

**THE IMPLICATION OF WETLAND DEGRADATION ON
THE ENVIRONMENT IN RUKUNGIRI DISTRICT. A CASE
STUDY OF NYARUZINGA VILLAGE.**

BY

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DECLARATION

I declare that the work presented in this book is solely from my own research. This work has not been presented for the award of a degree in any university or any other higher institution of learning.

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DEDICATION

I dedicate this book to the Almighty God who has guided me through my studies and to my late parents Mr. Rwabuneza Charles Kaniini, Mrs. Rwabuneza Robinah, the entire family of Pr. Murray Jackson, My brother Geoffrey and my sisters, friends and relatives. May the living God bless them all.

ACKNOWLEDGEMENT

I appreciate the tireless effort that my late parents Mr. and Mrs. Rwabuneza Charles and Mrs. Rwabuneza Robinah have rendered towards the completion of my studies. They have sacrificed a lot in terms of finance and moral support.

Great thanks also goes to my supervisor miss Anne Tumushabe who fore went her other activities in a bid to give me close supervision in pursuing my course.

I would like to thank my respondents in Nyaruzinga for their fruitful role in availing me with the information to make this work a reality.

Last but not the least, sincere thanks go to my friends and relatives and My brother Geoffrey Besigye who has done a great job in supporting this work, both materially, financially and spiritually may the almighty God bless him. And to brother Paddy who helped me to type, edit and print out this work.

Finally I am so grateful to the university administration who admitted in their university so that I may explore heights and all the facilities they have rendering to me so that I achieve my degree, may God bless them.

ABSTRACT

The purpose of this study is to understand the phenomenon of wetland degradation on the environment in Rukungiri District Nyaruzinga Parish with some references made to neighbouring parishes.

The study was guided by four objectives that is; to find out the causes of wetland degradation, identify the consequences of wetland degradation on the environment, to find out what has been done to minimize the consequences and to recommend and suggest possible solutions on how to control wetland degradation in Nyaruzinga Parish in Rukungiri District.

The methods used to collect data were recording, questionnaires, photographs, observation guides and this helped the researcher to get the data from the population and analyzed it.

The results revealed by people, the researcher found out that human activities such as agriculture, brick making, settlement or construction, poverty, population increase, sand mining and firewood collection are the main causes of wetland degradation in Nyaruzinga parish- Rukungiri District.

The following conclusion were made from the study; wetlands have been reclaimed at a high rate so as to meet the needs and aspirations of people. But this has led to loss and destruction of the biodiversity (plant and animal species), reduction in water table and loss of soil nutrients. It is apparent that wetland degradation in Nyaruzinga parish will continue to grow unless approaches are developed to assure that wetlands are protected, preserved, conserved and sustained for the future generations to enjoy the available natural resources.

The research therefore recommends the following as solutions to the problem; Afforestation, Avoiding constructing in swampy areas, sensitization about the dangers of wetland degradation, stopping people from carrying agriculture in wetlands and this should not be only the work of government but to any person and other organizations, focused study, comparative study and research.

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CHAPTER ONE

1:0 INTRODUCTION/ BACKGROUND

There are several definitions of the term “wetland” by different writers .

The united Nation Development programme (UNDP) 1999 defines wetland as the area of vegetation which is permanently or seasonally water logged. Most wetlands in the area are permanently water logged with distinct characteristics. They develop adaptive vegetation like aquatic plants and grasses and form peat loams. This is because the low oxygen conditions and the large amount of plant remains on sandy and clay soils.

Ocan Johnson-Onen (2002) define wetland as an ecosystem that arises when inundation by water produces wet soils dominated by an aerobic processes and forces the biota, particularly rooted plants to exhibit adaptations to biota and particularly rooted to exhibit adaptations to tolerant flooding. This broad definition includes everything from the tropical mangrove swamps to subartic peatlands.

The committee on characterization on wetlands (1995) therefore developed a ‘reference definition’ to stand outside of any single agency, policy or regulation. Their reference definition wetland is an ecosystem that depends on constant or recurrent shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of wetlands are recurrently sustained inundation or saturation at or near the surface and presence of physical, chemical, biological features reflective of recurrent, sustained inundation saturation, common diagnostic features of wetland are hydric soils and hydrophytic vegetation. These features will be present except where specific physiochemical, biotic or anthropogenic factors have been removed than or prevented their development.

The convention { Ramsar} uses a particularly broad definition of wetland in article 1 as areas of marsh, fen, peatlands, water, whether natural, permanent or temporary with water that's static or flowing, fresh brackish or salt, including areas of marine waters the depth of which at low tide does not exceed 6 meters.

Wetlands are certainly important, some of this specific importance performed by wetlands include protection against harmful cosmic influences, regulation of the local and global energy balance, regulation the local and global climate (including hydrological cycle), regulation of the chemical composition of the atmosphere, regulation of run-off and flood prevention (water shed), water-catchment and ground water recharge, prevention of soil erosion and sediment control, formation of top soil and maintenance of soil fertility, fixation of solar energy and biomass production, storage and recycling of organic matter, storage and recycling of nutrients, storage and recycling of human waste, regulation of biological control mechanisms, maintenance of migration and nursery habitats, maintenance of biological (and genetic) diversity, human habitation and indigenous settlements, nature protection, recreation and tourism, cultivation (crop growing, animal husbandry, aquaculture), energy conversion, ornamental resources, fuel and energy, genetic resources, oxygen, fodder and fertilizers, medicinal resources, food and nutritious drinks, biochemical (other than fuel and medicines), water (for drinking, irrigation, industry) raw materials for building, construction and industrial use, raw materials for clothing and household fabrics, historic information (heritage value), scientific and educational information, aesthetic information, cultural and artistic inspiration, spiritual and religious information.

Wetlands are widely used in Uganda for crop cultivation, livestock production, fishing, brick making and harvesting of raw materials for building houses and many others, the cultivation of seasonal wetland edges is carried out throughout the country.

In western Uganda, many wetlands have been converted into agricultural land for Irish potatoes, large scale dairy farming, brick making and sand mining.

In eastern Uganda many valley bottoms are used for small holder rice productions. In some urban areas yams and sugarcane are also planted in wetlands. Extensive commercial sugarcane plantations are located in wetland system.

Wet lands are one of the most valuable ecosystems Uganda has. Their most valuable attribute is their capacity to store, distribute, filter and gradually release large quantities of Uganda's fresh water stock. This ensures that most Ugandans have access to water throughout the year which is used for domestic purposes, livestock watering and increasingly for agriculture purposes.

The par moment availability of wetland is almost becoming their undoing. Farmers throughout the country are increasingly converting wetlands into agricultural land because of their water richness while a few decades ago, cultivation in wetlands only took place along the edges, today farmers are pursued further into them with water tolerate crops like rice and yams or by draining excess water through challenging and water diversion.

Although that the surface wetlands seem to be excellent agricultural land, wetland conversion for agriculture has in some cases led to serious problems. These problems not only affect farmers who after securing and cultivation a wetland plot at great cost and floated out see the yields diminishing. More to that, many other Ugandans experience problems like reduced water availability, floods change in micro – climate and reduced fish stocks due to wetland conversion for agriculture is done at the right place in manner not done where its likely to cause damage to farmers or others.

There is also brick making, sand mining, population increase, collection of fire wood, construction of settlements are the major cause of wetland degradation in Nyaruzinga parish.

Although thus wetlands cultivation can be allowed in certain cases not all wetlands and definitely not all wetlands and definitely not the whole wetland system should be converted for agriculture.

1:1 STATEMENT OF THE PROBLEM

The wetlands have been of importance to people in Nyaruzinga (Rukungiri district) in various ways that is it improving on water quality, stabilizing shore lines of the lake intrinsic ecological diversity of wetland communities and their utilization by residents, migratory birds and amphibians to both conservation and restoration. They even used to get papyrus for making mats, roofings baskets and others cure diseases and provide food due to presence of fish. However, due to human activities such as brick making, agriculture, grazing of animals, sand mining and collection of fire wood, wetlands have been degraded in Nyaruzinga parish. This has resulted into a serious consequence on the environment, loss of bio-diversity, water quality and quantity has been affected, loss or extinction of bio-mass and interruption of communications and transport net works. It's from this state that it is prompted to investigate the real facts about implications of wetland degradation on the environment.

1:2 OBJECTIVES OF THE STUDY

1. To find out the causes of wetland degradation in Nyaruzinga Parish.
2. To identify the consequences of wetland degradation on the environment.
3. To find out what has been done to minimize the consequences.
4. To recommend and suggest possible solutions on how to control wetland degradation in Nyaruzinga.

1:3 RESEARCH QUESTIONS

1. What are the causes of wetland degradation in the areas of Nyaruzinga Parish
2. What are the likely impacts or effects of these wetland degradation on the environment in the area.
3. What should be done to minimize the effects of wetland degradation in the area.
4. What should be done to control or reduce the frequency of occurrence and impacts of wetland degradation in the area.

