THE ROLE OF SUBSISTENCE AGRICULTURE ON WETLAND CONSERVATION: A CASE STUDY OF BUGOLOBI, NAKAWA DIVISION.

BY

WILOBO JOHN BAPTIST

BEM/11298/102/DU

A DISSERTATION SUBMITTED TO THE COLLEGE OF APPLIED SCIENCES AND TECHNOLOGY IN PARTIAL FULFILMENT OF THE AWARD OF BACHELORS DEGREE IN ENVIRONMENTAL MANAGEMENT OF KAMPALA INTERNATIONAL UNIVERSITY.

OCTOBER 2012.

DECLARATION

I, **Wilobo John Baptist**, declare that this dissertation on **"The role of Subsistence Agriculture on Wetland Conservation"** is my original work and has never been submitted to any university for any award.

Where the works of others have been cited, acknowledgements have been made.

Signature................................ Date................................

WILOBO JOHN BAPTIST.

APPROVAL

I certify that the work of this candidate has been under my supervision and is now ready for submission, to be evaluated for the award of a Bachelor of Science in Environmental Management of Kampala International University.

Supervisor........................ Date. 13th NOV 2012

MS. KATONGOLE HADIJJAH.

DEDICATION

This work is dedicated to my late sister Adoch Stella, Girlfriend Joy, brothers; Joseph, Simon, Morris and Mark, Sisters; Janet, Catherine, Patricia, and Sandra, my lovely and wonderful parents Mr and Mrs Okot.

ACKNOWLEDGEMENT

First, I thank the Almighty God for giving me the grace to accomplish this Work. Without him, I would not have achieved it.

Secondly,I want to thank my dear parents for not only bringing me to this world, but also to sacrifice everything they had to make sure that I acquired education up to University level. Daddy always believed in me and often spoke to me words of Blessing and Encouragement while Mom always prayed for me. I really appreciate!

A special thank you goes to my Supervisor Ms.Katongole Hadijjah for her time in offering me guidance, encouragement, corrections, and reading through my work to ensure that errors are omitted while remaining on the right course.

I also want to thank other Lecturers at the College of Applied Sciences and Technology (CAST) especially in the Department of Biological and Environmental Science, including among others; Mr. Danson, Mr. Amon, Ms. Abong, Mr. Omuna and Mr.Eniru, for giving me advice on how to write a good dissertation. Thank you!

I cannot forget to thank the local council leaders (LC1) and the farmers around Bugolobi who gave me the permission and information I needed to carry out my research work.

Lastly, I want to thank my friends including Mr. Moses Hategeka, Kemmie, and Edward Olik for their support and encouragement while writing this project. God bless you all!

ABSTRACT

Subsistence agriculture involves the growing of crops and rearing of animals on a small scale for home consumption, use of simple tools and more labour whereas Wetland conservation is aimed at protecting and preserving areas where water exists at or near the Earth's surface such as swamps, marshes and bog. This study was therefore carried out to assess the extent of Subsistence agriculture and its role on wetland conservation in Bugolobi, Nakawa division. The study was conducted among the small holder farmers around Bugolobi area. The general objective of the study was to determine the role of subsistence agriculture on wetland conservation, and the specific objectives were to, identify the types of subsistence agriculture practiced, determine the value of wetlands, and to establish the effects of subsistence agriculture on water quality, soil and biological diversity.

A descriptive study design in which both qualitative and quantitative methods were adopted. A total of 40 farmers were interviewed using interview guides and informal discussions based on questionnaires. Observation method was also used to assess the effects of subsistence agriculture on wetlands. This was done by focussing on the effects of subsistence agriculture on water (H20) and biological diversity (BD) within the wetland. Experimental research was also carried out to determine the effects of subsistence agriculture on soil. This was done by testing the soil for nutrient deficiencies such as nitrogen and potassium (NPK) using a soil test kit. Data was analyzed, coded and presented using pie charts and bar graphs.

The study established that subsistence agriculture had effects on Wetland conservation and contributed to the decline of biodiversity, soil and water quality through poor farming practices that affected the soil, and clearing of certain plant species like papyrus that affected the quality of drinking water. I concluded that it was critical to protect the Wetland from the destruction resulting from unsustainable agricultural practices. I recommended the development of wetland inventory/appraisal, monitoring and assessment, demonstration of integrated approaches to wetland management, and sustainable agricultural practices such as crop rotation, mixed farming and organic farming.

LIST OF ACRONYMS

$BaSO_4$	BARIUM SULPHATE
BD	BIOLOGICAL DIVERSITY
C	CARBON
CEC	CATION EXCHANGE CAPACITY
FGDs	FOCUS GROUP DISCUSSIONS
g/cm^3	GRAM PER CUBIC CENTIMETER
GHGS	GREEN HOUSE GASES
Gt	GIGATONNE
H^+	HYDROGEN ION
IUCN	INTERNATIONAL UNION FOR CONSERVATION OF NATURE
KCC	KAMPALA CITY COUNCIL
LC	LOCAL COUNCIL
MDGS	MILLENIUM DEVELOPMENT GOALS
NARO	NATIONAL AGRICULTURAL RESEARCH ORGANISATION
NEMA	NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY
NGO	NON GOVERNMENTAL ORGANISATION
NPK	NITROGEN PHOSPHORUS POTASSIUM
P^H	POTENTIAL OF HYDROGEN
UBOS	UGANDA BUREAU OF STATISTICS
UNEP	UNITED NATIONS ENVIRONMENT PROGRAMME
UWA	UGANDA WILD LIFE AUTHORITY
WCMC	WORLD CONSERVATION MONITORING CENTRE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

1.0 Introduction

1.1 Background

Wetlands are ecosystems or units of the landscape that are found on the interface between land and water. While water is a major factor of wetland definition (Ramsar Convention Bureau, 1997), soils, vegetation and animal life also contribute to their unique characteristics (Koetze, 1996; Howard, 1995; Roggeri, 1995). As a result, it has proved difficult to define wetlands, and over fifty (50) definitions exist. That used by the Ramsar Convention (1997: 2) is as follows: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres". This definition provides significant latitude – wetlands, as a result, come in a whole host of forms and types. The Ramsar Convention recognises five major wetland systems (Ramsar Convention Bureau, 1997), while others identify up to seven main groupings (Dugan, 1990). The major Ramsar groupings are:

i. Marine (coastal wetlands)
ii. Estuarine (deltas, tidal marshes, and mangroves)
iii. Lacustrine (lakes and associated wetlands)
iv. Riverine (rivers, streams and associated wetlands)
v. Palustrine (marshes, swamps and bogs)

These forms are further divided into more than thirty (30) sub-divisions classifying them according to physical, chemical or biological characteristics. Wetlands are distributed all over the globe and are estimated to cover about six percent (6%) of the earth's surface (Maltby, 1986) – some five point seven million square kilometres (5.7 million km^2) according to (WCMC, 1992). Although Africa is best known for its savannahs and hot deserts, one percent (1%) of its surface area (345,000 km$^{)}$ is covered by wetlands (Finlayson and Moser, 1991). These ecosystems range from the Senegal River and the Inner Niger Deltas in the West, to the Sudd Floodplains and the Ethiopian Wetlands in the East. Southwards, important wetlands include the Zaire Basin Swamps, the Okavango Inland Delta, the Kafue Flats, the African Great Lakes and the extensive Malagarasi-Moyovosi Wetlands in Tanzania.

Wetland characteristics will also vary with altitude, with high ground wetlands such as those found in the Ethiopian and Kenyan mountain systems, complementing lowland types found in the semi-desert.

Uganda covers a total land area of about 241,500 Km^2, of which 30,105Km^2 (13%) is Wetlands (NEMA 2000). Wetlands come in many shapes, sizes and types. Very large swamps form the edges of lakes Victoria and Kyoga. Many small wetlands are found throughout the country.

The Ramsar Convention 1971, defines wetlands as .areas of marsh, fen, peatland or water whether natural or artificial, permanent or seasonal with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.

The National Environment Statute (1995) defines Wetlands (or swamps) as areas, which are permanently or seasonally flooded by water, and where plants and animals have become adapted.

In general, a wetland can be defined as a shallow water body with teaming life of complex fauna and flora. It stays wet long enough for certain plants and animals to grow even when there is no rain.

The most common type of wetland in Uganda is the papyrus swamp, but other wet places such as flood plains, swamp forests, bogs and seasonally flooded grass lands are also referred to as wetlands.

Wetlands represent one of the vital natural resources Uganda is endowed with. They provide ecological services (climate modification, water purification, waste water treatment, flood control and water storage and distribution in space and time). Direct uses include a source of water for domestic purposes, livestock watering, source of fish, medicinal plants and animals, and various materials like clay. They also have vital attributes such as biological diversity, gene pool research material, cultural values and aesthetic values. The overall economic value of wetlands in Uganda has not yet been quantified. Emerton et al, (1999), estimates the purification function of the 5km^2 Nakivubo wetland in Kampala is at US$1.3 million per year. Papyrus harvesting and mat making in rural wetlands in Eastern Uganda contribute US$ 200 per year per family's income (IUCN 2005). Unfortunately the importance of wetlands is largely associated with the direct consumptive use value. The essential life support processes (ecological) are the least recognized. By 2000, an estimated 2,376.4km^2 of wetland area had been reclaimed for agricultural, industrial and related activities. By the late 1990s, almost 8%

of the wetland had been reclaimed (NEMA 2000). In 2006, with the exception of the two Ramsar sites, about twenty six community wetlands although managed under community based management plans and pockets of wetlands in various protected areas, a large portion of the wetlands still face degradation. The underlying cause of wetlands destruction is the insatiable desire of both the rich and the poor to derive livelihood from the wetlands. This is exacerbated by the high annual population growth rate of 3.3% (UBOS, 2002), and pressure from industrial construction. The communities that access these wetlands use them for agriculture and extraction of various raw materials, and fishing. The per capita income of a Ugandan is about US$ 300 per year (NEMA, 2000).

In the colonial period (before 1962), the wetlands like other natural resources, were designated as reserves. Much as the wetlands legally belonged to the central government, the traditional institutions through monarchical systems played a big role in their protection. These were almost exclusively based on traditional beliefs and spiritual attachment. With political changes since independence, the powers of traditional institutions were reduced. As a result, they lost direct control over these resources. The communities also lost the sense of attachment to such resources. Consequently, it became difficult to understand the definite tenure and property arrangements pertaining to wetlands.

Some evident impacts of wetland destruction include;

- Frequent flooding
- Destruction of biodiversity habitats and associated ecological processes
- Adverse local climate modification characterised by prolonged droughts. This has largely contributed to 2-metre drop in River Nile and Lake Victoria water levels.

The government has pioneered several interventions to counter wetland degradation. This includes;

- Knowledge base building,
- Policy,
- Legal,
- Institutional establishments and community based approaches.

Wetland conservation is aimed at protecting and preserving areas where water exists at or near the Earth's surface, such as swamps, marshes and bog.

Subsistence agriculture refers to a system of farming involving the growing of crops and rearing of animals on a small scale purposely for home consumption.

One school of thought views subsistence agriculture very negatively. It is perceived as an unwanted phenomenon "characterized by a low-external input level and low productivity as synonymous with backwardness and inefficiency, holding down economic growth and economic performance." (Heidhues and Brüntrup, 2003), "associated with poverty, low levels of technology, inefficient production and low levels of commercialization" (Mathijs and Noev, 2004) and the "making use of scarce resources which could have been allocated to a more efficient use" (Kostov and Lingard, 2004).

Barnett et al. (1996) defines subsistence farming in terms of the following characteristics:

- The farming activities form a livelihood strategy
- The output is consumed directly
- Only a few purchased inputs enter the production process
- The proportion of output sold is low

This type of farming is practised to meet the needs of the farmer's family. Traditionally, low levels of technology and household labour are used to produce on small output. The extent of subsistence farming varies from country to country in transition economies, but what is striking is its universal presence.

Over half the consumption of major agricultural products in Bulgaria is provided from self-sufficient small production units (Mishev.P, N. Ivanova, M. Tzoneva and P. Kostov 1999) According to survey data, 51% of Romanian farm households do not sell any production (Sarris et al. 1999), and in a survey for Bulgaria the figure is even higher with 77.25% of individual farms failing to sell any production (Kostov. P and J. Lingard 2003). About 40% of the overall agricultural output in Russia in 1951 could be attributed to the small scale self-sufficient sector (Serova et al.1999). In Poland over half of all farms have practically no involvement with the market (Kwasniewski, 1999).

Pre-industrial agricultural peoples throughout the world have traditionally practiced subsistence farming. Some of these peoples moved from site to site as they exhausted the soil at each location. As urban centres grew, agricultural production became more specialized and commercial farming developed, with farmers producing a sizeable surplus of certain crops, which they traded for manufactured goods or sold for cash.

Subsistence farming continues today in large parts of up-country Africa, and other countries of Asia and Latin America. Subsistence agriculture had by and large disappeared in Europe by the beginning of World War I, and in North America with the movement of sharecroppers and tenant farmers out of the American South and Midwest during the 1930s and 1940s. In Central and Eastern Europe subsistence and semi-subsistence agriculture reappeared within the transition economy since about 1990 (Wikipedia).

1.2 Statement of the problem

Subsistence agriculture in Bugolobi wetland is practiced by farmers who are grazing their animals, practicing both monocropping and monoculture, using fertilizers and herbicides to improve their crop production, and reclaiming the swamp for agriculture (NEMA, 2000).

