

**EFFECTS OF AGRICULTURAL PRODUCTION ON WETLANDS: A CASE
STUDY OF KONIALA WETLAND, KISUMU COUNTY, KENYA**

**BY
KERUBO MERCILLINE
BEM/8110/51/DF**

AUGUST 2011

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**A RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE AWARD OF BACHELORS
DEGREE IN ENVIROMENT MANAGEMENT OF
KAMPALA INTERNATIONAL
UNIVERSITY**

AUGUST 2011

DECLARATION

This study entitled, “*Effects of agricultural production on wetlands. A case study of Koniata Wetlands, Kisumu County, Kenya,*” has never been submitted to any institution of learning for any award.

Signed..........

Kerubo Mercilline

Date..........

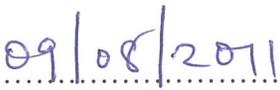
APPROVAL

This research proposal entitled, “*Effects of Agricultural production in wetlands. A case study of Koniata wetlands, Kisumu County Kenya,*” was done under my supervision.

Signed 

Mr. Omuna Daniel

SUPERVISOR

Date 

DEDICATION

This piece of work is dedicated to my beloved family, my father Dr. Titus Ocharo, my mother Mrs. Ocharo for their support, patience and love.

To my dear brothers Edgar, Dennis and Felix and to my Supervisor Mr. Daniel Omuna.

May the almighty God shower you with blessings.

ACKNOWLEDGEMENT

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Am also grateful to the entire Kampala International University Community especially my supervisor Mr. Daniel Omuna for his great guidance without which completion of this work would have been difficult.

I also extend my appreciation to my entire family for their emotional, moral and financial support, you are my treasure.

I also thank my friends who enthusiastically supported me and pinpointed my mistakes. I also thank the community of Koniala who took their time to give me the relevant data during my field study, thanks for availing me with the data; it has been helpful for the completion of this work in time.

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ABSTRACT

The purpose of this research is to evaluate the extent to which wetland agricultural production allows the wetland ecosystems of the developing countries to be tempered with due to the increased human activities i.e. agro-production. Similarly, it allows us to establish quantitative relationships between anthropogenic activities and ecological responses. Effect of farming practices on wetlands in Kisumu District was determined through assessment of farmers' environmental awareness.

Effective conservation of wetlands in the district cannot depend on prohibitions but should be based on users' knowledge and attitudes of wetlands. The present study examined farmers' knowledge of the environmental effect of agricultural expansion to wetlands; absence of knowledge of characteristics of farming activities and the attitudes of farmers with respect to planning mechanisms that might be used to support wetland protection in the area. The majority of farmers ignored the effect of agriculture on wetlands. Those who occupied wetland areas practiced intensive agriculture and were ignorant of the effect of this on water quality, soil and landscape. The government should implement training programmes for all wetland users in Kisumu County to make them more environmentally aware of the impacts of farming practices on wetlands.

This is meant to make them become more environmentally aware of the effects of farming practices on these ecosystems and eventually change their behavior. There is a need to build a conservation ethic among wetland users by educating them to sustainably utilize wetland resources and training them to practice sustainable agriculture. Specifically, we need to treat each new project and scheme as a "natural experiment" where the ecological resources and effects are quantified from before the project is implemented until long after implementation. Until this is accomplished, we run the risk of repeating the same mistakes that have been made in the past. The research used quantitative methods in tabulated information, percentages and charts. To sum up, the researcher was able to come up in agreement with the local community who came to understand the need of wetland sustainability hence agreed to carryout sustainable agriculture and conserve wetlands.

CHAPTER ONE

THE PROBLEM AND ITS SCOPE

1.1 Background of the Study

The global wetland area is generally estimated to be 7 to 9 million km² (4-6 percent of the land surface the earth). While there are many definitions of the term “wetland” many would agree that these are areas with high water tables contributing to a specific ecology. The mostly 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 a low tide dose not exceed 60 metres.

Wetlands are increasingly gaining global attention bringing together many scientists from different disciplines to study the unique ecosystems. One example of such attention is the *Rasmar convention on wetlands, adopted in 1971 and as of December 2002* has 1230 wetland sites distributed in six regions (Europe, Asia ,Africa, America, Neotropics Oceania and north America) recognised as wetlands of international importance.

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 to be identified depend 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 wetland provide include; habitant 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, shoreline stabilisation and storm protection; water purification; nutrient cycling; sediment retention and export; recreation and tourism; climate change mitigation; timber production; education and research; and Aesthetic and cultural value among others.

Few attempts have been made to calculate the economic value of the goods and services provided by wetlands. Although the accuracy and precisions 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 (Co stanza et al 1989) and between US\$19 million and US\$ 70 million per year for a 45 mile stretch of the platte River, Colorado (Loomis et al 2000)

1.2 Statement of the problem

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 according to Acreman, M.C.Hollis, G.E. (1996), he stated that drainage for agricultural production is the principal cause; by 1985 it was estimated that 56-65 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.

According to Monari (2007), in his study he stated that in Kenya alone, by 2002 it was estimated that around 20-30 percent of the available wetland has been degraded for intensive agriculture. Similarly, the OECD 2001, during its study of sub-Saharan Africa it stated that in Kenya alone about 7-15 percent of her wetland had been converted into agricultural production especially those along the lake Victoria.

1.3 Objective of the study

1.3.1 General objective

To make a situational analysis of effects of wetland agriculture to the ecosystem in Kisumu County

1.3.2 Specific Objectives

The Specific Objectives of the study includes:

- To find out the factors promoting wetland Agriculture in Koniala Wetland
- To find out the effects of Wetland Agriculture in Koniala Wetland
- To find out the practical solutions that could limit abuse of Wetland Agriculture

1.4 Research Questions

- What are the factors promoting Wetland Agriculture?
- What are the effects of Wetland Agriculture?
- What are the practical solutions that could limit Wetland Agriculture?

1.5 Scope of the study

While Wetland Agriculture may be spread to most parts of the Country (Kenya), the geographical scope of the study was Koniala located in Kisumu Town West Constituency in Kisumu County which was the interest of the researcher. The study focused on people's opinion about wetland agriculture and the factors that perpetuate the problem together with its effects to the ecosystem.