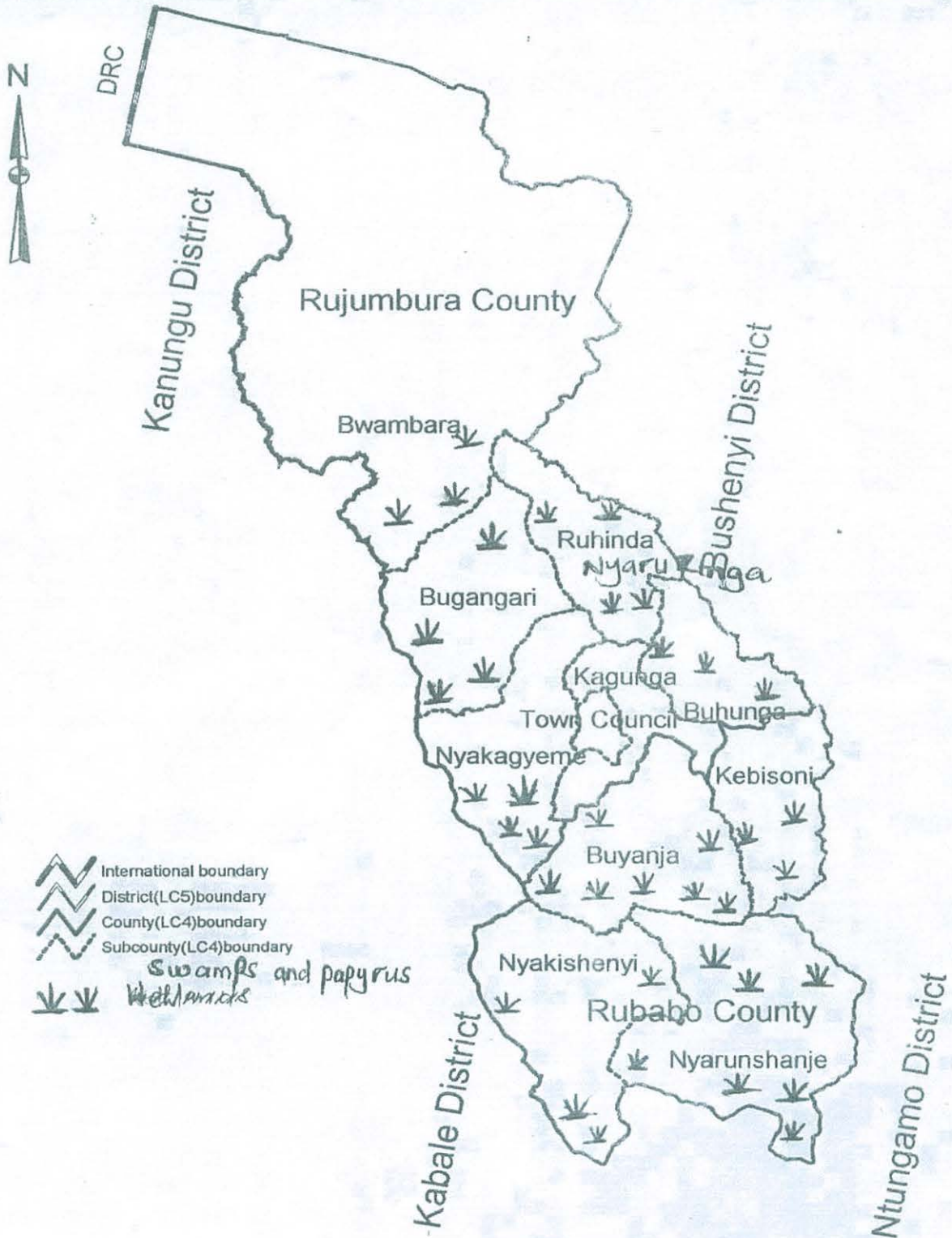
1:4 THE SCOPE OF THE PURPOSE OF THE STUDY

The study focused on the following variables, that is the causes that led to the wetland degradation in Rukungiri district (Nyaruzinga parish). The consequences of degradation to environment, what has been done to minimize the consequences and recommend or suggest possible solutions. The purpose of the study therefore, is to find out the causes of wetland degradation in Nyaruzinga parish in Rukungiri district and find out what has been done to minimize the degradation of the wetlands. The study is also intended to recommend and suggest possible solutions on how to control wetland degradation in Nyaruzinga parish.

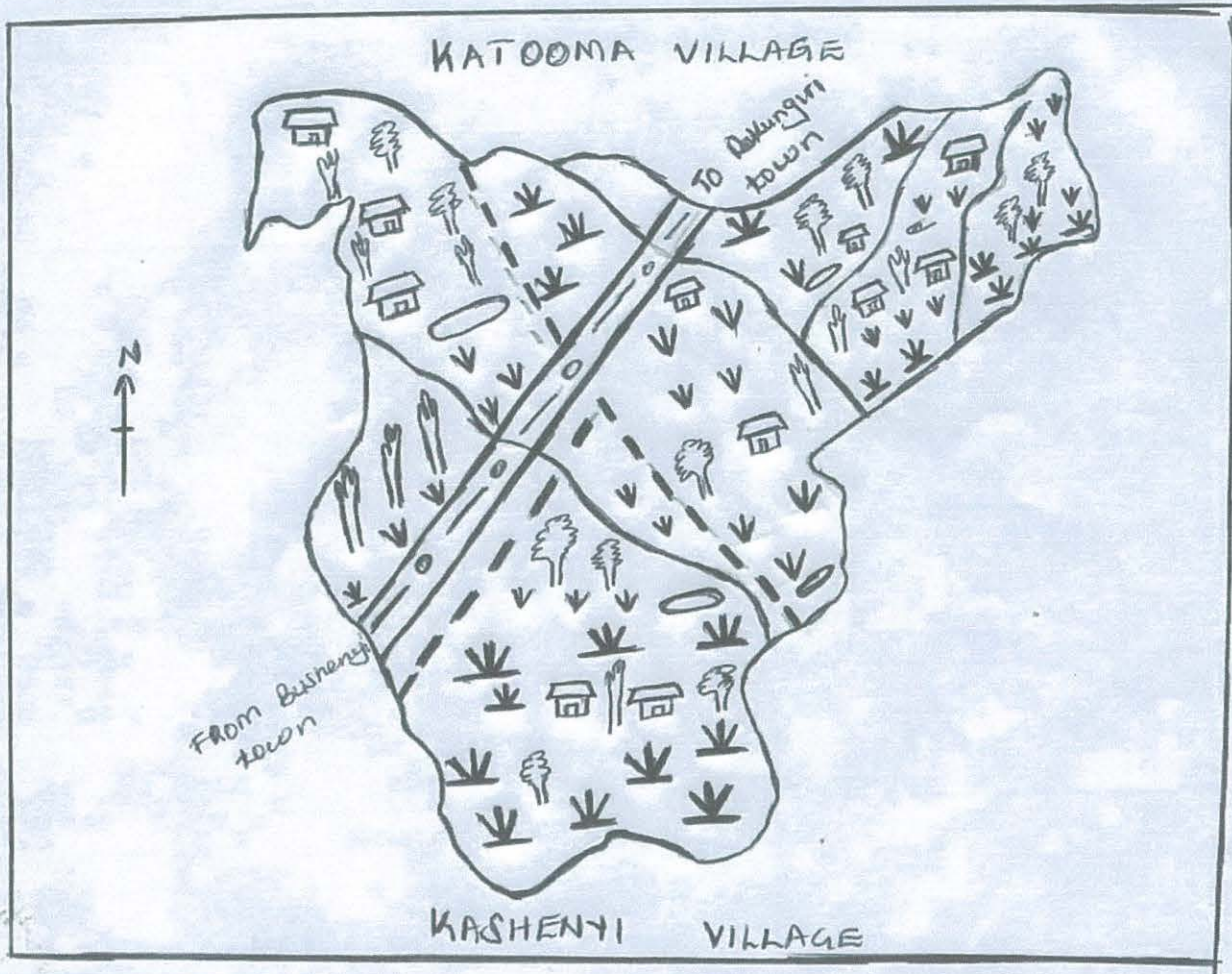
1:5 JUSTIFICATION OF THE STUDY

Sustainable management of wetlands requires reliable and up-to date information on land uses and nature of the wetland ecosystem. This study is focusing on land use practices and how they affect the wetland. The information got will help in making the situation of wetland broader since little research has been done in this area of study so it will act as a foundation for other researchers. The solutions got will facilitate incensitization of the local farmers on dangers of wetland degradation.

THE MAP OF RUKUNGIRI SHOWING WETLAND REGIONS



A MAP OF NYARUZINGA PARISH



KEY	
	SWAMPS
	HOUSES
	WOOD LOTS
	WELL
	CELL BOUNDARY
	MAIN ROAD
	BANANA PLANTATION
	FARM LANDS.

CHAPTER TWO

LITERATURE REVIEW

2:0 INTRODUCTION:

In this chapter, the researcher has presented various works of different authors world over. Concerning the implications of wetland degradation in different societies at different times.

2:1 DEFINITION OF WETLANDS

Ocan Johnson Onen (2002) defined wetlands as an ecosystem that arises when inundations by water produces soils dominated by aerobic processes and forces the biota particularly rooted plants to exhibit adaptation to biota flooding to tolerate flooding. This broad definition includes everything from the tropical mangrove swamps to sub arctic peat lands.

The United Nations Development Programme (UNDP) 1999 defines wetlands as areas of vegetation which permanently or seasonally water logged most wetlands in the area are permanently water logged with district vegetation characteristics they develop adaptive vegetation like aquatic plants and glasses and form peat loams. This is because the low oxygen conditi8ons and the large amounts of plants remain on sandy, clay soils.

The committee on characterization on wetlands (1995) therefore has developed a “reference definition” to stand outside of any single agency policy or regulation. There is a ‘reference definition’ to stand outside of any single agency, policy or regulation. Their reference definition is that a wetland is an ecosystem that depends on constant or recurrent shallow inundation or saturation at or near the surface of substrate, the minimum essential characteristics of wetlands are recurrent sustained inundation or saturation at or near the surface and presence of physical, chemical and biological features reflective of the current, sustained inundation saturation, common diagnostic features of wetlands are hydro soils

and hydrophytes vegetation. These features will be present except where specific physio chemical biotic or arthropologenic factors have removed than or prevented their development.

The NSW wetlands management policy 1996 “wetland areas that are wet for long enough period such that the plants and animals living in them are adapted to and often dependant on living in wetland conditions for at least part of the life cycle for the purpose of policy wetlands and defined as land that is inundated with water that may be fresh, blackish or saline the inundation determines the types and productivity of the soils, the plants and the animal communities.

The convention (Ramsar) uses particularly broad definition of wetlands in Article 1 as areas of marsh, fen peat lands or water whether natural or permanent or temporary with water that is static or flowing, fresh, blackish or salt including areas of marine waters depth of which at low tide does not exceed six meters. Dugan (1990)

The Ramsar convention (wise use protect) wetland destruction and degradation often have adverse and unforeseen long term costs, whilst organizations and individual can make short term profits from the conversion of wetlands. In the Mediterranean drainage of excess run off in exacerbate drought situations irrigation to over come water shortages for agriculture can be costly and is usually main trained by high levels of public subsidy.

Soil and ground water solemnization agro-chemical industrial and urban pollution and disruption of social patterns can result.

Destruction of wetland habitat by whatever means reduces the abundance and diversity of wetland dependent flora and fauna including exportable fish and shellfish stock.

Water Acids series of Acids (1989 and 1991) of UK parliament establishing controls over the quality of waters from the tap and the environment largely change for England and Wales amongst other things, these privatized the water

industry and established the National Rivers Authority (NRA) as regulatory body for England and Wales they have been supplied by the Environmental Act 1995.

The National Environmental wetlands River banks and lake shores management Regulations 2000 defines wetland as areas permanently or seasonally flooded by water where plants and animals have become adapted and include swamps, dambos, areas of marsh peat land mountain bogs, banks of rivers, vegetation areas of impeded drainage or blackish salt.

Popular version of the National Environment Statute 1996 (No. 4 of 1995) in spite of wetlands importance wetland resources are currently threatened with degradation as a result of drainage for agricultural production and location of industries the extraction of sand and clay especially for brick making.

Ebukali (1970) studied the swamp ecosystem and their utilization in Kumi district. Generally swamps have the most delicate ecosystems compared to any other type of existing ecosystems tampering with one element, the whole ecosystem and how it functions must be known. Several studies have already been taken on the impact on swamp reclamation on the various aspects of environment for example Odomel (1988) carried out a study on the impact of swamp reclamation on the domestic water supply revealed that the activity of swamp reclamation does not only reduce the availability of domestic water supply but also affects the quality.

