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SCHOOL OF THE BUILT ENVIRONMENT

DEPARTMENT OF URBAN AND REGIONAL PLANNING

**LAND USE STRATEGIES FOR SUSTAINABLE WETLAND
DEVELOPMENT AND PROTECTION: A CASE STUDY OF
YALA SWAMP**

FREDRICK OCHIENG OKECH

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the Requirements for the Award of the Degree of Masters of Arts in Planning

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Declaration

This research study is my original work and has not been presented to any other examination body. No part of this research should be reproduced without my consent or that of University of Nairobi

Signed: _____ Date: _____

Fredrick Ochieng Okech

B63/70005/09

(Candidate)

Approval

This research project has been submitted with my consent as Department of Urban and Regional Planning Supervisor.

Signed: _____ Date: _____

Dr. Fridah Mugo

(Supervisor)

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Dedication

This research is dedicated to the departed environmental conservation icon Professor Wangari Muta Maathai

"We lived in a land abundant with shrubs, creepers, ferns and trees ... Because rain fell regularly and reliably, clean drinking water was everywhere. There were large, well-watered fields of maize, beans, wheat and vegetables. Hunger was virtually unknown." From her article "Planting the future", The Guardian, 16th February 2007.

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Abstract

Kenya has a wealth of wetland ecosystems that support diverse and unique habitats. These wetlands provide numerous ecological goods and services but are under tremendous stress due to rapid urbanization, industrialization and agricultural intensification; manifested by the shrinkage in their areal extent, and decline in the hydrological, economic and ecological functions they perform. Yala swamp, the largest fresh water wetland in Kenya measuring about 17,500 ha supports a large biodiversity and is a source of livelihoods to communities around it. The aim of this study was to establish the current utilization of the wetland, the effects of the utilization on conservation and to explore sustainable land use strategies for deployment at Yala Swamp to safeguard it from negative impacts of development and associated human activities. Data and information were obtained from primary and secondary sources through field survey in the Yala Swamp wetland, in which 90 households drawn from two locations bordering the swamp in Bondo and Siaya sub-counties were interviewed. Interviews were also administered to local community leaders, selected key informants in the Siaya County Government and Kenya Wildlife Service as well as officers from Dominion Farms. The research instruments included questionnaires, Key Informant Interviews (KII), direct observation and, lastly, Focus Group Discussion (FGD) with two groups representing the two aforementioned counties. From the study, it is evident that Yala Swamp is the primary source of livelihood to the surrounding communities. They rely on it for a variety of ecosystem services such as fish harvesting, farming, papyrus extraction for mat making, livestock grazing amongst others. However, evidence on the ground such as land degradation, water pollution, encroachment and attendant conflicts shows clearly that continuous unplanned utilization of the wetlands' resources is a great and present threat to the existence of the fragile ecosystem. The study suggests a raft of land use strategies to bring order in access and utilization of the resource which in turn should ease the current pressure. These include development of land use plan whose outcome would be zoning of land for specific uses, regulation of intensity of use, formulation of legal and administrative instruments to support the plan; completion of survey of the swamp to define boundaries with the surrounding community and stem encroachment; compulsory acquisition of surrounding lands to create a buffer around the swamp; land exchange programme in which less ecologically sensitive parcels elsewhere are exchanged with private land near the swamp; and finally, the government through Kenya Wildlife Service to re-examine the process that led to the gazettment of a section of the swamp and come to a common understanding with the community.

Key words: Wetlands, Land use, Strategies, Sustainable, Yala Swamp, Kenya.

Abbreviations and Acronyms

NEMA	National Environment Management Authority
EMCA	Environmental Management and Coordination Act
EIA	Environmental Impact Assessment
KWS	Kenya Wildlife Service
MEA	Millennium Ecosystem Assessment
SDGs	Sustainable Development Goals
DPSIR	Driver Pressure State Impact Response
FAO	Food and Agriculture Organization
UN	United Nations
LBDA	Lake Basin Development Authority
FGD	Focus Group Discussions
NGO'	Non-Governmental Organizations
CBO's	Community-Based Organizations
WAPC	Western Australian Planning Commission
SEA	Strategic Environmental Assessment
CBNRM	Community-based natural resource management

Definition of Terms and Variables

Wetlands: Areas which are marshy, fen, peat land or water both artificial or natural, seasonal or permanent with water that is flowing or static, fresh, brackish or salty including areas of marine water the depth of which low tides does not exceed 6 metres.