However, these practices on Bugolobi wetland are threatening the integrity and sustainability of the wetland resulting into flooding, reduction in building and craft materials such as papyrus, reduction in water quality, soil pollution and reduction in both the flora and fauna species hence preventing the wetland from performing its functions (NEMA, 2000).

Therefore, the researcher intends to investigate the role of subsistence agriculture on wetland conservation in Bugolobi.

1.3 General objective

The general objective of this study was to determine the role of subsistence agriculture on wetland conservation in Bugolobi, Nakawa division.

1.4 Specific objective

i. To identify the types of subsistence agriculture in Bugolobi.

ii. To determine the value of wetlands in Bugolobi.

iii. To establish the effects of subsistence agriculture on wetlands in Bugolobi.

1.5 Research questions

i. What are the types of subsistence agriculture in Bugolobi?

ii. What is the value of wetlands in Bugolobi?

iii. What are the effects of subsistence agriculture on wetlands?

CHAPTER TWO

2.0 Literature review

2.1Definition of terms

Wetland

A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. Primarily, the factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation that is adapted to its unique soil conditions: Wetlands consist primarily of hydric soil, which supports aquatic plants. The water found in wetlands can be saltwater, freshwater, or brackish. Main wetland types include swamps, marshes, bogs and fens. Sub-types include mangrove, carr, pocosin, and varzea (Wikipedia).

Wetland conservation

Wetland conservation is a conservation measure aimed at protecting and preserving areas where water exists at or near the Earth's surface, such as swamps, marshes and bogs. Wetlands cover at least six per cent of the Earth and have become a focal issue for conservation due to the ecosystem services they provide. More than three billion people, around half the world's population, obtain their basic water needs from inland freshwater wetlands. The same numbers of people rely on rice as their staple food, a crop grown largely in natural and artificial wetlands. In some parts of the world, such as the Kilombero wetland in Tanzania, almost the entire local population relies on wetland cultivation for their livelihoods (Wikipedia).

2.2 The concept of Subsistence Agriculture

Subsistence agriculture is self-sufficiency farming in which the farmers focus on growing enough food to feed themselves and their families. The typical subsistence farm has a range of crops and animals needed by the family to eat and clothe themselves during the year. Planting decisions are made principally with an eye toward what the family will need during the coming year, and secondarily toward market prices. Tony Waters writes: "Subsistence peasants are people who grow what they eat, build their own houses, and live without regularly making purchases in the marketplace." However, despite the primacy of self-sufficiency in subsistence farming, today most subsistence farmers also participate in trade to some degree; though usually it is for goods that are not necessary for survival, and may include sugar, iron roofing sheets, bicycles, used clothing, and so forth. Most subsistence farmers today live in developing countries. Although their amount of trade as measured in cash is less than that of consumers in countries with modern complex markets, many have important trade contacts and trade items that they can produce because of their special skills or special access to resources valued in the marketplace (Wikipedia).

Subsistence grain-growing agriculture (predominantly wheat and barley) first emerged during the Neolithic Revolution when humans began to settle in the Nile, Euphrates, and Indus River Valleys. Subsistence agriculture also emerged independently in Mexico where it was based on maize cultivation, and the Andes where it was based on the domestication of the potato. Subsistence agriculture was the dominant mode of production in the world until recently, when market-based capitalism became widespread. Subsistence horticulture may have developed independently in South East Asia and Papua New Guinea (Wikipedia)

Subsistence farming continues today in large parts of rural Africa, and parts of Asia and Latin America. Subsistence agriculture had largely disappeared in Europe by the beginning of World War I, and in North America with the movement of sharecroppers and tenant farmers out of the American South and Midwest during the 1930s and 1940s. As recently as the 1950s, it was still common on family farms in North America and Europe to grow much of a family's own food and make much of its own clothing, although sales of some of the farm's production earned enough currency to buy certain staples, typically including sugar; coffee and tea; petroleum distillates (petrol, kerosene, fuel oil); textile products such as bolts of cloth, needles, and thread; medicines; hardware products such as nails, screws, and wire; and a few discretionary items such as candy or books. Many of the preceding items, as well as occasional services from physicians, veterinarians, blacksmiths, and others, were often bought with barter rather than currency. In Central and Eastern Europe subsistence and semi-subsistence agriculture reappeared within the transition economy since about 1990 (Wikipedia).

2.2.1 Types of Subsistence Agriculture

1) Primitive Subsistence farming.

This type of farming includes;

- Shifting cultivation
- Nomadic herding

a) Shifting cultivation (slash and burn or Jhooming)

Shifting cultivation is a form of agriculture in which the cultivated or cropped area is shifted regularly to allow soil properties to recover under conditions of natural successive stages of re-growth. In a shifting cultivation system, at any particular point in time a minority of 'fields' is in cultivation and a majority are in various stages of natural re-growth. Over time, fields are cultivated for a relatively short time, and allowed to recover, or are fallowed, for a relatively long time. Eventually a previously cultivated field will be cleared of the natural vegetation and planted in crops again. Fields in established and stable shifting cultivation systems are cultivated and fallowed cyclically. This type of farming is called jhooming in India.

Fallow fields are not unproductive. During the fallow period, shifting cultivators use the successive vegetation species widely for timber, for fencing and construction, firewood, thatching, ropes, clothing, tools, carrying devices and medicines. It is common for fruit and nut trees in fallows to be planted in fallow fields to the extent that parts of some fallows are in fact orchards. Soil-enhancing shrub or tree species may be planted or protected from slashing or burning in fallows. Many of these species have been shown to fix nitrogen. Fallows commonly contain plants that attract birds and animals and are important for hunting. But perhaps most importantly, tree fallows protect soil against physical erosion and draw nutrients to the surface from deep in the soil profile.

The relationship between the time the land is cultivated and the time it is fallowed are critical to the stability of shifting cultivation systems. These parameters determine whether or not the shifting cultivation system as a whole suffers a net loss of nutrients over time. A system in which there is a net loss of nutrients with each cycle will eventually lead to a degradation of resources unless actions are taken to arrest the losses. In some cases soil can be irreversibly exhausted (including erosion as well as nutrient loss) in less than a decade.

The longer a field is cropped, the greater the loss of soil organic matter, the reduction in the cation-exchange-capacity (CEC) and in nitrogen and phosphorus, the greater the increase in acidity, the more likely soil porosity and infiltration capacity is reduced and the greater the loss of seeds of naturally occurring plant species from soil seed banks. In a stable shifting cultivation system, the fallow is long enough for the natural vegetation to recover to the state that it was in before it was cleared, and for the soil to recover to the condition it was in before cropping began. During fallow periods soil temperatures are lower, wind and water erosion is much reduced, nutrient cycling becomes closed again, nutrients are extracted from the subsoil, soil fauna increases, acidity is reduced, soil structure, texture and moisture characteristics improve and seed banks are replenished.

No universal optimum relationship exists between the length of the cropping period and the length of the fallow period. In favourable agricultural environments, cropping periods can be longer and fallow periods shorter, than in less favourable agricultural environments. In favourable environments soil conditions at the beginning of a cropping cycle will be better and fallow successional stages will proceed faster. Nevertheless, even in the most favourable environments, it is likely that if the cropping period is extended beyond a certain point, the fallow conditions required for an adequate recovery of soils and vegetation will be jeopardized. Shifting cultivation used to be the backbone of smallholder agriculture throughout the tropics, but today it is abandoned in many places in favor of large scale cash crop production – e.g. for biofuels, cash crops. The extent of these changes is not well documented because shifting cultivation land rarely appears on official maps and census data seldom identifies shifting cultivators. Moreover, the consequences of these changes for livelihoods (e.g. food security) are not well known (Wikipedia).

b) Nomadic herding

In this type of farming people migrate along with their animals from one place to another in search of fodder for their animals. Generally they rear cattle, sheep, goats, camels and/or yaks for milk, skin, meat and wool. This way of life is common in parts of central and western Asia, India, east and south-west Africa and northern Eurasia. Examples are the nomadic Bhotiyas and Gujjars of the Himalayas (Wikipedia).

2) Intensive subsistence farming

In very densely populated countries like India and China, farmers use their small land holdings to produce enough for their own consumption, while the little remaining produce is used for exchange against other goods. These farmers try to obtain maximum yield from the available lands by intensifying cultivation techniques, including the preparation of paddy fields which can be used year after year. In the most intensive situation, farmers may even create terraces along steep hillsides to cultivate rice paddies. Such fields are found in densely populated parts of Asia, such as in the Philippines. They may also intensify by using manure, artificial irrigation and animal waste as fertilizer (Wikipedia).

2.3 The concept of Wetland conservation

Wetland conservation is aimed at protecting and preserving areas where water exists at or near the Earth's surface, such as swamps, marshes and bogs. Wetlands cover at least six per cent of the Earth and have become a focal issue for conservation due to the ecosystem services they provide.

Fisheries are also an extremely important source of protein and income in many wetlands. According to the United Nations Food and Agriculture Organization, the total catch from inland waters (rivers and wetlands) was 8.7 million metric tonnes in 2002. In addition to food, wetlands supply fibre, fuel and medicinal plants. They also provide valuable ecosystems for birds and other aquatic creatures help reduce the damaging impact of floods, control pollution and regulate the climate. From economic importance, to aesthetics, the reasons for conserving wetlands have become numerous over the past few decades (Wikipedia).

2.3.1 Wet land functions

One approach of wetland functions was provided by (de Groot (1992), who classifies them into four categories.

a) Regulation functions as ecosystems regulate ecological processes that contribute to a healthy environment.

b) Carrier functions, where ecosystems provide space for activities, like human settlement, cultivation and energy conversion.

c) Production functions—ecosystems provide resources for humans, like food, water, raw materials for building and clothing.

d) Information functions, where ecosystems contribute to mental health by providing scientific, aesthetic and spiritual information.

Wetland benefits are the capability of wetlands to provide humans with goods and services. Wetland services such as cleansing and recycling capacity are conditions and processes through which natural ecosystems sustain and fulfil human life. They maintain biodiversity and the production of wetland goods like wood, water and medicine. These goods and services constitute a value to humans. This total value consists of an ecological value, such as the maintenance of ecosystem stability and climatic stabilization; a socio aesthetical value, such as the role of ecosystems in cultural heritage; an intrinsic value, which is the value that resides in the environmental asset itself and an economic value (de Groot, 1992).

According to (http://www.usepa.gov/bioiweb1/wetlands/importance.html 2012) the following are the importance of wetlands.

Wildlife habitat – Many species are dependent upon wetlands for all or a portion of their life cycle. Wetlands provide habitat for fish, birds, mammals, reptiles, amphibians, and invertebrates.

Erosion control –Wetlands support vegetation that acts as a flood buffer and reduces stream bank erosion during flooding events.

Floodwater storage –Wetlands store water during flooding events and then slowly release the water as flooding subsidies. This can significantly reduce peak flood flows and resulting flood damage downstream.

Ground water recharge –Wetlands store surface water, which then infiltrates into the ground, providing recharge to aquifers. This ground water recharge in turn is slowly released back to adjacent surface water bodies, such as streams, providing water during low flow periods (base flow).

Water purification –Wetlands improve water quality by filtering polluted runoff from cities and agricultural lands. They trap sediments, utilize excess nutrients present in runoff, and breakdown many waterborne contaminants. Constructed wetlands are being used to treat contaminated waters from mines, sewer systems, and urban storm water runoff.

Recreation & Economic Benefits –Wetlands are often visited for recreational purposes such as hiking, bird watching, wildlife photography, and hunting. These activities can translate into dollars spent at local businesses, adding revenue to the economy.

Education – Wetlands make excellent and inexpensive outdoor laboratories for students of all ages. For example, the Cherry River recreation site located on the north side of Bozeman, Montana is visited by hundreds of school children each year. The students get to see numerous plants and animals, and the cost to local schools is minor, other than the transportation.

Erosion Control –Roots of trees, shrubs, and grasses hold soil in place along the banks of rivers and streams, reducing the potential for bank erosion, and deposition of sediment in streams and rivers.

Flood Control and combating drought –Wetlands act like sponges. The Vegetation along the banks of rivers and streams and within floodplains can soak up and hold water for longer periods and release it slowly there by controlling the rapid flow and at the same time keeping the local climate moist. When it rains heavily, this sponge-like characteristic protects houses and gardens from serious flooding. In South-Western Uganda, the kiruruma wetland protected the people of Kabale for many years. In 1961, four years after the wetland was drained, serious flooding occurred and since then flooding has been more frequent.

Wildlife Habitat –Riparian areas provide important wildlife habitat. Trees and other vegetation provide cover and shelter for wildlife. The riparian areas also serve as migration corridors for wildlife. Roots from trees and shrubs along the banks of rivers and streams often form "holes" that provide shelter for fish.

Temperature Control –Trees and shrubs adjacent to rivers and streams provide shade, which reduce water temperatures. High water temperatures harm fish and other aquatic life.

Recreation & Economic benefits –Like wetlands, riparian areas are often visited for recreational purposes such as hiking, bird watching, wildlife photography, fishing, and hunting. These activities can translate into dollars spent at local businesses, adding revenue to the local economy.

Filtering of Runoff –Riparian vegetation in floodplains and along rivers and streams act as natural filters to remove sediment and other contaminants from storm water runoff from adjacent land surfaces.