2:2 TYPES OF WETLANDS

2:2:1 Peatlands

There are four types of wetlands and they include peatlands, marsh, swamps and aquatic. Peatlands are flooded more or less permanently, but the water table is near the water surface. Under these conditions decomposition is reduced but since there are no waves, flowing or tides to carry away debris, the organic matter accumulates. Once organic matter has accumulated to the depth of 10 cm, roots are steadily isolated from access to the mineral soils beneath the peat. Plants

therefore become increasingly dependant upon dilute nutrients deposited in rain water (Gorham 1957; Godwin 1981; Van Breemen 1995) and have distributions strongly related to nutrient concentration on the ground water (e.g. Gore 1983; Glaser *et al* 1990; Vitt and Chee 1990). Adaptations to such infertile conditions requires a variety of unusual plant traits, the most visible of which is the tendency toward leathery and evergreen (sclerophyllous) foliage. the cause of sclerophylly in wet habitats was at first unclear, and thought to be a consequence of physiological drought (small 1972a,b ;Richard 1981), but it is now believed that deciduous leaves require conditions of relative fertility, since a plant must continually replace the nitrogen and phosphorus lost in deciduous foliage (Chapin 1980; Grime 1977, 1979; Vitousek 1982)

Peatlands also exhibit a distinctive abundance of bryophytes; in no other habitat of the world do bryophytes comprise such a large of the biomass and primary production.

2:2:2 Marsh

The final vegetation type arises in the region where peatland, swamp and aquatic vegetation types intersect. Here plants are exposed to three sets of environmental factors: (i) frequently inundated, plants here must be able to tolerate anoxia (ii) frequently exposed to the atmosphere, plants here can experience heavy herbivory or fire. During longer dry periods, dense canopies can develop, producing shade. (iii) Finally, when water levels are at intermediate levels, waves break over the plants. In northern climates, waves can also bring ice onto the shore, and during cold weather, ice freeze onto the shoreline and when water levels rise, large pieces of vegetation can be torn away. These three combined factors create severe constraints: marshes therefore occur. Woody shoots are not suitable: they would be burned by fire, ripped out by ice or torn away by floods. Sculthorpe (1967) comments upon the fact that a majority of emergent and floating leaved plants must survive ' the unfavorable tropical dry season or temperate winter'. In this case of the tropical *scirpus grossus*, he described how "As the water recedes as the approach of the dry season and the foliage dies back, the tip of the stolon swells and forms a hard, dark, globose tuber.

Laden with starch, each tuber survives until the next monsoon when it sprouts forth, forming a new plant either directly at its apex or at the end of the short stolon”.

2:2:3 Swamp

Swamp move to the bottom, trees that occur on flooded sites must be flood tolerant, and different species can be ranked in order of their tolerance to this stress (Kozlowski) 1984b; Lugo *et al.*1990). A defining property of swamps is that they are heavily forested, and as a consequence, the dense shade at the ground level inhibits the germination and the of tree seedlings (Grubb 1977; Grime 1979). R.H.Johns *et al.* (1994) studied seedling regeneration over four years in four floodplain forests, cataloguing over 10,000 seedlings, and finding high rates of motility during the first growing season. In all forest they examine the composition of the seedlings differed from the overstorey trees, suggesting that composition would change if the adult trees died. Many tree species require gaps for their seedling to establish (Grubb 1977; Pickett 1980; Dancan 1993). These gaps can be produced either by the death of individual trees, or when entire sections of forests are swept away by extreme floods or ice. The process of gap creation, seed dispersal to gaps and establishment in gaps (Pickett and White 1985) therefore become prominent features of the ecology of swamp forests whether freshwater (Nanson and Beach 1977; Salo *et al.* . 1986) or mango (Lugo and Snedaker 19740).

2:2:4 Aquatic

Aquatic: standing water at the upper right produces a different suit of conditions. Here, in addition to low concentrations, the environmental factors are constant submergence, disturbance by waves, reduced availability of carbon dioxide and the potential access to the atmosphere provided by the floating leaves. The traits of aquatic plants therefore include well developed aerenchyma, floating leaves, heavily dissected submersed leaves and remarkably modified flowers. These adaptations are sufficiently dramatic that they are already thoroughly explored into final monographs (Sculthorpe 1967; Hutchinson 1975).

In aquatic wetlands, however, something more must be said about the problem of carbon acquisition, because this secondary constraint and its solutions are almost entirely restricted to aquatic macrophytes. Submersed aquatic plants are isolated from atmospheric supplies of carbon dioxide.

2:3 IMPORTANCE OF WETLANDS

The importances of wetlands according (de Groot 1992) the concept challenges humans to recognize, inquire into, and quantify the benefits received from ecosystems.

In his overview, functions of nature, de Groot lists 37 functions that natural environments perform for humans. These range from the ozone layer's function of protecting humans from harmful cosmic influences to a landscape's function in artistic inspiration.

Further, de Groot, breaks these functions down into 4 categories and they include regulation functions describe the capacity of ecosystems to regulate essential ecological processes and life supporting systems on earth for example, regulation of the carbondioxide and oxygen concentrations of the atmosphere carrier functions describe the space or suitable substrate needed for the conduct of human activities such as living, cultivation and recreation. Examples include: soil and rainfall for growing crops, production functions describe the processes provided by the nature, including food, raw materials for industrial use and genetic raw material. E.g. would include production of clean water for drinking and wood for building and information functions describe the role played by natural ecosystems in the maintenance of mental health by providing cognitive development, spiritual inspiration and specific appreciation such as Parque Nacional in Latin America or historical landscapes such as the Medieval castles of the Rhine river valley in Europe.

Christensen et al (1996) argues for the benefits of ecosystem management using a slightly different terminology; they recognize three different categories of values provided by natural ecosystems processes goods and services. Processes include hydrological storage, biological productivity, biochemical cycling and biological

diversity. Goods include food, construction material, medicinal plants and tourism. Services include regulating climate, cleansing air and water and detoxifying pollutants. Although the classification scheme is somewhat different, their proposal captures many of the same functions as are covered in de Groot.

Wetlands are certainly important Sather et al (1990) and Larson (1990) examine some of these specific importance performed by wetlands (e.g. flood control). According to de Groot, there are 37 lists of importance of wetlands: protection against harmful cosmic influences, regulation of the local and global energy balance, regulation of the chemical composition of the atmosphere, regulation of local and global climate (including the hydrological cycle), regulating of run-off and flood prevention (watershed), water catchment and ground water recharge, prevention of soil erosion and sediment control, formation of top soil and maintenance of soil fertility, fixation of solar energy and biomass production, storage and recycling of organic matter, storage and recycling nutrients, storage and recycling of human waste, regulation of biological control mechanisms, maintenance of migration and nursery habitats, maintenance of biological (and genetic) diversity, human habitation and indigenous settlements, nature protection, recreation and tourism, cultivation (crop growing, animal husbandry, aquaculture), energy conversion, ornamental resources, fuel and energy, genetic resources, fodder and fertilizers, medicinal resources, food and nutritious drinks, biochemicals other than fuel and medicines) water (for drinking, irrigation and industry), raw materials for building, construction and industrial use, raw material for clothing and household fabrics, Historic information (heritage value), scientific and educational information, Aesthetic information, cultural and artistic inspiration, and lastly, spiritual and religious information.

2:4 CAUSES OF WETLAND DEGRADATION

Mukasa (1990), shows the effects of swamp reclamation. Reclamation in general he looked at the effects on both the biotic and a biotic components which includes animals, plants and climate. Although this was a piece of work, there were some loopholes, the paper did not handle the causes of swamp reclamation and the

tools used therefore this paper will look at the causes of swamp degradation, tools used and the effects on the environment without man it would be useless to study environmental degradation because the plants and animals don't care much whether they are affected or not but man cares and the effects man. Although it is man himself who degrades wetlands, the problems caused by this activity affect him. Reclamation of wetland affects the micro-climate and soil this leads to poor crop yields hence famine.

Aryamanya (1993) argued that brick making and tile making around swamps and at Kajjansi in particular have led to environmental degradation of places because many trees are cut down to burn bricks this has led to encroachment on forest reserves in brick making clay is excavated to make bricks and holes are created in most cases these holes are not covered therefore water collects into them and they become habitat for disease carrying organisms like snails which spread bilharzias. Grass is cut for covering fresh bricks and making bricks sheds all these greatly affect natural ecosystem.

Despite Uganda's abundant natural resources the country is experiencing serious environmental problems this is due to a result of over exploitation of these natural resources in the development process (Muganwa 1993) in attempt to re-address this imbalance the government launched the National Environment Plan (NEAP) in August 1991 to formulate a comprehensive national environmental strategy.

Focus on environment exposes poverty and ignorance and their intricate linkage with the on going swamp reclamation it also views the reduced soil fertility, lowered water table increase in flooding and appearance of acidic soils as a result altering the chemistry and bio-diversity of the ecologically specialized "climax wetland ecosystem" through cleaning and draining.

Rapid population growth of human and unsustainable resource continue to place increased demand on the world's limited renewable and non-renewable natural resources. In 2002 the United Nations estimated the population in the year 2050

to be 9.32 billion a 54% increase over the 2000 figure of 6.06 billion. Rapid increases and migrations of populations have the potential to endanger species and ecosystems and further regarded terrestrial and aquatic communities because of increased urban and rural development, soils, air and water pollution toxic wastes and over exploitation of biotic resources focusing only on their environmental impacts however essential, will be treating only the symptoms rather than the root causes of rapid population growth.

The Macmillan Encyclopedia of the environment, wetlands are being lost at an alarming rate. Human population growth has led to conversion of wetland areas to farm and housing developments and other development projects. Despite renewed efforts to protect them, millions of wetlands are lost each year in the 48 main land states mostly for agricultural use. Infact, the United States, fish and wild life service has estimated that more than half of the original wetlands of the United States have been destroyed since 1700's fresh water wetlands have been hardest hit between the mid 1950s and the mid 1970s nearly 6.3 million square miles (16.3million square Km) of these wetlands were drained and converted into farmland.

2:5 CONSEQUENCES OF WETLAND DEGRADATION

The United Nations Conventions on wetland was designed in a small island of Ramsar, in Iran on 2nd Feb 1971 the convention recognizes the fact that the destruction of a particular culture or wetlands represent the demise of people the convention entering a new avenue in its 31 years of existence in 2002 brings the treaty closer to people with the intention to contribute too safe guarding of the wetlands.

