# THE EFFECTS OF GROWING RICE IN WETLANDS: A CASE STUDY OF LUMBUYE WETLAND, IGANGA DISTRICT, UGANDA

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**A Research Thesis**

**Presented to the School of**

**Postgraduate Studies and Research,**

**Kampala International University**

**Kampala, Uganda**

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**In Partial Fulfillment of the Requirements for award of the Degree of**

**Master of Science in Environmental Management**

**And Development**

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**BY:**

**Mukebezi Ronald**

**August, 2012**

## DECLARATION A

I declare that this thesis report is my original and personal work and has not been presented for a Degree or any other academic award in any University or Institution of Learning.

Signature: Date

..... .....

Mukebezi Ronald

## DECLARATION B

I confirm that the work reported in this thesis was carried out by the candidate under my supervision.

Signature: Date:

..... .....

Dr. Twaha

SUPERVISOR

## APPROVAL SHEET

This thesis entitled **"the effects of growing rice in the wetland, using Lumbuye Wetland, Iganga District as a case study"** prepared and submitted by **Mukebezi Ronald** in partial fulfillment of the requirements for the degree of **Master of Science in Environmental Management And Development** has been examined and approved by the panel on oral examination with a grade of PASSED

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Name and Signature of Panelist Name and Signature of Panelist

Date of Comprehensive Examination: _____

Grade: _____

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Name and Signature of Director, SPGSR

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Name and Signature of DVC, SPGSR

## DEDICATION

This work is dedicated to my parents; father Mr. Mukebezi Moses, mother Ms Kyoyagala Mary who laid a foundation for my academic field.

To the Belgian government through the Beligian Technical Corporation (**BTC**) Uganda, who sponsored the completion of my master's degree.

To my spouse, Ms Shamina Abooki, my son Jeremiah, my brothers and sisters, Mukebezi Susan, Kirenda Eva, kyabogo George and Bamale phiona.

## ACKNOWLEDGEMENTS

I would like to express my gratitude to the following people for the assistance and contributions during the period of my study and research work.

Special recognition goes to my supervisor Dr Twaha, for providing me with his professional and constructive guidance before, during and until the completion of this work. I also thank the Beligian government through the (BTC) Uganda, for having accorded me financial assistance through out my study.

Thanks also go to the people I met in the field for there cooperation and willingness to avail me with the necessary information.

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## ABSTRACT

The research was carried out in order to assess the effects of growing rice in the wetland, using Lumbuye Wetland, Iganga District as a case study. The study objectively sought; to find out the factors influencing farmers to grow rice in the Wetland and to establish the solutions to the negative effects of growing rice in the Wetland.

Some important aspects were reviewed about the effects of growing rice in the wetland. This chapter revealed the theoretical perspective and the conceptual perspective and related literature while identifying the knowledgeable gaps. Data was collected using methods such as interviewing, questionnaires, observation, reliability and validity, procedure for data collection and lastly data analysis and presentation interview results were coded in SPPS for better analysis.

The study findings revealed that Wetlands provide the basic means of survival to the majority of the households in Lumbuye Wetland. There are a number of wetland resource conflicts that impede conservation efforts. The level of awareness about the importance of wetland conservation is slowly growing but is not yet adequate.

The findings, conclusions and recommendations from the field study were also presented such as; there is evidence to indicate that Uganda's history in wetland management particularly Lumbuye Wetland, Iganga district has not been without key milestones. It was recommended here that Intensify awareness creation, By-law formulation, Need for assessment, Popularize and enforces Environmental Impact Assessment, Advice on wetland-based ecologically friendly enterprises, and Factor in rural poverty, Need for Information packaging.

# CHAPTER ONE

# THE PROBLEM AND ITS SCOPE

## 1.0 Introduction

The study was carried out in order to assess the effects of growing rice in the wetland, using Lumbuye Wetland, Iganga District as a case study. This chapter presents the background of the study, problem statement, purpose of the study, objectives of the study, scope of the study, research questions and the significance of the study.

## 1.1 Background to the Study

Wetlands are ecosystems that occupy about 6 % of the world's surface; the term wetland was developed out of the need to manage these specific areas, for which several definitions exist. The difficulty of defining wetland arises partly because of the highly dynamic character and partly because of the difficulties in defining their boundaries (Tuner, 2000). Wetlands are therefore both land ecosystems that are strongly influenced by water and aquatic systems with special characteristics due to shallowness and proximity to land.

In North America, rice production is concentrated in areas that have historically provided wetland habitat for wildlife. Over time agricultural activity has significantly altered area hydrology and wetland habitat (Reinecke et al., 1989) and reduced its ability to support wetland wildlife. By 1978, an estimated 80% of the 10 million ha (25 million acres) of bottom land hardwood forest in the Mississippi Alluvial Valley (MAV) had been cleared for agriculture production (Forsythe, 1985; Reinecke et al., 1989).

A similar situation exists in the Central Valley of California, where rice production is concentrated in an area important to wetland wildlife. In 1986, the North American Waterfowl Management Plan (NAWMP) put forward the goal of restoring and maintaining continental waterfowl populations at their 1970s levels. Among the original Joint Ventures (JVs) established to implement these goals, three focused specifically on providing habitat for wintering waterfowl. The Lower Mississippi Valley Joint Venture (LMVJV), the Gulf Coast Joint Venture (GCJV), and the Central Valley Habitat Joint Venture (CVHJV) in California overlapped considerably with key rice-growing regions in North America. Accordingly, success in achieving the goals of the NAWMP is closely tied to rice production. A producer's decision to adopt management practices that provide waterfowl habitat is largely dependent on agronomic and subsequent economic results.

Rice cultivation in North America was first established in the mid-seventeenth century (Dethloff, 2003). Carolina Gold, a rice variety from Madagascar, was introduced to South Carolina in 1698, resulting in the export of 4.5 metric tons (Mg) (Littlefield, 1981). Early production was confined to the river and costal areas of South Carolina. Improvements in water management and milling resulted in annual exports of 16,364 Mg from South Carolina and Georgia at the onset of the American Revolution (Dethloff 2003). Westward movement and the Civil War caused production shifts from South Carolina and Georgia to the Delta of Louisiana (Babineaux 1967). Railroads extended production into Texas while new producers bought land in Louisiana and expanded

production to approximately 741,300 ha (183,175 acres) by 1895. Robust export market and corresponding increases in land values forced producers to relocate.

Much of Africa lies within arid and semi-arid climates, where fresh water is scarce. In fact, Africa is one of the two regions in the world facing serious water shortages Although Africa has abundant freshwater resources in rivers and lakes, they are unevenly distributed both within and between African countries. Currently, 14 countries in Africa are subject to water stress (1700 $m^3$ or less per person per year) or water scarcity (1000 $m^3$ or less per person per year), and another 11 countries are expected to join in the next 25 years (UNEP, 2000). In these contexts, wetlands are an important source of water and nutrients necessary for biological productivity and often sheer survival of the people (Thompson, 1996). In some cases, wetlands are the exclusive source of natural resources upon which rural economies depend. Sustainable management of wetlands is therefore critical to the long-term health, safety and welfare of many African communities.

Wetlands in Uganda cover about 13% of the country and include areas of seasonally flooded grass, land swamp, forest, permanently flooded papyrus and grass swamp and up bog. Wetlands are complex ecosystems with multiple values, including ecological, socio-esthetical, intrinsic and economic values. An example of ecological value is the facts that over 2,000 known species of indigenous freshwater fish live in African wetlands (Hails, 1996). Social esthetical value is reflected, for example, in the tradition of some tribes to have initiation rites in wetland areas, while intrinsic value is the value

residing in the wetlands themselves. Each of these values is known as a secondary value: the primary value of an ecosystem is its value as a life-supporting function (Turner et. al., 1994). This study focuses on one aspect of these secondary values, namely economic value, which reflects a significant part of the importance of wetlands for human populations. This value is very clearly demonstrated in Sub-Saharan Africa, where many people survive by exploiting natural resources of wetlands (Acreman and Hollis, 1996). Within the African continent, wetlands play a vital role in sustaining a significant portion of the population.

Despite their importance, African wetlands are being modified or reclaimed – their resources are over-exploited, their lands are converted to other uses or upstream developments alter the quality and flow of water feeding the wetlands. A major factor contributing to these activities is that decision-makers often have insufficient understanding of the economic values of wetlands, in which case the protection of wetlands may not be a serious alternative. Wetlands are often perceived to have little or no value compared to other uses of its lands and water that may yield more visible and immediate economic benefits. These other uses, such as the draining of wetlands for agricultural activities and using the wetlands waters for electricity generation constitute the opportunity cost of wetland protection. Decision-makers often perceive these opportunity costs, together with other costs of wetland protection including possible increases in diseases such as Malaria, as exceeding the benefits of wetlands. African wetlands, however, have numerous goods and services that have an economic

value to the local population living in its periphery but also to communities outside the wetland area.

Uganda's Wetlands support a rich diversity of plants and animals, Wetlands also have intrinsic attribute, perform functions and services and produce foods of local regional, national or international importance. Together they represent considerable ecological, social and economic value. The Uganda's economy is dominated by the agricultural sector accounting for 43% of gross domestic products, 85% of export earning, and 80% of employment and provides raw materials to mainly agro processing industrial sector.

Wetlands have since 1970s experienced large scale drainage for agricultural and industrial development, sand and clay mining, and other human activities, Iganga district has a total area of approximately 12,792 km, of which 1,215km or 9% is Wetland. 49 % of the Wetland was converted as per national Wetlands conversion and management programme, Iganga district Wetland status reports, 1996. The area of seasonal Wetland is 887 km of which 20km or 6% is converted and permanent Wetland 328 km of which 571km or 64 % is converted. Most Wetlands in the district drain towards Lake Kyoga, of interest being Lumbuye, Naigobya and Mpologoma, all draining north wards. Lumbuye Wetland is a river in a wide valley with impeded drainage, the flood plain includes both seasonally and permanently flooded areas, the catchment area extends up stream close to Lake Victoria and includes the rivers of Nakasamba, Kasanga, Masaba, Nabutndwe, Mptindibo, Wamalagwe, Kamirantunbu and Nabukolyo.

The wet land drains in Lake Nakawa, which is part of Lake Kyoga complex (Wetland status report for Iganga district 1996).

## 1.2 Statement of the Problem

Among the pressing and challenging environmental problems in Iganga district are the Wetland conversions for agricultural use, more especially for rice growing. Rice is a high value crop compared to other crops like maize commonly grown in the region. Loss of fertility in the up land especially due to soil erosion has left wetlands as an alternative to the declining crop yield. Wetland soils are still fertile and conducive to rice growing. The ever increasing population leaves the peasant farmers without enough land. There are threats of loss of all plant, animal species, water buffering and recharging capabilities. Currently, the rate at which the Wetlands in Iganga district are being reclaimed for agricultural use is high and there is need for intervention to reduce their degradation.

## 1.3 Objectives

### 1.3.1 General objective

The General objective of this study was to assess the effects of growing rice in the Lumbuye Wetland.