The total biodiversity (flora and fauna) of wetlands is high in comparison with terrestrial ecosystem. Wetlands provide protective cover and maturation areas for a wide range of invertebrates and vertebrates. In North America for example, muskrats and beavers are entirely dependent of wetlands ecosystem whereas raccoons and various species of deer are partially dependent on wetlands. In many areas, the remoteness and inaccessibility of wetlands has attracted species that may not be totally wetland dependent but take advantage of the protection and shelter they provide. For example the Pantanal in Brazil, Paraguay, and Bolivia provides an important habitat for the jaguar (Dugan 1993).

Some wetlands (usually peat land) contain potential energy for human consumption. In developing countries with shortages of energy and fuel, peat harvesting can be an attractive financial proposition if extensive peat deposits are available. This can have the effect of replacing imported energy sources and reducing foreign-exchange requirements. However, large scale harvesting of peat has led to the destruction of peat-land ecosystems. Wetlands especially peat lands play a significant role in the carbon cycle and presently are net sinks of carbon. A recent estimate reveals that the amount of carbon held in soil as organic matter is at a mean level of 1601 Gt, of which about 20% (412 Gt. of C) is stored in peat lands (Dugan 1993).

2.4 Effects of subsistence agriculture on wetlands

The following are the effects of subsistence agriculture on Wetlands.

- The conversion of bogs and fens to different cropping types that led to 23 fold increase in carbon dioxide (CO_2) equivalent emission. Degradation of wetlands and disturbance of their anaerobic environment lead to a higher rate of decomposition of the large amount of carbon stored in them and thus release green house gases (GHGs) to the atmosphere. Therefore, protecting wetlands is a practical way of retaining the existing carbon reserves and thus avoiding emission of carbon dioxide and GHGs. (Kasimir-Klemedtsson et al 1997).

- Drainage tile works by rapidly moving soil water to streams or drainage ditches and results in lowering the water table. This, in turn, allows more water to infiltrate and flow through the soil, thus keeping soil from becoming waterlogged and improving plant growth. Because tiling increases subsurface drainage there is less water remaining on the surface of farm fields that would have been stored in temporary wetlands, evaporated, or flowed over land to rivers and streams before tiling. Overland flow would only occur when these closed depressions are filled with water and overflowed. The reduction in overland flow as a result of tiling can mean less soil and phosphorus entering streams (Will Hoyer 2011).
- As a result of water management, especially through the extension of rice cultivation beyond existing wetlands, and to a lesser degree through reservoir formation, seepage from dams and irrigation systems, and the rehabilitation of former wetlands (this mainly for recreation, cultural or biodiversity conservation or flood management, primarily in high-income countries).However, in many of these cases, especially with rice production, the full range of ecosystem services is not developed. The growing interest in artificially constructed wetlands for wastewater treatment has also led to gains in wetland area in most parts of the world. In addition, some wetlands have been manipulated to create "artificially" constructed wetland environments for agricultural and aquaculture purposes (such as rice paddy fields and fish ponds) and water storage for irrigation. In such cases, there may be the enhancement of wetlands or the creation of additional ones. (Gopal. B 1999, Kivaisi, 2001).
- Another scenario is one where wetland agriculture occurs at a level that does not disturb the wetland eco-hydrology or ecosystem services. It may be characterized by eco-agricultural practices, where, for example, crops that are well adapted to the wetland environment are cultivated in an environmentally sensitive manner. An example is the multi cropping and agro forestry practices in the Terminalia wetland forests in Micronesia. Similarly, the management of water meadows in Europe does little to disturb wetland eco-hydrological conditions. A third case is on the upper Zambezi floodplain, where the scale of the annual flood and groundwater flows into the floodplain is so great and the areas of cultivation so limited at present that there is little or no alteration in the ecosystem services (Drew et al. 2005).

- Wetlands are most frequently influenced by upstream agricultural activity. A typical example is where upstream agriculture results in the diversion of water, which affects the quality and flow of water entering a wetland ecosystem. This may be associated with dam development or irrigation. Poor agricultural practices in the upland areas may also lead to soil erosion and sedimentation or the runoff of agricultural waste, both of which can affect wetlands. The subsequent pressures may lead to the degradation of that wetland and a reduction in its ability to perform certain ecosystem services. If that wetland is itself directly transformed by agriculture within it, this agriculture may also be affected. An example of this relationship is the case of an upstream dam and irrigation development influencing people's wetland-dependent livelihoods downstream in the inner delta of the Niger River (Zwarts et al. 2005).
- Wetlands can also play an important role in downstream agricultural activities. A key function of some wetlands is their ability to store water and regulate river flows. This has clear implications for the productivity of downstream agriculture. The direct use of a wetland for agriculture results in the alteration of its water regulation function, and can also have implications for downstream agriculture. Downstream agricultural activity such as water extraction for irrigation may alter the hydraulic gradient and result in the more rapid release of water from wetlands upstream, lowering the level of the water table. Similarly, downstream agriculture reliant on the extraction of water from upstream wetlands (either through gravity or mechanical means) will also tend to induce change.
- The conversion of natural seasonal wetlands to multi cropped rice fields has led to an expansion of surface water and aquatic habitats on the floodplain, both at the local level and the wider basin level, for storage and delivery of irrigation water. As well as a quantitative change in water at different scalar and temporal levels, there is also likely to be a qualitative change with greater external inputs. This is especially the case where rice cultivation has intensified under "green revolution" principles with greater external inputs, as this has led to a concurrent decline in water quality and to occasional pollution incidents and fish kills. Moreover, there are anecdotal observations by local people of the gradual deterioration in water quality for human and animal consumption (Blake and Pitakthepsombut, 2006b).
- In riverine wetlands, soil infiltration rates were much lower in cattle grazed areas than un grazed. Soil structural stability also decreased in the grazed plots

however this was due to grazing when soils were dry (trampling fractured and pulverised dry soil leading to smaller soil aggregates) rather than wet. They suggested that soil deterioration could be limited by reducing stocking intensities during dry periods (Taboada et al. 1999).

- The effects of livestock grazing on species composition have been found to ultimately affect the structure and function of wetland vegetation. The sedge meadows that were recovering from cattle grazing structurally changed into a dense shrub while sedge meadows that had never been grazed had a different species composition to grazed meadows but were still similar structurally (i.e., they remained sedge meadows). It appeared that consumption of biomass and trampling of sedges, opened up the habitat allowing the shrub, Cornus sericea to invade. Cattle grazing also facilitated a short-term proliferation of subordinate species that prevented sedges from expanding as a result of the introduction of seeds and propagules and creation of bare patches. Once cattle were removed, the shrubs expanded to become the dominant vegetation type (Middleton (2002).

2.4.1 Farming equipments/tools used in carrying out Subsistence Agriculture.

Handhoe

A hoe is an ancient and versatile agricultural tool used to move small amounts of soil. Common goals include weed control by agitating the surface of the soil around plants, piling soil around the base of plants (hilling), creating narrow furrows (drills) and shallow trenches for planting seeds and bulbs, to chop weeds, roots and crop residues, and even to dig or move soil, such as when harvesting root crops like potatoes.

Panga

A Panga is a large cleaver-like cutting tool. The blade is typically 32.5 to 60 centimetres (12.8 to 24 in) long and usually under 3 millimetres (0.12 in) thick.

Rake

A long-handled implement with a row of projecting teeth at its head, used especially to gather leaves or to loosen or smooth earth.

Slasher

A slasher is an implement with a long sharp blade used to clear scrub. Its long handle, and the open face of its blade, lends it to use for clearing thin and dense low-lying bush where an axe would be too clumsy.

Digging Stick

A digging stick, or sometimes yam stick, is the term given to a variety of wooden implements used primarily by subsistence-based cultures to dig out underground food such as roots and tubers or burrowing animals and anthills. They may also have other uses in hunting, farming or general domestic tasks.

They are common to the Indigenous Australians but also other peoples worldwide and normally consist of little more than a sturdy stick which has been shaped or sharpened and perhaps hardened by being placed temporarily in a fire. It is a simple device, and has to be tough and hardy in order not to break.

In Mexico, digging stick is used for traditional agriculture amongst the Ome indigenous communities. It is known as a coa stick in this area and usually flares out into a triangle at the end. Some newer 20th century versions have added a little metal on the tip. Digging sticks were the most important agricultural digging tools used in Mesoamerica and throughout the ancient Americas.

Garden Knife

Garden knives are an essential tool for any farmer. They are used to perform so many tasks such as cutting twine, opening bags and plant ties, and harvesting.

2.4.2 Activities involved Subsistence Agriculture.

- Subsistence agriculture is a labour-intensive method of cultivating food crops, which is sufficient for the farmer and his family.
- The production is done on a small scale which is adequate to feed a small population.
- Self-sufficiency is primarily focused in subsistence farming, due to which surplus food is reduced.
- An entire family or a small society depends on subsistence farming for their livelihood.

- In many parts of the world like Africa, Indonesia, Latin America, south and East Asia and some isolated areas, subsistence farming is prevalent and the people feed themselves and their family, by cultivating food crops on their own fields.
- Barnett et al. explains subsistence farming as "farming and associated activities which together form a livelihood strategy where the main output is consumed directly, where there are few if any purchased inputs and where only a minor proportion of output is marketed".
- Subsistence farmers, also hunt animals, get fruits and vegetables from the woods and add it to the food they produced from their lands.
- They cultivate crops like cotton in a small area of their land and sell it in the market, to get other essential commodities.
- Depending upon the socioeconomic conditions of the farmers, the size of their plot varies.
- The plot size also reduces as the number of shares increases, depending on the number of persons inheriting the land from their father.
- Subsistence agriculture can be divided into three parts that is Herding animals like goats, sheep, cows, Cultivating crops like rice, wheat, and Practicing mixed-farming.

2.5 Effects of subsistence Agriculture on soil.

The application of fertilizers in agricultural production harms the wetland by disrupting the nutrient balance within the wetland. This is because fertilizers contain high concentrations of phosphorus and nitrogen. Although naturally occurring in the environment, increased levels can cause algal blooms, which are explosions of rapid algae growth. As the algae dies, bacteria act on decaying plant matter. Bacteria use up the dissolved oxygen in the water, thus making the wetland in hospitable for plant life (eHow).

2.6 Effects of subsistence Agriculture on water quality.

Agricultural production can generate contaminants that can have many negative effects on surface or ground water supplies. Contaminants that are associated with cropping and livestock practices include sediment, nutrients (nitrogen and phosphorus) from inorganic fertilizers and organic livestock wastes, crop protection chemicals such as herbicides and insecticides, microorganisms from livestock wastes, and salts and trace elements from irrigation residues. Contaminants are transported, either attached to sediment or dissolved in water, to surface and ground water through all phases of the water or hydrologic cycle. Impaired water quality can restrict water uses for such activities as stock watering and irrigation, drinking water supplies, sport fisheries and other aquatic life, and recreation. In summary, agricultural activities, in addition to other land uses, can have a significant impact on the quality and uses of our water resources (Wikipedia).

2.7 Effects of subsistence Agriculture on biodiversity

Conversion of wetlands to agriculture means more than just a loss. The resulting land use changes as well as the agricultural practices in and around the remaining wetlands, which have many impacts upon the wetlands. Several recent studies have shown that the conversion of wetlands to agriculture or other land uses (including forestry) impacts upon the biodiversity though various taxonomic groups respond differently and at different spatial scales.

Mensing and others (1998) have observed that in the riparian wetlands of the Northern temperate United States, shrub vegetation, amphibians, and birds are influenced by land use at relatively smaller scales (500 and 1000 m), whereas fish respond to land use at landscape level (2500m or more). Diversity and richness of shrub carr vegetation, birds, and fish generally decrease with increasing cultivation in the landscape. A decrease in the proportion of open water to rangeland results in an increase of amphibian abundance but a decline of fish abundance. They also reported that wet meadow vegetation, aquatic macro invertebrates, amphibians, and fish respond to local disturbances.

Galatowitsch (1999) examined changes in floristic composition corresponding to land use differences at site to landscape levels in wet meadows associated with prairie glacial marshes in Minnesota. They observed that under the impact of agriculture, together with urbanization, the vegetation composition shifted from native graminoid and herbaceous perennial abundance to annuals or introduced perennials.

Bethke and Nudds (1995), who analyzed data on duck abundance in Canadian prairie parklands or the period 1975–89, observed that the recent decline in the number of breeding ducks, particularly in the West, have been partly due to loss of habitat to agriculture, in addition to loss to climatic change (drought). Agriculture can impact on aquatic invertebrates also in temporary wetlands. Based on a study of the resting eggs, shells, and cases remaining after wetlands dried in the prairie pothole region, Euliss and Mushet (1999) observed that the aquatic invertebrates were negatively impacted by intensive agriculture. There were more taxa and greater numbers of cladoceran resting eggs (ephippia), planorbid, and physid snail shells, and ostracod shells in wetlands withingrasslands than in croplands.

The changes in agricultural wetlands, such as paddy fields, depend upon the agricultural practices involving removal of plants other than the crop, water management, and the use of agrochemicals. In less intensive paddy cultivation, the paddy fields support large biodiversity and their productivity, taking into account that the production of all consumable biota is substantially high (Heckman 1979). Under intensive cultivation, the biodiversity is greatly reduced. Aquaculture is another form of agricultural activity that has adversely impacted the coastal wetlands in many countries through loss of biodiversity and pollution.