The artifacts they have found in water logged soils from all over the world document the extensive human use of wetlands. Today there are communities in many countries that still pertain those close links them daily activities formed by the rhythm of wetland cycles. The relationship between wetlands and people extends far beyond the value of natural resources. It included a rich cultural

heritage that has evolved over time, a heritage that is worthy of much greater attention by the wider community concerned.

A recent analysis of almost half of the Ramsar conventions sites has confirmed that there is an enormous wealth and diversity of cultural heritage recorded in these wetlands. Many of the traditional techniques people have evolved to manage wetlands for exploitation, whether its to be used for salt extraction, rice growing, make us of mangrove tree, fish harvest or cut reeds has stood rest of time as techniques that both sustain people and conserve wetlands.

Maltby (1986) wrote on hidden wealth of the world's wetlands giving examples from all over the world on the rolls and dangers of swamp utilization specific places in Uganda have been studied in relation to wetland reclamation and environmental degradation can be clearly understood when one takes time to study the impact on specific aspects of the environment.

According to the Ramsar convention, wise use of project wetlands are environmentary amongst the most sensitive area in European community. Although they are among the most sensitive area in European Community. Although they now probably cover less than 1% of its territory, they are among the productive and fragile ecosystems. Early Mediterranean civilization were based around coastal wetlands and depended on them for food, water and building materials. In more recent times these areas have often been regarded as wetlands. Consequently there has been a massive loss of wetlands especially in the Mediterranean basin although data to quantify this are scarce and difficult to obtain.

2:6 SOLUTIONS TO WETLAND DEGRADATION

According to National Environment (River banks, wetlands and lake shores management) regulation of 2000 drainage changes the water table and by its very nature the wetland dry out the immediate effect is the shrinkage of soils and oxidation of organic matter over a period of time. In specific circumstances where

there is excess sulphur, oxidation will be convert or reduce sulphate and extremely acidic conditions ensure soil acidification which renders the soil non production is noticeable in Kabale district. This also leads to loss of water holding capacity of wetlands and their inability to act as a buffer to water flow, destroys habitats that may lead to loss of species breeding habitat for fish is lost leading to reduction of fish stock increased contact with static water which is un purified, this increases the chances of bilharzias infection and other water borne diseases. Also wetland degradation causes the alteration of ecosystem, micro climate and also reduces the normal function of hydrological cycle.

Uganda has responded through article 245 of the constitution of the republic of Uganda that, "Parliament shall by law provide for measures intended to protect environment from abuse pollution and degradation".

Then therefore after to implement the constitutional obligation the parliament enacted the National environment statue No. 4 to provide the law on the protection of the environment further more, the national policy for the conservation and management of wetland resources was also adopted in 1995.

The National wetland policy of 1995 the ministry by part vii and section 108 of the National environment statue 1995 and upon the recommendation of the board and policy committee on the environment made on a statutory instrument supplement this regulation is the National Environment (wetlands, riverbanks and lakeshores management) regulation of 2000. This regulation was to provide for the management procedures and punishment from the identification of the policy goals principles and aims of the discussion is then to proceed and explain the usefulness of this policy in Uganda. Previously the use and importance of wetlands have been discussed and the possible dangers that may occur when wetlands are not protected. In general, the National wetland policy is to protect wetlands for major purpose that is maintenance of biological values, ecological values and functions and social economic functions.

The National wetland policy of 1995 environmental impact assessment and monitoring this policy therefore states the following that there will be requirement that all proposed modification and restoration on wetlands be subjected to Environmental impact assessment. Secondly it states that all planned new wetland development will be subjected to an Environment impact assessment (EIA) will continuously be monitored to assess their impact on the environment and where the impact is detrimental government will require that such development be halted. Thus the policy about EIA aims at protecting environment by preventing wetlands to be subjected to alterations or destruction and monitoring the impacting of any project or human activity.

Also the National wetland policy of 1995 is developing public awareness very often wetlands are degraded because the public is either not fully aware of do not appreciate the diversity of values and functions of wetlands.

Public awareness is therefore essential in creating commitment and positive attitudes towards conservation and sustainable utilization of wetland resources. Promoting international Action is a policy that serves to protect wetland resources that have trans-boundary significance. There are birds that may move to Uganda during certain period for breeding and other countries after breeding therefore to protect these migratory birds, it requires a continuous promotion and participation in the convention of wetlands of international importance especially as water flow habitats (Ramsar 1971).

Conservation and demand management measures are essential aspects of intergrated wet land resource management. These steps include cost effective water saving strategies employed in municipal, industrial and agricultural uses of water improvement, treatment, storage and delivery systems to reduce losses and increase efficiency measures to prevent pollution by altering production processes and re-use of water where ever safe and practical.

The clean water Act protects millions of square miles of wetlands from destruction. However the portion of the Act has become a political battle ground

in recent years. Many people in congress and else where favour new laws that redefine wetlands. Critics of such laws argue that would result in loss of nearly 80% of the wetlands that remain.

However, there are some very successful wetland protection programs in the United States for example since 1986, the North America water flow management plan (NAWMP) has protected and restored more than 6 million square miles [15.5m.sq Km] of the North America in wetlands NAWMP supporters include government representatives from the United States, Canada and Mexico as well as private conservation groups. Under NAWMP, more than 547 million dollars has been invested wetland conservation under the 1990 North American wetland conservation Act. The federal government is authorized to spend up to \$ 26 million annually for wetland projects much of this money is used to fund NAWMP projects.

Wetland project Act where by a law designed to protect the United States wetland. A wetland is an area of land covered by water at least part of the year. Wetlands include estuaries, swamps and marshes. In the past, wetlands were considered to be waste areas; much of the wetlands in United States had been destroyed by the 1970s. Since then the ecological importance of wetlands has been recognized efforts are now being made to preserve the remaining wetlands in the United States.

The wetland protection Act is short name for the emergency wetland resource Act of 1986. This Act authorizes the United States fish and wildlife service to designate and buy important wetlands. The service is also making an inventory and map of wetlands in the United States.

The reserves must be connected so that dispersal can occur from one reserve to the next as reserves become increasingly constrained and species [Mac Arthur and Wilson 1967, Hanski and Gilpin 1991, Hanski 1994] while local extinction from small areas of wetlands once reserves become isolated fragments with in a landscape. There may be local population available to re-colonize the site. In the longer term, habitat islands at the same time species with limited dispersal such

as flightless insects or anti-dispersed plants may be expected to solely disappear from the entire reserve system. Large reserves help to minimize this problem but in other cases, reserves may need to be deliberately linked by corridors (Noss 1995).

Wetlands are however difficult to classify because they share the characteristics of both permanently wet and generally dry environment. The difficulties are compounded further by the enormous variety of wetland types and their highly dynamic character which complicates defining their boundaries with precision. Recognized two types of wetlands in Uganda namely the littoral swamps covering lakes and Nile shores and the shallow valleys which are characteristic of the country between Lake Albert, Victoria and Kyoga. Tylarand Mutebi (1990) have gone further to place Uganda's wetlands into 3 categories namely swamps, swamp forests and sites with impeded drainage. The total wetland area in Uganda is 29,589 km² for which the swamps take up 8,832 km², the swamp forest 365 km² and the sites with impeded drainage 20,392 km². Thus total area is approximately 14% Uganda's total land area 205,333 km². Taylor and Mafabi (1990) whereas swamps have generally circulated soils and flooded for most parts of the growing season and are normally dominated by single emergent plant species the marshes though may be equally saturated and are usually dominated by reeds, rushes, grasses and sedges (Mafabi 1991).

CHAPTER THREE

METHODOLOGY

3:1 INTRODUCTION

This part presents the area of study, study population, data collection, instruments used, procedures, data analysis and presentation and research limitations.

3:2 AREA OF STUDY

LOCATION:

Nyaruzinga village is located in western Uganda Rukungiri district. It covers a total area of 182 square kilometer of which there is brick making, animal grazing agriculture, sand mining and collection of fire wood. The area is near Rukungiri district with neighbouring areas of Katoma, Kashenyi and Ndere. Nyaruzinga lies between longitude 1° 29 S and 1° 30 S and latitude 29° 18 E and between 30° 9E. The altitude ranges between 1000-2000 metres above the sea level, with temperature like climate, mean annual rainfall 10-22° c.

3:2:1 RELIEF

The relief of Nyaruzinga village ranges between 1000-2000 Metres above the sea level. Most of Uganda forms part of an interior, high plateau comprising of a number of levels which represent several stages of transition across underlying structures of the ancient rock basement. These states of transition are the result of long continued sub aerial denudation, which progressed in phases related to continental cycle changes, but which was complicated in the region by the direct and indirect effects of warping and lift valley development. The interaction of the sub aerial process with the underlying structures and tectonic deformation has produced the present landscape.

3:2:2 CLIMATE

3:2:2:1 RAINFALL

Rainfall in Nyaruzinga is bi-modal. The long and heavy rains are in the first half of the year starting from around March to May. There are also drier days that is: June, July and August months that's when they are making bricks and other activities. July shows a reasonable probability of getting nil rainfall. The mean annuals vary from 800mm-1000mm. In Nyaruzinga's annual rainfall seems to be stable although frequent below average epochs do exist.

TABLE 1: MEAN ANNUAL RAINFALL OF RUKUNGIRI DISTRICT.

Year	Rainfall	Mean
1993	1,077.3	
1994	1,124	
1995	1,211.5	1,072.1
1996	1,108.4	
1997	1,162	
1998	845	

Source: Meteorological department Rukungiri district 2000.

3:2:2:2: TEMPERATURE

On reference to the 1995 data from Rukungiri district meteorological location, the district records mean annual maximum temperatures of 24.4°. The station records 10.9 °. As mean annual minimum, this indicates slightly high temperatures throughout the year. An analysis of temperature covering the period from 1960-1980 shows a positive trend in both the minimum and maximum temperature covering all the months. The rate of the rise of annual temperatures is found to be 0.39° per decade. This rate of warming is quite and is very much above the global average (about 0.3° c per decade). One possible explanation for the micro-climate warming in Rukungiri could be that due to swamp reclamation. It is possible that the local radioactive balance in the region could have been affected.

(RUKUNGIRI METEOROLOGY DEPARTMENT 2000) BELOW ARE THE TABLE THAT GIVE UP-TO- DATE DETAILS CLIMATOLOGICAL ISSUES OF RUKUNGIRI DISTRICT.