### 1.3.2 Specific objectives

*The study was guided by the following specific objectives;*

1. To find out the factors influencing farmers to grow rice in the Wetland
2. To establish the solutions to the negative effects of growing rice in the Wetland

### 1.3.3 Research Questions

1. What are the factors influencing farmers to grow rice in Lumbuye Wetland?

2. What are the solutions to the negative effects of growing rice in Lumbuye Wetland?

## 1.4 Scope of the Study

The study was carried out in Bukooma, Nawandala Sub County, the Wetland area proposed for conversions in Iganga district 15 kms off Kaliro – Buwenge road near Naigobya town and Kamuli road near Namugoje trading center the area boarders Nawandala. The study's focus was mainly on the effects of rice growing on Lumbuye Wetland.

### 1.4.1 Subject scope

The study focused on the effects as an independent variable and growing of rice on the surrounding environment as the dependent variable since the variables are inter-linked.

## 1.6 Significance of the study

Gayiiya (2001) wrote about how the nature of land tenure systems and their associated effects on the periodic floods on the surrounding environment. However, in this study, the researcher's area of interest is specially on the effects on environment.

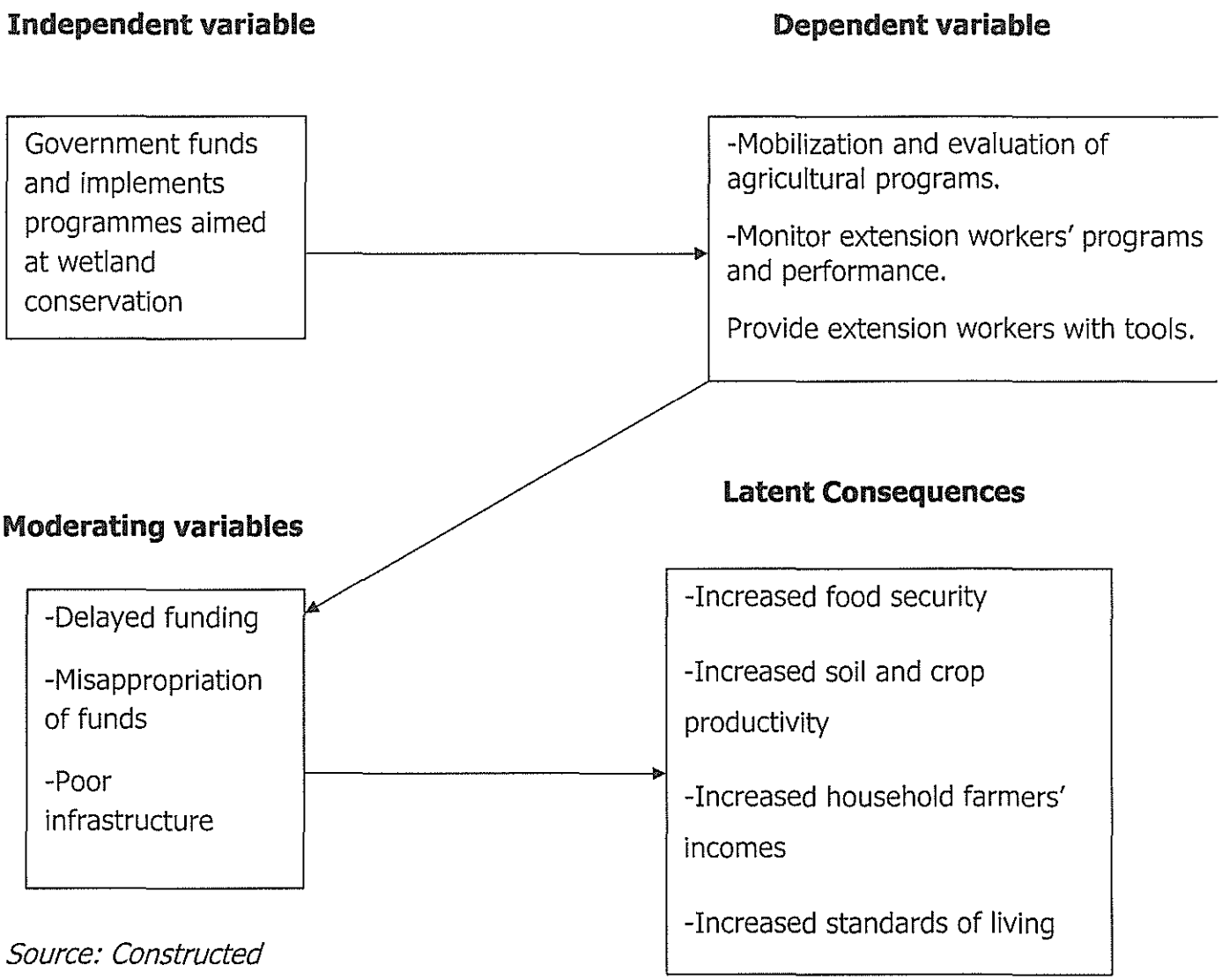
The study will be significant in that it would help individuals or organizations that would like information about farming in wetlands and its effects on the housing development in general.

The study would help the residents of Lumbuye wetland to get information that would be useful in overcoming poor land use systems and also controlling their environment against disastrous effects.

The study would help organizations which are concerned with the environment like National Environmental Authority (NEMA) to help in environmental protection.

The study will also be useful to other researchers in the field of land and construction works those who would wish to expand on the area of land usage to obtain a foundation in the form of literature review.

## CONCEPTUAL FRAMEWORK

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# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## 2.0 Introduction

In this chapter the researcher brings out a critical review of the issues that have been explored and studied both theoretically and empirically in the existing literature on the concepts of the effects of farming (growing rice) in developing countries and elsewhere in the world. This chapter will further show the varied views, opinions and concepts of different scholars on the subject at hand. It is important to note that the greatest part of the existing literature is the work of other scholars who have written about the topic of the study or those who have addressed similar issues will be discussed.

## 2.1 Effects of farming in wetlands

### 2.1.1The sponge effect

According to publications like the (UN, Report), the sponge working of swamps during high rain fall is not valid for peat soil domes are characteristic for peat swamps in Indonesia. There is no extra storage possible in already saturated peat soil and water will disappear directly to the adjourning lower lying layers, mainly by gravity surface flow and the shallow surface soil (first 20cm). As approval I can show you developed tidal low land areas bordering peat soil domes that could suffer severer deep flooding during high rain fall then there is no interception drain an dike bordering the pat soil dome. During the high rain fall the peat works like sponge, wrong thus peat domes

work only as sponge during dry periods when it still releases water to the lower lying areas. In the flat low lying areas of the tidal low lands. Usually not peat soils but clay soils, there surface water storage possible from mainly local rainfall during high rainfall periods. When these areas are developed and used for wetland rice cultivation this storage is still available and probably has even a bigger than before development in disturbed swamp forests and these extra tidal flooded areas in low lands will reduce the flood problem from the river else where. The tidal low lands are developed for housing and industry, like in plembang city, and then flooding problem is high likely because all local flooding storage potential has disappeared. Still even in this case the tidal lands have much better potentials for drainage than the areas more up stream, in the river flooding area, gravity drainage for tidal low lands is still possible during low tide, but only when the proper drainage system is installed that is needed for the urbanization.

Negative impact often mentioned, when Wetlands are lost is the effect on climate it could have. Wetlands work as a sponge and will release evaporation over along period of the year. That will be surely valid for more dry climate but for tropical rain forest climate of Indonesia that effect would be less important, when two Wetland rice crops are grown per year in swamp schemes, there would be even no significant differences with the original conditions in respect to evaporation (Lemly, A. et al. 2000), when tree crops are grown, high excess rain fall will be released with in a few days to the river, for rice crops this release will much slower. In the tidal stretches of the river, this impact will be small in comparison to areas more up stream with river flooding, where it could be important. The sponge working on the edge of the peat domes could be

important for the lands bordering these peat domes, mainly important for dry lands. These lands will receive water from the peat domes by surface flow for long period of time; reclaiming peat domes for development should take in consideration a sustainable flow to adjoining lands.

Fujioka, M.; Lane, S.J. (1997) asserted that, some people claim that swamp development has negative effect on drainage conditions of the peat dome itself. That effect very much depends on how deep the development enters into the peat dome itself and especially how large is the subsistence in the developed areas. How ever direct measurable water flows do not have an influence on the drainage conditions of the peat dome beyond 100 – 200 m from the edge. The river boarders are very important parts for the natural tidal swamps which should be preserved as much as possible. At other places, wildlife should have access to river boundaries through corridors.

In natural conditions the ground water level will also drop the pyrite layer in acid sulphate soils during along dry season, but not as frequently as in areas developed for agriculture. The reason is that under natural conditions the soil is often inundated at the end of the wet season, after which it takes long time before the water layer will evaporate and the ground waters drop below the pyrite level. it might be clear that in developed areas for agriculture such as deep continuous flooding can never be allowed and there fore pyrite will be exposed more often than under natural conditions when only one rice crop is grown per year or tree crops cultivated, after a number of years anew balance will be found between the drop of ground water level and acidity release

when sufficient leaching will be applied and the pyrite layer will drop to lower levels in the deep sub soil.

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 such as water for domestic purposes, livestock watering, source of fish, medicinal plants and animals and various materials. Although the overall value of wetlands in Uganda has not been quantified, it is clear that they have vital attributes such as biological diversity, gene pool research materials, cultural values and aesthetic values. They are among the most productive ecosystems and directly or indirectly support millions of people and provide goods and services to them. They facilitate important processes like the movement of water into streams and oceans; decay of organic matter; release of nitrogen, sulfur, and carbon into the atmosphere; removal of nutrients, sediment and organic matter from water moving into the wetland; and the growth and development of all organisms dependent on them.

The direct benefits of wetlands are in the form of products such as fish, agriculture, fuel wood, recreation and water supply, etc. and their indirect benefits arise from functions performed by the ecosystem such as flood control, ground water recharge and storm protection. They are dynamic ecosystems, continually undergoing natural changes due to infilling with sediments and nutrients, subsidence, rise in sea level, etc. They sustain all life and perform some useful functions in the maintenance of overall balance of nature. Rapid urbanization, reducing soil fertility, effects of climate change,

increasing human population and their various activities have contributed to the decline of quality and quantity of wetlands due to pressure beyond the ecosystem carrying capacity. Hence, it is imperative to focus on conservation of these endangered habitats to achieve ecological sustainability.

Kingsford, R.T. (2000) said that, sustaining the area of rice lands managed as wetlands and waterfowl habitat will require continued participation of a sizable number of producers. To achieve this there will need to be direct and indirect agronomic benefits accrued from land management practices that enhance waterfowl habitat. While not extensive, research suggests that managing rice-production areas as waterfowl habitat could enhance straw decomposition, provide a subsequent crop with additional nitrogen, reduce weed densities, abate soil erosion, improve soil and water quality, and reduce spring tillage. Benefits vary from region to region resulting from differences in how rice is produced. To capitalize on these benefits, producers will in some cases need to make capital investments even though the value of the benefits received are difficult to quantify. Studies on rice straw management have focused on enhancing decomposition. Studies indicate that straw biomass left after harvest can be reduced as much as 68% when winter flooding is combined with disking, and 54% by winter flooding alone.

Consistent waterfowl foraging aids to reduce straw biomass after harvest by as much as 78%. All studies measuring straw decomposition reported increases from holding winter water but, at the same time, recognized there would be cost tradeoffs between straw

management and water management. If fields must be pumped to maintain winter water there will be additional costs. In parts of the United States where heavy winter rains are common, one can consistently achieve adequate winter flooding without pumping. Nutrient benefits from water management are closely tied to the amount of plant material remaining in the field and how the subsequent crop is managed. There is strong evidence that keeping rice straw in the field and holding a winter flood will result in increased nitrogen (N) for the subsequent rice crop. These results were obtained after three years of straw management in a continuous rice rotation. Such benefits may not be expected from areas where rice is grown in rotation with soybeans or corn.