The agricultural impacts on wetlands are far more complex. The requirements of water for irrigation directly impinge on the wetlands as water flows are regulated and diverted. Shallow and smaller wetlands in drier climates are more severely affected as their water is used for irrigation. In Greece, irrigation is reported to be the most important activity negatively influencing all functions and values of Ramsar wetlands (Gerakis and Kalburtji 1998). Diversions of water and reduced freshwater flows to estuarine areas have affected the mangroves worldwide by way of changes in species composition due to increased salinity. The fertilizers and pesticides applied in the field find their way through surface runoff and subsurface flow into adjacent wetlands. Furthermore, the agricultural activities enhance erosion resulting in increased input of sediments into the wetlands. Thus, changes in the hydrological regimes and an increase in the sediment and nutrient loading impact upon the biota and ecosystem processes in wetlands.

Zalidis and others (1997) identified the four most frequent factors that caused change in the ecological character of Greek wetlands. Of these, agricultural and municipal pollution, causing changes in water quality, accounted for 54 percent, construction of irrigation schemes and diversion of water courses, for 12 percent, and the expansion of agriculture and settlement for 32 percent of the damage to wetlands. Change in water regime affected 50 percent of the springs and 40 percent of the rivers; loss of wetland area affected 60 percent of the marshes and 52 percent of the estuaries, whereas all deltas and 75 percent of rivers had their water quality impacted. Wetlands in the Evros River Delta are also affected by pollutants transported by the river from agricultural area in the catchment lying in Bulgaria, Turkey, and Greece (Angelidis and Athanasiadis 1995).

In Southern Ontario (Canada), cumulative effects of agricultural land drainage (runoff, subsurface flow, and nutrient loss) have been estimated to account for the loss of 47 percent of wetlands from 1800 to 1990 (Spaling 1995). In northern prairie wetlands in North Dakota, Freeland and others (1999) observed higher sedimentation and fertilization rates in wetlands next to cultivated fields as indicated by higher phosphorus, organic matter, and nitrate-N concentrations in subsoils (15–60 cm) of wetlands surrounded by cultivated land than in those surrounded by grasslands.

In a study of Dives marshes (France), Granval and others (1993), however, observed that agricultural practices such as fertilizer use and grazing are beneficial to earthworms, and, therefore, to their various predators such as snipes (Gallinago gallinago). The biomass of earthworms in grazed meadows was more than 10 times higher than in the adjacent reedbed (Arundo phragmites).

2.8 Conceptual framework

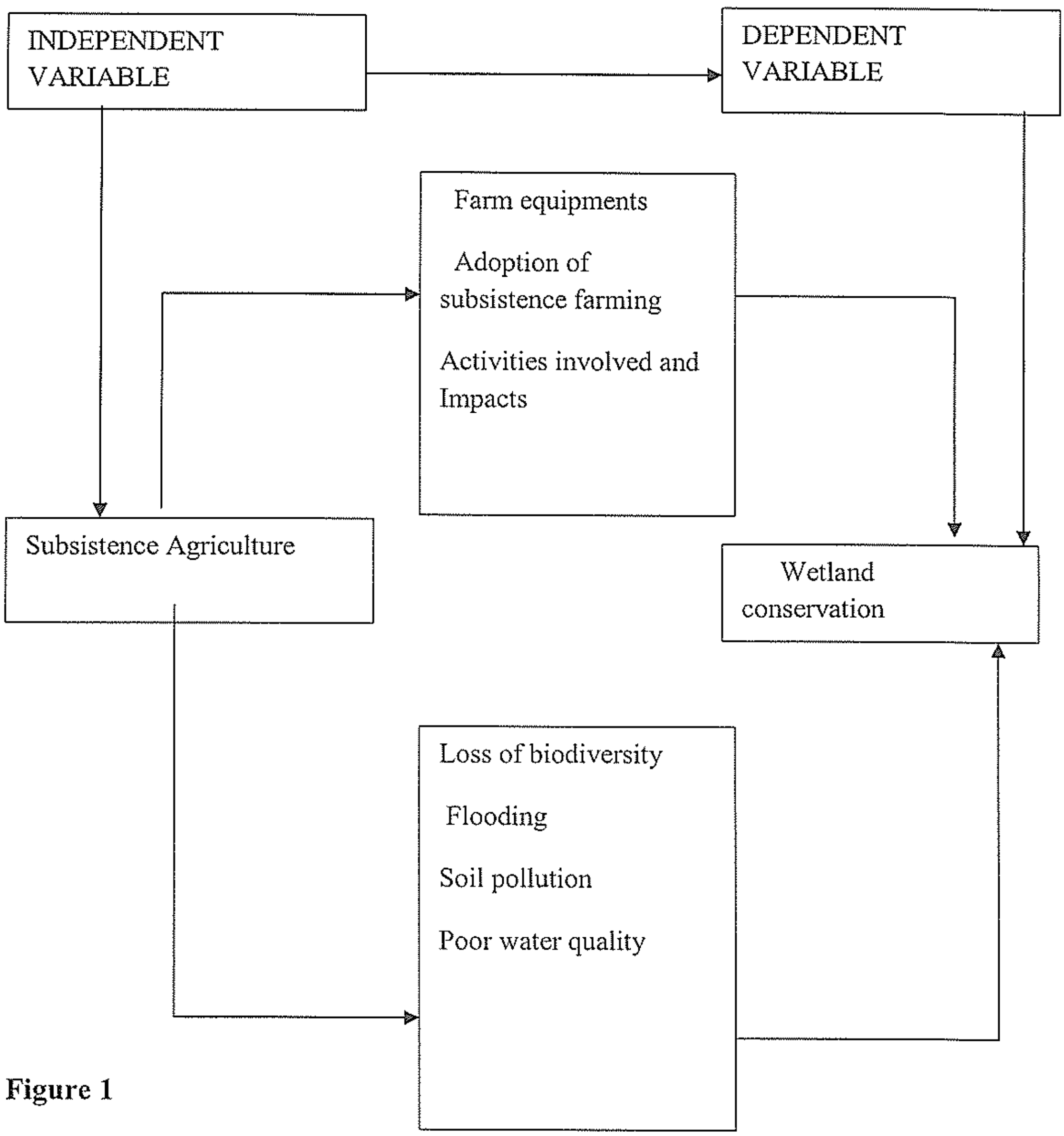


Figure 1

Source: Researcher 2012

CHAPTER THREE

METHODOLOGY

3.0 Scope of the study

3.1 Geographical scope

The study was limited to Bugolobi, Nakawa division, a city suburb in the district of Kampala. It is located approximately 7km (4.3mi) from the central district of Kampala in Uganda. Bugolobi is mostly inhabited by the affluent class; however, other minority classes such as the middle class and lower class also inhabit the area. The study was conducted in the lower reaches of Bugolobi among the farmers who practiced agriculture.

3.1.1 Content scope

This study focused on subsistence agriculture and wetland conservation within and around Bugolobi area, identifying the effects of subsistence agriculture on water and soil quality, and biodiversity within the wetland.

3.1.2 Time scope.

The study took a period of three months in the field where I carried out data collection from different farmers in Bugolobi. I also looked at data from other sources like NEMA, Internet, and Newspaper inserts on wetlands.

3.1.3 Sample scope

The study targeted the local farmers around Bugolobi. It also enabled information to be got from some of the owners of the gardens within the wetland along side their workers.

3.2 Significance of the study

- Through this research massive education and local campaigning to the people about the proper wetland utilization and management would be put in place through government bodies like NARO, NEMA; which are all concerned with the conservation of the environment as the problem of food would be stepped down.

- Clubs like Uganda Wildlife would assist in the sensitization of the masses about conservation of both the flora and fauna in wetlands as this would allow swamps to regenerate.
- Environmental bodies like NEMA would become aware of the possible negative consequences of subsistence agriculture and be prepared to act when confronted with cases of unnecessary wetland and swamp reclamation and this would promote conservation practices within and around Bugolobi.
- The final results of the study would work as an instrumental tool for the Ugandan government in achieving the Millennium Development Goals (MDGs) in particular those concerned with environmental conservation.

3.3 Research design

The study used both quantitative and qualitative research methods.

3.3.1 Quantitative method

A cross — sectional survey research approach was applied because the sample size was large and varied, and was also spread over a large area, which required other methods such as questionnaires. In this method, interview schedule and focus group discussions (FGD) were applied. The other approach was the case study. This was used concurrently with the cross sectional survey. Because of limited time and resources, this method was the most appropriate to use in particular cases to investigate the issue in question.

3.3.2 Qualitative method.

Review of documents, Internet and Library research pertaining to the issues under investigations was done. This method was very necessary in order to analyze the existing literature on the variables in my study. It was also the approach used in conducting focus group discussions (FGD). In this method, interviews, observations and content analysis were used. This was because these methods were the most appropriate in gaining information from the study population.

3.4 Sample selection

This study targeted farmers totalling to 50, the sample size was derived at by using of sampling technique that ensures that each farmer gets a chance of participating in the study.

3.4.1 Sample size and Sampling procedure

The sample size was 40 farmers who were randomly sampled from the field.

The sample was arrived at using the Yamane's formula (1967) of sampling.

$$n = \frac{N}{1+Ne^2}$$

N: Population of the study

n: Sample size

e: degree of confidence level at 95% which equals to 5%

($n = N/1 + N(e^2)$)

Where **n** = sample size, N = Constant, e^2 = level of significance = **0.05**

This research was stratified sampling. Stratified sampling technique is a technique that identifies subgroups in the population and their proportions and select from each subgroup to form a sample (Oso et al 2005).

In stratified sampling that the researcher used, he divided the population into sub-populations such that elements within these sub-populations were homogeneous to ensure equal representation of the population in the sample.

3.4.2 Sampling

The researcher used probability sampling method and in particular stratified sampling. In probability sampling every element in the population had a probability of being selected while in stratified sampling that the researcher used, he divided the population into sub-populations such that elements within these sub-populations were homogeneous. Then he selected simple random sample independently from each sub-population. The strata was based on farmers who practiced subsistence agriculture.

Table 1: How a sample of respondents was arrived at.

Type of farmer	Target population (farmers)	Sample size (farmers)
Arable farmer	15	10
Livestock farmers	10	08
Mixed farmers	25	22
Total	**50**	**40**

Source: researcher 2012

3.5 Study area

3.5.1 Location

The study took place in Bugolobi, Nakawa division in Kampala district. Bugolobi is a Kampala neighbourhood situated on Bugolobi Hill. On the lower reaches of the hill, to the northwest, the neighbourhood is contiguous with the city's Industrial Area. However, the commercial real estate in the neighbourhood is upscale. On the eastern slopes of the hill is a large apartment complex with lower middle-class tenants. The northern slopes and southern slopes of the hill, as well as the summit are occupied by residential bungalows, with the size of the homes getting larger, as you approach the top of the hill. The coordinates of Bugoloobi are: 00 18 36N; 32 37 30E (Latitude: 0.3100; Longitude: 32.6250). The road distance between Bugoloobi and the central business district of Kampala is approximately 7 kilometres (4.3 mi).

3.6 Administrative units

Bugolobi is sometimes spelt as Bugoloobi. It is bordered by Nakawa and Mbuya to the North, Mutungo to the East, Kitintale and Luzira to the Southeast, Muyenga to the South and Southeast, Namuwongo to the West and Kampala's Industrial Area to the Northwest.

3.7 Demographic and Population Profile

According to the 2002 national census figures, Kampala District had a population of approximately 1,189,100. The Uganda Bureau of Statistics (UBOS) estimated the population of Kampala at 1,597,900 in 2010. In 2011, the city's population is estimated at approximately 1,659,600.

The 1991 national census estimated the population in the division of Nakawa at 135,519 people. The 2002 census put the figure at 246,781 people, with 122,249 (49.5%) females and 124,532 (50.5%) males. In 2002, Nakawa Division contributed 20.3% of the total Kampala District population. Children below five (5) years of age contributed 20% of the total Division population. The youth aged 10 to 24 contributed to 30% of the total population and 26.7% of the population were women of child-bearing age. The population growth rate in 2002 was 4.8% and the total fertility rate was 5.1%. The average family size is 4 and the maternal mortality rate is equivalent to 265 per 100,000 live births.

Using the data above, it is estimated that the population in Nakawa Division in 2010 is approximately 359,100 as shown in the table;

Nakawa population Trends	
Year	**Estimated Population**
2002	246,800
2003	258,600
2004	271,000
2005	284,000
2006	297,700
2007	312,000
2008	326,900
2009	342,600
2010	359,100
2011	376,300
2012	394,400

(Source: UBOS)

3.8 Climate

Kampala has a tropical wet and dry climate; however, due to the city's higher altitudes, average temperatures are noticeably cooler than what is typically seen in other cities with this type of climate. Kampala seldom gets very hot during the year; the warmest month is January.

Another facet of Kampala's weather is that it features two annual wet seasons. There is a long rainy season from August through December and a short rainy season from February through June. However, the shorter rainy season sees substantially heavier rainfall per month, with April typically seeing the heaviest amount of precipitation at an average of around 175 mm of rain.