**TABLE 2: MEAN ANNUAL MONTHLY MAXIMUM TEMPERATURE
°C**

Year / Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	sep	Oct	Nov	Dec	Mean Annual
1993	24	25.4	23.4	23.6	23	24.2	24	24.3	25.1	23.6	23	23.6	
1994	24.6	24.4	23.9	23.7	23.9	24	24.1	25.2	23.7	24	22.9	23	
1995	24.1	23.8	24.1	23.6	22.9	23	23.3	24.5	24.5	23.8	23.2	23.9	
1996	23.9	25.8	24.3	23.2	23.3	23.8	23.9	25.5	27.2	25.1	23.3	23.1	
1997	24.2	24.7	25.3	24.3	23.8	25.4	24.3	25	24.2	25.1	24.5	22.3	
1998	24	24.2	23.6	23.5	23.1	24.5	24.8	23.2	24.4	23.9	22.8	23.5	
MEAN	24.3	25	23.6	23.7	23.3	24.2	24.1	24.6	25	24.3	23.3	26.6	24.1

Source: Meteorological Department Rukungiri district.

TABLE 3: MEAN ANNUAL MONTHLY MINIMUM TEMPERATURES
°C

Year / Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual
1993	11.2	11.7	11.5	12.2	12.8	10.1	9.7	11.1	11.7	11.9	12.8	12.5	
1994	11.2	11.4	11.9	11.9	12.9	11.7	10.3	9.8	11.7	12.3	12.3	10.6	
1995	10.9	11.3	11.9	12.3	12.5	11.9	10	10.2	11.8	12.4	12.2	11.9	
1996	10.9	10.5	11.8	12.9	12.3	10.6	10.4	12.5	10.6	12.5	13.4	13	
1997	13	13.3	13	13.6	13.3	10.9	10	10.6	11.1	12.8	12.1	10.4	
1998	11.4	10.4	11.9	11.8	10.9	9.8	9.6	23.3	10.7	11	11.5	11.9	
MEAN	11.6	11.4	12.4	12	12.5	10.8	10	10.9	11.3	12.2	12.4	11.9	11.6

Source: meteorological department Rukungiri district.

3:2:3 SOILS.

The soils in Nyaruzinga parish are loamy, sandy and clay. There is a lot of nutrients in loamy soils in the wetlands that's why they practice agriculture in the wetlands. The clay soil is used in brick making by people occupying the place of which this activity is mainly done. The soils are clay that is they lack ions, nutrients to support plant growth. Sandy soils provide sand for construction purpose.

3:2:4 POPULATION SIZE AND GROWTH.

The population size is very high that is why people degrade the wetlands in order to meet their needs and aspirations. Population growth is so due to fertile soils within the wetlands. In this case the land is not enough for them so that is why they have resorted to wetlands as an alternative by reclaiming or destroying them down.

3:3 STUDY POPULATION AND SAMPLE SELECTION

The study population comprised of both educated and uneducated people within the area because they are the victims of wetland degradation. The farmers were also included in since they also play a role in the wetland degradation. They reclaim the swamps in order to get land to grow crops and also rear animals so that they meet their needs. Here brick making is the main cause of wetland degradation and a high number of men are involved in it in order to earn a living. The sample selection was based on men, women and the youth because they are the user of wetlands. Because of the nature of study and time frame, a population of 50 men was selected and 15 in 10 respondents of the women and the youth were purposefully selected in order to bring out their view, opinions and judgment of the causes and the likely increase of what the study is based on.

SAMPLE SELECTION (N=50)

TABLE 4

POPULATION	ESTIMATED SAMPLE	ACTUAL SAMPLE	PERCENTAGE
Men (33-40Yrs)	25	38	50 %
Women (24-40 yrs)	15	12	30 %
Youth (18 -35 Yrs)	10	10	20 %
Total	50	50	100 %

3:4 DATA COLLECTION METHODS

The methods used during data collection included questionnaires, interviews, photographs, direct observation, recording, pen and paper and literature review.

3:4:1 Questionnaire and interview

In this case, questions were used to investigate the causes, consequences of wetland degradation and what has been done to minimize them in parish. The questions were both open and ended in nature. They were designed on the following variables; causes, consequences, control measures and recommendations.

The questionnaires were used in a way that the researcher held face-to-face interview with the respondents and asked the questions in the questionnaire while filling in the respondents' answers.

This method yielded a high response. Further, it helped enable the researcher to interpret the questions.

3:4:2 Photograph

The method helped to back up the study findings by providing a rich detail about the physical appearance of wetlands to appreciate what is really on the ground.

3:4:3 Direct observation

The method was widely used specifically reviewing on the ground for example brick making activities like how bricks are made, processed and manufactured. The method helped the researcher to discover the relationship of human activities and wetland degradation in the environment. It helped the researcher to acquire sufficient information which would have rather not been availed from other methods like questionnaires.

3:4:4 Literature review

The method involved the use of other related literature to provide information about wetland degradation and its remedial measures at world levels and national level. This included National Environmental Management Authority library, Kampala International University library, Human Resource Management Centre library and home library.

3:4:5 Recording

The method involved writing down on paper the information being said by the respondents.

3:5 RESEARCH LIMITATIONS

3:5:1 Conflicts in the study area

The research was carried out during a period when there was a conflict between the brick makers and the owners of the land. This interfered in the sense that most of the respondents could not be available at agreed time because they were attending court hearing over the issues.

3:5:2 Financial constraints

The study area is found in a constituency where money has been the main channel for soliciting an audience during political campaigns as some respondents thought of me as a government agent, they demanded money from the researcher in order to provide information.

3:5:3 Misinterpretation of research intentions

Some respondents had their own expectations out of the research study. Some respondents for example thought of me to be a government agent sent to the area to assess the causes of wetland degradation and try to solve the problems where necessary.

3:5:4 Seasons

The season was a rainy one so it was very hard for the researcher to gather information since the respondents were few in number.

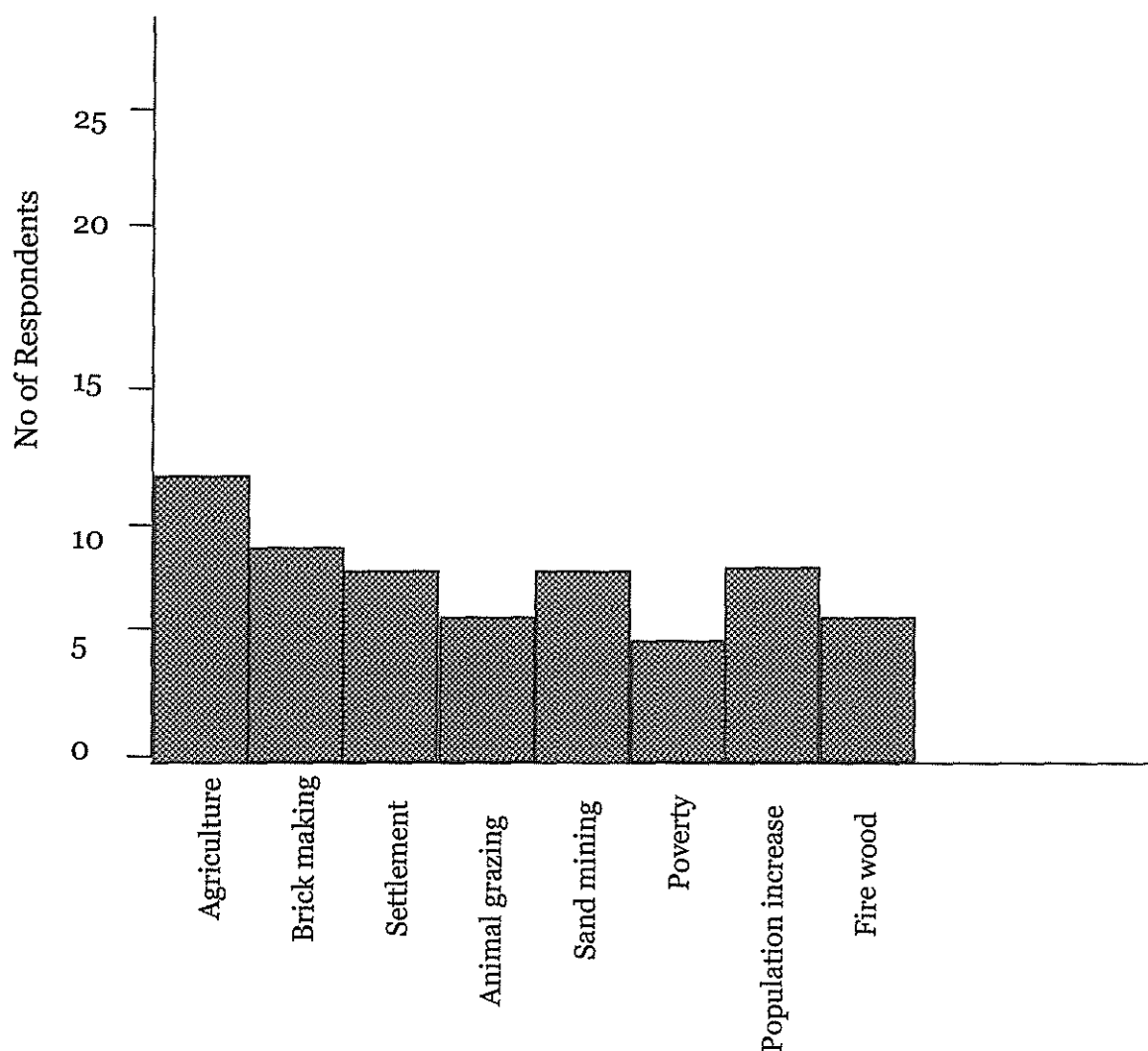
CHAPTER FOUR RESEARCH FINDINGS

4.1 CAUSES OF WETLAND DEGRADATION

	Respondents	Percentage
Agriculture	12	24%
Brick making	8	16%
Settlements or construction	6	12%
Animal grazing	5	10%
Sand mining	6	12%
Poverty	2	4%
Population increase	6	12%
Collection of firewood	5	10%
TOTAL	50	100%

Source: From the field by the researcher

A BAR GRAPH SHOWING PERCENTAGE NUMBER OF RESPONDENTS TO CAUSES OF WETLAND DEGRADATION



Source: Derived from the table above.

4:1:1 AGRICULTURE

In Nyaruzinga parish Rukungiri district however, as revealed by interviews the root cause of people's encroachment to wetlands here is Agriculture. Agriculture is a root cause of many problems in Uganda and many of the third world countries through interviews. It was found that many people in Nyaruzinga parish Rukungiri reclaim swamps to produce food for their families. They grow crops like sugar cane, Irish potatoes, yams, sweet potatoes, eggplants and other plant and this helped the people to earn a living and keep some surplus for home consumption. So with that, people have been forced to reclaim the wetlands so that they meet their needs. Also the population being high and yet the demand for food is high; people will resolve to use wetlands in order to satisfy their wants. For example mzee Bashasha who was formally an employee of Kilembe copper mines lost his job when Kilembe mines collapsed. So he went home and started degrading the environment by planting crops within the wetland which is near his home for survival. The excuse mzee Bashasha gave was that almost every body who cultivates land produces the same variety of crops and getting market for the produce is not easy. The produce thus fetches very little money therefore the profitability of swamps is one of other causes for wetland degradation.