Policy: is a principle that guides decision making and helps achieve rational outcome(s).

Conservation: is ethical use, allocation and protection of resources. The primary focus is on maintaining the health of the natural world; fisheries, habitats and biological diversity.

Household: Primarily the residential unit which economic production, child rearing, inheritance and shelter are organized and carried out.

Goals: Long-term aims to be accomplished.

Objectives: Concrete attainments that will be after following laid out steps.

Land Use: The management and modification of either natural environment or wilderness into build environment such as settlements and semi-natural habitats such as pastures arable fields and managed woods.

Strategy: A well laid out plan of action or policies designed to help achieve a major or overall aim.

Sustainable Development: development that meets the current needs without compromising the ability of future generations to meet their own needs.

Wise use of wetlands: is the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development.

Ecological character: is the summation of biological, physical and chemical components of the wetland ecosystem, and their interactions which maintains the wetlands and its products, functions and attributes.

Ecosystem services: are the benefits people obtain from ecosystems. These includes provision of services such as food and water, regulation services such as flood control,

cultural services and supporting services. The concept of “ecosystem goods and services” is synonymous with ecosystem services.

Ecological integrity: is a condition of ecological safety that ensures access to sustainable flow of ecosystem services needed by local communities to meet their basic capabilities.

Institutions: are social arrangements that shape and regulate human behavior, they have some degree of permanency and purpose, and transcend individual human lives and intentions and are often referred to as rules of the game in society.

Organization: refers to formalized institutionalized arrangements that have a structure and have defined roles.

CHAPTER I

INTRODUCTION

1.1. Background of the Study

Second to tropical rainforests, wetlands are highly productive ecosystems. The (Ramsar Convention, 1991) has adopted a very inclusive definition thus:

“...wetlands are 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 salty, including areas of marine water the depth of which at low tide does not exceed six meters.” (Article 1.1); and “may incorporate riparian and coastal zones adjacent to wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within wetlands” (Article 2.1)

The Convention on Wetlands which was signed in Ramsar, Iran in 1971, is an Intergovernmental Treaty which provides the framework for both national action and international cooperation for the conservation and wise use of wetlands and their resources. Currently there are 162 Contracting Parties to the Convention, with 2,040 wetland sites, totaling to 193 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance. (GoK, 2008) (Ramsar Convention, 1991)

Wetlands perform many functions that maintain ecological integrity of the systems. They also help in providing goods and services, (Ten Brink P., 2012). The functions and benefits that wetlands provide are very important for the general public as they support tourism, agriculture, industry and biodiversity conservation, cultural and economic activities.

Kenya has a variety of wetlands stretching from the coastal and marine wetlands to the inland freshwater lakes, dams, rivers and swamps as well as the saline lakes of the Rivi Valley system, the constructed wetlands in the irrigation schemes, sewerage treatment systems, mountain bogs, glacier lakes and peats. Some of the wetlands are

recognized as important conservation areas like National reserves, National parks, Ramsar sites World Heritage sites and Important Bird Areas.

Besides being biodiversity hotspots, wetland resources are equally crucial for livelihood, income generation, and well-being of communities. Kenya having an agricultural based economy has majority of her people deriving their livelihood from various form of agriculture. Different communities employ different forms of land use based on their social-economic needs and cultural practices. However, weather patterns, soil fertility, ecological and levels of social development are factors that influence land uses.