Most often than not, wetland agriculture are not stressed therefore it becomes difficult to establish the magnitude of its effect to the ecosystem. Nevertheless, the study attempted to discuss the extent of the effect, factors and solution in Kisumu County.

1.6 Significance of the study

The study was helpful in providing knowledge regarding what are some of the causes of wetland agriculture and also its effects on the ecosystem.

It was useful to the researcher in the sense that the knowledge gained from the study helped in the preservation of the ecosystems like, streams, rivers and the lake.

It was also useful to policy makers in implementing government programs that were to help in the preservation of water body along the lake region.

The data also contributed to knowledge in the academic world for posterity.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter depicts what has been put down in a view or with relation with findings with research related to effects of wetland agriculture. The issues are discussed according to the research objectives.

According to Kipkemboi, et al, 2007 "the relationship between agriculture and its effects on wetland ecosystems has often been portrayed as one of a direct trade-offs between the human need for food versus nature. The reality, as revealed 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 like Kenya where there are pressing needs for increased food production with the 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. The goal of this proposal is to assess the knowledge available to developing countries in supporting decisions on alternative future strategies for preservation of wetlands to assist in mitigating potential future ecological impacts of cultivating wetlands and for development of other alternatives. The focus of this review was on developing countries because it is there, rather than in the developed countries, that the potential for large-scale adverse impacts is severe Kipkemboi et al, 2007

Kipkemboi et al, 2007 adds that, 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. The most commonly known wetlands are open coasts, flood plains, fresh water swamps, lakes, peat lands and swamp forests. In Kisumu County therefore the swamps that generally exist is mostly fresh water swamps and flood plain i.e. the Kano Plains. Each one of these has a wide range of different wetland types. Irrespective of their types, sizes or locations, however, wetlands are of great and matchless ecological and socio-economic value. This is, for instance, true in the case of the valley bottom freshwater marshes which are central to this study.

Wetlands play a key role in pollution assimilation and flood control, serve as breeding and nursery grounds for many species of fish and wildlife, and help maintain ground water supplies and water quality." Africa has over 520 000 square kilometres of large standing water bodies the largest of them being the fresh water lake in East Africa (Lake Victoria) and the possibility of sustainable development is vast, providing a reliable and profitable asset. So accurate delineation of wetlands where they occur is of great importance.

Wetlands commonly occur in human-dominated landscapes such as agricultural and urban Regions Studies have shown that negative effect on wetland species and ecosystem functioning can be expected in such areas due to human activities. A strong 'utilitarian' attitude to the environment has been found among farmers owning vulnerable ecosystems compared to other populations (Patrick R 1976).

Thus, assessment of the ecological status of wetlands in human-dominated landscapes is critical for their effective management and protection. The values of wetlands are well documented, but the implications of their cumulative losses on national, regional and continental scales are not clearly understood. The following review indicates the kinds of impacts that could occur if we lose our wetland ecosystems. Wetlands are home to many plants and animals due to their temporal and spatial variability. They are rich in endemic, rare and endangered species. For example, more than half of Europe's most endangered birds depend on wetlands. In Belgium, 97% of the 306 plants classified as rare, vulnerable, endangered or already extinct are wetland species. Such information is missing in our country and this study comes up with such statistics of the study area to help emphasis the need for conservation of wetlands (Patrick R 1976)

Monari 2007 stated that one of the main ways in which mankind has been using the valley bottom wetland or fresh water marsh is cultivation. The importance of such wetlands in this regard lies mainly in their remarkably higher productivity compared to most upslope areas. In fact, as empirical findings indicate, some wetlands can produce eight times as much plant matter as an average wheat field.

The cultivation of wetlands, which as a rule calls for some degree of drainage, however, can lead to their rapid degradation and loss of perennial supply of water unless it is done wisely. One of the well known consequences of the unwise cultivation of wetlands is not only the loss of the wetlands themselves but also the fast decline in the fertility of the soils. Wetland soils are formed under special chemical conditions of a waterlogged environment and tend to turn acidic under drained conditions. Thus, it is quite common for drained or severely degraded wetlands to become unsuitable for crop production or even for grazing. Drainage and other forms of disturbance associated with agriculture are widely identified as the main contributor to wetland loss.

Williams 2000 suggested that globally, 160 600 km² of wetlands had been drained by 1995, primarily for agriculture and food production. For instance, it has been estimated that about 90% of New Zealand's former wetlands have been absorbed by arable, pastoral and horticultural developments 13. Wetlands are important elements in the global cycles of nitrogen and sulphur

Inevitably therefore, the continuing loss of wetlands through drainage must have significant impacts which repercussions at present are not clearly understood.

Research on the relationships between farmers and wetlands is nearly non-existent in Kenya and rather limited internationally. Similarly, quantitative analysis of the impact of agriculture on wetlands is limited due to insufficient environmental monitoring. Increased awareness about the adverse environmental and socio-economic consequences of the unwise exploitation of wetlands has resulted in worldwide calls for the sustainable management of fragile resources. However, the sustainable use of wetland resources has increasingly proven to be an extremely difficult and frustrating task in many developing countries. A substantial amount of literature that has appeared on this issue tends to carry the undertone that poverty is one of the major factors that make it very difficult to achieve the sustainable use of wetlands. Some

writers boldly point out that the modern notions of natural resource conservation are simply at odds with the survival strategies of the poor of the Third World that are dependent on wetland resources.

