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FACULTY OF ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

INVESTIGATING THE IMPACTS OF UNSUSTAINABLE EXTRACTION OF SAND ON LAND COVER LOSS AND SURFACE WATER QUALITY

A CASE STUDY OF LWERA WETLANDS

BY

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

Abstract

This study is based on the impact of un sustainable sand mining within Lwera wetlands along kampala masaka highwway in Mpigi and Kalungu districts in Uganada. For this research four sets of Ortho-rectified multispectral remote sensed imagery that is to say, two Landsat *5&8*(30m) two Sentinel 2A (10m) images to characterize the degree of damage of the wetland as a result of un-sustainable sand mining over time. The Landsat and Sentinel images were preferred given their high repetitive coverage and free accessibility. The images were extracted from the USGS web portal (http://glovis.usgs.gov/).Images used where those captured during the dry season. From the random Forest classification algorithm, the results representing the four years under this research were later processed in ArcGIS 10.8 software

In reference to the three land cover classes, random Forest results revealed that vegetation cover represented the biggest class followed by sand fields while open water was the least class for all the four study years. Vegetation area decreased from 2070 ha (2016) to 1900 ha (2019). The area under vegetation however declined to 1800 ha in 2021.The increasing trend in areal extent was also observed for open water for example from 750 ha in 2016 to 1000 ha in 2019 and then 1050 ha in 2021. The area under sand fields increased between 2016 and 2019 (for example from about 1300 ha to 900 ha). This however increased to 1000 ha in 2021.

In addition five locations were chosen for which the water collection process was carried out in the identified sand fields .These samples in their natural state were taken for physical parameter analysis and mainly three parameters were tested for every sampling point that's turbidity, total dissolved solid and total suspended solids. The geographical coordinates for each sampling point were taken by use of a Global Positioning System. . However, the result of this research will go to great extent in assisting in the developing sustainable development policies in term of discriminatory sand mining

In order to enforce the proposed potential management and mitigation measures for curbing unsustainable sand mining activities, a quantitative analysis method of mathematical models and numerical simulations in theoretical economics which analyses the supervision scheme of law enforcement officers to minimize costs as carried out.
Index Terms— *Land Degradation, GIS, Sand Mining, ArcGIS, Random forest classification algorithm*

DECLARATION

I **MAYENDE FRANCIS** hereby declare that this final year research project report is my own work and has never been submitted in any other Institution either in full or part for any award.

SIGNATURE: ..... DATE.....18/02/2023.....

APPROVAL

I hereby declare that this research has been submitted with my approval as the supervisor.

SIGNATURE: ..... DATE.....12/02/2023.....

MR. MUGISHA MOSES

DEDICATION

I dedicate this research work to my mom **BAGUME FLORENCE** and my uncle **MUGENI CORONEL** may the almighty Lord reward you abundantly and give you good health. Thank you, mum and uncle for the tremendous efforts in supporting me.

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GIS	Geographical Information System
Gou	Government of Uganda
NEMA	National Environmental Management Authority
NFA	National Forest Authority
UBOS	Uganda Bureau of Statistics
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
RF	Random Forest
WHO	World Health Organization
WQI	Water Quality Index
OOB	Out of Box
GPS	Global Positioning System
TDS	Total Dissolved solids
TSS	Total Suspended Solids
EIA	Environmental Impact Assessment
EMP	Environmental Management Program

CHAPTER I

1.0 Introduction

This chapter contains a problem statement, justification, objectives of the study, scope of the study.

1.1 Background

Sand is a natural aggregate formed by rock erosion over thousands of years. The evidence of sand use as an aggregate material for different civil constructions dates back to ancient times. Sand is used as a main component in various construction materials such as cement, mortar, tile, brick, glass, adhesives, ceramics and it has an important role in water filtration, in chemicals and metals processing and in plastic industry. These multiple utilizations led to an exponential consumption growth and this trend is expected to continue due to population growth and increasing standards of living (Gavriletea, 2017)

The demand for construction-grade sand is growing at a tremendous rate and the world is expected to run out of this resource by 2050. Construction-grade sand, hereafter referred to as 'sand', can be found in (former) aquatic environments, such as rivers, lakes and wetlands. Even under controlled circumstances, the practice of extracting the sand from the riverbed and lake banks impacts the environment. Unfortunately, many countries including Uganda lack sand mining regulation policies and in combination with a high demand, this results in indiscriminate and illegal mining of sand(E.S. Rentier, 2022).

Quite recently, wetlands with sand deposits have come under threat, occasioned by a growing construction industry (NEMA, State of the Environment Report for Uganda 2014, 2014)Sand excavators in these wetlands employ various techniques, mostly involving massive excavations that leave large footprints of change on the landscape (NEMA, State of the Environment Report for Uganda 2014, 2014)The resultant pits increase rates of evaporation, hence lowering the water table, and consequently impacting on plant communities around the wetland (Bradshaw, 2007)

The pits also expose the water table to contamination, and the people living around the wetland to death by drowning. On addition, aquatic species like migrating fish (e.g. lung fish) are unable to spawn in open water, thus affecting their diversity (Fahrig, 2003). Vegetation removal and

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