Climate data for Kampala													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Record high °C (°F)	33 (91)	36 (97)	33 (91)	33 (91)	29 (84)	29 (84)	29 (84)	29 (84)	31 (88)	32 (90)	32 (90)	32 (90)	36 (97)
Average high °C (°F)	28 (82)	28 (82)	27 (81)	26 (79)	25 (77)	25 (77)	25 (77)	25 (77)	27 (81)	27 (81)	27 (81)	27 (81)	26.4 (79.6)
Average low °C (°F)	18 (64)	18 (64)	18 (64)	18 (64)	17 (63)	17 (63)	17 (63)	16 (61)	17 (63)	17 (63)	17 (63)	17 (63)	17.3 (63.1)
Record low °C (°F)	12 (54)	14 (57)	13 (55)	14 (57)	15 (59)	12 (54)	12 (54)	12 (54)	13 (55)	13 (55)	14 (57)	12 (54)	12 (54)
Rainfall mm (inches)	46 (1.81)	61 (2.4)	130 (5.12)	175 (6.89)	147 (5.79)	74 (2.91)	46 (1.81)	86 (3.39)	91 (3.58)	97 (3.82)	122 (4.8)	99 (3.9)	1,174 (46.22)
Source: BBC Weather													

3.9 Soils

. The soil consists of a variety of metamorphic largely granitoid rocks, acid gneisses, schists and sand stones. Most of these rocks are highly weathered.

3.10 Economic activities

Agriculture: Maize milling industries, Dairy Farming, Industries: manufacturing and agro processing industries.

3.11 Agricultural Potential

The city is divided into 5 divisions, four of which have 25% of their area being peri-urban with agricultural activities. Over 35% of the city's population practice some form of agriculture. Until 2005 it has been illegal to carry out farming in the City. In the early 1990s, there were few activities to support urban agriculture but after decentralization in 1993 the Kampala District Agricultural Extension Officer started building capacity for urban agriculture work, mainly through collaboration with NGOs e.g. Environmental Alert. By 1999, despite many people within KCC still regarding urban agriculture as illegal, there was more open collaboration between KCC, NGOs and researchers. Through these initiatives there has been marked international and local research into urban agriculture, and regional meetings which have exposed Kampala's technical officers, researchers, NGOs and politicians to wider thinking on urban agriculture.

3.12 Relief

The topography of Nakawa division is characterized by flat-topped hills of uniform height divided by shallow valleys forming papyrus swamps. Most of the streams flow into Lake Victoria. The streams are characterized by low gradient and comparatively broad valley floors. Owing to alluvial aggregation, low gradient and frequent local tilting, many valley floors have become seasonal or permanent swamps. The soil geology from which the soils of the corridor formed belongs to the Basement Complex. It consists of a variety of metamorphic largely granitoid rocks, acid gneisses, schists and sand stones. Most of these rocks are highly weathered.

3.14 Research instruments

The researcher used four types of research instruments for the collection of data in the study namely:

3.14.1 Questionnaire.

This was a set of questions sent to the respondent with a request to answer the questions and return the questionnaire. The questionnaire consisted of a number of printed or typed questions in a definite order on a form. This was administered to the selected participants in the study. Structured and unstructured questions were largely used in order to get in-depth information and experiences from the respondents.

3.14.2 Interview method.

This type of collection involved the presentation of oral or verbal stimuli and reply in terms of oral or verbal responses. Collection of data through the interviews in the study was through different methods such as face to face interview, telephone interviews and in-depth interview with the key informants.

Both structured and non-structured interview techniques was also used to gather key data from respondents and key informants. The interviews also based on a guide that had a checklist of questions for the respondents.

3.14.3 Observations

Observations method was also used because this provided the researcher with the chance to validate the responses from the respondents with what was actually on the ground on a first hand basis.

While in the field, the researcher witnessed the following wetland changes forexample, dumping of plant materials and human excreta on the wetland led to the growth of algae on the water and hence eutrophication. In addition, some farmers practiced poor farming techniques such as monocropping which resulted in the yellowing of leaves of their crops especially maize hence indicating nutrient deficiency. Over grazing of cattle was carried out among the farmers and this resulted in increased floods after heavy rainfall because the green vegetation which would have protected the soil from exposure to erosional agents such as running water, acted as fodder for their cattle. Further more, some farmers used chemicals to spray their fields and yet these chemicals leaked in the ground causing both soil pollution and water pollution and hence destroying undergound aquifers.

3.14.4 Documentary Review

The researcher reviewed articles, internet, journals, books and documents to obtain information about subsistence agriculture, Wetland conservation, and history of the area.

3.15 Experimental approach of methodology

To measure the effects of subsistence agriculture on soil, biodiversity and Water quality, the researcher, carried out the following:-

3.15.1 Determining soil nutrient deficiencies using a soil test kit

The researcher collected 10 different soil samples from the same garden. This was done by following a soil profile, which refers to the vertical cross-section taken through the soil showing horizontal arrangement of soil layers called horizons from topsoil to the parent rock. For example, top soil which was dark coloured was collected first, followed by subsoil which was light coloured, then parent materials which contained weathered rock was collected last. These different soil samples were put separately to prevent them from mixing. Then the soils were tested in laboratory for nitrogen phosphorus and potassium (NPK). The results were given in terms of percentages.

3.15.2 Determining Soil P^H

Soil PH refers to the degree of acidity or alkalinity of the soil. The measurement of the PH was based on the PH scale which ranges from 0 to14. PH of 1 to less than 7 indicates acidity, PH of 7 indicates neutrality, while PH of more than 7 to 14 indicates alkalinity. The researcher put 10gms of soil in a clean test tube. 10 mls of Barium sulphate (BaSo4) was added, this helped to break the soil particles and make them settle. Then 20mls of water was added. The mixture was shaken and then allowed to settle. After, a few drops of 1 ml of universal indicator solution was added. The content was mixed and shaken vigorously and thoroughly from where a clear area was seen in the middle of the test tube. Then the test tube was held against the PH colour chart and observation was recorded.

3.15.3 Determining the rates of drainage

Drainage refers to the ability of the soil to absorb all the water.

The researcher measured 20cm of water in 2 conical flasks. Then 20gms of each soil sample was weighed. Then each weighed soil sample was placed in the funnels containing filter papers. A working clock was set and time was noted and taken for the first drop of water to come out.

3.15.4 Measuring soil living organisms

The researcher dug up some soil with a hoe in a ploughed field and in an unploughed area and looked at the difference in number and diversity of fauna species. Several living organisms such as termites, centipedes, millipedes and tiny worms were observed which indicated abundant fauna diversity in the unploughed field as compared to less living organisms in the ploughed field.

3.15.6 Determining Water quality

The researcher observed the colour of water which had changed to green due to algae and the disposed wastes of man. In addition important plant species such as papyrus were exploited for making mats and baskets, and this activity denied these plant species of purifying water and hence the water quality was poor.

3.16 Data analysis and presentation

Data analysis was done after the collection of the required information from the participants in the study. Data analysis was done both quantitatively and qualitatively.

3.16.1 Quantitative Data Analysis

After collection, data was edited to check for uniformity, consistency, legibility and comprehensiveness. It was then coded by assigning numbers to different questions for easy analysis. After this exercise, data was finally analyzed using a computer program called Statistical Package for Social Sciences (SPSS). In this program, frequency tabulations and cross tabulations then worked out. The edited and coded data was then arranged in tables, charts, and graphs to help in deducing the required information regarding the study.

3.16.2 Qualitative Data Analysis

Analysis of qualitative data was done during data collection, by assigning different categories to different kinds of information. Content analysis was also used in cross- checking questions with similar others to ensure the validity and authenticity of the answers given. All information was then analyzed according to the set research questions and other relevant information captured to allow validation of the objectives.

3.17 Validity and Reliability of the research instruments

3.17.1 Validity

A pilot study was conducted among the sampled population. The purpose was to access the worthiness of the instruments to generate correct data so that items discovered to be inappropriate in answering the research questions and attaining the research objectives were modified to improve the quality and the appropriateness of the instruments or be discarded.

3.17.2 Reliability

Reliability refers to the consistency that an instrument demonstrates when applied repeatedly under similar conditions (Kerlinger, 1983). The reliability of the research instruments was established by the researcher before analysis and consequent presentation. This was achieved by comparing the pilot and final data collected. The same instruments were presented to experts from Kampala International University inclusive of the supervisors for careful scrutiny.

3.18 Research procedure

The researcher secured a letter of introduction from the College of Technology and applied sciences (CAST) seeking permission to carry out the study at Bugolobi regarding the role of subsistence agriculture on wetland conservation. The participants willing to provide information were guided in the questionnaire filling process, and questions were asked by the researcher for clarification.

3.19 Ethical Considerations

The researcher maintained the confidentiality and privacy of the respondents for example, keeping their personal issues private and also non disclosure of responses from particular respondents in order to maintain integrity and also protect them from potential harm.

CHAPTER FOUR

RESEARCH FINDINGS, DATA PRESENTATION AND ANALYSIS

4.0 Introduction

This chapter deals with the analysis, interpretation and presentation of the research findings. The analysis and research findings were interpreted and analyzed basing on the research questions. The study was set to investigate the role of subsistence agriculture on Wetland conservation in Bugolobi, Nakawa division, Kampala district. The findings were obtained through the use of questionnaires, interviews, documents, experiments and observation from the Bugolobi farming fields was used as the case study.

Table 2: The rate of response

Category of respondents	Planned responses	Actual responses	Non-responses
Local farmers	40	35	05
Total	**40**	**35**	**05**

(Source: Field 2012)

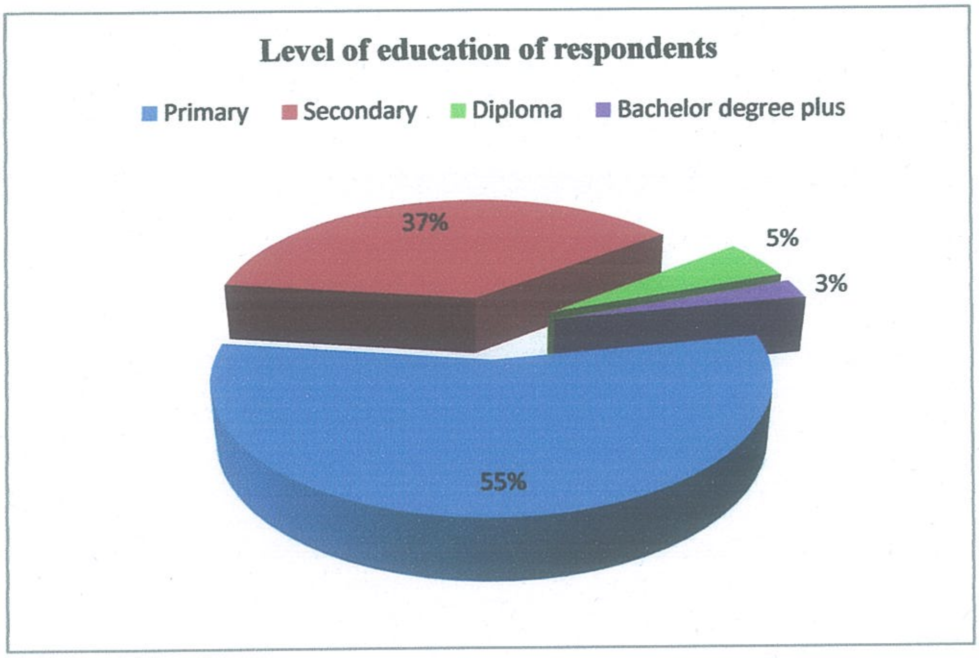
The results showed that only 35 respondents out of 40 respondents were positive. This figure was an adequate proportion of the sample size. Only 5 non-responses out of 40 respondents were also recorded. The negative response was as a result of inaccessibility of the farmers as some of them stayed far away and therefore they were unavailable. In addition, there was no clear passage in the thick vegetation to access the farmers who had their gardens deep in the wetland because the area was too boggy and dangerous to move on.

Table 3: Background information of the respondents

Level of education	Frequency	Percentage
Primary	22	55
Secondary	15	38
Diploma	2	5
Bachelor degree plus	1	2
Total	**40**	**100%**
Gender	**Frequency**	**Percentage**
Male	24	60
Female	16	40
Total	**40**	**100%**
Age group	**Frequency**	**Percentage**
18-25	15	38
26-33	10	25
34-41	10	25
42-48	3	7
49+	2	5
Total	**40**	**100%**
Marital Status	**Frequency**	**Percentage**
Married	26	65
Single	14	35
Total	**40**	**100%**

(Source: Field 2012)

Pie chart showing the education level of the farmers.