Mitsch, W.J.; Gosselink, J.G. (2000) in his recent research suggests that Nitrogen uptake in the subsequent rice crop might be reduced when rice straw remains on the fields and they are flooded throughout the year. There is a need to better understand the process involved and to develop ways to manage flooded fields to maximize nutrient benefits.

The relationship between agriculture and its effects on wetland ecosystems has often been portrayed as one of a direct tradeoff between the human need for food versus nature. The reality, as revealed by (Mitsch and Gosselink 2000), is much more complex, as both systems human and nature may be adaptive. Where nature might adapt automatically, such as a waterfowl adapting to paddy rice as a replacement for natural wetland habitat, humans too adapt consciously. For example, as humans have learned about the valuable services wetlands provide, the response has been to find ways to preserve and restore wetlands. This is relatively achievable in the developed countries,

which has access to funds and the institutional and legal capacity to impose no loss of wetlands, but it is much more difficult in the developing countries where there are pressing needs for increased food production with limited funds available. In such situations, nature may have to absorb the full costs of change, rather than humans modifying their expectations and requirements in the face of natural needs. A brief discussion of the status and importance of both wetlands and irrigated agriculture is given in the next section.

The first experimental plantings of long-grain rice were made on the California Agricultural Experiment Station from 1893–96. In 1906, William W. Mackie discovered a short-grain Japanese rice variety from Hawaii that was suitable for production (Dethloff 2003). By 1914 California represented 3.8% of the total U.S. production. During World War I rice production throughout the United States increased tremendously, yet that trend reversed at the end of the war. Collapsing prices during the Great Depression led to passage of the Agricultural Adjustment Act of 1933 that created the Agricultural Adjustment Administration (AAA). This agency allowed rice producers to enter into voluntary agreements to reduce production and abide by acreage allotments and marketing quotas. They, in turn, would receive support prices on rice at a predetermined parity level (Perkins 1969). Between 1946 and 1954 the area of rice planted in the United States rose from 0.6 million ha to 1.0 million ha (1.5–2.5 million acres) due to increased production along the lower Mississippi River (Reid and Gaines 1974). After 1950 rice production was influenced by fluctuating world demand and a

series of farm programs. Rice area remained relatively constant between 1950 and 1970 .Between 1970 and 2002 there was a significant increase in rice acreage in Arkansas and Missouri.

There is a long history of development leading to the complete destruction of massive areas of wetlands, particularly in the developed countries. In a generalized overview, the Organization for Economic Co-operation and Development (OECD 1996) stated: Some estimates show that the world may have lost 50 percent of the wetlands that existed since 1900; whilst much of this occurred in the northern countries during the first 50 years of the century; increasing pressure for conversion to alternative land use has been put on tropical and sub-tropical wetlands since the 1950s. No figures are available for the extent of wetland loss worldwide, but drainage for agricultural production is the principal cause; by 1985 it was estimated that 65 percent of the available wetland had been drained for intensive agriculture in Europe and North America; the figures for tropical and subtropical regions were 27 percent for Asia, 6 percent for South America and 2 percent for Africa, making a total of 26 percent worldwide. Future predictions show the pressure to drain land for agriculture intensifying in these regions.

The economic value of these goods and services can be quantified through economic valuation studies. The economic value of those wetland goods that are traded on the market place, such as fish, can be valued through the market price of the resource. Many wetland resources and almost all wetland services, however, are not traded in the

market place and economic theory provides shadow-pricing methods that allow for the economic valuation of such important services as retention capacity and water cleaning capacity of wetlands, and wetlands as nurseries. The results of economic valuation studies can be weighed against other land and water uses, including the reclamation of wetlands or the diversion of water from wetlands for the purpose of agriculture.

Numerous economic valuation studies of wetlands around the world have been carried out; however, most of these studies have focused on wetlands in developed countries. In those studies carried out for developing countries, African wetlands are clearly underrepresented. At the same time African wetlands are facing serious threats, and the importance of their protection for the survival of local people is increasingly recognized. At present studies present an overview and evaluation of economic valuation studies that have been carried out for African wetlands. According to Ramsar Convention, Wetlands are areas of marsh, fen, peat land or waste water whether natural or artificial, permanent to temporary with water that is static or flowing fresh, blackish or salty, including areas of marine water that do not exceed 6 meters at low tide.

The global wetland area is generally estimated to be 7 to 9 million km2 (6 percent of the land surface of the Earth) (Gosselink, 2002). While there are many definitions to the term wetland many would agree that these are areas with high water tables contributing to a specific ecology. The most broadly accepted definition of wetlands is: Areas of marsh, fen, peat land 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 6 meters (Ramsar Convention 1971). Wetlands are increasingly gaining global attention, bringing together many scientists from different disciplines to study these unique ecosystems. One example of such attention is the Ramsar Convention on Wetlands, adopted in 1971 and as of December 2002 has 1230 wetland sites distributed in six regions (Europe, Asia, Africa, Neotropics, Oceania and North America) recognized as wetlands of international importance (Acreman, M.C.; Hollis, G.E. 1996).

However, there are likely to be many more wetlands to be identified and recorded as many countries have only recently begun identifying important wetlands. The functional value of wetlands depends on their size and placement within the landscape, as well as their relationship to adjacent water areas. Wetlands can be natural or artificial or mixtures of both. There is general agreement that the existence of wetlands is due to specific hydrology, soil type, and vegetation and animal communities, and that their functions depend on the context of their relative placement within the ecosystem. Some of the services wetlands provide include: habitat for aquatic birds, other animals and plants, fish and shell fish production, biodiversity, food production, water storage, including mitigating the effects of floods and droughts, groundwater recharge and shoreline stabilization and storm protection.

Few attempts have been made to calculate the economic value of the goods and services provided by wetlands. Although the accuracy and precision of these attempts may be debatable, they have merit in that they draw attention to and emphasize their

enormous economic importance. Previous estimates include: between US$8,977 and US$17,000 (1983) for the goods and services provided by each acre of Louisiana wetlands (Costanza et al. 1989), and between US$19 million and US$70 million per year for a 45mile stretch of the Platte River, Colorado (Loomis et al. 2000). In the developing countries, the existence and functioning of wetlands can be crucial for adjacent agricultural and extractive economies (Hollis et al. 1993b). While the functional and economic values of wetlands are increasingly recognized, development projects continue to lead directly or indirectly to their loss. As presented in the following section, irrigated agriculture has been destructive in the past, and has the potential to continue to do so in the future unless better management processes are established in the developing countries.

According to (Drijver, C.A.; Marchand, M. 1985) the consultants established that intensive use of fertilizers and agrochemicals will lead to eutrophication of soil and water by nutrients in the drainage water as this water contains residues of fertilizers and agrochemicals, parasites and pathogens. This water is not suitable for human consumption.

### 2.1.2 Wetland rice may make a major contribution to global warming

According to Heinz – Urich Neune (1993) public concern about global warming mostly focuses on carbondioxide. The most prevalent green house gas methane the major component of natural gas is second in importance as a green house gas. Methane concentration in the atmosphere has more than doubled during the last 200 years. Its

current atmosphere concentration of 1.7 ppm by volume, up from 0.7 pmm in pre-industrial times, is much lower than the 345 ppm of carbondioxide up from 275 ppm. But one molecule of methane traps approximately 30 times as much as heatv as does carbondioxide. The heating effects of atmospheric methane increase is approximately half that of carbon in crease (Dickinson .C, 1986) continued increase in atmospheric methane concentration rate, current rate approximately 1 % per year is likely to contribute more to future climatic change than any other gas except

Carbondioxide (Cicerone. O, 1988) may significantly contribute to negative feed back system with unpredictable consequences for the whole chemistry of the atmosphere. Aside from being an important green gas, methane also affects the chemistry and oxidation capacity of the atmosphere, for example by influencing concentrations of troposphere ozone, hydroxyl radicals, and carbonmonoxide. In the stratosphere, it is asink for chrone but sources of hydrogen an water vapors (ice crystals) the current burden of methane in the atmosphere is 4700Tg =1 million ton0( Whalen 1989), and the global annual emission is estimated to be 500Tg with an apparent influx of 40 Tag/yr ( cicerone., O, 1988).

The overall budget of atmospheric methane is fairly well established, but the strength of individual sources remains uncertain. Wetlands rice fields have recently been established as a major source of atmospheric methane. Although the potential for methane to release from rice fields have long been noted (Harrison and Anyer, 1913), the first comprehensive measurements of methane fluxes in rice fields were reported only in the early 1980s (Cicerone and Shelter, 1980, Cicerone, 1980), (Holzaptal. P,

1980), (Seiler 1984) as in natural Wetland, flooding rice fields cuts off oxygen supply from the atmosphere to the soil, which results in anaerobic fermentation of soil organic matter.

Methane is a major end product of anaerobic, it is unreleased from sub merged soils to the atmosphere by diffusion and ebullion and through stems and roots of the rice plants. Recent global estimates of emission ate from Wetland rice fields range from 20 to 100 tg/yr 9 pcc 1992) which corresponds to 6 – 29 % of the total annual anthropogenic methane emission.

Wetlands being used for rice production, conserving and enhancing Wetland soils are essential to meet and sustain food production for future generation, as well as to conserve habitants for endangered plants and wild life specie. In Asia, Wetlands have been used intensively for food production for thousands of years. In Africa and Latin America, Wetlands are becoming a significant resource for food production, how ever, in Europe and North America, Wetlands are being drained and turned into dry lands.

### 2.1.3 Loss of capacity to filter the waters

According to Barbier, E. 1998, "For the Mpologoma system, you will see the water there is right now very brown which never used to be the case meaning that the capacity of even the wetlands to filter have also now been lost. So you can see the effects are going to be beyond just the wetlands". In above analysis, lumbuye wetlands have lost the capacity to filter the waters as its role; this is evident with the current colour of lumbuye wetland, loss of the aquatic life.

### 2.1.4 Vector-borne diseases

Wetland rice culture and irrigation schemes in tropical and subtropical regions create ecological conditions favourable to the propagation of vector borne diseases. The most important of these are malaria, schistosomiasis, and Japanese encephalitis, whose vectors require an aquatic environment, (Roger and Bhuiyan, 1990). The Invertebrate vectors of human diseases in rice-growing environments are basically mosquitoes and aquatic snails. The reproduction of mosquitoes in rice fields is affected by plant height, Water depth, soil and other environmental conditions, and cultural practices. Generally, larval populations are low after transplanting, peak a few weeks later, and decline as the plants reach a height of 60-100cm. Mosquito Reproduction in rice fields ranges from 2 to 20 m-2 day-'(Roger and Bhuiyan, 1990).

Aquatic snails are very common in rice fields where they can develop large populations, especially at the beginning of the cropping season when Organic manure is applied. Populations up to 1000 m-2 have been observed In Philippine rice fields. Behavioral experiments showed that snails having to choose between various soils were most often attracted (75%) to rice. Basing on the above the researcher adheres with the author above, this has also manifested in Lumbuye wetlands, where by the people living around the wetland have suffered from diseases such as Malaria, Bilharzia.

