.Showing reclassified land use classes and their area coverages	38
Table 10. Showing percentage change in land use area between 2000 and 2016	39
Table 11.Shows the sub basins and their corresponding Areas and Curve Number	43
Table 12.Shows the simulated flows for the various land use scenarios at the watershed outlet.	48
Table 13. Shows the percent flow of land use scenarios	49
Table 14 Shows the peak flows at the outlet for different land use scenarios	51

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Internationally, land resources are vital for human survival and prosperity and the maintenance of the terrestrial ecosystem. One of the critical elements for managing natural resources is to monitor the change in land use. Land use refers to how humans utilize the Land and their habitat (such as agriculture, settlement); on the other hand, land cover refers to the feature, present on the surface of the Earth captured in the distribution of vegetation, water, soil, and other physical features (Mfwango et al., 2022). Land use is one of the significant environmental challenges facing the globe, especially in developing countries where agriculture is the main economic activity (Galata et al., 2020). From the Central intelligence Agency (CIA) World Fact book website, the 2012 estimate of Uganda's annual population growth is 3.3%, a clear indication that the nation's population is increasing at a high rate. Increased population growth among other things leads to increased urbanization, over exploitation of natural resources such as agricultural lands, forests, wetlands, and water bodies (Martin et al., 2012)

Population growth has led to urbanization and expansion of agricultural lands for food production and industrial development.

In Uganda, most parts of the regions are vulnerable to problems concerning food production that mostly affects rural livelihood, mainly due to an increase in population on the one hand and inappropriate management of resources on the other hand.

Between 1990 and 2015, Forest cover in East Africa were reduced at the rate of 1% annually while the human population increased at the rate of 2% annually (Guzha et al., 2018). 13 million hectares of forest in East Africa were lost in the last 20 year period, while the remaining forest is fragmented and continually under threat (FAO, 2010). Conversion of Forest to settlements and agricultural fields has resulted into soil compaction, limited water movement, increased bulk density and decreased hydraulic conductivity since soil properties are altered, causing more surface runoff following rainfall, accelerating erosion, reducing water availability, and affecting water quality (Guzha et al., 2018).

In the Comet catchment, Australia, during (1971–2007) upon forest clearing, there was increasing inter-annual stream flows resulting in decrease of inter-annual evapotranspiration.

Measures which increase the opportunities for harvesting and marketing of non-timber forest and papyrus products such as honey and fiber are recommended. Zoning should be applied to separate incompatible change of land-use and protect the water sources like springs, river, wet lands and forests. Soil protection and erosion control measures, such as ploughing parallel to contour lines, or the prescribed planting of trees should also be encouraged in the River Malaba Sub Catchment. Establishment of riparian buffer vegetation using appropriate plant species will increase infiltration and water storage in the sub-catchment and reduce sediment loading and surface runoff.

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