There has been a growth of interest in wetlands and an accompanying change of attitude. In some countries, rates of loss are now slowing at international level, the protection of wetlands is clearly reflected in the Ramsar convention. This convention plays an important role in facilitating the protection of wetlands of international significance. However, according to Monari (2004), the full protection of the remaining wetlands in Kenya and in all other countries can only be achieved through implementation of management strategies at national or sub-national levels. This conclusion follows simply because most of the remnant wetlands do not qualify under the terms of the Ramsar convention, which is aimed at protecting wetlands of international significance (Williams 2000)

Although the literature tends to portray the poor as the primary users and abusers of wetlands in developing countries, there are sufficient indications that the poor may not always have access to these resources. For instance, Kipkemboi et al (2007) stated that, some communities are known to have traditional resource management arrangements that regulate the ways in which and the extent to which wetlands could be exploited. Wetlands could either remain in near pristine conditions or the people may use them in an appreciably sustainable way where such resource management arrangements are strong enough to check their destructive exploitation by economically desperate and uncaring individuals. This is not to say that exploitation of wetlands by wealthier members of a community is necessarily sustainable. This simply means that such regulatory controls could significantly lessen the devastating pressures to which a substantially large and predominantly poor community could subject these fragile resources if they were open to unlimited access.

To some extent, this appears to be true in the case of the wetlands of Kisumu County of Western Kenya, which is presently being threatened by expansions of settlement and cultivation, brick making, urbanization and so forth.

Wetland losses are not easily reversible thus protection and conservation of the remaining ones is of paramount importance. There has been some progress toward

protection of wetlands, but the pace has been slow. In the 1960's, the International Biological Programme (IBP) initiated the project AQUA and the IUCN began project MAR. These were designed to increase protection of wetlands and to increase awareness of the importance of wetland and peat land ecosystems and the threats, to which they were exposed,

In 1975 the Ramsar convention came into force and it was one of the world's first International conservation treaties with 45 signatory states, of which Kenya is one of. Reports in 1987 suggested that the convention was short of funds, was breached by some of the signatories and did not include some crucial nations like the U.S. In practice, signatories also apparently tend to ignore the terms to which they are signatory a case the proposed study hopes to look into.

There is also lack of an adequate database on wetlands. With inadequate information on extent, structure and function of our wetlands effective management is severely hindered. Despite much effort by IUCN to establish a database on wetlands databases covering areas such as Kisumu County are missing.

2.2 Factors that promote wetland Agriculture

Research also indicated that there is no single cause of wetland Agriculture but it is caused by a combination of different factors. Some of the factors include:

The fertility nature of wetlands

As many authors indicate, most wetlands are very fertile due their nature and location which supports their organic composition due to deposits from raised surfaces. According to Antony Bruce and McCarthy, 2001 most of the wetlands have been found to be important as a storage site for organic carbon stored in living plants, soil and the soils that makes the soil very fertile thereby becomes very productive, therefore viable for farming.

Introduction of new crops

Rice, which is a new crop in Kenya, was introduced on a large scale in the 1960's as a wetland based crop. Beginning from the Chabera Irrigation Scheme, in Eastern Kenya to Kano Plains in Kisumu County, rice has now spread as a major crop in that region to cover a number of wetlands in the region. The clearing of wetlands for rice has resulted in the loss of biodiversity and a number of wetland functions.

Poverty

Kipkemboi et al, 2007 stated that, Kenya depends heavily on environment and natural resources. Over 90% of the population directly or indirectly depends on the products and services from agriculture, fisheries, forests, wetlands etc Natural resources account for 85% of export earnings and more than 80% of the workforce is active in agriculture.

About 90 percent of those beyond the poverty line live in rural areas. According to the poor, the quality of natural resources is declining; soil fertility and productivity of land, depletion of fish stocks, wetland encroachment and reclamation and pollution of water resources. Common property resources for cultivation or grazing are declining. Limited access to land is the other most cited cause of poverty and the poor perceive that the wealthy are gaining more control over environmental resources.

Similarly according to M. Monari, 2007 Wetlands are valuable assets for the poor. Most authors contend that poverty contributes to wetland degradation in two closely related ways. First, they point out the fact that an intense competition exists between different categories of wetland users whose livelihood rests largely on their access to these resources. The lack of other means of survival makes the competition between them so uncompromising that they fail to reach a consensus on the sustainable exploitation of wetland resources. This, they say, is true in the case of the conflicts that often arise between upstream farmers who want more flooding, downstream farmers who want less, fishermen who are interested in early flooding and herdsmen who want greater access to wetland grazing.

Economic Disparity

Most of the authors for example Kipkemboi et al, 2007 they argue that the people who tend to exploit wetland resources in developing countries are in such a desperate

economical situation that they cannot afford to use such resources judiciously. The main argument here is that since the poor "live within biomass-based subsistence economy"; their interests for short-time gains by far outweigh their willingness to treat wetlands caringly in anticipation of the long-term returns. In turn, since most of the people in Kisumu County were mostly fishermen, they are forced to turn to wetland agriculture when the catch becomes too low due to increased number of fishermen thus increasing competition.

2.2 Established effects of agriculture on wetlands

The human consequences of degraded natural resources include malnourishment, bad health and increased absence from educations due to more time spent collecting water and firewood, on the other hand, the environmental effects related to agricultural production on wetlands ranging from;

Loss of wetlands

Bruce and McCarthy, 2000 they noted that, direct loss of wetlands due to draining and conversion to agricultural land; indirect loss of wetlands area due to water withdrawal from rivers and streams for irrigation; Loss of wetland area and function due to damming for water storage; Loss of seasonal wetlands due to changed hydrologic cycle from water storage; Loss of wetland function due to Stalinization, sediment deposition, erosion, eutrophication; Pollution from use of pesticides and other chemicals; and Creation of wetlands.

Pollution

According to Patrick, R. 1976 he noted that pollution is the major effects of wetland production. Pollution from use of pesticides and other chemicals; and Creation of wetlands; examples of many of these effects are described with specific examples in subsequent sections of this review.

Most of the wetland is the source of rivers and ponds that supply most of the Kisumu County residents with water for domestic use for both human and livestock which entirely depend on such rivers. Residents of Kano plains in which wetland agricultural production is taking place have faced such pollution in their rivers from pesticides used in Wetlands used on rice produced in the region.

Threatened extinction of other species

The study by the NEMA officials (Kenya) and the Kenya Wildlife Services (KWS) officials done around the areas where wetland agro production is taking place has found out that there has been vast extinction of wetland species who either move to other areas as a result of wetland clearance for farming or others dies as a result of chemicals used in the wetlands.