### 2.1.5 General effects of crop intensification on biodiversity in rice fields

Traditional rice fields, some of which have been cultivated for several hundred Years may be considered as climax communities. Modern technologies, which utilize fertilizer-

responsive varieties, fertilizers, pesticides, and optimum water and crop management practices, have tremendously increased yields and production but have, indeed, caused profound modifications to traditional rice-growing environments. In general, a disturbance to a stabilized ecosystem reduces the number of species while provoking 'blooms' of certain others; such effects have been observed in rice fields (Roger and Kurihara, 1998).

### 2.1.6 Impacts related to rice pests

As result of growing rice in wetlands, vertebrate pests especially rodents and birds are likely to manifest especially in the rice fields, mostly at the time of harvesting (jeetna rice irrigation scheme 2008). In the last decades, Iganga district has not registered any serious rice pests hence its not expected to happen with the introduction of high yielding and better varieties which have been introduced by government courtesy of National crops resources research institute publication. In the bid to grow rice in the wetlands, in Indonesia vegetation was cleared during the phase when putting in place irrigation infrastructure, access roads, Labour camps when constructing the mill (Heinz – urich neune (1993)

### 2.1.7 Effects on soil quality and its characteristics

Pesticides have three major effects on rice field algae:

(i) A selective toxicity that affects preferentially green algae and thus promotes cyan bacterial Growth

(ii) A short-term promoting effect of insecticides on micro algae Caused by a temporary decrease of invertebrates that graze on algae;

(iii)Selective effect of insecticides on the cyanbacterial flora by causing recruitment of grazers which results in the dominance of strains forming mucilaginous Macrocolonies (e.g. Nostoc) resistant to grazing.

Field and laboratory studies showed that pesticides applied to soil at the recommended rates and intervals had either no effect on microbial populations or their activities, or had an effect that was followed by recovery after1-3 weeks. Herbicides seem to have more short-term negative effects on the soil micro flora than insecticides. A few studies indicate that repeated applications of the same pesticide may cause its rapid inactivation because of the Enhanced growth of related specific decomposing microorganisms (P.A. Roger 1984.). This was observed in gamma-BHC, diazinon, aldicarb, and nitro phenols, but not incarbofuran and benthiocarb. Repeated application of a pesticide may also change the metabolic pattern of its decomposition. In the case of benthiocarbSuch a change produced a very phytotoxic compound (Moon and Kuwatsuka 2004),

## 2.2 Solutions to the negative impacts of growing rice in the wetlands

### 2.2.1 By avoiding flooding

According to Scoones, I. (1991) for jeetna rice irrigation scheme, the effect of methane emissions can be mitigated or solved by good water management practice, avoiding flooding, applying fermented manure of low carbon nitrogen ratio, and application of

sulphate containing fertilizer. Aerobic degradation of organic matter such as rice husks or incorporation into soil during the off season drainage period could prove of advantage.

### 2.2.3 Massive education

The best solution to wetland depletion is massive education and local campaigning to the people. It's important to note too, that high demand for land for settlement in urban centers like Kampala has also tended to endanger the existing wetlands e.g. Nakawa, Industrial area, Nalukolongo and Bwaise. No wonder that today most of these areas are affected by frequent flooding, especially when it rains heavily. This education and campaign can be done through meetings with their local councils and through publication of different environmental sectors (KCC, 2002).

There need for massive education to people of Iganga district who grow there rice in Lumbuye wetlands as in the above, this will avert the effect of wetland depletion for growing rice.

### 2.2.4 Planting of upland rice

The majority of people joining rice growing are actually planting upland rice, newly introduced in Uganda the rice variety is called NERICA ( new rice for Africa) according to Dr. Asea Godfrey National development research centre, which is good news to us In fact as we speak; 48,000 hectares of land are under upland rice. At the moment the acreage is growing by the day. We expect that at some point lowland rice cultivation will actually stop (Moore D.; Driver, A. 1989).

If upland rice is introduced to the Iganga district farmers, this will be an alternative for them and lumbuye wetland will be saved from further depletion. Upland rice with stands dry whether, encourages larger acreage cultivation and matures early according to the (Tchamba, M. et al 1995).

### 2.2.5 Water management practices

Water management in wetlands has often been oriented solely towards the needs of humans, such as transportation, agriculture, flood control and settlement. Instead of an integrated approach towards water management issues, in which the ecosystem and its different stakeholders play a key role, wetlands have been transformed to a wide variety of human uses. In this respect, several engineering techniques have been applied (Roggeri, 1995). First of all, for the purpose of embankment and water retention, man may construct dikes, dams and reservoirs in rivers that feed wetlands. These may prevent flooding, promote water storage for drinking water or irrigation, or produce electricity.

The table below of the plant genera and species by the inventory team shows the species in Lumbuye Wetland.

**Table 1; Wetland Dependent Plant Genera and Species Recorded by the Wetlands Inventory Team in Some Wetlands, 1995/96.**

| Wetland | No. of Genera | No. of Species |
|---|---|---|
| Lumbuye Dam | 9 | 11 |
| Lake Namabeere (L. Kyoga) | 18 | 19 |
| Lugala (L. Victoria) | 5 | 5 |
| Mpologoma River (L. Kyoga) | 10 | 13 |
| Ruhuhuma Swamp (Nyamuriro) | 6 | 6 |
| Rubaya Swamp (L. Bunyonyi) | 5 | 5 |
| Minani (Naigombwa Swamp) | 7 | 7 |
| Buwongo (Naigombwa Swamp) | 5 | 5 |
| Lumbuye Swamp (Lumbuye River) | 6 | 6 |
| Iyingo (Lake Kyoga) | 15 | 17 |
| Lake Nakuwa (Lake Kyoga) | 9 | 11 |
| Naigombwa Valley dam | 3 | 3 |
| Ivukula (L. Kyoga) | 10 | 10 |
| Lake Munyanyange | 2 | 2 |
| Kahendero (L. George) | 8 | 11 |
| Lake Katwe | 2 | 2 |
| Hamukungu (L. George) | 12 | 15 |

| | | |
|---|---|---|
| Kasenyi Landing (L. George) | 13 | 16 |
| Katwe bay (L. Edward) | 7 | 9 |
| Lake Mutanda | 16 | 17 |
| Lake Mulehe | 9 | 10 |
| Muchoya Swamp | 4 | 4 |
| Nabajjuzi Swamp | 8 | 9 |
| Lake Nabugabo | 13 | 15 |
| Lake Mburo | 5 | 5 |
| Lutembe bay (Kachindo Swamp – L. Victoria) | 18 | 19 |
| Mpologoma Swamp (River Mpologo ma) | 8 | 8 |
| Lake Opeta | 23 | 30 |
| Muko (L. Bunyonyi) | 10 | 12 |
| Chabahinga (L. Bunyonyi) | 13 | 16 |

**Source: Scott D.A.; Omoding, J.; Byaruhanga, A.; K.M; and Mutekanga, M.N.; Eds. (1993)**; Inventory of wetlands biodiversity in Uganda. Design and Methodologies. National wetlands conservation and management Programme.)

Created wetlands for non-point source pollution control are advocated as an important part of any watershed or floodplain restoration plan (Mitsch, 1994). Location of constructed wetlands in the landscape is an important factor in determining their role. As discussed in the Riparian Wetlands subsection, the most important wetlands to manage and protect as stream quality buffers may be those along first- and other low-order streams (Brinson 1993). Wetlands along first-order streams are very efficient at nitrate removal from groundwater and runoff, and sediment removal from surface

water (Whigham et al., 1988). Constructed wetlands bordering agricultural fields can be designed to intercept tile drainage with high nutrient levels that otherwise often flows directly into receiving streams, bypassing even riparian areas. Placing wetlands in a distributed pattern high in the watershed may incur less total runoff and erosion for the entire watershed than the same acreage put into large wetlands low in the watershed (van der Valk and Jolly, 1993).

Mitsch (1993) observed in a comparison of experimental systems using phosphorus as an example that retention as a function of nutrient loading will generally be less efficient in downstream wetlands than in smaller upstream wetlands. Wetlands (floodplains) along higher-order streams influence water quality to a much smaller degree, since the upland runoff that passes through them and joins the stream is a much smaller fraction of the total stream flow than it is for headwater wetlands. Wetlands along large streams do, however, provide water quality benefits during flood events, a function that headwater wetlands do not provide. Mitsch (1993) cautioned that the downstream wetlands could retain more mass of nutrients than upstream systems, and that a placement tradeoff might be optimum. From a management standpoint, creating many smaller wetlands around a watershed would mean dealing with more landowners, but taking less land out of production on any one farm than creating a few large wetlands, and is more fair in terms of not asking any landowner to contribute more than what is needed to treat the runoff from their land (van der Valk and Jolly, 1993).

Hammer (1992) envisions a holistic watershed wetland management approach involving a hierarchical arrangement of restored or created wetlands within a watershed landscape. Following conventional on-farm BMP systems, first-order control involves constructed wetlands designed specifically for animal wastewater, processing facility wastewater, or septic tank effluent treatment. Second-order control also occurs at the individual farm level, and consists of constructed wetland/upland systems, such as the nutrient/sediment control system described above, for treating cropland runoff or discharge from animal wastewater treatment systems, and providing some ancillary benefits as well. Third-order control requires a larger, watershed picture, and involves nutrient/sediment control systems, constructed wetland/pond complexes, and restored or created wetlands and riparian areas along many small streams higher in the watershed, providing water quality, hydrologic buffering, life support, and other values. Finally, fourth-order control uses large wetlands low in the watershed primarily for hydrologic buffering and habitat support values in addition to limited water quality benefits. First- and second-order systems are located within the bounds of individual farms and require active operation to maintain optimum treatment performance, while third- and fourth-order elements provide water quality benefits to runoff from numerous farms or entire watersheds, and function without intervention.

In stream wetlands can be created on small streams by impounding or adding a control structure to the stream. Mitsch (1993) observed that creation of in-stream wetlands is a reasonable alternative to upland locations only in lower-order streams and that such wetlands are susceptible to reintroduction of accumulated pollutants in large flow

events as well as being unpredictable in terms of stability. Such systems would also likely involve higher maintenance and management costs than off-stream designs.

Wetland creation or restoration can provide significant benefits to surrounding systems in addition to water quality improvement. Diversity of wetland structural habitat in the landscape (particularly small multiple wetlands that differ in water level, plant species, and size), tends to increase species diversity and abundance (Weller 1981; Fleming et al., 1994). Similar to natural wetlands created systems can act as buffers for wildlife habitat. They protect streambanks from erosion, and moderate stream temperatures by shading the water, which benefits aquatic life. Larger riparian wetlands further downstream provide flood control and wildlife benefits. Knight (1993) noted that wetlands placed high in the watershed are likely to have more intermittent, less reliable water supplies, and thus exhibit lower primary production and lower overall food-chain benefits than those low in the watershed with perennial water supplies.

# CHAPTER THREE

# METHODOLOGY

## 3.0 Introduction

This chapter presents a description of the approach used for the research to gain information on the study problem. It consisted of the research design, population of study, sample size and sampling method, data collection instruments, measurement of variables, data management and analysis.

## 3.1 Research design

The study used a cross-sectional research design which was often used in assessing respondents' views towards the effects of growing rice in wetlands. This type of research design utilizes different groups of people who differ in the variable of interest, but share other characteristics such as socio-economic status and educational background. The cross-sectional research design was used designed to look at a variable at a particular point in time and focused on finding relationships between variables at a specific point in time.