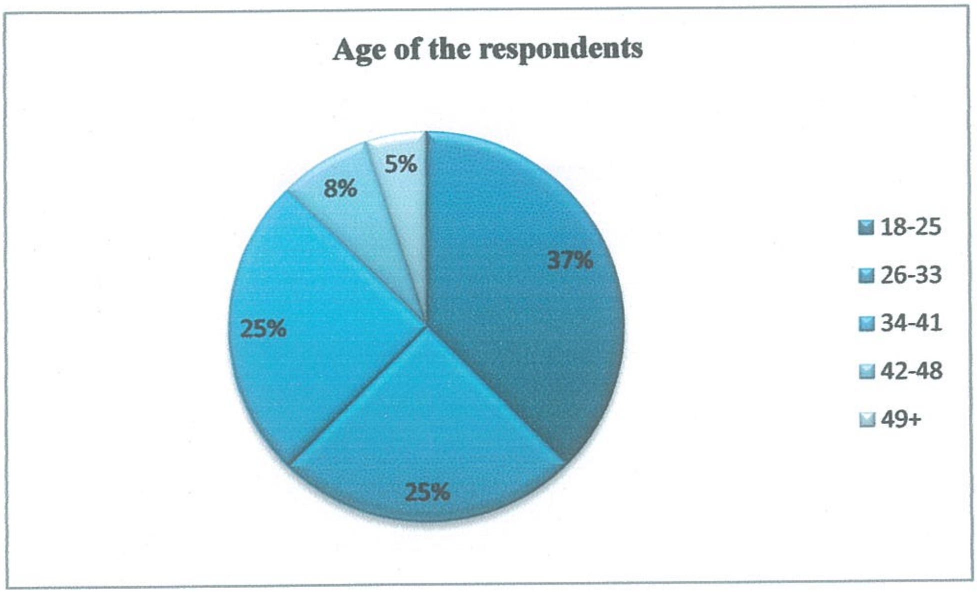


(Source: field 2012)

Figure 2

Most farmers (55%) had acquired primary education, followed by secondary education (38%), then at diploma level (5%), and lastly Bachelors degree and above at only two percent (2%). The researcher could therefore tell that farmers with low education levels as the majority while those with diploma and degree level of education being the minority in Nakawa division. The farmers with high levels of education always held top positions such as chairman, and they always instructed the farmers with lower education levels what to do. In addition, they also helped in settling disputes among the farmers. The majority of the respondents were male. It could be noted that, (60%) of the respondents and (40%) were male and females respectively. This literary implied that the farmers were composed of mostly males than the females in Bugolobi, Nakawa division.

Pie chart showing the age of the respondents

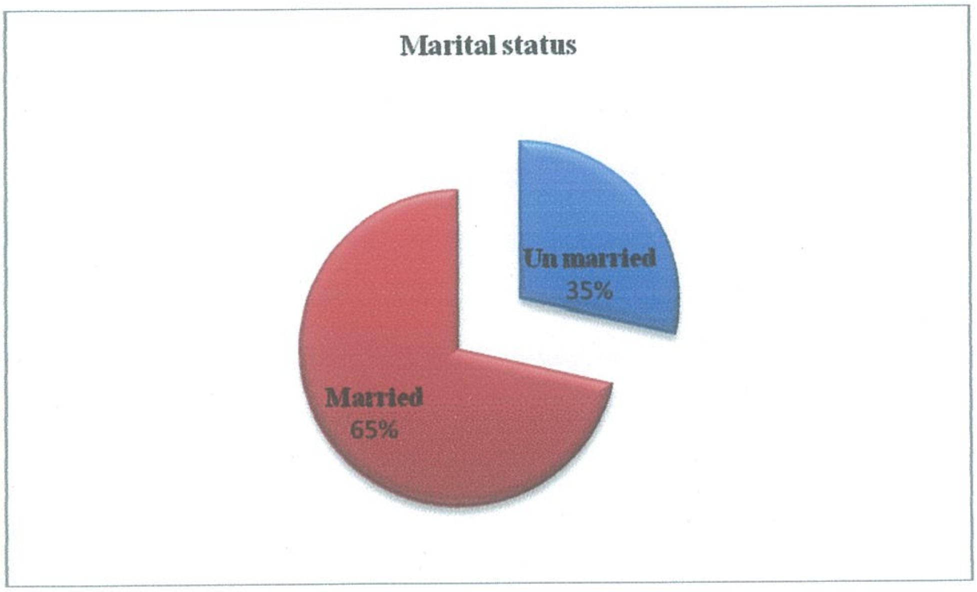


(Source: field 2012)

Figure 3

The researcher noted that all the farmers were adults since they were all above 18 years of age. The youths formed the largest number of the farmers (37%), jointly followed by the middle aged population (25%), and then the older population formed the least number at 8% and 5% respectively.

Pie chart showing the marital status of the farmers



(Source: field 2012)

Figure 4

The majority of the farmers were married (65%) as compared those who were unmarried (35%).This was partly because the local people got married at an early age. In addition, due to poverty, most of the farmers did not study for a long time and hence they got married early.

4.1 Subsistence agriculture and equipment

Type of subsistence agriculture adopted

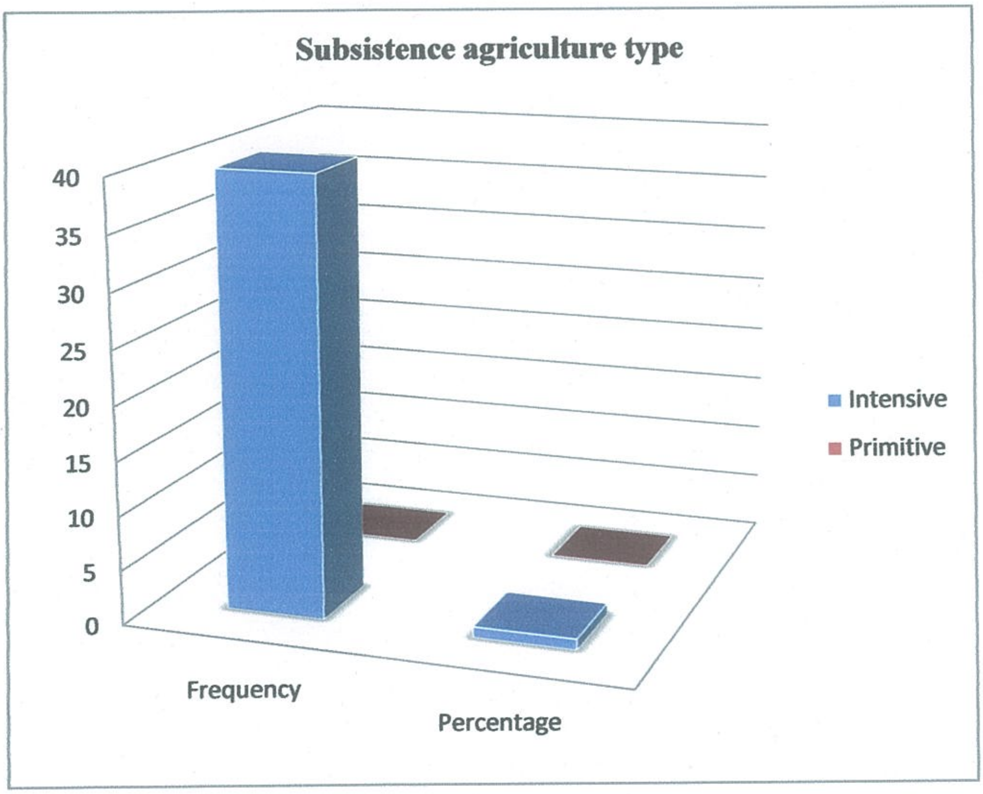
The researcher observed all the farmers in Nakawa division adopted intensive subsistence agriculture. The farmers used their small land holdings to produce enough for their own consumption, while the little remaining produce was used for exchange against other goods. These farmers tried to obtain maximum yield from the available lands by intensifying cultivation techniques, including the preparation of their fields which could be used year after year. They also intensified use of manure, and animal waste as fertilizer. The adoption of subsistence agriculture is shown in the table below.

Table 4: Type of subsistence agriculture adopted

Subsistence	Frequency	Percentage
Intensive	40	100%
Primitive	0	0%
Total	**40**	**100%**

(Source: field 2012)

Bar graph showing the type of subsistence agriculture practiced



(Source: field 2012)

Figure 5

According to the study findings, it was established from the analysis that all the farmers in Nakawa division adopted intensive subsistence agriculture. This is partly because of limited land within the wetland and therefore, they concentrated on their small plots of land for agriculture. In addition, the farmers used simple farming equipments such as hand hoes, pangas, rakes, slashers, and all these tools could not permit large scale production.

4.2 Subsistence agriculture equipment used

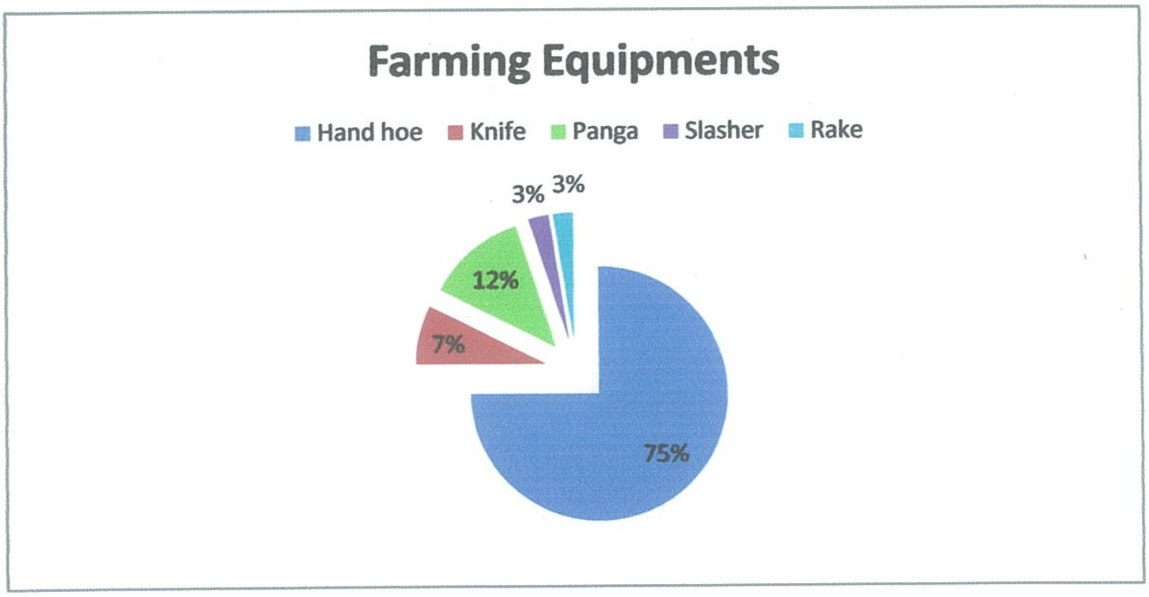
The study aimed at studying the types of equipments used in practicing subsistence agriculture in Bugolobi, Nakawa division.

Table 5: Agricultural equipments used

Equipment	**Frequency**	**Percentage (100%)**
Hand hoe	30	75
Knife	3	8
Panga	5	13
Slasher	1	2
Rake	1	2
Total	**40**	**100%**

(Source: field 2012)

Pie chart showing farming equipments used in carrying out subsistence agriculture



(Source: field 2012)

Figure 6

The researcher established that hand hoe (75%) was the most used equipment. This was because the hand hoe was used for carrying out alot of activities such as digging, planting and clearing of land. Panga (12%) was the second most used equipment. This was because a panga was used for harvesting yams, digging holes for planting seeds, and also clearing of bushes. The use of a Knife (7%) was also observed. This was because knives were used for cutting and harvesting of crops such as maize. Slasher and rake (3%) were the least used farming equipment. This was because most of the farmers preferred to use hand hoes for clearing and collecting of cut vegetation.

(Source: field 2012)

4.3 Types of crops grown under subsistence agriculture

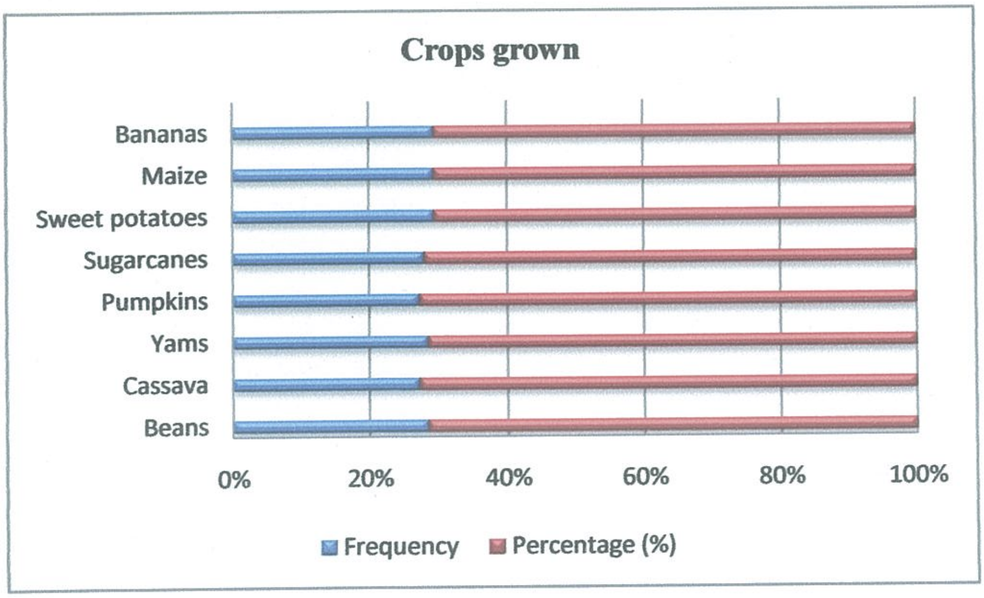
The researcher observed the different types of crops grown by the farmers, and these were;

Table 6: Table showing types of crops grown

Crops	Frequency	Percentage (%)
Beans	2	5
Cassava	3	8
Yams	10	25
Pumpkins	3	8
Sugarcanes	7	18
Sweet potatoes	5	12
Maize	5	12
Bananas	5	12
Total	**40**	**100%**

(Source: field 2012)

A bar graph showing the crops grown



(Source: field 2012)