In Kisumu region only the study showed that a number of water fowls a long the lake have either migrated or died since the practice of wetland production begun in those areas. The mud fish numbers have also extensively reduced due to the practice in the last ten or so years Kipkemboi et al, 2007

Water quality

Wetlands are essential for water purification. However, wetlands are degraded or converted to other uses thus constraining water purification services and losses of livelihoods for the poor. In 1995 alone, about 35% of the burden of disease in Kisumu County was attributable to malaria, diarrheal diseases and respiratory infections largely caused by polluted water or air.

2.3 Practical Solutions that could limit wetland agricultural production

There should be a review of Legislation on Wetlands and Associated Institutional Arrangements. Kenya acceded to the Ramsar Convention on 4th March, 1988 and the Convention entered into force for Uganda on 4th July 1988. Kenya, therefore, is under an obligation to implement the convention in her national laws. As shown above, the state of the law in Kenya is in a pathetic state seen from the view point of fulfilling those obligations, especially the wise use concept. It was, therefore, necessary that a comprehensive re-assessment of Uganda's national policy and law relating to wetlands be undertaken Bruce and McCarthy, 2000

Assessment of the ecological status of wetlands

Assessment of the ecological status of wetlands in human – dominated landscapes is critical for their effective management and protection. The values of wetlands are well documented, but the implications of their cumulative losses on national, regional and continental scales are not clearly understood. The following review indicates the kinds of impacts that could occur if we lose our wetland ecosystems. Wetlands are home to

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Creation of awareness of importance of wetlands

Wetland losses are not easily reversible thus protection and conservation of the remaining ones is of paramount importance. There has been some progress toward protection of wetlands, but the pace has been slow. In the 1960s, the international Biological Programme (IBP) initiated 10 project AQUA and the IUCN began project MAR. These were designed to increase protection of wetlands and to increase awareness of the importance of wetland and peat land ecosystems and the threats, to which they were exposed,

The Ramsar convention of 1975 came into force and it was one of the world's first International conservation treaties with 45 signatory states, of which Kenya is one of. Reports in 1987 suggested that the convention was short of funds, was breached by some of the signatories and did not include some crucial nations like the U.S. In practice, signatories also apparently tend to ignore the terms to which they are signatory a case the proposed study hopes to look into.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methods that were employed in data collection and analysis. It describes the research design, study area and population study sample, sample procedure, data collection methods, data analysis and limitations.

3.1 Research Design

The study used both qualitative and quantitative approaches. Qualitative methods was used wherever quantifiable methods were inapplicable. Quantitative methods was used in getting rates, percentages tabulated information and charts.

3.2 Study area and population

Kisumu county is located in coordinates $0^{\circ}15'S$ $34^{\circ}55'E$. Kisumu County has a population of 332,024 with urban population being 194,390. The county has three constituencies namely Kisumu Town East, Kisumu Town West and Kisumu Rural constituency. The main economic activities include: fishing, subsistence agriculture and trade hence majority are business men and women. Inhabitants are majorly the Luo.

3.3 Sample Size and sample selection

The research employed a purposive sample selection method to identify respondents. These enabled the researcher to get appropriate data.

The respondents used environment officer, students and the local community members. Besides systematic random sampling also enabled in the obtaining of data from the community.

3.5 Data Collection methods

The study employed both primary and secondary data collection methods. The primary data collection methods which was used was questionnaires and interview guide.

3.5.1 Questionnaires

For this case, the researcher was provided with a set of well typed closed and open ended questions which was answered through writing by the selected group of people who practice wetland agriculture. The questionnaires were clear, easy to understand and very simple language was used to avoid giving the respondents hard time while attempting to answer the questions. The researcher used questionnaires in preference to other methods of data collection so that the respondents would be free in answering the questions. The questionnaires targeted the local community and environmental officers.

3.5.2 Interview guide

For this case the researcher used a set of well typed open ended questions which were directed to the environmental officers in the office of wetlands and water resources with regard to wetland rehabilitation and conservation. This method gave the researcher a chance to personally engage the environmental officers on issues of wetland agricultural production and make a comparison with other agricultural productions.

3.5.3 Observation method

This enabled proper understanding of behavior patterns of people who encroach wetland resources. This method acted as a physical technique for suggesting measures for improvement in the context of wetland conservation and sustainability.

3.6 Data analysis

This method involved the use of physical eyes in obtaining data for example the economic activities. This involved the organization, interpretation and coding of the data that the researcher obtained from the research. Data was analyzed appropriately with facts and figures arranged in chronological order. It was organized in frequencies, percentage and averages out of the information obtained from both secondary and primary data collection.

3.7 Limitation of the study

There were difficulties in getting exhaustive information from the respondents since they were unable to give out all the information due to suspicion. For example issues'

regarding wetland production and its effects on the ecosystem as it is very sensitive. The respondents mistook the researcher for a detective.

Data collection was difficult for both the respondents and the researcher in the rainy season as it became inconveniencing to go to the field.

Financial drawbacks negatively affected the research activities on many fronts. In the process of data collection, it was expensive in terms of transport to travel to the various places to conduct interviews and distribute the questionnaires. Hence the limited number of places the researcher visited and as a result this affected the quality of research.

Producing Questionnaires which extensively covered the area of study was expensive since the researcher had limited funds. This limited the quality of information solicited.

There were other challenges that the reporter came across like language barrier, irrelevant answers, failure of respondents to reply the questionnaires, sunny seasons and failure of companies to give out files for factual and recorded data. Some did not even have such records.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter deals with presentation and discussion of the information gathered from various sources. The study focused on Koniala wetland in Kisumu county, the research study used 40 respondents. The discussion was done in the context of the study objectives which included: factors that promote wetland agriculture, effects of agriculture on wetlands and the practical solutions that could limit wetland agricultural production. The researcher presented the findings systematically according to each section of the research questions which guided the study.