However, despite the diverse benefits that wetlands provide, lack of effective management has led to their continued degradation that includes unsustainable activities such as converting wetlands into agricultural and grazing lands, using them as waste disposal sites, and overexploitation of the natural resources. The UN Millennium Ecosystem Assessment (MA) determined that degradation of the environment is more prominent in wetland systems than other ecosystems on earth. They are least understood and are heavily abused (Maltby, 1990). In fact, until recently, wetlands that were not used directly for agriculture were treated by many with contempt as wastelands. This contempt has resulted in the loss of many areas of wetlands over the years (Gosselink & Maltby, 1990). It is estimated that over 1.6 million square kilometers of wetlands had been drained prior to 1985. Three-fourths of this were in the temperate regions (L`vovich, 1990).

The government of Kenya appreciates the importance of wetlands and their contribution to her gross domestic product. Kenya ratified the (Ramsar Convention, 1991) and has since embarked on comprehensive reforms to address sustainable utilization of wetland resources. Kenya already has 6 designated Ramsar sites namely: Lakes Naivasha, Baringo, Elementaita, Nakuru, Bogoria; and Tana Delta. Other sites proposed for designation as Ramsar sites include: Yala, Sio-Siteko and Saiwa swamps.

Tropical wetlands as the case of Yala Swamp are known to be very productive providing the water and primary productivity upon which large numbers of animals and plant species depend on for their survival. They are also important location for plant genetic diversity and support large numbers of bird, mammal, reptile, amphibian, fish and invertebrate species. However, rapidly growing human population, especially in the sub-Saharan Africa, coupled with unsustainable exploitation, has led to a decline in wetland products especially fish. This is evidenced by increase in levels of poverty among the riparian communities as well as the unsustainable encroachment wetland ecosystems. This has resulted to a continuous drainage, pollution, overexploitation and other unsustainable uses of these resources (Okeyo-Owuor J.B, 2012). Conservation and sustainable use of biodiversity should contribute to eradication of poverty and not harm the livelihood of the poor communities in those areas. However, in developing countries including Kenya where poverty and food security are given very high priority than environmental conservation, wetland conservation then is difficult if local communities are not made to understand the value of wetlands (Wood, A., A. Hailu, P. Abbot, and A. Dixon., 2002).

In spite of many countries ratifying the Ramsar Convention, wetlands continue to be under great threat of being drained and reclaimed (Hassan R., Schole R., & Ash N., 2005). The study therefore, seeks to explore the challenges in maintaining and enhancing the beneficial services provided by wetlands in order to secure livelihoods, food, health, water and security; and ameliorate the negative impacts occasioned by land use change which is characterised by the wetlands despite the increased awareness about their importance and the need for their conservation.

1.2. Problem Statement

In Kenya, wetlands cover approximately 14,000km². This is (2.5%) of the surface area of the whole country (Crafter S. A., Njuguna S.G. & Howard G. W., 1992). This fluctuates up to 6% during the rainy seasons. Throughout the tropics, these wetlands provide important goods and services to local people. Wetlands are considered to be

important ecosystems; they contribute considerably to the national economy and rural livelihoods. Wetlands offer provisioning, regulating, cultural and supporting services.

Human activities in the Lake Victoria Basin (LVB) where Yala Swamp lies have accelerated the rate of ecological change and also increased the threat to the existing natural resources. In the last fifty years, wetlands in the LVB have been facing serious degradation problems and their ability to continue providing valuable ecological services is also threatened as stated by Kairu (2001) in his research on wetland use and impact of Lake Victoria, Kenya region. Despite the manifest utmost significance and value of Yala Swamp, there is increasing pressure on the swamp as the local community and large investors exploit it for crop production, biota extraction to ensure food security and secure employment in the area. The area is experiencing high population growth, low literacy levels, ecological stress, escalating poverty, and limited productive resource base (Kinaro Z. , 2008). The wetland is experiencing rivalry for access and control, and its utilization amongst multiple and contented uses by various stakeholders within the local community is eliciting user conflicts. The entry of large-scale investment in agricultural activities such as those carried out by Dominion Farms (K) Limited, has introduced more challenges to wetland conservation as issues of pollution have also arisen. And lately, it is reported that a second large – scale investor (Godavari Enterprises) with interests in large scale sugar production, will be moving into the wetland.

