BUSITEMA UNIVERSITY

Pursuing Excellence

IMPACT OF LAND USE CHANGE ON WATER QUALITY AND PRODUCTIVITY

A CASE STUDY ON LAKE WAMALA-UGANDA

BY

HARRIET TUMUSHABE

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DECLARATION

I, Tumushabe Harriet, declare that this study is original and has not been submitted for award of any degree at any other University before.

Signature: ..... Date: 16th/09/2017...

APPROVAL

The research work culminating into this dissertation was conducted under our guidance and supervision.

1. Assoc. Prof. Ochwoh Victor Akangah (Ph. D.)
   Coordinator, Directorate of Graduate Studies, Research and Innovations,
   Busitema University,
   Signature: ..... Date: 16/09/2017

2. Dr. Twaibu Semwogerere (Ph. D.)
   Engineering Mathematics, ME, MAK, Uganda
   Signature: ..... Date: 16/09/2017

DEDICATION

I dedicate this research to my beloved father Mr. Kisembo Joseph and my colleagues John, Paul, Julius, Pascal, Moses, Opio, Betty and Prossy for their efforts and sacrifices.

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ACRONYMS

AFIDEP: African Institute for Development Policy

GIS : Geographical Information Systems

IPCC: Intergovernmental Panel on Climate Change

KEA: Kikandwa Environmental Association

LULCC: Land Use and Land Cover Change

LVBC: Lake Victoria Basin Commission

LVEMP: Lake Victoria Environmental Management Project

NaFIRRI: National Fisheries Resources Research Institute

NARO: National Agriculture Research Organisation

NEMA: National Environment Management Authority

NRC: National Research Council

NTA: National Transfer Accounts

NWDR: National Water Development Report

PAI: Population Action International

PRB: Population Reference Bureau

REDD+: Reducing Emissions from Deforestation and forest Degradation plus

SPSS : Statistical Package for Social Scientists

TM and ETM+: Thematic Mapper and Enhanced Thematic Mapper Plus

UBOS: Uganda Bureau Of Statistics

UN: United Nations

UNDP: United Nations Development Programme

UNEP: United National Environment Programme

USGS : United States Geological Survey

ABSTRACT

Aquatic systems are important sources of water for domestic use, agriculture and fisheries. In fact 70% of Ugandans depend on agriculture and fisheries for their livelihood. The Ugandan population is growing at a very fast rate of more than 3% per annum, which is among the highest in the world. Increase in human population has been accompanied by rapid conversion of land into agricultural fields and urban areas, resulting in deforestation, wetland drainage and pollution from agrochemicals. This has in turn, resulted into increased siltation and nutrient enrichment in aquatic ecosystems thereby affecting their quality and productivity. Therefore, the main objective of this study was to examine the impact of land use and cover changes on water quality and productivity using Lake Wamala as a case study. The study used qualitative methods that involved reconnaissance visits, observations and photography to describe land use and cover changes and collection of environmental and biological indicators of land use and cover change. Quantitative methods were also used in experiments about testing physico-chemical and biological water quality parameters of Lake Wamala; they were also used in the analysis to derive means, standard errors and statistical significances of physico-chemical and biological parameters. Results show that there is an exponential increase in Uganda's human population from 1911 to 2014. This trend of population increment was also registered by the districts of Mubende and Mityana from 1991 to 2014. There were reciprocal changes between land and water, with high vegetation cover having dominated in 1990 with 87.2%, in 2005 with 49.5%, in 2010 with 78.4% and in 2015 with 44.7%. Moderate vegetation cover was observed in 1995 with 69.3%, and low vegetation cover in 2000 with 62.9%. The results further show high primary production of the sampled transects that ranged between 1354.6 – 1642.2 mg of $O_2m^{-2}h^{-1}$. The study concluded that there was an exponential increase in human population size around Lake Wamala catchment over the years accompanied by multiple unsustainable land use practices within the riparian areas of the lake that undermine the quality and productivity of Wamala waters. The study made several recommendations, including advocating for better coordination of initiatives to conserve Lake Wamala by District authorities, strengthening use of available population control methods and sensitization of the farmers, fisher men and women bordering the lake to ensure that they avoid cultivating up to the shores.

CHAPTER ONE
1.0 INTRODUCTION

1.1 Background

Inland fisheries make substantial contribution in meeting the challenges faced by individuals, society and the environment in a changing global landscape (Lynch *et al.*, 2016), through food and economic security, empowerment, availing cultural and recreational services, climate moderation, human health, well-being and biodiversity maintenance, especially for the rural poor (Traore *et al.*, 2012). Riparian areas are important in maintaining the health of aquatic ecosystem and support high population densities (NWDR, 2005).

Despite the economic, environmental and nutritional benefits from inland fisheries and aquatic ecosystems, water resources are mainly threatened by agricultural land use practices, pollution, over-exploitation and climate change (Musinguzi *et al.*, 2015). The practices have been accelerated by the rapidly growing human population. Over 80% of Uganda's population depend directly or indirectly on the products and services from agriculture and fisheries (Gollin and Rogerson, 2010; UBOS, 2010). The agricultural sector is the most important sector of the country's economy with a population growing at approximately 3.2% which is among the fastest in the world (UBOS, 2010). Throughout history, agriculture has had a significant effect on the world's landscape which has resulted into environmental changes (Ndulue *et al.*, 2014).

However, according to the National Environmental Act, Cap 153, the National Environment Management Authority in consultation with District environmental committees is mandated to take all measures it considers necessary in order to protect the banks of rivers and the shores of lakes in Uganda from human activities that adversely affect the rivers and the lakes.

Changes in land use have transformed natural land covers into farmlands, grazing lands, human settlements and urban centers at the expense of natural vegetation (Lambin *et al.*, 2003; Tiffen, 2003). The changes are associated with deforestation, biodiversity loss and land degradation, which impact the productivity of aquatic ecosystems as more agro-ecosystems are created and less cover of natural vegetation around riparian areas is conserved. When cropland and other land uses expand, the soil is left bare, oils spill over, fertilizers, manures and pesticides are added to it and end up being driven into aquatic systems by runoff,

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