PLATE 1: DEGRADED WETLANDS DUE TO AGRICULTURE



Source: From the field by the researcher.

4:1:2 BRICK MAKING

Brick making is an activity that is threatening many swamps in Nyaruzinga parish. Brick making leaves behind deep holes which are dangerous to human beings, such holes are potential breeding grounds for mosquitoes which spread malaria to people. Brick making requires a lot of fire wood and this leaves the catchment areas without trees. In the process of making of brick making grass is cut to cover the fresh bricks and thatch the brick shade. Vegetation is cleared to leave clear ground. Brick making have therefore caused genetic erosion especially of vegetation and consequently disturbed the ecosystem of the area.

Brick making as an economic activity was noted to be expanding in Nyaruzinga because bricks are on a high demand and some are exported to Rukungiri town. Brick making degrades environment through distruction of vegetation cover which consequently leaves soil bare hence soil erosion.

Many environmentalists are saying that the planet (earth) is in the midst of destruction. In 1970, it was estimated that one specie became extinct each day. By 1990, a specie vanishing 12 time (Awake 1992) this therefore implies that the rate of extinction is increasing at a high rate. In connection to Dr. Mostohper Tolba said “if Charles Dawn were alive today, his work would likely focus not on the origins of species but rather on the obstuaries of species” (Awake 1992).

Brick making under wetland degradation and the destruction of vegetation in Nyaruzinga parish has changed the habitat for many plants and animals. According to interviews with the people living near these wetlands, the availability of water loving plants like cyperus rotunders and other animals and birds have declined sharply.

The below picture was taken from Katooma village where brick making has degraded wetlands. Here people are making bricks and they supply the bricks to Rukungiri town and some are supplied to Bushenyi since the area is at the boarder of Rukungiri and Bushenyi. In the presentation of this data and anylsis, photographs taken from area of study are used.

PLATE 2: DEGRADED WETLANDS DUE TO BRICK MAKING



Source: From the field by the researcher.

NUMBER OF KILN AT THE TIME OF CARRYING OUT THE RESEARCH IN DIFFERENT BRICK MAKING

TABLE 4

Names of sites	Mirambi	Katooma	Bukongoro
No. of Kilns	3	2	7

Source: Field work

As noted above, brick making is responsible for the genetic erosion of both fauna and flora.

An old woman by names Kabashaki Peninah who claimed to have been born in Nyaruzinga and grew up from there revealed that during the days of her youth water was not a problem even in dry seasons leave alone fire wood which one could pick just from around home. But now as was got from the field, women and young children are suffering. The nearest good well is at a distance of two kilometers and keep wondering in the thickets spending the whole day in an attempt to get fire wood. The old woman further narrated that wetlands were

very extensive and was a source of fish especially lung fish, though this is still there, they are very few. This fish used to constitute a major part in the diet of the local people in Nyaruzinga.

However it was observed that there were only a few permanent wells and in get swamp which according to interviews with some elders was extensive in the past is now represented by a small area. From the foregoing table of Nyaruzinga generally has dropped. This was evidenced by drying up of plants so soon when dry season begins. This drying up is a result of the disappearance of mists which because of abundant water surface and vegetation used to stay in the lower atmosphere up to around 10:00am. This mists helped plants to survive even in dry seasons. But with too much drainage of swamps and cutting down of vegetation mists have disappeared.

The data on Arable was got by observation Arable farming is dominant activity in the degraded wetlands of Nyaruzinga. Here different activities were noted on different portions. The portions that are used for cultivation as reported by one of the farmers were used seasonally that is there is a dry season only once. The seasonal use had no serious effects on effect on wetland. But at present these are used throughout the year. This was presented by Mr Karihoona who is himself an active participant in wetland degradation. The researcher also witnessed cultivation being done in wet season because part of the research was carried out during rainy season, this rainy however cultivation season is not very beneficial because an occasion was witnessed when rainwater had flooded. A whole plantation could flood. Because of constant cultivation of wetlands, the vegetation composition has been altered so much, soils here especially clay type bears wide cracks in any seasons. This makes it very hard to manage with long term exposure to dryness. When rains come they are sticky and heavy to plough on this type of soil. In such a condition are scanty vegetation, yams and potatoes. Forestry is also practiced here on the degraded wetlands in Nyaruzinga.

Afforestation is done by individual, the major type of tree species grown here is eucalyptus; this tree species has adverse impact on the environment in that its rate of water uptake is very high hence a lowered water table is experienced when the water table is lowered so much there are other problems that follow problems that follow. Problems like disappearance of vegetation and death of animals, lack of water for domestic use and the change in the micro-climate generally soil physical properties are also altered.

Grazing or pasturing is done here in dry season when the upland pastures can't support grazing any more. Both cattle and goats are grazed here. Cattle grazing is to some extent controlled but goats are constant grazers in this season because they are left free in summer to mate and also grass is dry and goats can't be limited with in narrow grazing areas like tying them to a tree thus limiting grazing ground to the tree only. These goats continuously graze the swamp vegetation to beyond regeneration point.

What makes grazing more dangerous to both vegetation and soil is that these areas are grazed communally, the hooves of these animals break loose the soils making them prone to wind erosion. To make grazing even more dangerous here in dry season is that this is a period with very strong winds. These winds blow off the soils leaving bare ground which can not support any vegetation growth even when rain comes. This is because all plant nutrients are blown away.

4:1:3 SETTLEMENT AND CONSTRUCTION

In Nyaruzinga Parish wetland degradation is caused due to high population growth, demand for land is high yet it's scarce so people have resorted to wetlands by people constructing houses in wetland places to accommodate their families. This is so due to population growth in that area and yet the land is not enough for them to construct houses on dry land. This has led to the destruction and extinction of bio-diversity within the wetlands and fertile soils have been displaced in the process of construction.

4:1:4 ANIMAL GRAZING

In Nyaruzinga parish wetland degraded is also caused by animal grazing. In the below photograph people over graze cattle in areas of Katooma and it has resulted into wetland degradation with its implications on the environment have settled else where and they normally come to work on wetlands and go back to their homes. The few people who settled there are those that have no alternative to secure a land somewhere.

Most of these activities have adverse impact on the wetland and the environment at large.

PLATE 3: DEGRADED WETLAND DUE TO ANIMAL GRAZING



Source: From the field by the researcher.

4:1:5 SAND MINING

Furthermore, Nyaruzinga Parish wetland degradation is caused by sand mining whereby the activities carried out in order to earn a living by the people in that area. In this case there is a lot of sand in the wetland and they have a say that “resources are God given”. In other wards they do not diminish so they have to over utilize them since they are abundant and available to them. In this process there is displacement of fertile soils and both animals and plant species.

PLATE 4: WETLAND DEGRADATION DUE TO SAND MINING.



Source: From the field by the researcher

4:1:6 POVERTY

Interviews further revealed that swamp reclamation was an attempt by people to increase their individual income of the local people. This is true because some people are employed to work for some other people. Men do cleaning of swamp for planting, women collect rubbish and weed the crops while children are engaged in scaring birds. All these people are paid their daily wages at the end of the day. The money used to pay workers wages is got from the sale of the products.

Thus poverty is a leading cause of wetland degradation, the poor contribute to the degradation of diverse biological species largely because they often have no alternative source of income. The poor are both agents and victims of the destruction of the environment and bio-diversity there in.

4:1:7 POPULATION INCREASE

Another cause which was revealed by interviews is population increase. A number of people in Nyaruzinga is not enough to accommodate the available population so as to meet their needs. Because of this reason, they have resorted to wetlands by reclaiming them down and this has led to plants and animals species extinctions and distraction hence resulting to wetland degradation and environment.

4:1:8 COLLECTION OF FIREWOOD

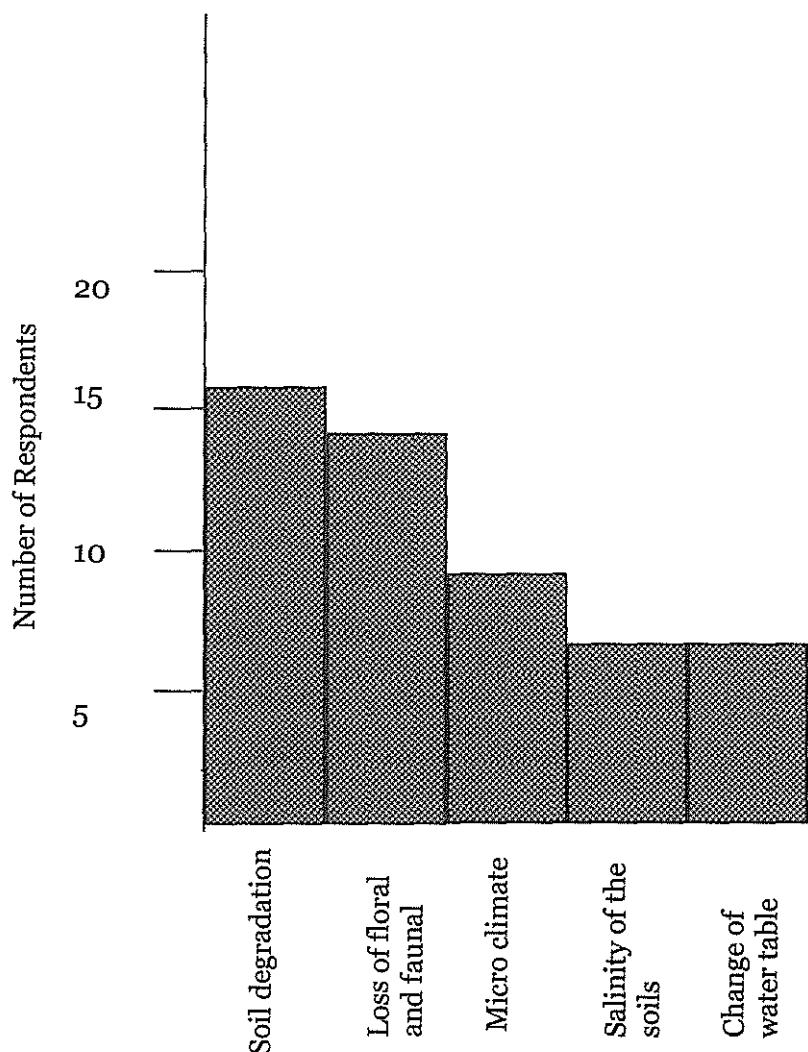
The people in Nyaruzinga are always faced with a problem of firewood. This has made the wetlands in the area to be the only alternative source of firewood. Plant species like papyrus have been over harvested to be used as firewood. This unsustainable harvest of the species is increasing with increased human population. A change in the vegetation cover especially in the fragile ecosystem greatly affect the hydrological cycle and other ecological functions like that of natural filtering of water sponge effect is in releasing water.