Figure 7

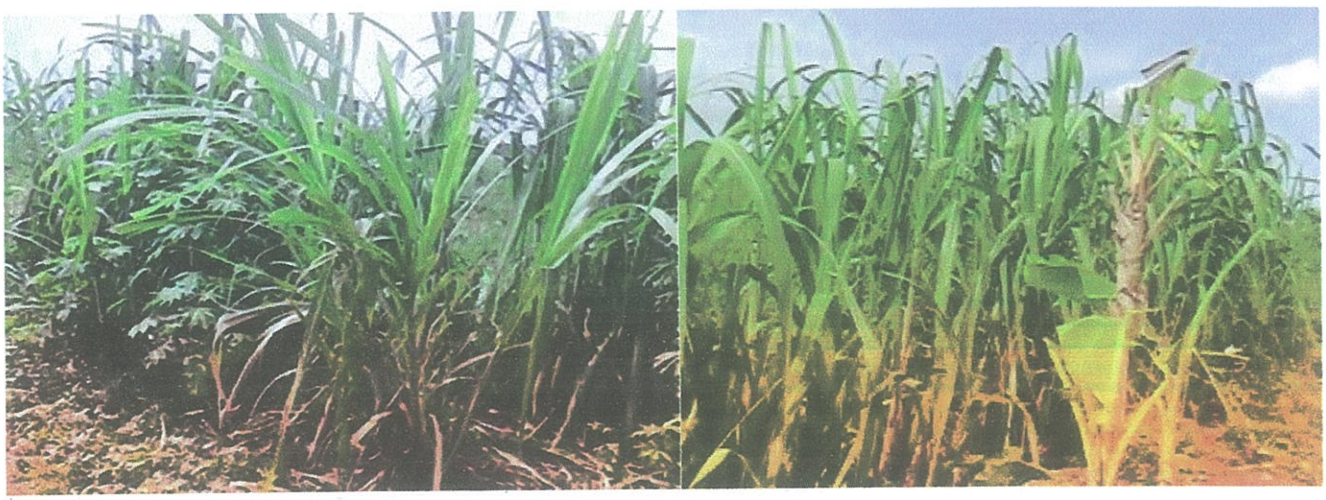
The researcher analysed that, yams (Dioscorea villosa) were the most grown crop at 25%. This was because yam tubers can grow up to 1.5 metres (4.9 feet) in length and weigh up to 70kilograms and 3 to 6 inches high and hence a vital source of food. In addition, yams can be stored up to six months without refrigeration and yet still retain its taste. Further more, yams are very versatile vegetables. They can be roasted, fried, grilled, baked and smoked unlike other vegetables and hence they were the most cultivated crop in Bugolobi.

Sugar canes (18%) were the second most grown crop in Bugolobi. This was because the soils favoured their quick growth and maturation. In addition, some farmers explained that during food scarcity, sugar canes are eaten as food for the farmers.

Sweet potatoes (Ipomoea batatas), bananas Musa acuminate) and maize at 12% were also grown. This was because these crops were regularly consumed by the farmers and their families.

Cassava and pumpkins at 8% were also grown. This was because the soils supported their growth. In addition, these plants were so easy to plant.

Beans (5%) were the least grown food crops. This was because they were constantly infested by pests such as bean weevils and chicken.



(Source: field 2012)

4.4 Effects of Subsistence agriculture on water quality

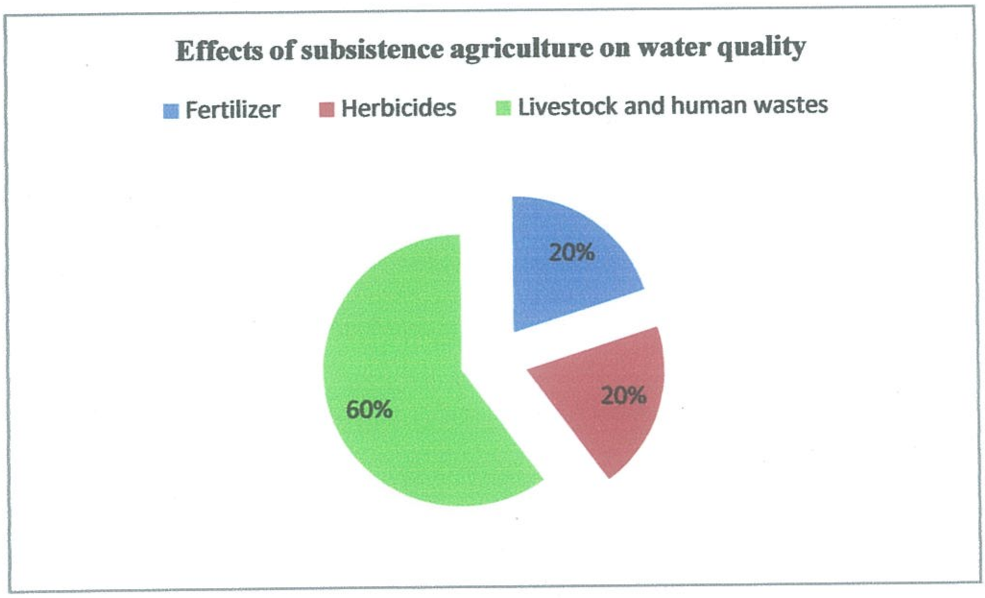
The researcher sought to find out whether subsistence agriculture had any effects on water quality Bugolobi, Nakawa division. Observation was made on the colour of the water, the types of aquatic plants present, and the level of industrial and human activity present.

Table 7: Effects of subsistence agriculture on water quality

Contaminants	**Frequency**	**Percentage (%)**
Fertilizer	8	20
Herbicides	8	20
Livestock and human wastes	24	60
Total	**40**	**100%**

(Source: field 2012)

Pie chart showing effects of subsistence agriculture on water quality



(Source: field 2012)

Figure 8

Both live stocks and human wastes (60%) were the biggest threat on water quality.. This was because of poor waste disposal as well as lack of paddocking of the livestock and hence their waste was disposed on the water hence affecting water quality.

Herbicides and fertilizer use (20%) were the least harmful on the water quality. This was because the good fertilizers and herbicides were too expensive to afford.

(Source: field 2012)

4.5 Effects of subsistence agriculture on soil

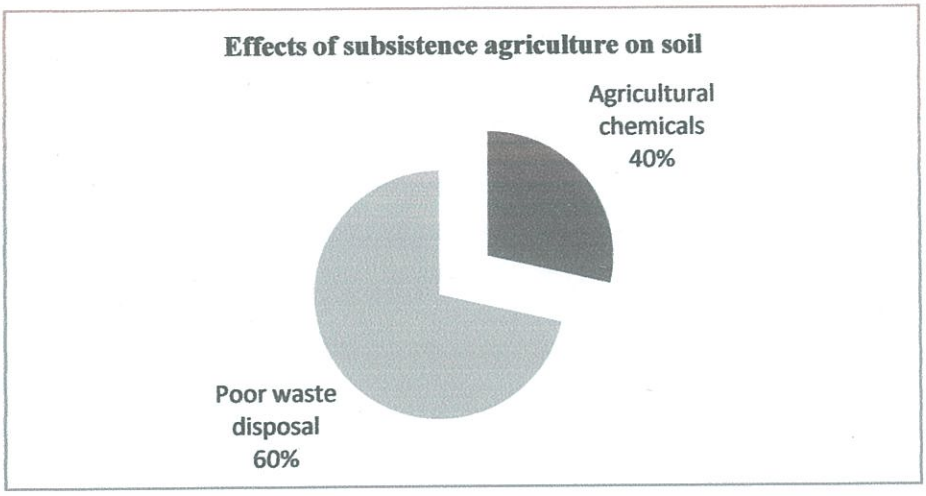
To determine the effects of subsistence agriculture on soil in Nakawa division, the researcher used experiments such as finding the rates of soil drainage using two different soil samples, soil test kit, and soil PH. Observation was also made on the type of soil structure and colour, types of crops grown and their level of maturity and the level of human and industrial activity.

Table 8: Effects of subsistence agriculture on soil

Activity	**Frequency**	**Percentage (%)**
Agricultural chemicals	16	40
Poor waste disposal	24	60
Total	**40**	**100%**

(Source: field 2012)

Pie chart showing effects of subsistence agriculture on soil



(Source: field 2012)

Figure 9

The researcher analysed that, Poor waste disposal (60%) was the biggest challenge. This was because the farmers lacked proper sanitary facilities like toilets, refuse bins and hence they disposed their wastes on the wetland.

Agricultural chemical usage (40%) was the least harmful to the soil. This was because very many farmers did not now how to use chemicals in spraying their crops. In addition, chemicals were too expensive for the farmers to afford since most farmers had modest incomes.

(Source: field 2012)

4.6 Effects of subsistence agriculture on biodiversity

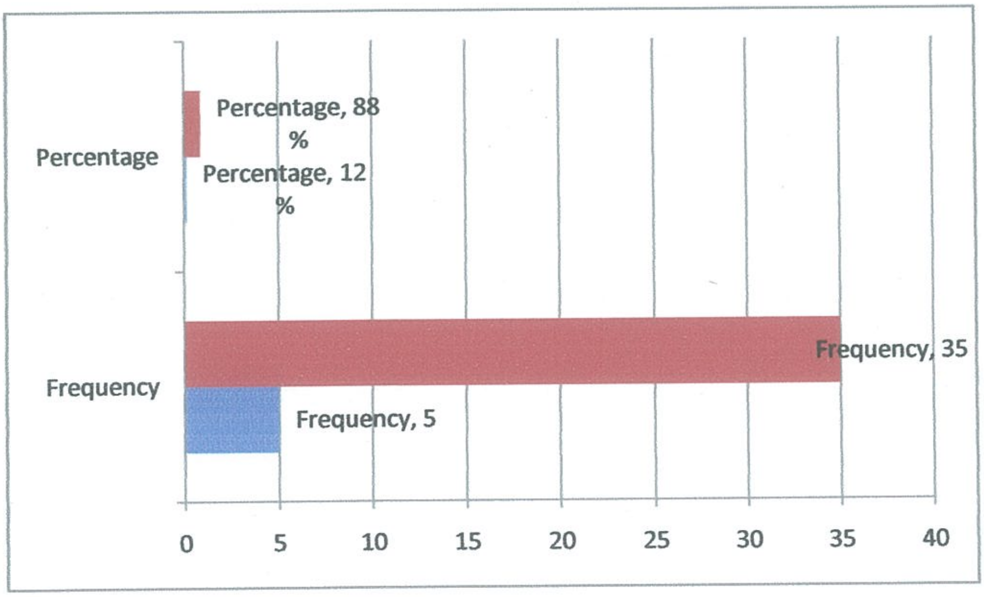
The researcher used observation on the different flora and fauna species in the wetland. The researcher observed colour of plant leaves, plant species such as papyrus, and different species of both aquatic and terrestrial animals such as fish, tadpoles, frogs, insects, and birds in the wetland.

Table 9: The effects of subsistence agriculture on bio diversity

Species type	Frequency	Percentage
Plants	5	12%
Animal (fish, birds, frogs)	35	88%
Total	**40**	**100%**

(Source: field 2012)

A bar graph showing the effects of subsistence agriculture on bio diversity



(Source: field 2012)

Figure 10

The researcher deduced from the above figure that, the flora species (12%) were the least affected as a result of subsistence agriculture in Bugolobi, Nakawa division. This was because the soils in the wetland were so fertile and supported plant growth. This was evidenced by the green leaves of plants. In addition, the huge vegetation cover ensured that rain water was trapped in the soil and made it available for plant roots to suck hence leading to their growth.

The fauna species (88%) were the most affected by subsistence agriculture. This was because as most of the farmers ploughed their fields, they exposed very vital soil forming organism on the surface and hence they got destroyed. In addition, the trophic levels of some fauna species such as birds were destroyed for example, the farmers interfered with the niche of the birds, frogs, and other insects like butter flies. This was evidenced by observing birds and butterflies that flew away to new areas where they would not be interfered with.

(Source: field 2012)

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.0 Conclusions

Subsistence agricultural practices such as over grazing of cattle, use of fertilizers, poor farming methods such as monocropping and monoculture negatively affected wetland conservation through causing floods, sedimentation, poor water quality and reduction in flora and fauna species.

The study findings show farmers were ignorant of the dangers of excess fertilizer application on soil and water and hence there was both soil and water pollution.

According to the study findings, all the farmers in Nakawa division adopted and practiced intensive subsistence agriculture. This was because the majority of the farmers owned small fields and much of their efforts were for home consumption.

Poor waste disposals such as plant stalks, and domestic wastes, fertilizers and human excreta, old spray cans used in spraying crops were disposed on the wetland and these resulted into floods, soil pollution, stunted growth of plants and spread of diseases such as malaria, and cholera.

The farmers in Bugolobi, Nakawa division used simple equipments such as hand hoes, pangas, rakes, knives and slashers. This was because they were involved in small scale production motivated by production for home consumption.

The researcher also established that most of the crops grown such as beans, cassava, maize, pumpkins and sweet potatoes were mainly for home consumption, while the excess was sold in the market.

The researcher also observed that so many plants were stunted in their growth while others had yellow leaves an indication of nutrient deficiencies especially as a result of poor and un sustainable farming practices forexample, monocropping.

5.1 Recommendations

All activities in the wetland should be controlled by NEMA through regulating agricultural production requiring that the farmers form voluntary societies and be licensed in accordance with the national policy on the management of wetland resources.

