

**LIVELIHOOD, SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF  
BRICK MAKING AND SAND MINING IN WETLAND AREAS OF IBANDA  
DISTRICT, WESTERN UGANDA**

BY

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**JUNE 2014**

### Declaration

I, **Turyahabwe Davis**, do here declare that this dissertation is my own work and has not been submitted for a Degree Course in any other University.

Signature  ..... Date 26/05/2014 .....

**Turyahabwe Davis**

**APPROVAL**

This is to certify that TURYAHABWE DAVIS..... did research and this report is a true representation of the findings. I am therefore recommending that this report be submitted to the Faculty of Natural Resources and Environmental Sciences of Busitema University.

.....

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## **Dedication**

To my parents; Tibeteisa Moses and Kobusingye Naome, siblings; Nyakato Doris, Kakuru Daniel, Turinawe Denis, Turyasingura Dorcus and Atuhaire Joan.

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### **Glossary of Acronyms and Abbreviations**

**NOAA-** National Oceanic and Atmospheric Administration

**CIANEA-** Community Based Impact Assessment Network for East Africa

**NWMCP-** National Wetlands Conservation and Management Programme

**UBOS-** Uganda Bureau of Statistics

**SAPs-** Structural Adjustment Policies

**MoNR-** Ministry of Natural Resources

**NEMA-** National Environment Management Authority

**CWA-** Clean Water Act

**ha-** Hectares

**Ugshs-** Uganda shillings

**\$ US-** United States Dollar

**UNCCD-** United Nations Convention to Combat desertification

**UNEP-** United Nations Environmental Programme

## **Abstract**

The recent boom in the construction industry has led to drastic and indiscriminate increase in informal brick making and sand mining to provide building materials of sand and bricks. This has come at the cost of wetlands which are degraded to extract sand and clay. The focus of this study was to find out environmental sustainability and livelihood output of brick making and sand mining economic activities in wetlands of Ibanda district. The environmental impacts of brick making and sand mining practices were studied. The statistical examination of individual interview data from questionnaires illustrates that although there are social, economic and marginal food security benefits, degradation as a result of production activities of brick making and sand mining activities characterized by unfilled pits were major impacts on the environment. It can be concluded from this study that the community foregoes agricultural output for example, 8.56 per year revenue from common beans, as a result of a single brick making activity due to land becoming unproductive because of unfilled pits. However, only crop production was assessed. Quantifying and assessing of other ecological values foregone reduces the gross profits from brick making and sand mining by a big value.

**Keywords:** *Natural Resources Exploitation, Brick making, Sand Mining, Wetlands, Livelihood, Environmental impacts, western Uganda*

# **CHAPTER ONE: INTRODUCTION**

## **1.1. Introduction**

This chapter contains background of the study, problem statement, objectives, hypotheses, research questions, conceptual frame work and the scope.

## **1.2. Background of the study**

Wetlands provide a range of goods and services and possess a variety of attributes of value to society (Barbier 1993). They offer provisioning (sand and clay), regulating, cultural, and supporting services (Millennium Ecosystem Assessment 2005) that generate economic value from their direct, indirect, or potential use. Yet, despite legislation designed to protect them, wetlands continue to be degraded and lost at an alarming rate (Turner et al. 2000). This is at least partly because of a lack of understanding of their ecological, livelihood, environmental and socio-economic importance. This situation leads to their over exploitation.

Over the last 30 years, in Ibanda district (western Uganda), many wetlands have been lost or degraded as a result of increased extraction of sand and brick making. An understanding of the socio-economic value of wetlands is crucial when deciding on conservation and development priorities related to land use and the allocation of scarce wetland resources that are still remaining in this district. Therefore, the value of the natural resources that wetlands provide to poor communities is a critical consideration to policymakers and to any other stakeholders interested in sustainable development while improving the well-being of people.