4.1 Demographic characteristics of respondents

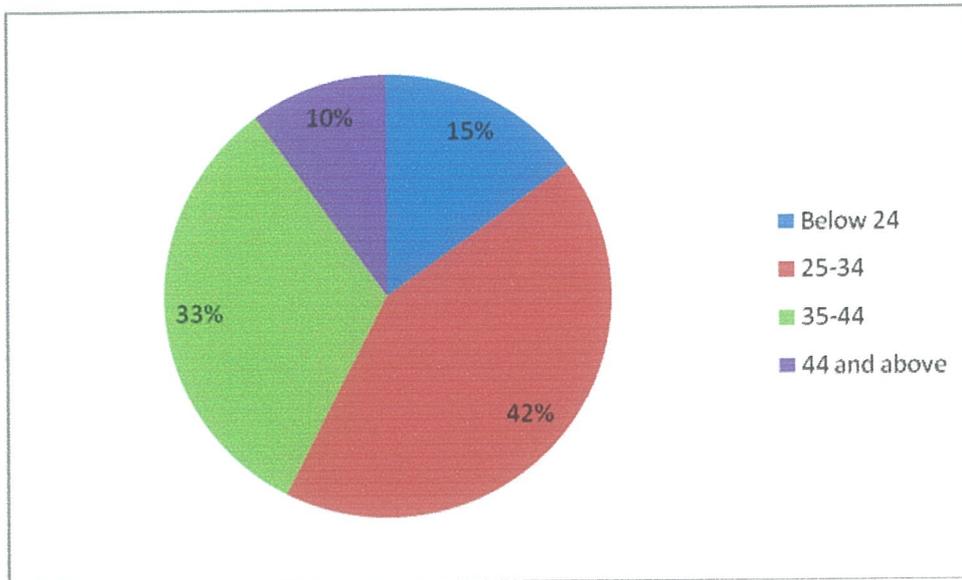
The research study came in contact with 40 respondents and demographic characteristics of respondents observed included: age class in years, gender, marital status, level of education and occupation as shown in the table below.

Table 1: Showing Age of the respondents

Age class in years	Frequency	Percentage (%)
Below 24	6	15
25-34	17	42.5
35-44	13	32.5
44 and above	4	10
Total	40	100

Source: Field research

Figure 1: Showing Age of the respondents



Source: Table above

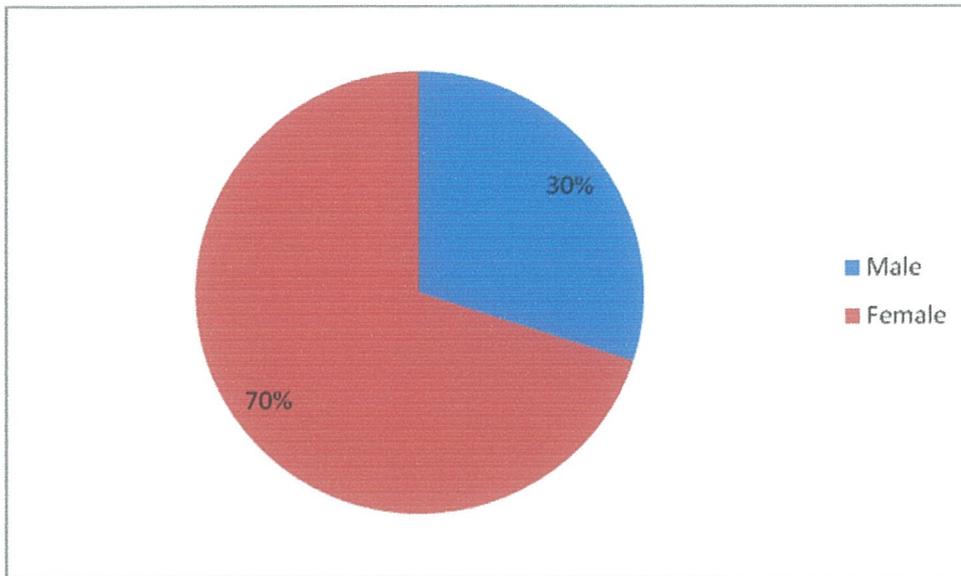
The study indicates that most respondents are between the age of 25-35 years which accounted for 42.5%. The age of 44 and above had less respondents as compared to others because most aged people migrate to the rural areas after retirement. The age below 24 is mainly composed of college students and secondary school students who were in boarding schools and other colleges therefore the turn up was low which accounted for 15%

Table 2: Showing gender of the respondents

Gender	Frequency	Percentage %
Male	12	30
Female	28	70
Total	40	100

Source: Field research

Figure 2: Showing gender of the respondents



Source: Table above

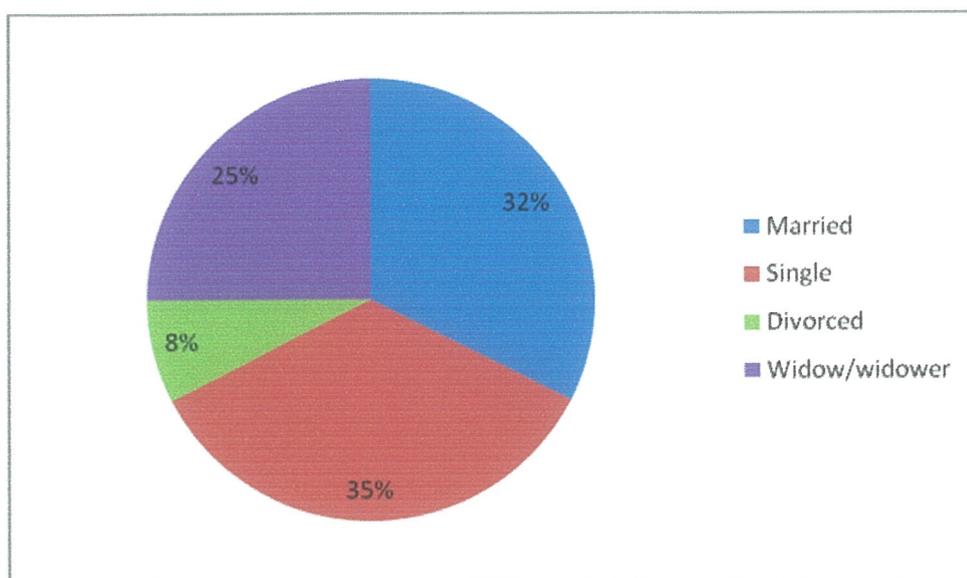
The study indicates that 70% of the respondents were female while 30% of the respondents were male. Women were easily available because of the role in taking care of children and performing farming activities. The male respondents performed other duties such as grazing of animal herd and fishing in order to get income for survival. Both the male and female need to be encouraged to carry out sustainability in their area of specialization.