From literature, most studies carried out on Kenyan wetlands have laid a lot of emphasis on natural science. Some of the examples being; water quality, nutrient dynamics, aquatic ecology, fisheries, hydrology and catchment's modelling vegetation dynamics and the impacts of their utilization. However, they have not interrogated how land use planning and management can be used as a tool to minimize the negative utilization impacts, which this study seeks to do.

1.3. Research Questions

The research sought to answer the following questions:

- i. What are the dominant land uses of Yala Swamp?
- ii. What are the effects of current land uses on wetland conservation?
- iii. What are the suitable restoration and conservation strategies of Yala Swamp?

1.4. Research Objectives

- a) To establish the dominant land uses in Yala wetland;
- b) To determine the effects of current land uses on wetland conservation;
- c) To explore suitable restoration and conservation strategies based on current land use and the value attached to the wetland;

1.5. Significance of the Study

Previous studies on Yala Swamp have laid much emphasis on natural science. This means that there is no adequate information to help in the planning of the wetland. This study therefore sought to provide information that would be used to guide development and conservation of the Swamp.

1.6. Purpose of the Study

The purpose of the study is to collect and analyse information about access and use of the Yala Swamp ecosystem with a view to generating policy, proposals, procedures and systems that will assist in safeguarding the wetland. This is seen to result in the provision of guidelines and tools for land use professionals like physical planners, and decision makers to govern use of the wetland.

1.7. Scope of the Study

This study is intended to identify the land uses and effects of the different uses to which Yala Swamp is put. It also aims to identify suitable conservation strategies. The study seeks to summarize some of the descriptive information, as well as information from the historical record, in an attempt to understand the evolution of Yala Swamp. The work will be carried out within the Dominion Farms project area but will also include the stakeholders' residing around the swamp, as well as the

government agencies in the country: ministries of agriculture, health, environment, wildlife, water and irrigation, livestock and fisheries.

1.8. Limitations and Delimitations

Limitations

The following are the limitations the researcher anticipated in the study:

- i. Over-reliance on secondary data and goodwill of the inhabitants to participate in the study.
- ii. Limited geographical coverage due to the logistics required.
- iii. The researcher was not able to distribute and collect questionnaires alone.

Delimitations

The following are some of the delimitations in the study:

- i. The research used face to face interview to get a high response rate.
- ii. The researcher made use of research assistants.
- iii. This research used a representative sample selected randomly from the population.

1.9. Assumptions of the Study

This study assumes respondents of this study will be factual, truthful and give information that will be helpful in drawing conclusions and generalizations.

CHAPTER II

LITERATURE REVIEW

2.1 Overview

This chapter focuses on the published and unpublished information that can help bring out better understanding of wetland management. Also, the review focuses on global and national policy documents and legislations that have been formulated in an attempt to improve wetland management.

2.2 Sustainable Wetland Development

In the drive for growth in the economy, agricultural practices and development have continued to threaten wetlands and their biota. Major threats include drainage, clearing, filling and reclamation for cash crop production, building of roads, construction of dams or barrages for water storage, irrigation, flood protection, hydroelectric schemes, construction of waterways and irrigation channels, pollution by pesticides and fertilizer residue, overfishing, overgrazing by livestock and conversion to aquaculture ponds (Ojoyi, 2006).

The (Ramsar Convention, 1991) declared the wise use of wetlands to be “their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem.” Thus the wise use of wetlands will serve human interests and at the same time conserve natural values. It involves conservation of the ecosystems while ensuring benefits amongst the local communities especially the weaker section of the society on long-term basis. It also involves provision of maximum benefits to the people of the current generation who depend on these resources and at the same time keeping its potential for the future generations. The concept of wise use is closely related to the concept of sustainable development. The concept of wise use emphasizes on integration of economic, social and ecological dimensions in the management of resources (Jyoti P. & Hemant D., 2003).

In the development of wetlands, four aspects may usefully be considered:

- **Productivity** – the yield or income per unit of resource.
- **Stability** - the degree which productivity is constant in the face of small levels of disturbances caused, for example, by normal fluctuations of climate.
- **Sustainability** - the system's ability to maintain productivity in the face of a major disturbance such as unexpected drought, soil erosion or even new pest.
- **Equitability** – the distributive aspect of the system, how far agricultural products are shared among the community.