These wetland resources include rich and moist soils for cultivation and for brick making; grazing pasture for livestock; papyrus reeds for crafts; and water for domestic use, watering livestock, etc. It has been estimated that several millions of rural Ugandans are dependent on agriculture which solely is backed by natural resources for

## REFERENCES

- Acharya G.(1998)** Hydrological–Economic Linkages in Water Resource Management. Unpublished PhD thesis, University of York; 273 Pages
- Akwetaireho S (2009)** Economic Valuation of Mabamba Bay Wetland System of International Importance, Wakiso District, Uganda, Alps-Adriatic University of Klagenfurt, Klagenfurt, Austria, 41 pages
- Atlas for Uganda’s Changing Environment ( 2009)** National Environment Management Authority, Kampala, Uganda, 34 pages
- Barbier EB, Markandya A, Pearce DW (1991)** Sustainable Agricultural Development and Project Appraisal, *European Review of Agricultural economics* **17**(2):181-196.
- Barbier E B(1993)**. Sustainable use of wetlands; valuing tropical wetland benefits: economic methodologies and applications. *Geographical Journal* **159**(1):22-32.
- Barbier E B, Acreman M, Knowler D (1997)** *Economic valuation of wetlands: a guide for policy makers and planners*. Ramsar Convention Bureau, Gland, Switzerland: 26-93
- Begg G (1986)** *The wetlands of Natal. Part 1: an overview of their extent, role and present status*. Natal Town and Regional Planning Report, Natal Town and Regional Planning Commission, Natal, South Africa. Volume 68, 100 pages
- Béné C(2003)**. When fishery rhymes with poverty: a first step beyond the old paradigm on poverty in small-scale fisheries. *World Development* **31**:949-975.
- Bisaro S (2007)**. Formal and informal institutions in the wetlands of the Lesotho Highlands. in C. Pahl-Wostl, P. Kabat, and J. Moltgen, editors. *Proceedings of the International Conference on Adaptive and Integrated Water Management: coping with complexity and uncertainty*. (Basel, 2007). Springer, Berlin, Germany, 21 pages
- Buyinza M Khainza C, Bukenya M (2009)** Emerging local economic dynamics shaping the transformation and use of wetlands for brick making in Goma subcounty, Mukono district, *Online Journal of Earth Sciences* **3 (1): 23-31**



- Crafter SA, Njuguna SG, Howard GW (1992).** Wetlands of Kenya. Proceedings of the KWWG Seminar on Wetlands of Kenya, National Museums of Kenya, 3 to 5 July 1991. International Union for Conservation of Nature and Natural Resources (IUCN). viii + 183 pp.
- Cordell Ken H, Danielle M, Kurt HR, Harvard JE (2005)** The natural ecological value of wilderness, 249pages
- Davis H (1993)** Indigenous Views of Land and the Environment. The International Bank for Reconstruction and Development/THIE WORLD BANK, 1818 H Street, N.W.Washington, D.C. 20433, U.S.A, 66 pages
- Delang C O (2006a)** Economic valuation of non-marketed wild edible plants in Thailand. *Environmental Conservation* **32**:285-287.
- Delang C O (2006b)** Not just minor forest products: the economic rationale for the consumption of wild food plants by subsistence farmers. *Ecological Economics* **59**(1):64-73.
- United Nations Convention to Combat Desertification **(2013) Economic and Social Impacts of Desertification.** *Land Degradation and Drought*: 5 - 16.
- Emerton L, Iyango L, Luwum P, Malinga A (1998)** The Present Economic Value of Nakivubo Urban Wetland, Uganda. IUCN — The World Conservation Union, Eastern Africa Regional Office, Nairobi and National Wetlands Programme, Wetlands Inspectorate Division, Ministry of Water, Land and Environment, Kampala, 20pages
- Nellemann C, MacDevette M, Manders T, Eickhout B, Svihus B, Prins AG, Kaltenborn BP(2009).** The environmental food crisis – The environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal, www.grida, 57pages
- FAOSTAT(2010)** Agriculture; Agricultural Production, Crops Primary, Sweet Potato; Population: Annual Time Series, Land: *Land Use*: 6 - 44
- Frank P(2009)** Land Tenure and Agricultural Productivity in Africa: A Comparative Analysis of the Economics Literature and Recent Policy Strategies and Reforms, *World Development Vol. 37*(8):1326–1336

