BUSITEMA UNIVERSITY

FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES.

DEPARTMENT OF NATURAL RESOURCE ECONOMICS

TOPIC OF STUDY:

EXAMINING LAND USE/LAND COVER CHANGES IN NALWEKOMBA WATERSHED BETWEEN 2000 AND 2020 IN NAMASAGALI SUB COUNTY, KAMULI DISTRICT.

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REG. NUMBER: BU/UP/2019/3198

COURSE: NRE

A RESEARCH DESSERTATION BEING SUBMITTED TO THE FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELORS DEGREE OF SCIENCE IN NATURAL RESOURCE ECONOMICS OF BUSITEMA UNIVERSITY.

2022

DECLARATION

I BYALEBEKA MARK CEDRIC, declare that this research thesis titled "Examining land use/land cover changes in Nalwekomba watershed between 2000 and 2020 in Namasagali Sub County, Kamuli district" submitted to the faculty of Natural resource and environmental science has been through my own efforts and never has it been submitted to Busitema University or any other institution of higher learning for the award of a degree or any other qualification.

Any other information sourced from other literature is referenced. I therefore take the full responsibility of any errors that may arise in this work as a result of omission or otherwise.

Signature……. **date……**

BYALEBEKA MARK CEDRIC

BU/UP/2019/3198

APPROVAL

This is to satisfy that this research report titled, "Examining land use/land cover changes in Nalwekomba watershed between 2000 and 2020 in Namasagali Sub County, Kamuli district"; **by Byalebeka Mark Cedric** has been successfully completed under my supervision for partial fulfillment as one of the requirements for the award of the degree of Science in natural resource economics. I therefore recommend it for submission to the faculty of Natural Resources and Environmental Sciences, Department Of Natural Resources Economics, Busitema University with my approval.

Signature…… **date……..……..**

MOSES ISABIRYE (Professor, PhD)

Research Supervisor.

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DEDICATION.

I dedicate this piece of work to my loving father, Dr. John Byalebeka, and mother, Ms. Betty Amongin for the selfless love, encouragement, support and sacrifice towards my education.

I also dedicate this report to my mentors Mr. Bwambale Gerald and Mrs. Ssenoga Caroline Nyakato for their continued mentoring, advice, and encouragement throughout my education journey.

I also dedicate this research work to myself for believing, persevering, and staying focused despite all the challenges faced throughout the journey of education till today.

Finally, I would like to dedicate this project work to my brothers and sisters; Emma, Vivian, Aol, Matthew, Angel, and Ruth, friends and well-wishers as motivation and encouragement to help them pursue their goals in Education.

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ABSTRACT

The Nalwekomba catchment on the Eastern shoreline of Victoria Nile basin is a high valued ecosystem because of the numerous human-related activities it supports in Namasagali, Kamuli district in Eastern Uganda. The catchment has undergone tremendous human-induced land use/cover changes, which have not been quantified. This study aimed at quantifying the land use/cover changes as well as the rate at which these changes occurred over the last two decades in the catchment. This was achieved using remote sensing techniques and Geographic Information System (GIS) to analyze and contextualize the changes. To that effect, images of Landsat satellites TM, ETM+ and OLI with a resolution of 30metres were obtained and interpreted using supervised image classification technique to determine the land use/land cover changes from 2000 to 2020.

The Catchment area was classified into seven major LU/LC classes i.e. Built up areas, croplands, water bodies, forestlands, grassland, fallow/bare-land and wetlands. Change detection analysis was performed to compare the quantities of land cover class conversions between time intervals. The results revealed both increase and decrease of the different LULC classes from 2000 through to 2020. Significant shifts from some classes to others was also observed. Drivers of the observed changes ranged from Climatic factors such as rainfall and drought to socio-economic factors like poverty, population pressure. The obtained results also indicated that the catchment has undergone huge land use and land cover transformations over the last two decades attributable to rapid population growth, industrialization and urbanization. The prevailing changes in footprint between 2000 and 2020 were expansions and increment of built–up area (0.76% in 2000 to 18.49% in 2020) and cropland (8.42% in 2000 to 53.76% in 2020), and decreases in the following sectors: forestlands (from 29.19% in 2000 to 6.14% in 2020), grassland (from 31.18% in 2000 to 12.24% in 2020), fallow-land (from 19% in 2000 to 0.38% in 2020), open waterbody(from 0.25% in 2000 to 0.21% in 2020) and wetlands (from 11.20% in 2000 to 8.78% in 2020). The changes pose a threat to the environment and water quality of the Nalwekomba catchment and consequently increases socio-costs like flooding and access to safe water.

Therefore, there is the need to take critical and practical measures to regulate and police land use, water use rights and conserve the environment especially wetlands. Consistent LULC mapping should be carried out in order to quantify and characterize LULC changes. This will help establish trends and enable resource managers to project realistic change scenarios helpful for natural resource management.

Keywords: land cover, land use, change detection, supervised classification, Nalwekomba Catchment

LIST OF ABBREVIATIONS.