Table 3: Showing Marital status

Marital status	Frequency	Percentage %
Married	13	32.5
Single	14	35
Divorced	3	7.5
Widow/widower	10	25
Total	40	100

Source: Field research

Figure 3: Showing Marital status



Source: Table above

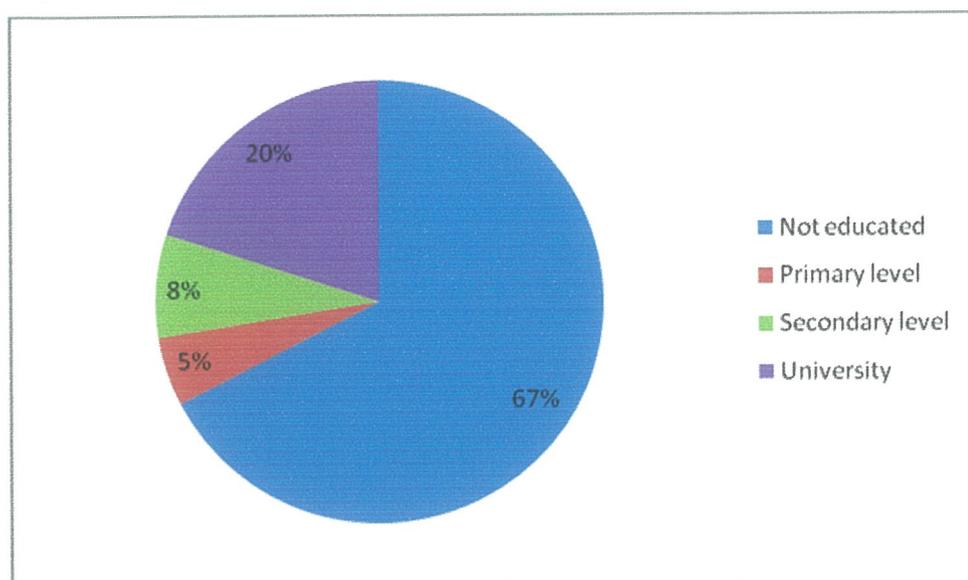
The study indicated that 35% of the respondents are single 32.5% of the respondents are married which indicated the likelihood for a population increase. 10% of respondents are either widowed or are widows. The majority of the respondents are dependant of wetland agriculture for their survival. These women need to be supported by NGOs, government and donor agencies for them to be able to provide education, food and medical facilities to their families.

Table 4: Showing level of education

Level of education	Frequency	Percentage (%)
Not educated	27	67.5
Primary level	2	5
Secondary level	3	7.5
University	8	20
Total	40	100

Source: Field research

Figure 4: Showing level of education



Source: Table above

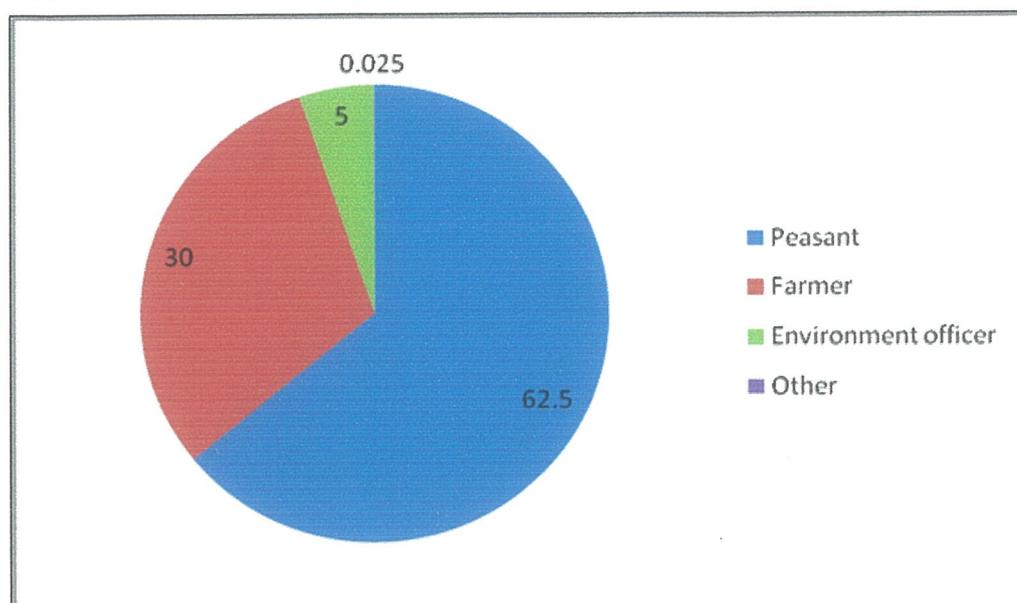
The study indicated that 67.5% of the respondents are not educated which clearly portrays for a need for the Kenyan government to promote free education and affordable university education 20% of the respondents are in University which implies that the Koniala community needs to be empowered on the value of education.

Table 5: Showing occupation of the respondents

Occupation	Frequency	Percentage (%)
Peasant	25	62.5
Farmer	12	30
Environment officer	2	5
Other	1	0.025
Total	40	100

Source: Field research

Figure 5: Shows the occupation of the respondents



Source: Table above

The study indicated that 30% of the respondents are farmers. These farmers use chemical fertilizers and pesticides. Besides the livestock trample on wetland soils during grazing hence compacting the soil. The pesticides tend to interfere with the water quality hence affecting the aquatic organisms. The community of Koniala is lucky to have one environment officer who can help NGOs and local government in reaching the community. The community members especially the 62.5% peasants should be allocated land and given jobs which will enable them to improve on their livelihood.