Therefore, wise use of any wetland may be high in stability, equitability and sustainability but low in productivity.

Natural resources can be managed and protected by three groups – national decision makers, the local community and conservationists. Strong guidelines are needed to realize sustainable wetlands development. Therefore, it is important for both large-scale investors and local individuals use wetlands wisely. There is also need for subsistence communities to be equipped to utilize and enhance wetland resources in a more sustainable way.

2.3 Land Uses in Wetlands

According to EPA (1994), wetlands are among the most productive ecosystems in the world compared to coral reefs and rainforests. They are also a source of substantial biodiversity in supporting numerous species from all the major groups of organisms – from the mammals to microbes. A more advanced understanding of conditions and benefits of wetlands require more elaborate information on the way people use and impact them. There are many wetland uses which include; water extraction, tourism, harvesting of native animals and vegetation, cultivation of land for agriculture and damming. Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. They are also a source of substantial

biodiversity in supporting numerous species from all the major group of organisms- from the microbes to mammals. A more advanced understanding of wetland conditions and benefits requires detailed information on the way people use and impact on them. There are many wetland uses that include; tourism, water extraction, harvesting of native animals and vegetation, cultivation of the land for agriculture and damming.

2.3.1 Tourism

In addition to providing crucial services such as food, water and energy, wetlands provide significant opportunities for tourism, which can in turn deliver economic benefits for the local communities and the sustainable management of wetlands. There is a trend among tourist of turning towards green forms of tourism, towards destinations that provide both wildlife and heritage (UNWTO, 2012). This in turn has the least damage in use of wetlands and this implies that no or very minor modification of its plants, animals or hydrology. Oram (1995), argued that strategies in management of ecotourism should attempt in moving ecotourism experience beyond mere enjoyment to a more active role that incorporates learning, attitude and behavioral change.

2.3.2 Water extraction and harvesting of native animals and vegetation

This includes hunting, fishing, livestock grazing, harvesting of herbaceous vegetation and harvesting of trees. These uses can be sustainable only if the harvesting does not exceed the rate of natural regeneration, ensuring water withdrawals are replenished adequately and no other changes such as pollution and diseases occur. Under such a scenario, other ecosystem services such as flood control and water filtration can be maintained. The wetland is a very important habitat for many fish species and wildlife. According to EPA (1994), wildlife and fish use wetlands to varying degrees depending on the species involved. While others live on wetlands for their entire lives, others require wetlands for a least part of their life cycle. Others use wetlands much frequently and generally for feeding purposes. Therefore, wetlands are very important as they provide both permanent and seasonal habitats, where food, water and cover are plentiful.

2.3.3 Replacing natural wetland vegetation with food, fibre, or tree crops

Such conversion generally lower species composition and the levels of biodiversity in a given wetland. The impacts of such uses on regulating services such as water purification, water regulation cannot be *a priori* and this depends on the specific location and circumstances. In certain cases, the regulating services are only slightly impacted and tend to stabilize after an initial disturbance phase. In other cases, they can be greatly affected (Hunt, R. J., & Anderson, M. P., 1997).

2.3.4 Removal of soil and plants for mineral extraction

In most cases, this entails excavating clay to produce bricks or complete destruction of wetlands to pave way for human settlements. As expected, the impact of such activities is also related to the magnitude of the use. These uses are the most destructive to wetlands and have negatively impacted the ecosystem services (Massachusetts Department of Environmental Protection, 2007).

2.3.5 Damming

According to Massachusetts Department of Environmental Protection (2007), wetlands are flooded by dams, as wetlands are found in places which are ideal for dam sites. While dams perform certain wetland functions (e.g. Water storage and sediment trapping), they however, do not perform other functions of wetlands well. Wetlands are often found in places which are ideal dam sites. Whilst dams perform certain wetland functions (e.g. sediment trapping and water storage) they do not perform other wetland functions well.

