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FACULTY OF NATURAL RESOURCE AND ENVIRONMENTAL SCIENCES

DEPARTMENT OF NATURAL RESOURCE AND ENVIRONMENTAL ECONOMICS

ESTIMATION OF ABOVE GROUND CARBON STOCK OF DIFFERENT LAND COVER TYPES IN NAMASAGALI SUB COUNTY

BY

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A RESEARCH THETHIS SUBMITTED TO THE FACULTY OF NATURAL RESOURCES AND ENVIRONMENTAL SCIENCES IN PARTIAL FULFILMENT OF THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN NATURAL RESOURCES ECONOMICS OF BUSITEMA UNIVERSITY

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DECLARATION

I YERINDE AMBROSE, assert that this research report submitted to the Faculty of Natural Resource and Environmental Sciences is my original work and to the best of my knowledge, it has not been submitted by any other person to any institution for the award of a degree or any other purposes.

Signature.....

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APPROVAL

This is to certify that **YERINDE AMBROSE, REG No. BU/UG/2017/135** has submitted this research thesis to Busitema University, Faculty of Natural Resource and Environmental Sciences for consideration; as his research which shall bid a partial fulfillment for a Bachelor of Science degree in Natural Resource Economics.

Signature: .....

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DATE: ..11/12/2020.....

DEDICATION

This dissertation is dedicated to my beloved parents and siblings, and NRE Class of 2017 whose unyielding love, support and encouragement have enriched my soul and inspired me to pursue and complete this research.

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List of Acronyms

AGC	Aboveground Carbon
AGB	Aboveground Biomass
CO_2	Carbon dioxide
^0C	Degrees centigrade
C	Carbon
CFR	Central Forest Reserve
DBH	Diameter at Breast Height (1.3M)
Exp	Exponential
EPA	Environmental Protection Agency
FACE	Forests Absorbing Carbon Emissions
FAO	Food and Agricultural Organization
g	gram
GHG's	Green House Gases
GIS	Geographical Information System
GPS	Global Positioning System
GtC	Gigatons of carbon
H	Height
Ha	Hectare ($10000m^2$)
IFAD	International Fund for Agricultural Development
IPCC	Panel for Climate Change International
Km	Kilometer
MAAIF	Ministry of Agriculture, Animal Industry, and Fisheries
M	Meter
Mg	Mega grams

MW	Mega Watts
NFA	National Forestry Authority
NGO	Non-Governmental Organization
NTFP	Non Timber Forest Products
PEMA	Participatory Environmental Management Programme
PHRD	Policy and Human Resources Development Fund
KPO	Palm Kernel Oil
RED	Renewable Energy Directive
SOC	Soil Organic carbon
t/Ha	tons per Hectare
TEV	Total Economic Value
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Framework Convention on Climate Change
USA	United States of America

ABSTRACT

This study on assessment of aboveground carbon stock in different land cover types of agriculture and forestry was carried out in Namasagali Sub County. Forests sequester and store more carbon than any other terrestrial ecosystem and are an important natural 'brake' on climate change. When forests are cleared or degraded, their stored carbon is released into the atmosphere as carbon dioxide (CO_2). According to the Kyoto Protocol, land use, land-use change, and forestry (LULUCF) are recognized as serving the role of carbon source and sink in relation to a change in land cover and carbon stocks. It also influences the amount of biomass and carbon stored in vegetation (Ipcc et al., 2019). The main objective of the study was to estimate the above ground carbon stocks in different land cover types. This was achieved by, assessing the biomass in a plot of 50 m*50 m established in all forests and all the tree stands within the chosen plots while measuring tree diameter for all qualified trees in the sampled plots with consideration of the DBH while in agriculture land cover, maize stalks were collected and weighed. The biomass was converted to carbon using the form factor "carbon = 50% of the biomass in trees and 0.45^ (19). In this study, it was found out that carbon stock was highest in forest land cover especially under eucalyptus plantation and least in agriculture, maize in particular. It was also confirmed through hypothesis testing there is significant variation in carbon stock capacity among different land cover types, where the overall Prob > chi2 = 0.0007. The study concludes that there was a variation in carbon pools in different land-cover types in Namasagali, where ABGC stock estimated was highest in forestry ranging from eucalyptus plantation to agro-forestry land-cover and least in agriculture, maize in particular. However, it was realized in the study that the dry mass of maize stored very low carbon content because much of the carbon was accumulated in soil to form soil organic carbon (SOC) during maturity of maize. However, it emphasized that planting of more fast growing tree species such as eucalyptus to increase on the terrestrial carbon sink capacity and need for establishment of schemes such as payment of ecosystem services (PES), carbon markets such that the individuals practicing conservation are rewarded.