## 3.2 Sampling Procedure

The study used both simple random sampling and purposive sampling procedures. Purposive sampling was used to select different activities in the area of investigation in order to get first hand information from the key informants. Simple random sampling was used because respondents have equal chances of being selected.

**The sample size was determined using Slovin's formula;**

$$n = \frac{N}{1+Ne2}$$

Where by; n=Sample Size

N=Population

e=0.05

In this particularly case, the formula when worked out yielded the figure for the sample size which is indicated hereunder:

$$N = 60791$$

$$e = 0.1$$

$$n = \frac{60791}{1 + 60791 \times 0.01}$$

$$n = \frac{60791}{1 + 607.91}$$

$$n = \frac{60791}{608.91}$$

$$n = 99.8$$

**n = <u>100 respondents</u>**

### 3.3 Sample size

The respondents were randomly selected and categorized. They comprised both sexes but of different marital status and age groups and the study targeted 200 respondents; 10 NEMA officials, 10 District agricultural officials, 5 Local council officials, 75 Rice farmers and 100 from the general public. This sampling intended to get a variety of views and unbiased response which made the study practical. Also this sample was selected since, Sutton and David, (2004); state that a sample size should not be less than 30. Beyond basic description it would be difficult for the researcher to undertake more complex statistical analysis, as most of these analyses require a minimum sample of 30.

**Table 1; Population and categories of respondents that were used in the study**

| **Population category of Respondents** | **Population** |
|---|---|
| NEMA officials | 10 |
| District agricultural officials | 10 |
| Local council officials | 5 |
| Rice farmers | 75 |
| General public | 100 |
| **Total** | **200** |

### 3.4 Research Instruments

The researcher used questionnaires and an interview guide as the main tools for collecting data. The selection of these tools was guided by the time, objectives and the

nature of data to be collected. The researcher was interested in capturing the views, perceptions, feelings, attitudes and opinion of respondents.

### 3.4.1 Questionnaire Method

A comprehensive questionnaire covering all the aspects of the study variables was designed. The first section of the questionnaire covered general information (gender, age, education, marital status). Section B covered the effects of growing rice in wetlands. The questionnaires were first pre-tested before being administered on the respondents. The questionnaires were self administered to ease data collection. The questions were both open and close ended. This enabled the respondents to express their opinions about the effects of growing rice in wetlands. The self administered questionnaires were delivered and distributed to the target respondents in the selected schools.

### 3.4.2 Interview Method

Interviews with the target respondents were conducted to interview all the categories of respondents shown in table 1 above. A separate interview was used for the NEMA officials and district agricultural officials to assess the effects of growing rice in wetlands. This involved first making an appointment with the target respondents after which an interview meeting between the researcher and respondents was held.

### 3.5 Content Analysis of Secondary Documents

Involved the researcher revisiting existing literature on the study variables by reading news papers, journals, text books plus the literature already existing on internet and magazines.

### 3.6 Procedure for data collection

After the approval of the proposal by the responsible authority at the faculty, the researcher got an introductory letter to go to the field for data collection. The researcher presented the letter to the concerned officials in Iganga district who later introduced him to different officials who assisted him to make sampling frames with the help of other relevant respondents. The researcher fixed appointments with respondents on when to meet them. The interviews were conducted in the offices and the compound.

### 3.7 Validity of the instruments

Validity means that a research tool actually measures what it is meant to measure. Alternatively it means that the tool is logical. For this case, the validity of the questionnaire was tested using the Content Validity Index test (CVI). This involved item analysis to be carried out by the supervisors and an expert who was knowledgeable about the theme of the study. The process involved examining each item in the questionnaire to establish whether the items used were to bring out what it was expected to bring out.

### 3.8 Reliability

Reliability means the degree of consistency of the items, the instruments or the extent to which a test, a method, or a tool gives consistent results across a range of setting or when it is administered to the same group on different occasions. The reliability of research questionnaire was tested using Cronbach's alpha coefficient test for its internal consistency to measure the research variables.

### 3.9 Data Analysis

The Statistical Package for Social Scientists (SPSS) was used for data analysis. Main ideas in qualitative data were clearly recorded. The data filled in the questionnaires was copied and analyzed by tallying it and tabling it in frequency tables identifying how often certain responses occurred and later evaluation was done. This yielded the primary data which was raw in nature. The recorded data was later edited and interpreted which ensured uniformity, legibility and consistence. Also, interview results were coded in frequency tables which was calculated in terms of percentages and presented in this study.

Tables are the most common method of presenting analyzed data. Tables offer a useful means of presenting large amounts of detailed information in a small place. Frequency distribution tables in this case were used whereby response values were summarized in a table.

### 3.10 Ethical considerations

It is important during the process of research for the researcher to understand that participation is voluntary; participants are free to refuse to answer any question and may with draw any time.

Another important consideration, involved getting the informed consent of those going to be met during the research process, which involved interviews and observations bearing in mind that the area bears conflict.

Accuracy and honesty during the research process is very important for academic research to proceed. The researcher should treat the project with utmost care, in that there should be no temptation to cheat and generate research results, since it jeopardizes the conception of research.

Personal confidentiality and privacy are very important since the thesis was public. If individuals have been used to provide information, it is important for their privacy to be respected. If private information has been accessed then confidentiality has to be maintained.

# CHAPTER FOUR

# PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

## 4.0 Introduction

This chapter presents the facts, which the research discovered. The findings were presented in line with the objectives of the study whereby the raw data in form of questionnaires was edited and interpreted which ensured uniformity, legibility and consistency. The data-filled questionnaires were copied and analyzed by tallying and tabling in frequency polygons while identifying how often certain responses occurred and later evaluation was done. The information was then recorded in terms of percentages. Also, interview results were coded on frequency tables which were calculated in terms of percentages and presented in this study as illustrated below.

## 4.1 Background Characteristics of the respondents

The background information of the respondents was important because they comprised of both sexes but of different marital status and age groups from various settings. This was intended in order to get a variety of views and unbiased responses which made the study a reality. The respondents were divided into the administrative and general staff groups. The findings are shown in the figures below;

### Gender of respondents

During the field it was found out that, females took a greater percentage in the survey as represented by 60% whereas 40% represented males, implying that, females to a greater extent participated in the study as portrayed in figure 1 below.

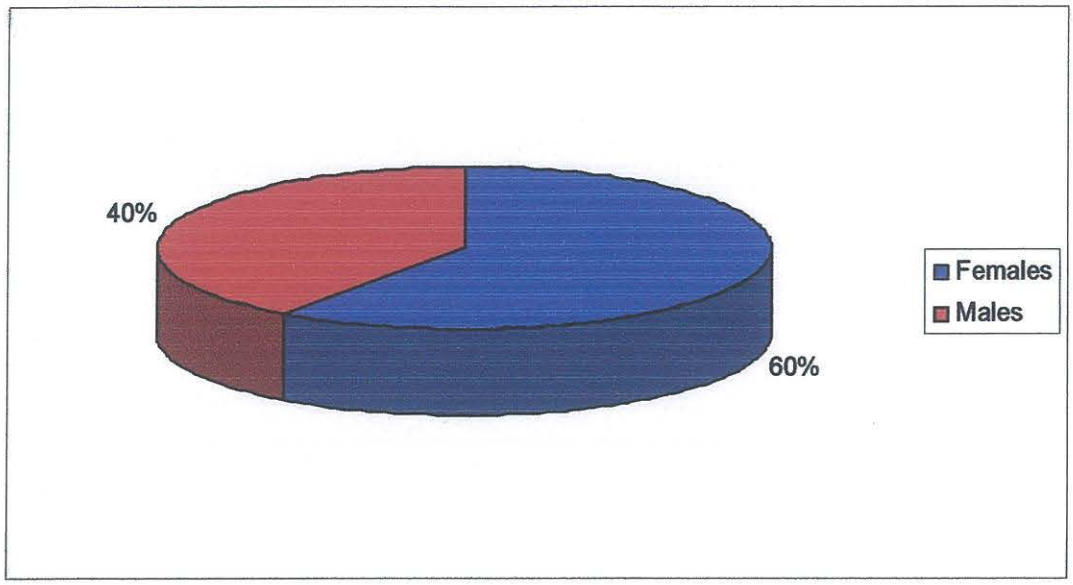



**Figure 1: Classification of respondents by gender**

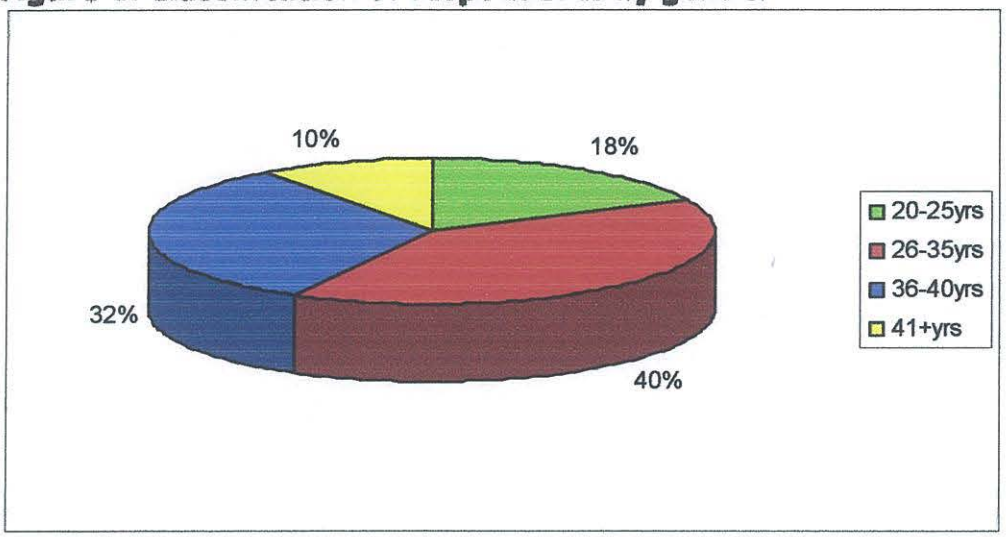



**Figure 2: Classification of respondents by age**

Figure 2 shows that the biggest percentage of the interviewees were in the age bracket of 26-35 years as showed by 40% while 32% represents interviewees who were in the age bracket of 36-40 years, then 10% of the respondents were 41 and above years,

implying that, to a greater extent respondents in the age bracket between 26-35 years actively participated in the study as portrayed in figure2 above.

**Respondents' level of education**

The biggest percentage of respondents had completed Bachelors degree in Education as it was revealed by 60% of the respondents, then 25% represented respondents who had Masters' degrees in different fields whereas 15% of the interviewees were secondary school level as shown in figure 3 below.