2.4 Effects of Land Use in Wetlands Conservation

2.4.1 Direct Impacts

The extent of the impact of land use on the wetlands is determined by the manner in which the wetlands are used and the scale on which it is done. Uses which provide good economic returns are not necessarily sustainable. Land-use activities e.g growing of food crops or damming water, often affect how wetlands function and what benefits it provides to the society at large (Hunt, 1997). In most cases, the effects are negative, such as when the wetland is disturbed in order to plant crops, the function of trapping sediments and holding the soil by the wetlands is reduced. This

therefore reduces the benefits of water purification and erosion control that society receives from the wetland (Hunt, 1997).

According to Hunt, R. J., and Anderson, M. P. (1997), impacts on wetlands results from both “off-site” activities in the wetlands surroundings (e.g. afforestation, mining and crop production) and from “on-site” activities at the wetland site (e.g. drainage, disturbance through cultivation, infilling and flooding by dams).

2.4.2 Drainage and the production of crops and planted pastures

Most of indirect benefits of wetlands are lost when wetlands are converted to cropland especially if the wetland is drained. Drained wetlands are less effective at regulating stream flow and purifying water since the drainage channels speed-up the movement of water through the wetland (Kyle, 2015). Drainage also increases the danger of erosion as water flow is increased thus increasing erosive power of the water. The hydrological changes which results from drainage have negative effects on the soil (e.g. there is reduced organic matter and moist levels, and sometimes there is increased risk of underground fires and increased of acidity due to the oxidation of sulphides to produce sulphuric acid (Kyle, 2015).

Kyale (2015) stated that soil is disturbed when plants are planted, when crops do not bind or cover the soils as well as natural wetland vegetation. Thus, erosion is less effectively controlled. This becomes a very serious problem in areas with high erosion hazards. Adding fertilizers and pesticides (which may leach into the water system) further reduces the effectiveness of wetland purifying water. The impact of cultivation can be minimized if practices characteristic of low input/traditional cultivation are followed.

2.4.3 Timber Production

Timber plantations have a high impact on the water storage function of wetlands since a lot of water is lost by the trees through transpiration (Sing, L., Ray, D., & Watts, K., 2015). Some trees such as eucalyptus trees use more water than other trees e.g. poplars, which lose their leaves during winter. Trees have a great negative effect on the habitat value of wetlands. The robustness of indigenous plants which are not

adapted to increased shading beneath the trees, is reduced and they are usually out-competed by the alien invasive plants. In South Africa there is law (Section 75 of the Forestry Act No 122 of 1986) which prevents planting of timber trees on wetlands.

2.4.4 Grazing of undeveloped wetlands by domestic stock

Grazing may have both negative and positive effects on the indirect benefits of wetlands. In wetlands which have some areas grazed short and other areas left tall, the diversity of the habitats is increased. In wetlands which are grazed short completely, there is decrease in habitat diversity. Heavy grazing therefore may cause valuable grazing species to be replaced by less productive and/or palatable species. Some wetlands easily erode when disturbed by grazing and trampling. The most easily eroded wetlands are the ones with unstable soil where water flows diffusely across the wetland and concentrates into a channel. In these situations, erosion can cause the channel to cut up into the wetland and dry it out destroying most of its value. Thus, grazing pressure should not be too high and cattle need to be kept away from these flow concentration areas (Agricultural Research Council- Animal Production Institute, 2013).

2.4.5 Mowing and harvesting of plants

Both mowing and harvesting of plants by hands tend to have less negative impact on the indirect benefits of wetlands than cultivation. Cutting plants has similar effects to grazing and generally increases diversity of habitats, as long as mowing and cutting is not done at once on an extensive area (Amer, 2013). However, mowing and harvesting can be harmful if done when the animals are still breeding. In mowing, the machines used for cutting may also disturb the wetland soil increasing the danger of erosion. This would not be the case if hands were used instead of machine to harvest and mow. Harvesting must also be done on a sustainable basis if we are to continue benefitting from the wetland plants. If harvesting is done beyond the resource's capacity for renewal, then resource degradation is bound to occur and the benefits derived by the users will be lost (Amer, 2013). Plants should therefore not be harvested more than once a year and the harvested areas should be rested for at least a

whole year at least every third or fourth year (Crafter S. A., Njuguna S.G. & Howard G. W., 1992)

2.4.6 Fishing and Hunting

The number of animals hunted or caught should obviously not be allowed to exceed the capacity of the population to renew itself for fishing and hunting to be sustainable. If the number of animals hunted or caught is too high then there will not be enough animals left to reproduce and replace the once removed. Consequently, the value of the wetland to continue providing these resources will be reduced (Hunt, 1997).

