



FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF WATER RESOURCES

FINAL YEAR PROJECT

**ASSESSING THE IMPACTS OF LAND USE LAND COVER
AND CLIMATIC CHANGES ON THE COST OF WATER
TREATMENT**

CASESTUDY: RIVER MALABA CATCHMENT.

By

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of the requirement for the award of the Bachelor of Science in water resources engineering of Busitema
University**

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ABSTRACT

This research aimed at assessing the impacts of land use land cover and climate changes on the cost of water treatment in river Malaba catchment. The MOLUSCE plugin (version 2.18.16) in QGIS Desktop software was used to predict future land use land cover (LULC) changes from 2035 to 2050 using the Cellular Automata-Artificial Neural Network (CA-ANN) model and weather data was projected using a statistical downscaling model (SDSM version 4.2) considering two climate change scenarios (RCP4.5 and RCP8.5). ArcSWAT2012.10.26 in ArcGIS 10.8.2 was used to build a rainfall-runoff model for sediment modelling. The model considered four scenarios and used 10m resolution DEM data to delineate the watershed into 26 subbasins with an automatic delineator. HRUs were defined by setting threshold proportions for land use, soil, and slope classifications. Daily rainfall and temperature data for 1990 to 2005 were used for weather input. The SWAT simulation was run for 1990 to 2020 with a 3-year warmup period for model stabilization. Calibration, validation, and sensitivity analysis were performed using SWAT-CUP software version 5.1.6. Water samples were collected at various land use locations along the river to analyse physical, chemical, and bacterial properties. Statistical analysis (ANOVA at 95% confidence interval) was conducted using Excel to assess how land use variations affect water quality parameters. Data on treatment costs influenced by water quality was obtained from the National Water and Sewerage Corporation (Tororo) and similarly analyzed using ANOVA at a 95% confidence interval. sediment yield for priority intervention. Four best management practices (BMPs) (filter strips, sedimentation ponds, and no-tillage) were evaluated for their effectiveness in reducing sediment. The study found that sedimentation ponds and filter strips were most significant in reducing sediment .Four different BMP scenarios were simulated in SWAT to determine BMPs effectiveness and found out that filter stripes reduce sediment by 30%, sedimentation ponds by 24%, no tillage is by 16% and reforestation by 12% and the significance test was performed which showed sedimentation pond and filter strips were significant at 5% interval and the design of filter strip was done with the width(Filter.wt) of 50ft. Results showed that these changes worsen water quality, leading to increased treatment costs. Water quality parameters like EC, pH, and turbidity were significantly affected by land use and climate change. Treatment costs for aluminum sulfate, HTH, and polymer were higher during the rainy season and in years with high rainfall. The study recommends watershed restoration and specific BMPs like filter strips and sedimentation ponds to reduce sediment and mitigate the impact on water quality and treatment costs.

Keywords: Cost of water treatment, water parameters, sediment yield, climate change, land use land cover, SWAT, MOLUSCE and projection.

DECLARATION.

I, Kisekya Keneth, Onduri Simon, Iramu Alice Elizabeth, hereby declare that all the work material portrayed in this project is our original work except where explicit citation has been made and it has not been presented to any Institution of higher learning for any academic award.

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APPROVAL.

This is to certify that the project under the title “**Assessing the Impact of land use land cover and climate changes on the cost of water treatment in River Malaba catchment.**” has been done under the best of our efforts and is now ready for examination.

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DEDICATION

This report is dedicated to all those who strive to protect and preserve water resources, to all scientists and researchers whose efforts advance our understanding of the environment and all activists who work diligently to implement sustainable practices.

Special thanks to our families and friends for their unwavering support and encouragement throughout this academic journey. Your belief in us was a constant motivation.

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LIST OF ACRONYMS

ANOVA	Analysis of Variance
CC	Climate change
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GCMs	Global Climate Models
GPS	Global Positioning Systems
LULCC	Land Use Land Cover Changes
PH	Potential of Hydrogen
RCMs	Regional Climate Data
SWAT	Soil Water and Assessment Tool
SWAT -CUP	SWAT Calibration and Uncertainty Programs
HRU	Hydrological Response Units
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

XRD	X-Ray Diffraction
HA	Hectares
MWTP	Malaba waterworks treatment plant
NWSC	National water and sewerage cooperation

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