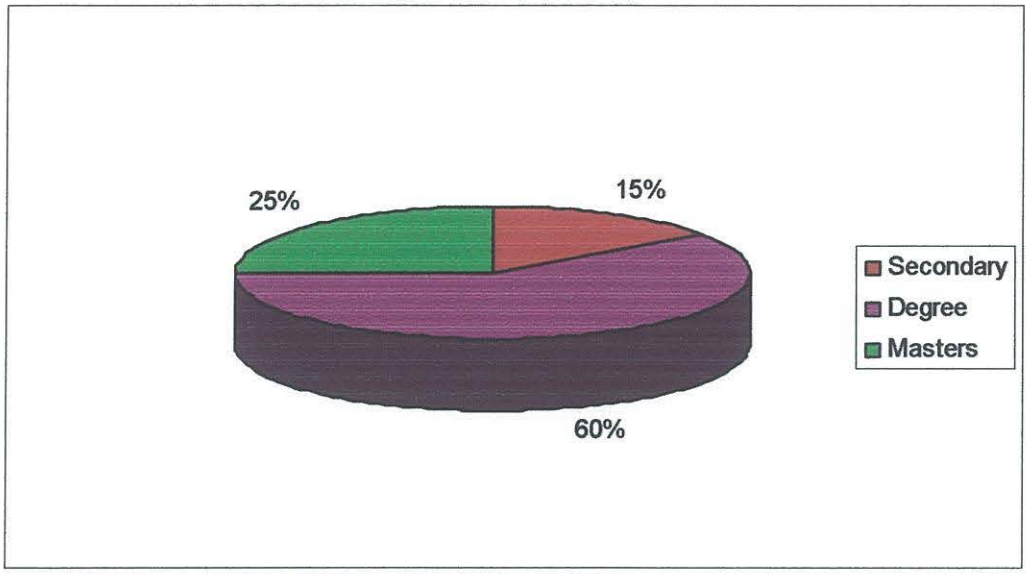



**Figure 3; Respondents' level of education**

**Number of years of service of respondents in farming**

In figure below, it was found out that the biggest percentage of the respondents had worked in the wetlands for a period between 1-5 years as represented by 50% whereas 25% shows respondents who had stayed in the school for the period between 6-10

years, 15% represents interviewees who had worked in the wetlands for the period of 11 years and above, implying that they have been rice farmers for a long time.

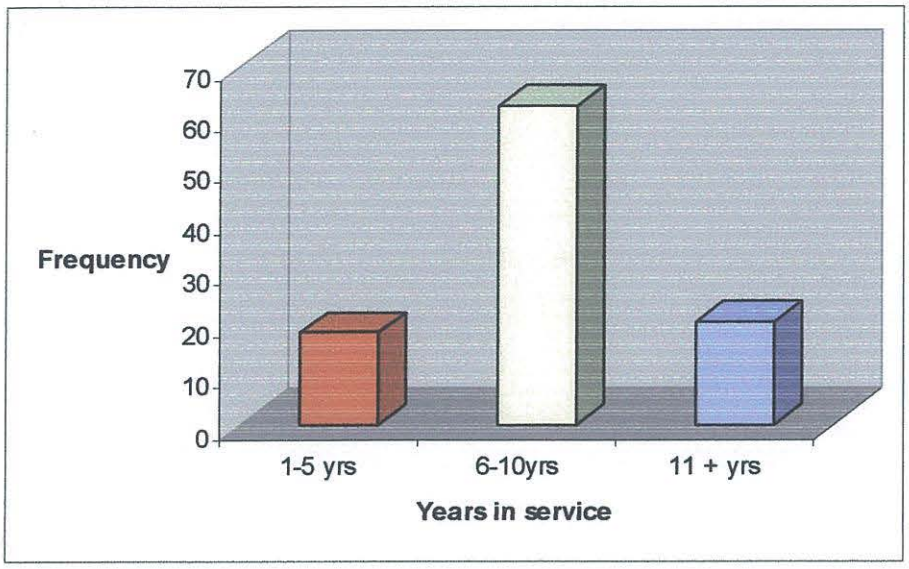



**Figure 4: Number of years of service of respondents in farming**

**Table 2; Respondents' marital status**

| Marital status | No of respondents | Percentage |
|---|---|---|
| Married | 20 | 40 |
| Single | 18 | 36 |
| Separated | 10 | 20 |
| Living with partner | 02 | 04 |
| Total | 50 | 100 |

An assessment of the respondents' marital status was as follows; the biggest percentage of the respondents were found to be married as shown by 40% where as 36% of the interviewees were single, 04% of them were living with partners but were

not officially married lastly 20% of the respondents were separated from their spouses as illustrated in Table 2.

**Respondents' religion**

During the field study, it was found out that majority of the respondents were Protestants making 30% of the respondents, 20% of the respondents were Moslems and 15% were Adventists and lastly the Roman Catholics which were revealed by 25% of the respondents in Figure 5.

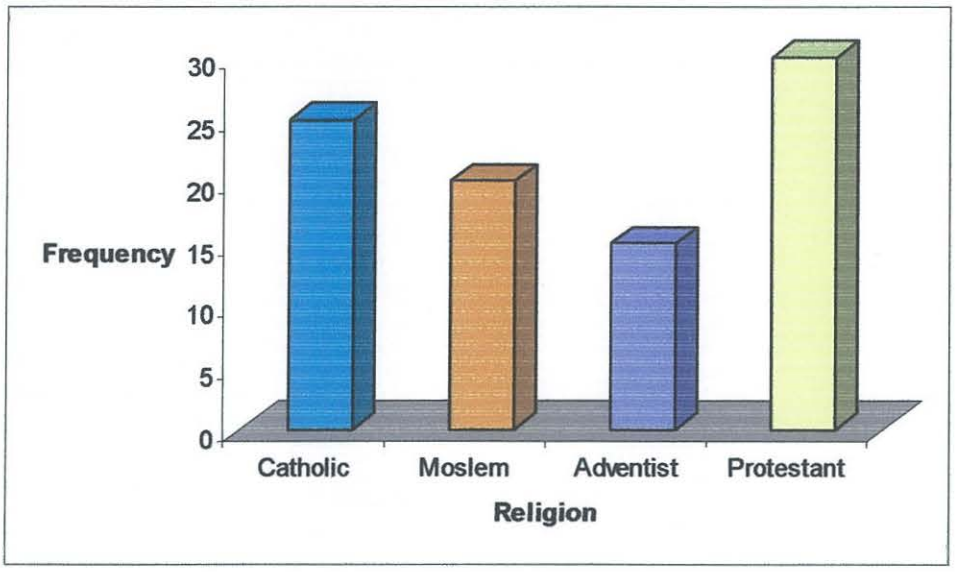



**Figure 5: Respondents' religion**

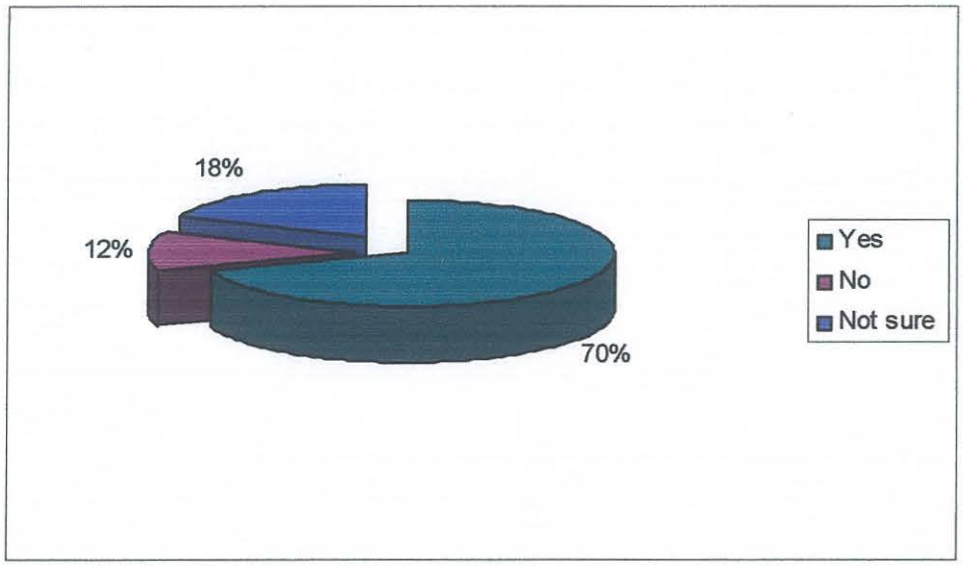



**Figure 7; Awareness of rice growing in wetlands**

### 4.3.1 EFFECTS OF GROWING RICE IN THE LUMBUYE WETLANDS

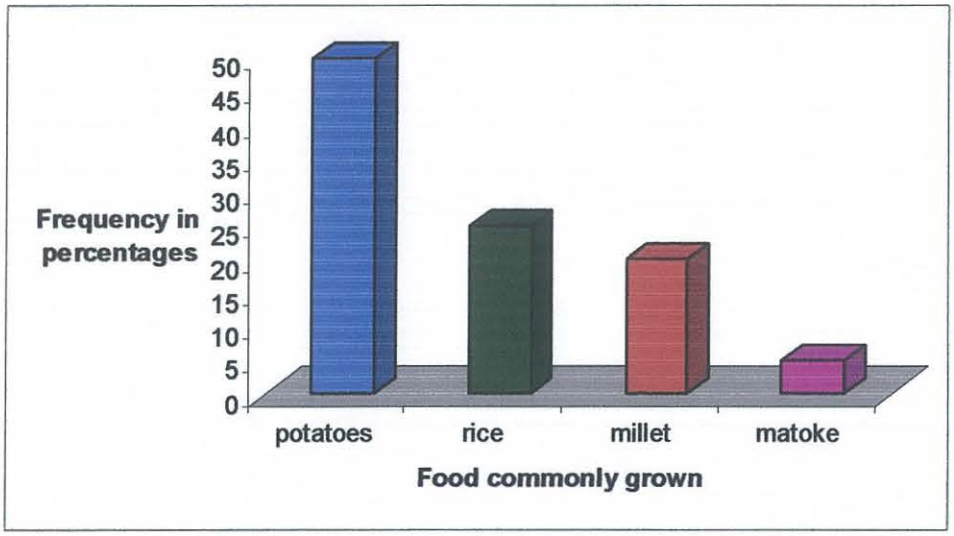



**Figure 4.8: Food commonly grown around Lumbuye Wetland.**

Positively people have benefited from growing rice in the Wetland in away that they have also grown other foods as discussed below

**Potatoes**

The study revealed that the staple food in this area are potatoes, 50% of the respondents said that potatoes are easy to grow and they can adhere to any seasons of the year, given the fact that people around this area grow potatoes in the Wetland which contains water though out the year hence yielding.

**Rice**

The study also revealed that rice is grown, since these people are near by the Wetland as mentioned by 25%, of the respondents. initially it was widely grown in the area but due o the hostility of the Wetland, where by now it contains water through out the year, rice can not grow in such conditions as mentioned by the respondents, they further said that due to the "obukoka" species of plants that grows in the Wetland, affects the growth of the Wetland, and on additional they said that papyrus is also a problem, when it grows in the Wetland it competes for nutrients with rice hence affecting its growth.

So people living around Lumbuye Wetland have turned to growing other foods as mentioned in this study on a large scale.

**Millet**

Supplementally, we also grow millet, as revealed by 20% of the respondents; it's in order to have a balanced diet as mentioned by the respondents. They further said that since we are around the Wetland, we also grow millet which grows very well around the Wetland although grown at a small scale.

**Matooke**

When asked about matooke, 5% of respondents at Naigobya village around the Wetland revealed that very few grow matooke, when asked why; they revealed that the conditions of Lumbuye Wetland have not favoured the growth of matooke.