2.4.7 Burning

Wetlands are burnt for various reasons: to improve grazing value for livestock by removing old dead material and increasing productivity; to improve the habitat value for wetland dependent species; to assist in alien plant control; and to reduce risks of run-away fires (Kotze, 2010).

Wetland fires mostly burn above-ground plants parts and most plants recover rapidly. Some fires also burn plant parts below the ground and the soil destroying the plants. This generally lessens the value of wetland (e.g. by increasing the risks of erosion). However, by burning away the upper soil layers, open water areas may be created. This may enhance the diversity of wetlands.

While burning has short term impacts such as killing some animals which were unable to escape, it also has many positive effects (e.g. controlling of alien plants and increased productivity of indigenous plants which increases the breeding success of certain wetland dependent animals (Gray, 2013). A number of factors will determine whether or not the overall effect will be positive or negative namely; timing, extent of the fire, frequency of the fire and the type of fire (determined by other conditions that were there at the time of the fire such as humidity and air temperature). Late winter burning is least likely to impact on breeding animals, since few species are likely to be breeding during this time. Early winter or summer fires on the other hand are more likely to affect breeding animals.

It is important that when a wetland area is burnt, the unburned areas are present nearby where animals can seek cover while the burnt area is re-growing (Kotze, 2010).

He argues that back fires (burning against the wind) tend to have a greater impact on the growing points of plants than head fires (burning with the wind). Burning when humidity is high and air temperature low generally has a lower impact than burning when humidity is low and air temperature high.

2.4.8 Damming

The habitat required by specialized wetland dependent species is mostly lost when wetlands is dammed. The vegetation that develops along the shoreline is limited in many dams due to sudden fluctuations in the water levels and the steep sides of the dam. According to Massachusetts Department of Environmental Protection (2007), when a series of dams occur along a stream, the cumulative effects that the dams have in reducing the stream-flow may be considerable especially where water is pumped out of the dams. The effects of dams are usually noticeable in the early wet seasons, when the dams are at their lowest levels after the dry season and retain the early flows.

2.4.9 Off-site Impacts

Most of the water in wetlands derives from the catchments surrounding them. Therefore, activities in the surrounding catchment strongly influence wetlands even when they are distant from the wetland. When carrying out assessments on the impacts of off-site land-uses on wetlands, there is need to know how to look at how these uses change the quantity and quality of water entering the wetland from the surrounding catchment and how this, in turn, affects the benefits and functioning of the wetland. (EPA, 1994).

Probably, the two most important land-uses affecting runoff quantity and timing from the wetland's surrounding catchment are damming and/or pumping of water (usually for irrigation) and afforestation (Hunt, 1997). As a general rule, trees use more water than natural grassland. In particular, eucalyptus uses the most water (sometimes

increasing water loss more than twice that of natural grassland) followed by the wattle and the pine trees. Sugarcane too increases water loss. The extra water used by trees, sugarcane or any other crop that has a high rate of transpiration would no longer reach the wetland. Dams reduce run-off through evaporation from their surface. Dam also allow for large quantities of water to be abstracted and used for irrigation, which greatly reduce runoff to the wetland (Hennemann., 2001).

The following land-uses affect the quality of runoff:

- a) Sewage works
- b) Industries
- c) Mining
- d) Crop production
- e) Intensive animal production
- f) human settlements with inadequate sanitation
- g) poorly managed grazing land

2.5 Suitable Conservation Strategies of Wetlands

There is an array of possible mechanisms for protection of conservation and landscape values that range from those that are statutory in nature to those that are non-statutory; i.e. policy or guideline oriented. (Lamsal, P., Pant, C. P., Kumar, L., & Atreya, K., 2015). There exists various options for both privately owned and publicly owned. A combination of mechanisms may serve to meet planning objectives.