4:2 CONSEQUENCES OF WETLAND DEGRADATION IN NYARUZINGA PARISH.

	Respondents	Percentage
Soil degradation	16	32%
Loss of flora and faunal specie diversity	14	38%
Loss of micro climate	8	16%
Salinity of the soils	6	12%
Change in water table	6	12%
Total	50	100%

Source: From the field by the researcher

BAR GRAPH SHOWING THE NUMBER OF RESPONDENTS ON CONSEQUENCES OF WETLAND DEGRADATION



Source: Derived from the table above

4:2:1 SOIL DEGRADATION

The degradation of the soil was investigated. To investigate this, the physical properties of soil were studied, this involved physical analysis of soils, organic matter content, texture, porosity, drainage, water, retention color and depth.

To establish the quality of the organic matter in different soil samples, each sample weighing 20 grams was sun dried, the samples were weighed after every

two minutes for 20 minutes until there was no further change of weight. Ten samples were used, five from degraded portion and five from the un-degraded. The results were tabulated for analysis as below.

In summary degradation of wetlands affect organic matter content. This is due to massive removal of natural vegetation which are replaced by crops which when harvested from the area, the remains are in most cases burnt or heaped in specific places thus reducing the general organic content of soils. This affect organic matter. Alteration is reflected in the rest of the soil properties like drainage porosity colour and texture. However digging and siltation are responsible for spartial variation in soil depth.

4:2:2 LOSS OF FLORAL AND DIVERSITY

Just as wetland degradation affects the diversity of faunal species in Nyaruzinga parish, it has a similar effect on the flora species. This has a negative implication on the flora as part of the living environment of Nyaruzinga parish was realized after visits to the field and data collection. The data was collected from both the degraded and un-degraded wetlands in order to assess the destruction caused by wetland degradation and its associated activities on the environment of Nyaruzinga parish the table below show the plant species

PLANT SPECIES IN DEGRADED WETLANDS

Sample no.	Species identified	Species identified	Total
1	1. Reed swamp 2. Algae	1	3
2	1. Sugar cane 2. Green vegetables 3. Potatoes 4. Tomatoes 5. Senecio species	0	5
3	1. Manihot esculenta 2. Sweet potatoes 3. Cabbages 4. Ageratum conyzoides	0	4
4	Hibiscus species	0	1
Total		1	13

PLANT SPECIES IN UNDEGRADED WETLAND OF NYANZINGA PARISH

Sample	Identified Species		Total
1	1. Chlorophyta 2. Reed swamp	2	4
2	1. Cynodon dactylon 2. Cyperus rotundus 3. Cyperus rotundus	1	4
3	1. Pennisetum purpureum 2. Cyperus rotundus 3. Cynodon dactylon 4. Pennisetum purpureum	1	5
4	1. Pennisetum purpureum 2. Cyperus rotundus	1	15

	3. <i>Cyperus papyrus</i> 4. <i>Cynodon dactylon</i> 5. <i>Commelina species</i>		
5	1. <i>Cyperous papyrus</i> 2. <i>Pennisetum Purpeleum</i> 3. <i>Crassoce Phalm species</i> 4. <i>Urena Lobata</i> 5. <i>Argeratum conyzoids</i> 6. <i>Nomedica Conzoida</i> 7. <i>Commelina Africana</i> 8. <i>Physalis species</i> 9. <i>Cynodon dactylon</i> 10. <i>Bistus Pilosa</i>	5	16
Total		10	34

From the above table, its clear that there are more plant species in un-degraded wetlands and in degraded ones.

Wetland degradation has effect on the plant species diversity of the wetland ecosystem. The constant weeding limits plant diversity and keeps the succession trend static in the wetlands where man has not yet had any influence, maximum plant diversity is realized and the succession is clearly represented. Plants near the water channels are water loving and grow in moist environments hence they are referred to as hydrophytes. Following the hydrophytic zone are plants which grow in areas that are not dry and not too wet. These are the mesophytes which include *pennisetum*, *purpeleum* and *cyperus commelina*. In the areas away from water channels the plants are adopted to live in a dry habitat for example *crass cephalum*, *mormodica*, *foetida* and *cynodon dactylon*.

In the degraded swamps the natural vegetation has been replace by crops, these are food crops comprised of green vegetables, cabbages, sugarcane and sweet potatoes. This modification of natural vegetation into gardens of crops has

impact on both the soil properties and natural environment at large. The cultivated crops are normally harvested and taken away thus the wetland ecosystem loses nutrients in the process the loss is aggranated malter content affect soil structure and properties like porosity, drainage and water retention plus texture.

The removal of vegetation cover paves way for accelerated evaporation from the surface hence soils are prone to rapid water loss. Morgan (1986) realized that the soil properties are prone to alterations due to changes in the vegetation and cultivation is a major factor worth considering the transformation of the natural environment in to a cultural landscape by man has far reaching implications on the biotic components of the environment.

4:2:3 LOSS OF FAUNA SPECIES AND DIVERSITY

Animals being a vital component of the respect to this activity of wetland degradation. The species richness and diversity were the key factors to this study. Animals put under considerations include insects, soil organisms, fish, birds, frogs and mammals both degraded and un-degraded wetlands were studied.

Frog number was established by direct counting where they could be seen and behavioral method when they were croaking the number of birds was got by frequent visiting of study areas where these birds fed. They usually stayed in groups and such that their presence could be easily realized counting was done in the morning at 10:00am when they were feeding. The number of fish caught in a month was established by interviewing the people who participate in fishing, soil organisms were collected by digging up soil up to the depth of 30 cm. The samples were analysed for both species and numbers. The population of the mammals was established by observation and interviews. All the data above were tabulated for analysis as below.

Through interviews it was realized that Nyaruzinga parish especially around the wetlands used to be a home for hippopotamus, these animals were present here up to late 1980s when reclamation of wetlands intensified and their habitats destroyed. Because of loss of habitat, these animals were exposed and killed to extinction by hunters.

It is clear that wetland degraded areas affected habitats of many organisms or changes them adversely is highly responsible for the change in population and species diversity of animals found in Nyaruzinga parish through cultivation and brick making. The natural habitat of wildlife is destroyed. T. Lewis and Taylor (1972) lamented that the different agricultural practices greatly affect the total number and species of earth worms present in the soil depending on the degree of disturbance caused, the different fertility level maintained and the amount of organic matter. The different vegetation soil and drainage affect animal distribution consequently the species community is a measurable character of diversity man's activities usually diminish diversity.

4:2:4 LOSS OF MICRO – CLIMATE

Wetlands act like sponges, they can soak up and hold water for long periods and release it slowly hence keeping the local climate stable. Wetlands through their local breezes together with land breeze keeps the surrounding areas moist and cool. This role played by the wetlands is no longer prevailing, as a result of wetland reclamation, many wetlands have been drained and the few that still remains have very little influence. Information on microclimate was collected through interviews with people who have lived there for at least 20 years. In the 1980s, the dry seasons were normally hot this falls in months of June – July but towards the close of 1980, crossing 1990s up to present, the July heat has been realized to be hotter than in the past. The little knowledged elders were wondering if it could be because of their sins that God is annoyed and is beginning to punish them like that. One respondent who was an old man told the researcher that when they were still young boys, they could dig up to 1:00pm.

From these a great change in the local temperature was realized this is accompanied by no moisture at all in the atmosphere. This is a result of wetland degradation. The rain season was from April to October (hang lands 1947) this has changed today to begin from June to September and the rains are no longer heavy because of this local climatic change, the farmers were unable to get good yields from their crops despite the hard work done.

The variation in microclimate has influence on the entire wetland ecosystem. It determines the rate of water loss from soil through evaporation. It affects the physiology of organisms by influencing nutrient recycling consequently, it is admitted that the alteration of vegetation has been significant in the spatial variation of the microclimate of Nyaruzinga parish.

4:2:5 SALINITY OF THE SOILS

From the interviews, people revealed that wetland degradation has resulted into salinity of the soils. This is due to concentration of salts within the soils. Here as people are cultivating, mining sand and making bricks in the wetlands, fertile soils are affected and displaced and in the end it results into soil salinity then in this case, soil nutrients are destroyed in that process.

4:2:6 CHANGE IN WATER TABLE

There is also an effect faced for example, reduction in water table as a result of human activities practiced by people in that area and in so doing the waters are affected. In this process the aquifers are destroyed and this results into changes in water table.

However man being a component of the environment is not exempted from the problems of environmental degradation on. Although many of the environmental problems are caused by man's activities, man himself is also affected at the end. One scholar stated that whatever befalls the children of earth, we didn't weave the web of life we are merely stranded of it. What ever we do to web, we do to ourselves. The world web, we do it to ourselves. The world we have made as a

result of the level of thinking we have done this so far, creates problems we can't solve at the same level of thinking at which we created them.

Wetland degradation in Nyaruzinga any other place has an indirect effect on man. Man doesn't face the effects directly but through other means like wetland degradation affects wildlife and vegetation reduces the water table and changes the soil properties. Here problems then surface to man, he will be faced with famine because the soil no longer gives good crop yields even if there may be some to cook there is no firewood since vegetation is already depleted even the problem of clear water supply especially in rural areas comes in therefore there is no way man can dodge the effects of his own making environmental degradation.

4:3 SOLUTIONS TO WETLAND DEGRADATION IN NYARUZINGA PARISH

Because of short period of time with in which this research was conducted, it was not easy to come out with concrete remedies to wetland degradation but from the interviews carried out, it was found out so many people are likely to join in the wetland degradation. For example Mr Karutsigarira who already has fifteen plots said that he still has plans of making more eight plots from the un-degraded wetland. Interviews with many people around wetland gave the same direction of vision for more degradation. The reasons they gave for degrading wetlands were so strong that one would have to think over and over again to begin posing and implementing the policy against wetland degradation.

Most of these places in Nyaruzinga parish are economically weak. These people can only survive by getting cash from the sale of their wetland products. Therefore as much as this activity is dangerous to the environment, its not simple to pass out a policy banning wetland degradation without providing an alternative to wetland users. Thus the government should first settle the causes of

wetland degradation which are rooted in poverty before taking any step to stop this activity presenting it is so beneficial to local people.

Alternatively although this may need centuries to begin operating in Nyaruzinga with the present rate of development in Uganda, a system reported by George Perkins (1965) could be adopted. This is recreation of artificial springs which could be permanent. This is by husbanding rain and snow water storing it up in artificial reservoirs of earth and filtering it through purifying strata in analogy with operations of nature. Primarily all springs are derived from precipitation with enough technology. These springs can be created through the processes below.