Lastly, it was observed that because of the papyrus and "obukooka" that are in habited in the wetland, it has been hard for people of Naigobya in Bukooma Sub County to grow rice in Lumbuye Wetland, these species of plants compete for nutrients with rice and in the end rice will not be in position to grow.

Initially, that was before 2008, we used to grow rice on large scale but this year it has been a problem and on additional the water contains water through out the year hence affecting the growth of the Wetland.

### 4.3.2 Number of people and where they grow rice.

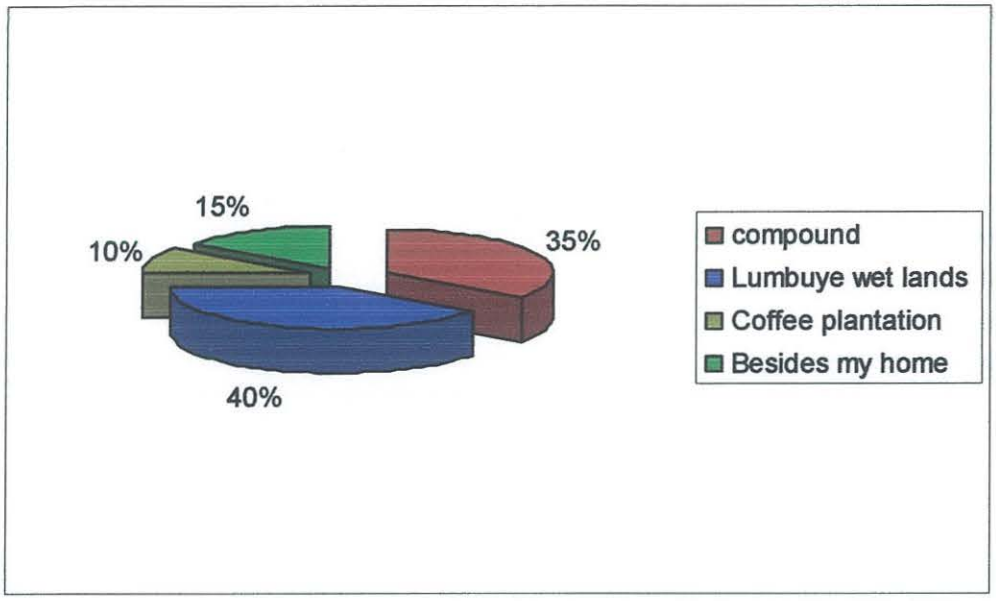



**Figure 4.9: Number of people and where they grow rice.**

View froms respondents revealed that they grow rice besides their homes as per the observation their small gardens of rice besides their homes as represented by 15 % whereas as 35% of the respondents grow rice in there compounds, when asked about the type of rice they grow they revealed that it is a new species of rice called "up land rice" as explained by one of the farmers in Naigobya village.

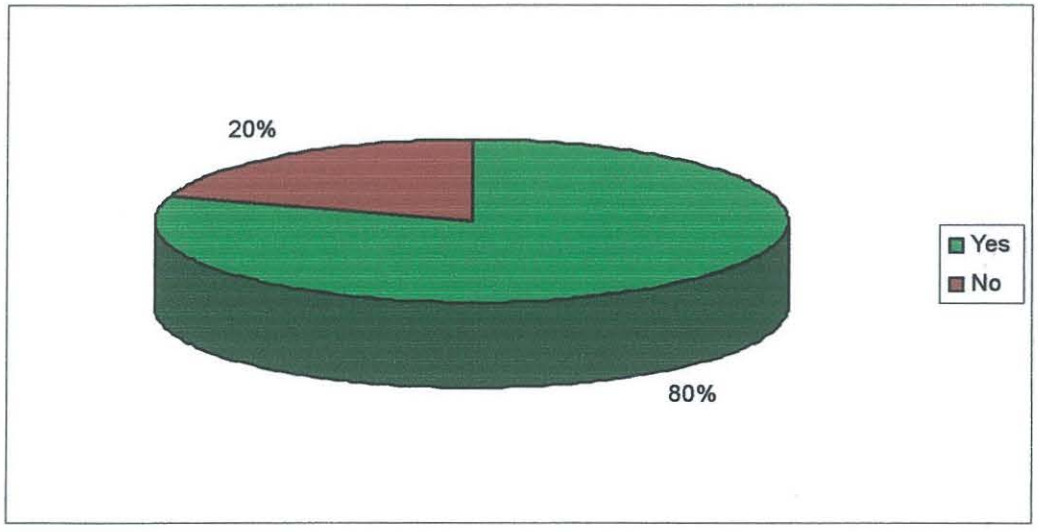
Some of the respondents showed by 10% attributed that; grow rice in their coffee plantations, as per the researcher's observation, found out that in these plantations up land rice is newly introduced species well as doing well in some of the homes, who preferred growing it in the coffee plantations to Wetlands.

Lastly the biggest percentage of the respondents as represented by 40% revealed that they grow rice in Lumbuye Wetland. When asked why, one of the respondents said

that, it is cheap and easily available, since he lives near the Wetland and he also said that rice initially has been doing very well but the situation is changing now where by the Wetland contains water through out the year hence affecting the growth of rice in the Wetland, despite the waters in the Wetland we have continued but on a smaller scale to grow rice in Lumbuye Wetland he reported, but my worry is this Wetland is going to be taken over by the spencon group of companies to put up rice growing scheme, so we are worried because we have been benefiting from the Wetland through various activities like growing there food, fishing, brick making he reported.

So when contacted the District Environment officer, Mr. Mununuzi Nathan he confessed that the developer had already carried out an Environmental impact assessment, and he had a copy of the (EIA) in his office. When asked about when the project was to commence, he said he was not sure but the project was in the pipe line.

### 4.3.3 Water in the Wetland




### 4.3.4 Figure 4.9: Water in the Wetland

Respondents said that Lumbuye Wetland contains water through out the year, before in the past years as was showed by 80% and went out saying that, it was seasonal but now in 2008 the Wetland contains water through out the year said one of the respondent.

Now it is inevitable to grow rice in Lumbuye, especially this year, we have not benefited from that Wetland, said the respondent. Because of the Wetland being water logged and also with the papyrus that has grown in the Wetland "omusaala"a Lusoga word used to mean papyrus and "obukoka"is also another species of a plant that grows in the Wetland that affects the growth of rice.

Then some respondents in the village of Naigobya represented by 5% said that during January to march the Wetland was dry and they were able to grow some rice but then from then up to around April to June, it has been water logged, because of the massive rainfall, this has made it impossible to grow rice in Lumbuye Wetland.

They also added that never the less, there animals have been taking water from Lumbuye Wetland and we also have been using water for domestic purposes from Lumbuye Wetland. When asked about the floods, in the area they said that they have never received any floods in the area.

### 4.4.1 Negative Effects of Growing Rice in the Wetland

When asked about the dangers of growing rice in the Wetland, they had this to say.

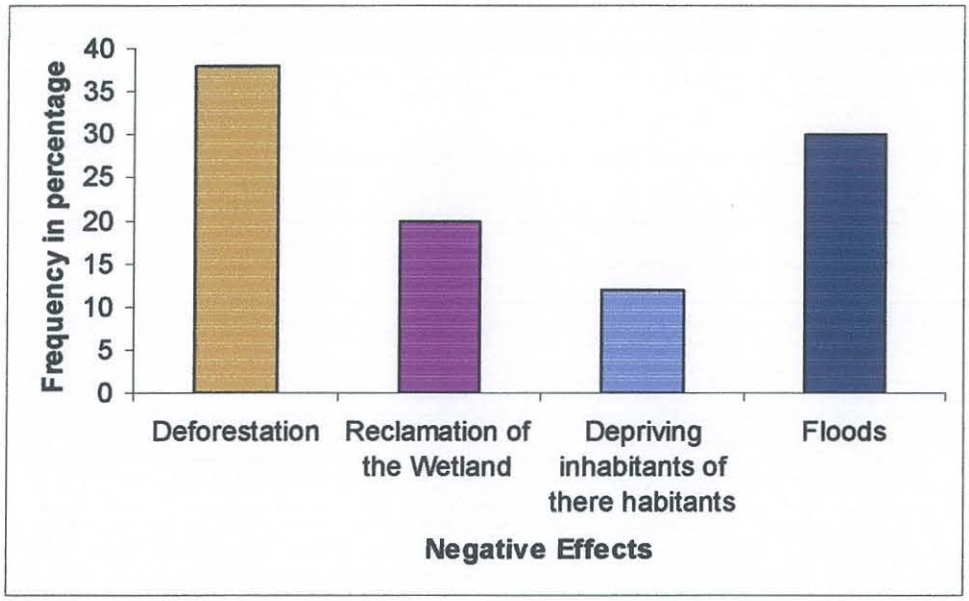



**Figure 4.10: Negative Effects of Growing Rice in the Wetland**

Lumbuye is of great importance to us, we grow maize potatoes and millet in the Wetland, said one of the respondents, how ever before the above plants were grown the trees and grass that was in the Wetlands, had been cleared as per the researcher's observation hence deforestation as a result of growing rice and other food crops in the Wetland.

Respondents reported they also said that due to deforestation, there is silting in Lumbuye Wetland when it rains in and around this area, people experience floods which at times wash soils from up hill into the Wetland since the scrub has been reduced as represented by 38 %.

Lumbuye Wetland has been reclaimed as per the researcher's observations, and as reported by 20 % of the respondents, it is used for cattle grazing. Apparently there individuals who have settled in and around the Wetland, hence affecting the inhabitants of the Wetland.

As result of using Lumbuye Wetland for growing food and other activities which are not regulated, there has been massive floods in the area, as reported by 30% of the respondents these floods normally occur in the rain season when the area is infested with heavy rains, these floods normally destroy our roads especially the Naigobya road hence making transport hard.

Rice growing will lead to changes in water quality and water levels. The quality of water is likely to be influenced by use of fertilizers and agro chemicals. Due to the introduction of varieties of rice species the vertebrate pests especially rodents and birds are likely to increase due to rice growing in Wetlands.

### 4.4.2 Solutions to negative impacts of growing rice in Lumbuye Wetland.

Awareness and sensitization as reported by the key informants, who said that people in this area are ignorant of Wetlands management, he also suggested that government should organize and educated the masses especially of Bukooma through the media so that they can know the importance of sustainable development regarding Wetlands management.

By-laws have been put in place by the sub county environmental committee headed by a woman councilor, the bye laws are basically to stop the grazing of animals in the Wetland as reported by one of the key informant Sarah.

The District environmental officer of Iganga district, as a key informant he asserted that through the (EMCBP 2) Environmental management capacity building project. a project by NEMA , people of Bukooma have been sensitized on the importance of Wetlands and the environment as whole.

As a result of the project that was on sanitizing communities on Wetlands management there is change, people of Bukooma have started the conservation of the Wetland.

Alternating of crops in the wetland has been the only way soils and ecological productivity has been conserved as expressed by the district agricultural officer Mr. Kagino Fred he further said that its a few of the rice growers that use fertilizers and agrochemicals, this is because most of them have been taught how to use them in there small groups of (NAADS), National agricultural advisory services.

Construction of water dams, will help in the reduction of floods, these dams are to be constructed by jeetna irrigation scheme. Rice growing scheme owned by spencon, it is establishing it's self on the Wetland, said the district environmental officer Mr. Mugabi Stephen.