- George J (1998)** Life cycle analysis of brick and mortar products, Athena sustainable materials institute, Merrickville, Ontario, Canada, 9
- Grab S, Morris C (1997)** A threatened resource: Lesotho's alpine wetlands, unique in many ways, are facing a complexity of threats. *African Wildlife* **51**(3):14-16.
- Kangalawe RYM, Liwenga ET (2005)**. Livelihoods in the wetlands of Kilombero Valley in Tanzania: opportunities and challenges to integrated water resource management. *Physics and Chemistry of the Earth* **30**:968-975.
- Mangheni M N (2007)** Experiences, Innovations and Issues in Agricultural Extension in Uganda: Lessons and Prospects, Kampala, Fountain Publishers, 52pages
- Meltzer M I (1995)** Livestock in Africa: the economics of ownership and production, and the potential for improvement. *Agriculture and Human Values* **12**(2):4-18.
- Millennium Ecosystem Assessment (2005)** *Ecosystems and human well-being: synthesis*. Island Press, Washington, D.C., USA.
- MINEO Consortium (2000)** Review of potential environmental and social impact of mining, at <http://www2.brgm.fr/mineo/UserNeed/IMPACTS>. 27pages.
- Ministry of Natural Resources (1995)** The Republic of Uganda National Environment Action Plan. Kampala, Uganda, Ministry of Natural Resources report, 25pages
- Namubiru I (2004)** The impact of brick making on the environment of Ntawo ward Mukono district, Kampala, 13pages
- Niering William A (1991)**. Wetlands of North America. Charlottesville, Virginia: Thomasson-Grant, Inc. Introduction to wetlands, cocktail table style. Fine textual information, great photographs. 160pp
- Nuwagaba A, Namateefu LK (2013)** Climatic Change, Land Use and Food Security in Uganda: A Survey of Western Uganda, *Journal of Earth Sciences and Geotechnical Engineering* **3**(2): 61-72
- NWCMP (1996)**. *Wetlands Status Report for Kampala District*, National Wetlands Conservation and Management Programme, Ministry of Lands Water and Environment, Kampala

**Palmer R W, Turpie J, Marnewick GC, Batchelor AL (2002)** *Ecological and economic evaluation of wetlands in the Upper Olifants River Catchment, South Africa*. WRC Report Number 1162/02. Water Research Commission, Pretoria, South Africa.

**Reint J , Lucy I ( 2000)** Engaging local users in the management of wetland resources. the case of the national wetlands programme, Uganda at <https://portals.iucn.org/library/efiles/edocs/2000-019-03.pdf>: 2-10

**Sardar K, Rasuljan M(2000)** Assessment of environmental and socio-economic factors of brick kilns in Peshawar, Pakistan. *Geol. Bull. Univ. Peshawar, Vol. 33:97-102*

**Schuyf K D (2005)** Economic consequences of wetland degradation for local populations in Africa. *Ecological Economics* **53**:177-190

**State of the environment report for Uganda (1998)** National Environment Management Authority Kampala, Uganda, 50pages

**State of the environment report for Uganda (2006/2007)**, National Environment Management Authority Kampala, Uganda, 55pages

**Tindamanyire T, Iyango L, Kiwazi F, Kaganzi E, Busulwa H, Mafabi P (2000)** Traditional wetland practices in rural communities in Uganda. Wetlands Inspection Division, Ministry of Water Lands and Environment, Kampala, Uganda, 7pages

**Turner R K , van den Bergh JCJM, Soderqvist T, Barendregt A, van der Straaten J, Maltby E, van Ierland EC (2000)** Ecological-economic analysis of wetlands: scientific integration for management and policy. *Ecological Economics* **35**:7-23

**Turyahabwe N, Kakuru W, Tweheyo M , Tumusiime DM (2013)** Contribution of wetland resources to household food security in Uganda, *Agriculture & Food Security* **2**:5-17

**Wasswa H, Mugagga F, Kakembo V (2013)** Economic Implications of Wetland Conversion to Local People's Livelihoods: The Case of Kampala- Mukono Corridor (KMC) Wetlands in Uganda, Department of Geosciences, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. Department of Geography, Geo-Informatics and Climatic Sciences, Makerere University, Kampala, Uganda. *Academia Journal of Environmental Sciences* **1**(4): 066-077