Choose a piece of ground containing four or five acres with sandy soil and a gentle slope to determine the flow of water along its upper line, dig a trench 5.6feet deep and 6 feet wide, level the bottom of the trench and make it impermeable by paving by bitumen or more simply by a lower of the clay by the side of this trench dig another and so on until you have rendered sub soil of the whole parcel impermeable to rain water. Build a wall along the lower line with an aperture in the middle for the water and other low trees upon the whole to shade the ground and check the currents of air which promote evaporation. This infallibility gives a good spring which flow without intermission and supply the wants of the people (Palissy 1857).

In order to save wetlands from being degraded, problems are discussed already. There should be a policy whose effects are already closely monitored. Other uses like fish farming which does not require draining water should be encouraged and those that involve draining off water like arable farming, brick making should be discouraged. Wetland degradation problems, affect the community as a whole yet the benefits got from degraded wetlands benefit only few individuals who are directly involved. People are not in favour of wetland conservation, therefore its only a strict law that can control or stop them from wetland degradation and its implications on the environment.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5:0 INTRODUCTION

This chapter outlines the summary of findings got from the research survey carried on implications of wetland degradation on the environment in Rukungiri (Nyaruzinga parish). Conclusions are made and consequently the researchers way forward towards solving these problems is presented.

5:1 CONCLUSIONS

5:1:1 CAUSES OF WETLAND DEGRADATION AND EFFECTS ON THE ENVIRONMENT

Wetland degradation has had implications on the environment of Nyaruzinga parish as seen from the research findings. Some actions must be taken to save the environment.

5:1:2 Alterations in plant and animal community

There has been alterations in the plant and animal communities. This has also affected physical soil properties which in turn affect the situation.

Reclamation is primarily caused by poverty which is due to low income levels of wetland users. Human activities which were found to cause environmental degradation is encroachment of wetland with its associated land use practices like brick making, Arable farming, grazing and destruction of vegetation mainly for fire wood. These affect the environment in different ways and in varying magnitudes most of these activities lead to destruction of habitats of the fauna. The destruction of vegetation cover leaves the soil bare and at the mercy of agents of soil erosion.

5:1:3 Lack of adequate and clean water

Environment degradation manifests itself in lack of adequate and clean water as in the case in rural areas, pollution, loss of bio diversity, increased soil erosion and exhaustion. It was found that there is dependency on the environment which causes environmental problems which in turn affect man himself.

5:1:4 Economic, social and political problems.

Environmental degradation in Uganda and Africa as a whole is part of the general economic, social and political problems which are interdependent. It was also found out that it is profitable to grow crops compared to the uplands, swamp products have ready markets and this encourages farmers to continue reclaiming wetlands.

5:1:5 Cultivation

However, cultivation in wetland areas has effect on the natural ecosystem of the area. The cleaning of vegetation to initiate cultivation has altered the natural ecosystem stability. This has altered the habitats of organisms there by affecting the level of equilibrium formerly attained in the natural ecosystem.

5:1:6 Change in soil properties

Due to degradation, the soil properties are altered, the propensity and drainage of soils generally increase while water retention decreases. Degradation has affected the species composition of the area hence affecting the working of ecosystem. The natural plant communities are being replaced by crops, in addition animal communities have been affected and are being dominated by insects and pests.

The modification of the environment has been coupled with variation in the micro-climate of the area in terms of temperature and relative humidity. However, its important to note that people of Nyaruzinga parish are not infavour of wetland degradation.

5:2: WHAT SHOULD BE DONE TO SOLVE WETLAND DEGRADATION PROBLEMS?

Wetland users need to be sensitized about the importance of wetlands to the well being of man and to attain sustainable development. However government needs to come up with another alternative if its to over come the problem of wetland degradation. Because people are using wetlands due to its profitability by selling off the products and its this money they use to send their children to school and supporting the entire family, therefore the problems of poverty needs to be addressed first and there after the problem of wetland degradation will also be solved.

5:3 RECOMMENDATIONS

5:3:1 Comparative study

In studying the implications of wetland degradation on the environment, the researcher recommends a comparative study of degraded areas so as to understand the process of change on the environment through degradation.

5:3:2 Research

It is also recommended that research work be carried out in other places where wetlands are being reclaimed to confirm and improve on the findings of this paper.

5:3:3 Focused study

It is further recommended that researchers wishing to study the environment of wetlands should make soils and plants the focus of study since these are the key factors to the working of wetland ecosystem. All these may lead to the sustained use of wetland in general and Nyaruzinga county in particular.

5:3:4 Government intervention

All problems on the environment caused by wetland degradation can be solved by the joined efforts of the government together with the local people. On the side of government, the authorities and policy makers should carry out a detailed study on the physical and chemical properties of soil before policies are implemented. This could be coupled with investigations in the physiology of different plants so as to avoid the problem of stress that may be done considering the prevailing socio-economic conditions of the area.

Government should also mobilize an effective use of resources to facilitate environmentally sound development policies promote sustainable solutions to environmental problems. The community should be involved in decision making at local level, which will enable community members to articulate both involvement and development needs and collect and disseminate data which would ensure effective management of natural resources in development initiatives.

At the individual level government should focus more on women in terms of equity for education opportunities, land ownership access to credit, agricultural and forestry extension as well as providing suitable incentives to facilitate the protection of the quality of land and water resources under individual control.

At the international level government should promote the integration of environmental appraisal, monitoring evaluation of all foreign assistance policies and programmes. It is very important for any work or project to be carried out by indigenous people or any other company or organization environmental impact assessment must be carried out.

Finally a further and more comprehensive research on the effects of wetland degradation must be carried out.

5:3:5 Sensitization

On the side of the local people, they should be sensitized on the importance of environmental protection which is a world wide concern today. The programme of sensitization of these people should be done right from the grass root level through participatory approach that is the local people should be educated on the importance of conserving environment and they should be encouraged to participate actively in conserving their environment.

5:3:6 Law implementation

Environmental laws should be enforced or reactivated where the local people are not co-operative. Some kind of force should be used to make them appreciate that neither man nor physical environment is the master of the other. But there is a need for co-existence between man and his environment. All the environmental problems as were discussed can be controlled by government setting and enforcing laws which protect the environment. The local authorities like the LCs. Should help the central government to enforce laws. The local people should be encouraged to appreciate government's efforts to protect the environment by co-operating with their local authorities. The environment conservation law should not however completely stop people from utilizing resources like swamps but should stress their sustainable utilization for example the utilization of forest resource laws like 'plant four trees for each tree you cut' should be implemented or levy some form of tax on the people who would like to take large scale exploitation of these resources.

However, for the purpose of this paper, the author recommends that the use of scientific methods of cultivation be carried out on dry lands to increase individuals income and save the wetland areas.

5:3:7 Sustainable use of natural resources

Natural resources conservation should not be looked at as constraints to development. Rather it should be regarded as a critical sector of development and sustainability should be linked to improved environmental planning. This concept of sustainability must be clearly understood. This is a process of change

in which the exploitation of resources, the direction of investment, the orientation technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs. The quest for sustainable development therefore, not only refer to need for harmony between environment but also acknowledgement of the fact that poverty is itself a critical cause of deterioration of the environment.

The key to sustainable development lies in the government's ability to integrate economic and environmental considerations at various levels of decision making namely at government, international agency, community and individual household levels. To this end, government should incorporate the environment should incorporate the environmental issues into planning and policy making, strengthen the institutional machinery necessary to co-ordinate and monitor environment/natural resource activity like wetland degradation and development of a data base on the status of environment.

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APPENDICES

APPENDIX A

INTRODUCTORY LETTER TO RESPONDENTS

KAMPALA INTERNATIONAL
UNIVERSITY
P.O. BOX 20000
KAMPALA
UGANDA

Dear Respondent,

I am Birungi Ziporah a student of the above institution faculty of Social Sciences offering a course in Environmental management. I am researching on implications of wetland degradation on the environment in Rukungiri District (Nyaruzinga parish).

I hereby request you to honestly answer the questions below. Your contribution towards this research is highly appreciated. I am optimistic that with your help to this research will contribute to the general body of knowledge.

NB: All the above information will be held as the truth, please answer with utmost sincerity, write answer in the space provided. When you have finished filling in this questionnaire, keep it with you, I will move around to collect the filled questionnaires. This will also be the time for concluding face to face interview.

Sincere thanks in advance for your co-operation

Yours faithfully

BIRUNGI ZIPORAH



KAMPALA
INTERNATIONAL
UNIVERSITY

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Faculty of Social Sciences and Law

To:.....Chairman.....

.....Nyarundungu village.....

This is to introduce to you Mr. /Miss.....BIRUNGI.....ZIPORAH.....
who is a bona fide student of Kampala International University,
He/She is working on a research project, which is a partial
requirement for the award of a degree.

I hereby kindly request you in the name of the University to accord
him/her all the necessary assistance required for this work.

Thank you very much in advance.

Prof. A. G. G. Ginyera Pinywa
DEAN FACULTY OF SOCIAL SCIENCES AND LAW



APPENDIX B

QUESTIONNAIRES

1. Name
2. Village
3. Age
4. Sex
 - a. Male ()
 - b. Female ()
5. Number of member in the household
6. Occupation
7. Tribe
8. Education level
 - a. None ()
 - b. P1 – P2 ()
 - c. P2 – P7 ()
 - d. Secondary ()
 - e. Tertially ()

SECTION B

CAUSES OF WETLAND DEGRADATION

9. Do you use the wetlands Yes/No

10. If yes, what forces you to do so?
11. If no, why?
12. How long have you been doing it?
13. What activities do you carry out in the wetland?
14. Is land owned communally or privately?

SECTION C

CONSEQUENCES OF WETLAND DEGRADATION IN THE ENVIRONMENT

15. Do you think wetland activities degrade environment?
 - a. If no, why do you think so?
 - b. If yes, why do you think so?
 - c. Has the wetland affected availability of the following:
 - i) Bio-diversity
 - ii) Water table
 - If yes describe how?
 - If no why?
 - d. Name the plants and animal species that are no longer seen as a result of wetland degradation

16. SECTION D: WETLAND MANAGEMENT STRATEGIES IN
NYARUZINGA

- a) Have you tried to solve or minimize the above consequences (Yes/No)
- b) If no why?
- c) If yes explain how you have done it.
- d) How has your control management helped you in reducing the undesirable changes brought about by wetland degradation on the environment?
- e) Apart from your own efforts, how have the following helped you in minimizing the consequences of wetland degradation on the environment of Nyaruzinga parish?
- Government
 - Ngo's
 - Extension services

17. SECTION E:

SOLUTIONS TO WETLAND DEGRADATION CONSEQUENCES ON THE ENVIRONMENT OF NYARUZINGA

Despite the efforts put in place to minimize or solve the consequences of wetland degradation, the problem still exists.

- a) Do you think something can be done to further solve the problem? (Yes/No)
- b) If yes, how?
- c) If no why?