Protection of catchment area should be promoted to ensure that all areas upstream of a wetland are properly managed to prevent wetland degradation. In addition, wetland plants should also be encouraged to grow other using them as fodder for livestock.

Grazing of cattle in the wetland should be permitted but this should be ered as a public amenity to all those who require it, and hence fencing should not be erected to exclude any user.

Water balance activities should be promoted for example, users of the wetland must ensure that the overall water balance is maintained so that the surface does not dry out. In addition, ridging and trenching may be performed within the wetland, allowing the growth of crops requiring drier soils, as long as the water does not fall below 0.5 metres from the top of the ridges.

Traditional uses and access rights should be maintained since people living adjacent to the wetland have been deriving benefits from that wetland such as cutting of trees, reeds, water supply and grazing for many years, and therefore, any change of use of the wetland should allow those traditional uses to continue.

Environmental impact assessment (EIA) should be applied. EIA is a detailed technical document which determines the legally binding environmental management measures to be incorporated into an economic development programme. This will curb down on wetland degradation and promote sustainability.

Communication, education and public awareness strategy should be promoted to ensure that information of relevance reaches the most appropriate types of stake holders.

Demonstration of approaches for wetland restoration and rehabilitation should be promoted on the selected wetland site based on the results of wetland inventories and on national priorities.

Farmers should embrace good farming techniques such as crop rotation to overcome the threats of pests and diseases, thereby reducing on the use of chemicals for spraying since these chemicals tend to escape into underground aquifers and polluting water.

Live stock farmers should also embrace paddocking and practicing rotation grazing. This will ensure that vegetation will not be completely lost and promoting sustainability.

REFERENCES

Blake and Pitakthepsombut, 2006b.The three Dimensional commons of the Lower songkhram River.

Chris Dinesen Rogers,eHow; Wetland pollutants.

De Groot, R.S., 1992. Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision Making. Wolters-Noordhoff, Groningen.

Drew, W., Ewel, K.C., Naylor, R.L. & Sigrah, A. 2005. A tropical freshwater wetland: III. Direct use values and other goods and services. Wetl. Ecol. Man., 13: 685–693.

Dugan, P.J., 199O. Wetland management: a critical issue for conservation in Africa. In: Matiza, T., Chabwela, H.N. (Eds.), Wetlands Management: A Critical Issue for Conservation in Africa, Wetlands Conservation Conference for Southern Africa. IUCN, Gland, pp. 1 –8.

Dugan, P. J. (ed.). 1990. Wetland Conservation: A Review of Current Issues and Required Action. IUCN, Gland, Switzerland 94pp.

Dugan, P., ed. 1993. Wetlands in danger. London, Mitchell Beazley.

Emerton et al.1999. Managing Wetlands and Reducing poverty: Issues and challenges.

Finlayson M. and M. Moser (eds.). 1991. Wetlands. International Waterfowl and Wetlands Research Bureau. Facts on File Ltd. Oxford, UK 224pp.

Gopal, B. 1999. Natural and constructed wetlands for wastewater treatment: potentials and problems. Wat. Sci. Technol., 40(3): 27–35.

Howard, G. 1995. Fresh water Wetland Plants in East Africa. Swara. 18 (1): 18 - 21.

IUCN (2005); From Conversion to Conservation: Fifteen Years of Managing Wetlands for People and the Environment in Uganda.

Jones, R. Kamugisha (1993): Management of Natural Resources and Environment in Uganda: Policy and Legislation Landmarks, 1890-1990. Published by SIDA.s Regional Soil Conservation Unit, RSCU, Nairobi, 1993.

Kasimir-Klemedtsson L, K Berglund, P Martikainen, J Silvola, O Oenema. 1997. Greenhouse gas emission of methane from farmed organic soils: a review. Soil Use Manage., 13: 245-250.

Kivaisi, A.K. 2001. The potential for constructed wetlands for wastewater treatment and reuse in developing countries: a review. Ecol. Eng., 16: 545–560.

Koetze, D. 1996. How wet is a Wetland? An introduction to understanding wetland hydrology, soils and landforms. Wetland Use Booklet 2. Share-Net. Wildlife and Environment Society of South Africa. 24pp.

Kostov, P. and J. Lingard (2002) Subsistence Farming in Transitional Economies: Lessons from Bulgaria, Journal of Rural Studies, 18(1): 83-94.

Kostov, P. and J. Lingard (2003) Subsistence Farming in Transitional Economies: Lessons from Bulgaria, Journal of Rural Studies, 18(1): 83-94.

Kwasnewski, A. (1999) Address of the President of the Republic of Poland Aleksander Kwasnewski to the 9th European Congress of Agricultural Economists, Warsaw, August.

Maltby, E. 1986. Water-logged wealth. London: Earthscan Publication, 1950pp.

Middleton, B. (2002). Non-equilibrium dynamics of sedge meadows grazed by cattle in southern Wisconsin. Plant Ecology 161(1): 89-110.

Mishev; P., N. Ivanova, M. Tzoneva and P. Kostov (1999) "Influence of Structural and Income Policies on Size and Product Pattern of Production Units in Bulgarian Agriculture", Bulgarian Journal of Agricultural Science, 5(2): 337-45.

Mitsch, W.J. & Gosselink, J.G. (1986): Wetlands. Van Nostrand Reinhold, New York.

National environmental statute 1995.

NEMA (National Environment Management Authority), State Of The Environment Report For Uganda, 2000/2001.

OMUNYIN ONYANGO; Revision notes in Principles and Practices of Agriculture; 3RD Edition-April 2005, Baraza Enterprises Limited.

Ramsar Convention on the Management of Wetlands of International Importance, 1971.

Ramsar Convention Bureau, 1997. The Ramsar Convention Manual: A Guide to the Convention on Wetlands (Ramsar, Iran, 1971), 2nd ed. Ramsar Convention. RCB, The Gland 170pp.

Roggeri, H., 1995. Tropical Freshwater Wetlands—A Guide to Current Knowledge and Sustainable Management. Kluwer Academic Publishers, Dordrecht.

Serova et al.1999. What is Beh ind the fall in Russian Agricultural Production?

Taboada, M.A.; Lavado, R.S.; Svartz, H.; Segat, A.M.L. (1999). Structural stability changes in a grazed grassland natraquoll of the Flooding Pampa (Argentina). Wetlands 19 (1): 50-55.

UBOS (2002); Uganda Population and Housing Census.

UNEP; Action plan of the Environment initiative of the new partnership for Africa's Development (NEPAD), June 2003.

WCMC (World Conservation Monitoring Centre). 1992. Global Biodiversity: Status of the Earth's Living Resources. Chapman and Hall, London, 585pp.

WETLANDS: National Wetlands Conservation and Management Programme, Department of Environment, Ministry of Natural Resources; P.O Box 9629, KAMPALA, Tel: 241239.

Will Hoyer (2011) Agricultural Drainage and Wetlands: Can They Co-exist?.

Zwarts, L, Beukering, van, P., Kone, B. & Wymenga, E. 2005. The Niger, a lifeline: effective management in the upper Niger basin. Wageningen, Netherlands, RIZA Wetlands International.

APPENDIX I-INSTRUMENTS

Dear Respondent,

I am a student of Environment from Kampala International University. First, I want to thank you in advance for taking time to complete this questionnaire. The questionnaire is designed to obtain data on "**The role of subsistence agriculture on wetland conservation in Bugolobi, Nakawa division**", which is being carried out as a partial fulfilment for the award of a Bachelor of Science degree of environmental management. The information obtained is for educational purposes only and will be treated with strict confidence. Thank you!

Please tick (✓) wherever necessary.

1. Section A: Background information

(i) Age Bracket

18-25 [ ]   26-33 [ ]   34 – 41 [ ]

42 – 48 [ ]   49+ [ ]

(ii) Sex

Female [ ]   Male [ ]

(iii) Education Background

Primary [ ]   Secondary [ ]   Diploma [ ]   Degree and above [ ]

(iv) Marital Status

Single [ ]   Married [ ]

2. Section B: Types of subsistence agriculture

(i) What economic activity do you practice?

....

....

....

(ii) What kind of subsistence agriculture is practiced in your area?

Intensive subsistence [ ]   Primitive subsistence agriculture [ ]

(iii) Explain what the kind of subsistence agriculture you practice entails

....

....

....

....

(iv) What factors led you to adopt this type of farming?

....

....

....

....

(v) What type of crops do you grow?

....

(vi) What type of farmer are you?

Mixed farmer [ ] arable farmer [ ] livestock farmer [ ]

3. Section C: Value of wetlands

(i) Give your opinion on wetland conservation

....

....

....

....

(ii) Is there any way in which you conserve wetlands?

Yes [ ] No [ ]

If yes briefly explain

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(iii) Do you have any values attached to wetlands?

Yes [ ]   No [ ]

(iv) Who gains from the wetlands?

Farmers [ ] industries [ ]   all [ ]   don't know [ ]

(v) Which of the following values of wetlands applies to you mostly? (Choose one)

Flood mitigation [ ]   water source [ ] Raw materials [ ]   recreation [ ]

4. Section D: Effects of subsistence agriculture on wetlands

(i) Do you think subsistence agriculture has an effect on wetland conservation?.

Yes [ ]   No [ ]

If Yes, Please explain.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(ii) Would you recommend someone to conserve wetlands?

Yes [ ]   No [ ]

(iii) Please indicate any problems that are faced by wetlands as a result of subsistence agriculture.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(iv) From the problems mentioned above in **(4 iii)** above which one is the most serious? Explain briefly.

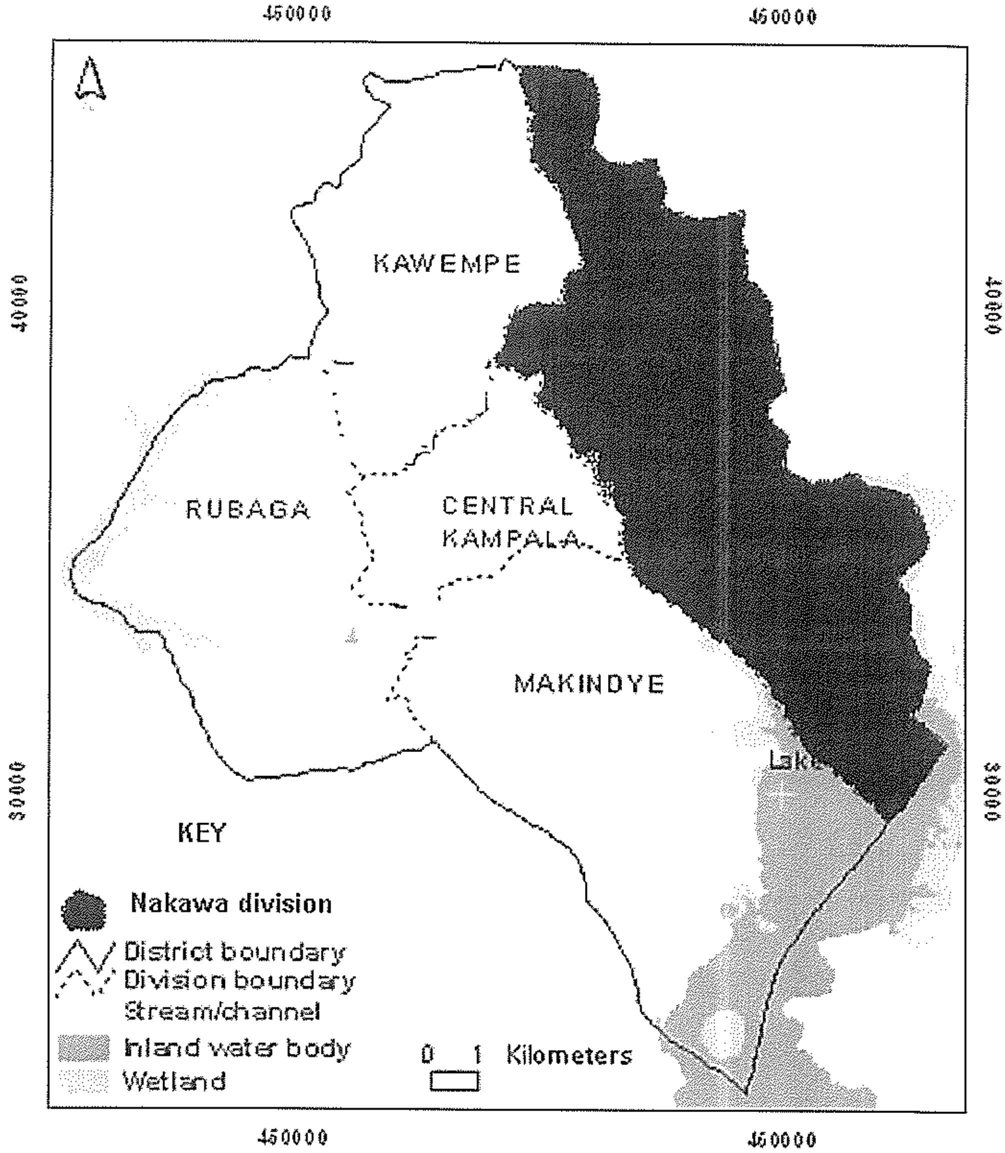
....
....
....

(v) How can the above problems be minimized?

....
....
....

Thank you for your contribution. May God bless you!

APPENDIX-11 MAP OF KAMPALA SHOWING NAKAWA DIVISION



Source: Google maps 2012