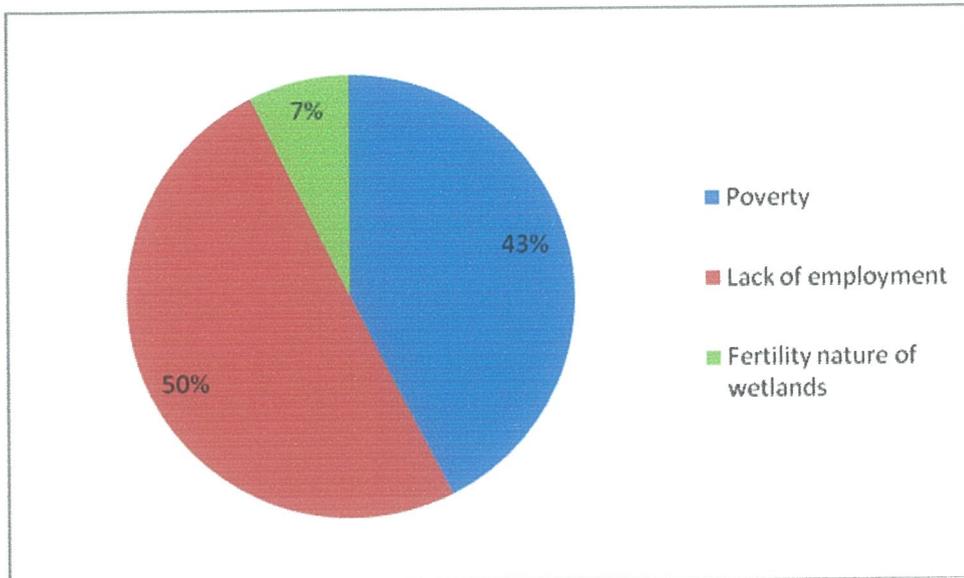
4.2 Factors that promote wetland agriculture

Table 6: Showing the rate of poverty

Factors	Frequency	Percentage(%)
Poverty	17	42.5
Lack of employment	20	50
Fertility nature of wetlands	3	7.3
Total	40	100

Source: Field research

Figure 6: Showing the rate of poverty



Source: Table above

The study indicated that 50% of the respondents are unemployed therefore depend on wetlands for agricultural production. 7.5% of the respondents believed in the fact that wetlands are naturally fertile therefore preferred to carryout wetland agriculture. 42.5% of the Respondents suggested that poverty as the factor that promoted wetland agriculture.

The respondents suggested that the government should provide them with employment opportunities to enable them meet their basic needs. The respondent also requested that the Kenyan government should provide sponsorship for the poor family whose children want to access higher education.

Poverty to a large extent accounted for the reason of wetland production. Living in poor environmental conditions influences people to engage in wetland production since they are faced with inability to meet basic needs for example food therefore they become vulnerable to food insecurity, thereby resorting to wetland agricultural production.

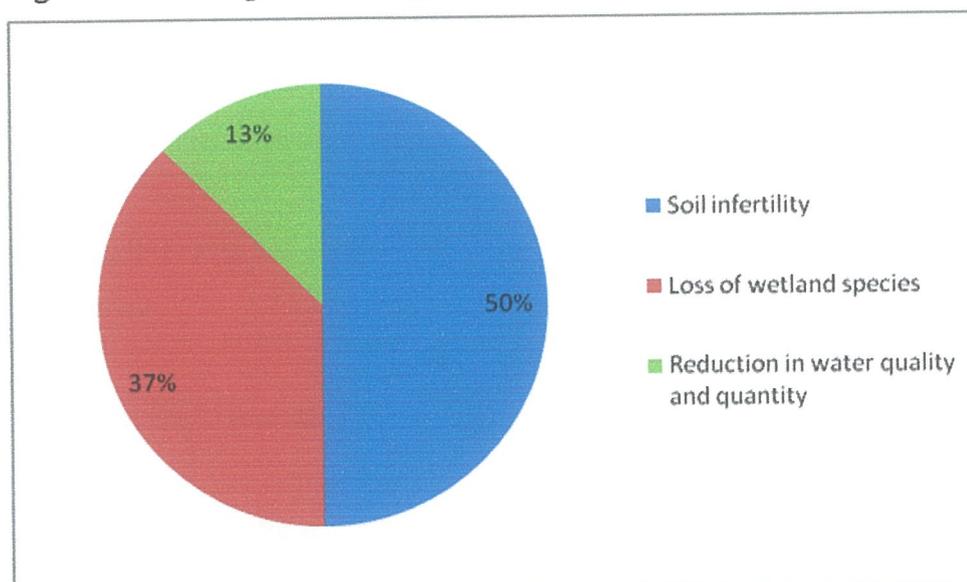
4.3 Effects of agriculture on wetlands

Table 7: Showing effects of agriculture

Effects	Frequency	Percentage(%)
Soil infertility	20	50
Loss of wetland species	15	37.5
Reduction in water quality and quantity	5	12.5
Total	40	100

Source: field research

Figure 7: Showing effects of agriculture



Source: Table above

The study indicated that 50% of the respondents stated that wetland agriculture promoted soil infertility

The research also found out that the presence of nitrate ions from nitrogen fertilizers in water masses encouraged the rapid growth of algae which eventually led to the reduction in the oxygen content in the water. As a result, aquatic animals like fish die hence resulting in the reduction in fish stocks.

The study indicated that 42.5% demanded that the Kenyan government through the vision 2030 should put proper policies that aim at wetland conservation. According to the researcher the government should come up with policies that ensure protection of wetlands from degradation, this can be through provision of free education and making it accessible to all. The government of Kenya has of late come up with a policy which ensures that all children are educated on environmental issues.