Ha	Hectares
LU	Land Use
LC	Land Cover
LUS	Land Use System
LULC	Land Use-Land Cover
LULCC	Land Use-Land Cover Changes
DPSIR	Drivers, Pressures, State, Impact, Response
NFA	National Forestry Authority
GIS	Geographic Information System
SDG	Sustainable Development Goals
Q-GIS	Quantum Geographic Information System
ILWIS	Integrated Land and Water Information System
RS	Remote Sensing
FAO	Food and Agriculture Organization
SLM	Sustainable Land Management
GLCC	Global Land Cover Characterization
UNEP	United Nations Environment Program
USGS	United States Geological Survey
NDVI	Normalized Difference Vegetation Index
GDP	Gross Domestic Product
LIS	Land Information System
ETM	Enhanced Thematic Mapper
NEIC	National Environment Information Centre
NEMA	National Environment Management Authority
OLI	Operational Land Imager.
Sq.km	Square Kilometer
M	Meters
NRE	Natural Resource Economics

DEFINITION OF TERMS

Land use: this is the term used to describe the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place. Public and private lands frequently represent very different uses.

Land cover: refers to the surface cover on the ground, whether vegetation, urban infrastructure, water, bare soil, or other. Identification of land cover establishes the baseline from which monitoring activities (change detection) can be performed, and provides the ground cover information for baseline thematic maps.

Remote sensing: is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance

Land degradation: the deterioration or loss of the productive capacity of the soils for present and future

Land productivity: is an indication of the level of sustainable land use, calculated as the relationship between land quality in general productive terms and what is obtained as output.

Ground trothing: is a technical term that refers to the activity of verifying remote sensing data collected through aerial photography and satellite imagery. Information is collected on site through surface observations and measurements in order to compare the pixel image with the real data of a location.

GIS: A geographic information system (GIS) may be defined as the integration of computer hard & software with spatially referred digital data so that storage, retrieval, manipulation, analysis and display all forms of geographically referenced information.

Image classification: this is the process of categorizing and labeling groups of pixels or vectors within an image based on specific rules. Involves assigning classes to an image.

Digitization: This refers to the process of converting documents, images, sounds, symbols, and objects into a digital format that can be processed and analyzed by a computer.

Georeferenced: this refers to the process of entering actual ground coordinates acquired on an area and aligning them with satellite image data.

Plug-in: This refers to a module or software which can be added to a system or another software to give extra features and functions.

Research: is a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific professional fields and academic disciplines.

CHAPTER ONE: INTRODUCTION

1.1Background of the study:

The land is the earth's terrestrial surface, immediately above or below the surface that is delineable and with attributes (Keil, A. OSM-LCS, 2016). It's characterized by land objects (distinguishing properties) and lands key elements. (Anandhi et al. 2020) provided a narrow and broad definition of land resources more recently. They broadly defined a land resource to include multiple components such as ecological resources of climate, water, soil, landforms, flora, and fauna, and all the socio-economic systems that interact with agriculture, forestry, and other land uses within some system boundary. The land is the most important natural resource on which all activities are based. Land use refers to the conversion or transformation of the land cover into the desired human purposes which are associated with that cover, e.g., cropping, conservation, or settlement (Miheretu, B.A.; Yimer, A.A, 2018). Land cover refers to the physical characteristics of the earth's surface, captured in the distribution of vegetation, water, soil, and other physical features of the land, including those created solely by human activities, e.g., settlements (Kumar et al., 2013). The land use/ land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Hence, information on land use/land cover and possibilities for their optimal use are essential for the selection, planning, and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. According to Olofsson et al. (2013), the impact of land use and land cover change may be felt across a wide spectrum of environmental systems including the atmosphere, hydrology, geomorphology, and ecology. Overutilization of land resources has caused numerous forms of degradation such as loss of biodiversity, deforestation, and land and water degradation (Diyer et al., 2013). It is estimated that about 83% of the global terrestrial land surface has been affected by the activities of humans and 60% of the ecosystem degraded over the past half-century. The modification of the terrestrial surface of the earth is generally referred to as land use and land cover change (Ellis, 2013). Land use and land cover changes are found to be the most evident indicator of these human footprints and the greatest driver of biodiversity loss and other land degradation forms (Nkonya et al., 2012). The disturbance of the land through these human activities has wide-ranging and long-term consequences that affect important ecosystem processes and services. The rapid land-use changes by the growing population have reduced natural vegetation cover and resources in most countries of the world. As a result, information on the rate and kind of changes in the use of land resources is essential for proper planning, and management and to regularize the use of such important resources. Knowledge about existing land use and land cover and its trend of change is essential for various reasons. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels. Changes in land use can be due to urban expansion, loss of agricultural land, changes in river regimes, the effect of shifting cultivation, the spread of erosion and desertification, and so on. Therefore, this requires not only the identification of features but also the comparison of subsequent data to recognize when valid changes have taken place. The use of satellite remote sensing techniques and geographic information systems (GIS) for the identification, mapping, and analyses of land use and land cover changes has gained prominence in recent years as high-resolution satellite data have become more readily available. Remote Sensing (RS) and Geographic Information systems (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional, and global scales

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