# CHAPTER FIVE

# 5.0 SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

This chapter mainly deals with summary of key findings, conclusion and recommendations related to an assessment of the effects of rice growing in wetlands in Lumbuye Wetland, Iganga district being drawn from the findings and analysis made after conducting the study. The effects of the surroundings' aspect were characterized by blocking drainage channels, leading to flooding aspects, water stagnation among others.

## 5.2 Summary

Wetlands provide the basic means of survival to the majority of the households in Lumbuye Wetland. There are a number of wetland resource conflicts that impede conservation efforts. The level of awareness about the importance of wetland conservation is slowly growing but is not yet adequate. A number of community wetland activities are not necessarily ecologically acceptable and pose a variety of conservation challenges. Stakeholder roles in wetland resources management are not clearly delineated because more than 90 percent of the respondents were found to be engaged in wetland-supported farming and petty trade. The appreciation of the regulating services of wetlands is still inadequate amongst local communities. The two survey areas were over populated in some parts and had a number of human activities with the associated ecological footprint.

Wetland issues do not feature prominently in Local Government planning whether at district or sub-county level since communities do not have viable alternative sources of products and services they obtain from wetlands. There is a total lack of incentives for wetland resources conservation (especially) at community level. Respondents think that proper boundary marking and a strong governance infrastructure will go a long way in securing wetland sanity while at the same time maximizing community benefits. Further, the analysis of data collected indicated total dependency of 78%, 18% moderate and 4% less with a variety of livelihood activities including cultivation (54%), cattle keeping (28%), crafts making (4%), fishing (7%), brick making (4%) and firewood collection at 3%. Against this background, the economic value of wetlands to the neighboring communities cannot be underrated. It explains the way community members interact with wetlands and consequently determines the efforts that can be used to ensure the wise management of these ecosystems.

In both systems, wetlands are threatened by the already high and increasing population density of both humans and livestock, the reduced soil fertility elsewhere, the effects of climate change (prolonged droughts), changing community lifestyles, pollution of surface water sources, the unpredictable and low rainfall, the de-vegetation/deforestation, the limited access to clean water/sanitation and the inappropriate and degrading fishing practices. Therefore, in an effort to ensure the wise-use of wetland ecosystem goods and services and improved livelihood, the Community Based Wetland Biodiversity conservation Project (COBWEB) project must

seek to bring on board all stakeholders, key to the project being local communities whose involvement or neglect has the power to lead the project to the achievement of its set goal or not. Relatedly, the study should be able to advice on livelihood alternatives for strategic purposes of reducing the ecological footprint. At policy level, COBWEB should make an effort in encouraging the inclusion of wetland issues in planning and decision-making frameworks such as District Development Plans (DDP) as well as Sub-county Development Plans (SDP) to give wetland management some mandatory backing.

### 5.3 Conclusion

There is evidence to indicate that Uganda's history in wetland management particularly Lumbuye Wetland, Iganga district has not been without key milestones. Since1986, a number of landmarks have been made in legal and institutional development in response to undesirable trends in wetland destruction over the years. The constitution and the subsequent laws are quite realistic and impermeable. The requirement for Environmental Impact Assessments for example has been used as a decision making tool in the use of some wetlands. However a number of limitations and challenges still prevail and need serious attention. The success of the COBWEB project will be determined by the level of understanding of such impeding issues and the ability to design mechanisms for overpowering them.

The importance of wetlands cannot be underrated and as evidence, almost all households surveyed in areas around Lumbuye Wetland, Iganga district benefit from wetlands in various ways. These findings show the role wetlands play in the lives of these communities. On the other hand this gives an idea on the extent of pressure that is being exerted to wetlands. Community training needs must be met, awareness creation on wetland values intensified, and laws and guidelines for wetland utilization formulated. A participatory approach to the implementation of COBWEB will go a long way in ironing out conflicts interest and giving an opportunity to stakeholders to partake in deciding on the next steps at different phases of project implementation. This will also concretize the sustainability plan, especially if target frontline beneficiaries (communities) get a sense that this is for their own good.

Also, there is a general level of ignorance and a lack of awareness among the population of the adverse consequences of their actions on the wetlands. Communities, who generally are agro-based and look at wetlands as a means towards achieving high production levels, there are hardly any thoughts put to the survival of the wetlands and their ability to adequately meet future needs. It is therefore not surprising that when asked about the importance of wetlands, respondents mainly thought of tangible benefits until probed to think about other ecological aspects. The sites visited exhibited a lack of trained and committed personnel in wetland resources management at community level. The only service provider in the Local Government is a Wetlands Officer based at the district. There is inadequate and/or weak institutional coordination

and links on environment management in general and wetland conservation in particular. Wetland use and management is dispersed in several Government and Non-Governmental Organizations strategies and programmes with no operational coordinating mechanisms at most levels. As a result, interventions calculated to maximize benefits from wetlands to communities are not sustained and end up not causing the expected impact on the ground.

Overdependence on agriculture and an apparent minimal diversification of livelihoods is a limiting factor to enjoyment of wetland resources. Most people are entirely dependant on crop cultivation and animal rearing. These are seasonal activities that are dictated upon by seasonality (dry or wet conditions) and this ultimately impacts a lot on wetlands especially during the dry season when agricultural activity can only meaningfully thrive in wetlands, also in the absence of irrigation structures at community level. Under this aspect, communities neither have the means nor the capacity for a viable alternative.

### 5.4 Recommendations

There is need of massive sensitization of masses on wetlands, and there importance, this can be done through the media, formation of sub county environmental management committees mainly at the grass roots to educate and also help people utilize the Wetlands in a sustainable way that is embracing sustainable development.

*Intensify awareness creation:* While community participation is already being archived through formation of Community Based Wetland Management Plans (CWMP),

sensitization and educational programs to empower local communities with knowledge and awareness particularly on the ecological roles of wetlands need to be scaled up to influence a positive shift of attitude and practices towards these ecosystems

*By-law formulation:* The researcher made an observation that there was a general lack of by-laws to guide the implementation of interventions geared towards wetland resources management, and that resource degradation was being done with impunity. To counter this, the study recommends that the COBWEB project triggers a process of enacting wetland by-laws and advises districts on an effective implementation mechanism. This can be done by bringing district councils on board in the implementation of the 4-year interventions in their respective jurisdictions.

*Needs assessment:* The current level of reliance on wetlands for survival is too overwhelming and in most areas the footprint can be seen. The demand for wetland resources in the surveyed areas is far beyond the ecosystem's carrying capacity, which is a recipe for resource degradation, reduced production, poor community health and aggravated poverty. There is, therefore, a need for COBWEB, with the support of the district, to assess needs of communities adjacent to wetlands and advise accordingly on how such needs can be addressed without necessarily degrading the wetland resource.

*Popularize and enforce Environmental Impact Assessment:* EIA as a tool for Natural Resource Management (NRM) must be popularized and rigorously enforced for all

proposed activities on wetlands for purposes of inclusion in wetland management planning and for resource use examination. In addition, with respect to Uganda's commitment to wetland management, new and innovative approaches that effectively integrate various aspects of wetland management be adopted to curtail the current excesses in human activity that degrade catchments and breed ecological imbalance.

*Advice on wetland-based ecologically friendly enterprises:* The COBWEB project should advise on activities that can be sustainably carried out in wetlands in an environmentally sound manner but yet making substantial contributions to household incomes. Enterprises related to eco-tourism, fish farming, craft making, forestry/woodlot management and bee keeping have proven their capacity to uplift communities from poverty and when well designed, they are more income generating than traditional destructive activities that communities find comfort in, in wetlands.

*Factor in rural poverty:* All through this study, the researcher laboured to demonstrate that the majority of the wetland adjacent communities are low income earners, perhaps due to limited alternative sources of income, low levels of education and cultural influence. Because of this, communities continually look at wetlands as the only means towards getting out of poverty, by way of using wetland-based goods and services to generate income but also for household survival. Indeed, discussions with communities revealed that poverty was one of the driving forces to wetland resource use (or misuse). This is likely to have implications on the extent to which project outcomes can

be achieved. Thus there is need to promote alternative sustainable wetland-based activities and non wetland-based activities to double in reducing rural poverty, while at the same time easing the pressure on wetlands.

*Information packaging:* The way information on wetlands is packaged and communicated to its target audience should make a substantial difference from mere communication in the ordinary sense of the word. The survey findings reveal that formal education levels of most of the people in the communities neighboring the wetlands are generally low. The fact that majority of the household decision makers have no formal education has implications for the type of wetland management and conservation message packaged for their consumption. As such the project ought to package its information in tailor-made styles and adopt direct communication methods e.g. village meetings and radio communication, and probably posters in the local languages as a more appropriate communication medium in communities of this kind of socio-cultural and economic set up.

## 5.5 Recommendations for further research

Due to limited resources, and scope of study, it was not possible to conduct the study covering all aspects concerning effects of growing rice in Wetlands, case study of Lumbuye Wetland. There fore it is recommended that further research should be carried out on other aspects of effects of growing rice in Wetlands, and the solutions and recommendations to the effects.

What environmental factors affect how much water can be withdrawn for human use without unacceptable adverse ecological impacts being incurred?

What environmental cues (indicators) may tell us whether or not we are stressing the wetland-watershed system to the extent that significant costs may be incurred?

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## APPENDIX I

## QUESTIONAIRE FOR THE RESPODENTS IN LUMBUYE WETLAND, IGANGA DISTRICT

**Dear respondent**

I am Mukebezi Ronald, a student at Kampala International University conducting a research study about ***the effects of growing rice in wetlands;*** as a requirement for the award of a Masters Degree in Environmental Management and Development. I kindly request you to spare some time and fill this questionnaire. The information given will be used for academic purposes only and will be treated with utmost confidentiality. Your cooperation will be highly appreciated.

### SECTION A: BACKGROUND INFORMATION

Please tick the most suitable answer.

1. What is your job title?.....
2. In which department are you?.....
3. Gender
   (a) Male ☐
   (b) Female ☐
4. Age bracket
   (a) 20-25 ☐
   (b) 26-35 ☐
   (c) 36-40 ☐
   (d) 41 and above ☐

5. Highest level of education.

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(b) Diploma/Certificate ☐

(d) University education ☐

(e) Masters degree ☐

(f) Others (specify).....

6. How many years have you worked in this wetland?

(a) 1-5 ☐

(b) 6-10 ☐

(c) 11 and above ☐

7. What is your marital status?

(a) Single ☐

(b) Married ☐

(c) Widowed ☐

(d) Divorced ☐

8. What is your religion?

(a) Catholic ☐

(b) Protestant ☐

(c) Moslem ☐

(d) SDA ☐

(e) Others (specify).....

9. Are you aware of the effects of growing rice in wetlands in this sub-county?

Yes ☐

No ☐

Not sure ☐

10. If yes in question (9) above, mention some of the effects of growing rice in wetlands?

(i).....

(ii).....

(iii).....

11. Are these effects felt by the community around the sub-county besides the people living around?

Yes ☐

No ☐

Not sure ☐

12. What possible measures can be put in place to overcome these disastrous effects caused by these wetlands?

(i).....

(ii).....

(iii).....

13. To you as an individual what can be put in place to overcome these disastrous effects caused by these wetlands?

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***Thank you very much for your cooperation***

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(d) University education ☐

(e) Masters degree ☐

(f) Others (specify).....

6. How many years have you worked in this wetland?

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(b) 6-10 ☐

(c) 11 and above ☐

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