Besides, 32.5% of the respondents preferred that environmental education to be promoted at all levels of education. Awareness campaigns are also very necessary in addition to the application of the law on wetland projects. This is because most people seemed to have difficulties implementing the set laws due to long processes of trial, inability to access the needed information wetland assessment plan or sometimes the community not knowing who to consult when they need assistance. The government and NEMA should take a lead in these and ensure that people observe the existing laws seriously by taking stringent actions against those who degrade the wetlands.

It is also necessary that other forms of farming like irrigated farming should be introduced to increase productivity of those areas to avoid wetland production. The community should be involved with some form of other productive activity to enable them generate income to sustain them and their families. They can also be taught on various issues of sustainable agro-production through seminars to enable them use what they have to get what they don't have. The community should also be taught effective means of fishing to avoid dubious fishing methods to avoid the community resorting to wetland encroachment.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter deals with the conclusions and recommendations.

5.1 Conclusion

The conclusion was made in line with the various themes of the study and was based on the objectives and findings of the study

The study reveals that wetland Agricultural production is real in Kisumu County and it is a complex practice and is contributed by a number of factors such as fertility nature of wetlands, lack of employment and poverty.

Some practical solutions need to be undertaken to ensure that the problem is dealt with. The government and other stakeholders can play a leading role in this but more effort is needed. In most cases the practice goes undetected in many areas due to poverty and illiteracy level.

5.2 Recommendations

Purchase of wetlands by the government

The government should purchase all wetlands' this should be done by the government and establish wildlife refuges, sanctuaries or conservation areas. The protection of wetland and its natural resources in its natural state would protect them from human activities that would destroy their functions. Once they have been set aside, they remain in their best state and do not become subject to lobbying efforts by private citizens who want to use wetlands for private purposes.

Economic initiative

The government should provide economic initiatives to private, and owners and industry to promote wetland preservation i.e. wetland preservation i.e. wetland owners who sell or donate them to government agencies or qualified organization that can claim the quality of land as a charitable organization. The government can also create economic discentive to wetland destruction, such as "swamp buster" provisions of

written into legislations with intention to discourage further conversion of wetland into farmland.

Regulation of wetland is also important for example putting some requirements of getting a permit to use wetlands and that failure to obtain such permits or to comply with its terms results into civil or criminal sanctions. The legislation should also criteria of permitting projects in wetland.

The government should also establish office of wetland protection with charge of providing leadership to a broad based national effort to protect wetlands.

Private parties

Private protection strategies in addition to government action should also take part in wetland conservation. Because private land owners own many of the wetlands in the country, they are in a key position to determine future of wetlands under their control. Whether or not they actually own these wetlands, citizens can actually help by supporting a number of wetland conservation policies/activities as there are a number of opportunities for citizens, corporations, and government agencies to work together to slow rate of wetland loss and improve quality of wetland remaining. Some of the options include;

Seeking compatible use

Rather than drain/ fill wetland for agricultural production, there should be a competitive and a compatible use involving minimal wetland alteration like water fowl production, hunting and trapping leeks and fish farming especially mud fish commonly found in wetland along the lake.

Select upland sites for development project rather than wetlands and avoid wetland alteration or degradation.

Supporting various wetland conservation practices by private and public agencies

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APPENDIX 1
QUESTIONNAIRES TO THE LOCAL COMMUNITY

Dear respondent

I am Kerubo Mercilline pursuing a bachelors in Environmental management, final year. I am carrying out a research on the topic “effects of agricultural production on wetlands: a case study of Koniala Wetland in Kisumu county Kenya”.

The purpose of this study is to gather data on the effects of agricultural production on wetlands in Koniala wetlands in Kisumu county of Kenya.

Precisely, your response will be treated with confidentiality and the information obtained will strictly be for educational purposes.

Tick one or write the relevant information in the space provided.

Bio Data

1. Age

- a) Below 24 years
- b) 25-34 years
- c) 35-44 years
- d) 44 and above

2. Sex

- a) Male
- b) Female

3. Marital status

- a) Married
- b) Single
- c) Divorced
- d) Widow /widower

4. Education level

- a) Not educated
- b) Primary level
- c) Secondary level
- d) University

5. Occupation

- a) Peasant
- b) Farmer
- c) Environment officer
- d) Other (specify).....

SECTION A

Factors that promote wetland agriculture

1. What is a wetland?

.....
.....

2. What is wetland agriculture?

.....
.....

3. Why do you prefer farming on wetlands

- a) They are fertile
- b) Availability of water
- c) Easily accessible
- d) Other (specify).....

4. What factors have promoted wetland agriculture?

- a) Poverty
- b) Economic disparity
- c) The fertility nature of wetlands
- d) Introduction of new crops
- e) Other (Specify).....

5. Have you ever practiced wetland agriculture?

a) Yes

b) No

SECTION B

Effects of agriculture on wetlands

1. Do you know of any effects associated with wetland agriculture

a) Yes

b) No

If yes, what are the effects?

.....
.....

2. How has agricultural activities contributed to the fish stocks of Koniala wetland?

.....
.....

3. What is the effect of wetland agriculture on the dams of Koniala wetlands?.....

.....

4. What are the common effects associated with wetland agriculture?

.....
.....

SECTION C

Practical solutions that could limit wetland agricultural production

1. Do you know of any practical solution that can limit wetland agricultural production?

a) Yes

b) No

If yes, what are the practical solutions?

.....
.....

2. What are the importance of wetlands?

.....
.....

3. Does the government implement policies aimed at protection of wetlands?

.....
.....

THANKS FOR YOUR MAXIMUM COOPERATION

APPENDIX 2:
INTERVIEW GUIDE FOR ENVIRONMENT OFFICER

1. How many active projects of wetland conservation do you have in Koniala?

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

2. What major activities are conducted by Millennium Villages Project as an NGO in Koniala?

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

3. What major challenges do you face as the office of wetlands and water resources?

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

4. What government policies have been put in place to ensure wetland resources are conserved?

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

5. Is there any research that has been conducted on wetland conservation?

(a) Yes

(b) No

If yes, how has it impacted on wetland conservation?

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

6. How has poverty as a factor promoted wetland agriculture?

.....
.....

7. How has wetland agricultural production led to depletion of wetland species?

.....
.....