Keywords: Carbon stock. Land cover, Aboveground, Biomass

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Forests sequester and store more carbon than any other terrestrial ecosystem and are an important natural 'brake' on climate change. When forests are cleared or degraded, their stored carbon is released into the atmosphere as carbon dioxide (CO_2). According to the Kyoto Protocol, land use, land-use change, and forestry (LULUCF) are recognized as serving the role of carbon source and sink in relation to a change in land cover and carbon stocks. It also influences the amount of biomass and carbon stored in vegetation (Ipcc et al., 2019). Tropical deforestation is estimated to have released of the order of 1–2 billion tonnes of carbon per year during the 1990s, roughly 15–25% of annual global greenhouse gases (GHGs) emissions (Fearnside and Laurance 2003; Houghton 2005). The largest source of GHGs emissions in most tropical countries is from deforestation and forest degradation. So, that terrestrial ecosystem in the global carbon cycle has raised considerable interest among researchers and policy makers. Exchange between atmosphere and vegetation involves large two way fluxes, with fixation of CO_2 into biomass through photosynthesis approximately balanced by the release of CO_2 through processes of decomposition and burning. It is estimated about 60 Pg carbon is exchanged (in both directions) between terrestrial ecosystems and the atmosphere every year, with a net terrestrial uptake of 0.7±1.0 Pg C (Lasco 2002).

However, relative to the size of the atmospheric pool of CO_2, land use change and forest conversion are significant source of CO_2 contributing to around 1.7±0.6 Pg C per year. Current efforts to mitigate the impact of climate change are through ways of increasing carbon sequestration and/or mitigating carbon emission (Roxburgh et al. 2006). Increased carbon stocks (carbon sequestration) can be achieved by (1) natural increases in forest growth and biomass, (2) increasing tree stocks in existing forest either through increasing growth or decreasing harvest and (3) establishing fast growing tree plantation (Niles 2002). Carbon sequestered is stored in the form of woody biomass, thus the simple way to increase carbon stock is to plant and manage trees (Bonino 2006). Terrestrial carbon stocks consist of above and below ground carbon. Above ground carbon stocks component includes biomass (stems, twigs, leaves, vines, epiphytes and

REFERENCES

Allometric models for tree volume and total aboveground biomass in a tropical humid forest in Costa Rica. (2005). *Segura M, Kanninen M.*

The Effects of Forest Management on Carbon Allocation in Eucalyptus Plantation. . (5. Wan, S.Z. The Effects of Forest Management on Carbon Allocation in Eucalyptus Plantation. Ph.D. De 2014). Guangzhou, China: Wan, S.Z Ph.D.

. Allometry and partitioning of above- and belowground tree biomass in an age-sequence of white pine forests. (2007). Peichl M.; Arain and M.A,.

Chiabai, A., Travisi, C., Ding, H., Markandya, A., & Nunes., a. P. (2009). *Economic Valuation of Forest Ecosystem Services: Methodology and Monetary Estimates.*

Development of Allometric Equation for Estimating Aboveground Biomass in Ampang forest reserve. (2017). Khalid N, Hamid JRA.

Economic Valuation of Forest Ecosystem Services: Methodology and Monetary Estimates. (2009). Chiabai, A; C.M. Travisi; H. Ding; A. Markandya.

Huang, L., Liu, J., Shao, Q., & Xu, X. (2012). *Carbon sequestration by forestation across China: Past, present, and future.*

IPCC . (2007). *Climate Change Impacts, Adaptation and Vulnerability. Four Assessment .* IPCC.

IPCC. (2006). *Guidelines for National Greenhouse Inventories.* IPCC.

International, W., & December, O. (2013). *Continuing to exploit and deforest Wilmar 's ongoing abuses.* 1–6.

Ipcc, A., Report, S., Roberts, D., Ferrat, M., Connors, S., Haughey, E., & Malley, J. (2019). *Climate Change and Land.*

Isaac Kiyingi, A.-K. E. (2016). *The economics of the carbon sequestration potential of plantation forestry in south-western Uganda.*

J, N. (2009). *Allometric equations for tree species and carbon stocks for forests of Northwestern Mexico.*

J., K. (2011). *Forest plantations and woodlots in Uganda.*

Jayakumar, K. T. (2012). *Methods to Estimate Above-Ground Biomass and Carbon Stock in Natural Forests .*

Kasten, T. (2009). *Carbon Stock Assessment and Modelling in Zambia A UN- UN - REDD.*

Methods to Estimate Above-Ground Biomass and Carbon Stock in Natural Forests. (2012).

N. H. Ravindranath, a. M. (2008). *Handbook for greenhouse gas inventory, carbon mitigation and round wood production projects.*

NFA. (2009.). *Land cover of Uganda 2005 by NFA Inventories.* NFA.

Omoro L.M.A., S. M. (2013). *Tree biomass and soil carbon stocks in indigenous forests in comparison to plantations of exotic species in the Taita Hills of Kenya.*

Raich, J., Clark, D., Schwendenmann, L., & Wood, T. (2014). *Aboveground tree growth varies with belowground carbon allocation in a tropical rainforest environment.*

Sekajugo J, I. M. (2015). *Sugarcane carbon sequestration potential under th (Allometric models for tree volume and total aboveground biomass in a tropical humid forest in Costa Rica., 2005)e clean development mechanism.*

Singh V, T. A. (2011). *Formulating allometric equations for estimating biomass and carbon stock in small diameter trees.*

Wei, Y., Li, M., Chen, H., Lewis, B., Yu, D., Zhou, L., . . . Dai, L. (2013). *Variation in carbon storage and its distribution by stand age and forest type in boreal and temperate forests in northeastern China.*

Zhang, H., Guan, D., & Song, M. (2012). *Biomass and carbon storage of Eucalyptus and Acacia plantations in the Pearl River Delta, South China.*

Zhao, J., Wu, J., & Shao, W. Z. (2015). *Carbon Storage and Allocation Pattern in Plant Biomass among Different Forest Plantation Stands.*