2.5.1 Statement of Planning Policy (SPP)

SPPs are “higher order” planning instruments. In England, for example Planning Policy Statements (PPS) set out the government’s national policies on different aspects of planning in England. Public Policy Statement 9 or PPS9 sets out planning policies on different aspects of planning policies on protection of biodiversity and geological conservation through the planning system. SPP is a statutory instrument with the force of law that states the State’s policy about a matter of state interest. SPPs prevail, to the extent of any inconsistency, over local planning instruments but,

in hierarchy of State planning instruments, are subservient to regulatory provision and regional plans and are therefore to be read in conjunction with other relevant statements of national planning policy (Nicholls, D. 2012). The policies set out in this PPS need to be taken into account by regional planning bodies and authorities in the preparation of local development documents. They may also be material to decisions on individual planning applications (Department for Communities and Local Government, 2008).

SPPs are generally directed towards facilitating coordinated planning – to balance competing land uses at all levels of planning. They provide a flexible mechanism and can be prepared to manage critical environments or resources in specific locations, possibly in conjunction with the environmental protection policies (Department for Communities and Local Government, 2008). Implementation of such an SPP formulated for protection of conservation and land values relies partly on statutes contained in other legislations.

2.5.2 Local area planning strategies

Local Planning Strategy is a strategic planning tool that enables the Council and community to set out its vision for the locality and to establish short, medium and long term directions for sustainable land use and development. They can be incorporated into town planning schemes to add statutory force (Town of Bassendean Local Planning Strategy, 2008).

2.5.3 Zoning under the local town planning scheme

Zoning of land within a local planning scheme is a basic way of controlling land use and is a significant consideration in the assessment of subdivision, development and rezoning applications (Ironbark Environment , 2008). Under this mechanism, private ownership is retained. However, under the local town planning scheme, new land use and development control provisions can be incorporated for areas where there is a need for greater controls to meet landscape and conservation objectives. The scheme would specify those uses that are permitted and those that are discretionary (use which the local government may permit subject to compliance with particular

conditions). In this case, use of land that is lawful immediately prior to a new scheme coming into effect, but which do not conform to the amended scheme, may continue as nonconforming uses.

2.5.4 Special Control Area (SCA) provisions

These can be included in the local town planning scheme to identify areas which are significant and where special provisions in the scheme may need to apply. Special control areas are mechanisms that deal with specific issues, which may overlap zone and reserve boundaries. Special control areas can place requirements on the development of land that apply in addition to the requirements of the underlying zones and/or reserve, (City of Bunbury Local Biodiversity Conservation Planning Framework – Factsheet 5). Such provisions could target specific measures and requirements relating to, for example, development control, the process for referring applications to relevant agencies and matters that need to be taken into account in determining development proposals.

Reservation under the local town planning scheme is generally concerned with ensuring open space and public recreation areas. Regarding land with regionally significant open space and public recreation areas. Regarding land with regionally significant conservation and landscape values, reservation under a local government town planning scheme is likely if financial support for the acquisition of land is available from the state government, (Department of the Environment, Community and Local Government, 2013).

2.5.5 Conservation agreements and conservation (restrictive) covenants

Conservation Agreement is a voluntary commitment by a landowner to protect and conserve an area of their land with significant conservation value. The agreements are often known as voluntary conservation agreements because they may be initiated by individual landowners. However, it is an in-perpetuity agreement, and once entered into and registered on the land title, is binding on all current and successive land owners, (Department of Environment and Climate Change NSW, 2007). As flexible ‘tools’, they can be designed to reflect the individual needs of the landowner

and the conservation requirements of land. For example, they may limit the clearing and use of native vegetation and the subdivision and development of land with special values.

Conservation agreements may be made between a private landowner and a relevant State Government department or agency (e.g. CALM) under section 16 of the *Conservation and Land Management Act, 1984* in Western Australia. Under a statutory management agreement, the management would be undertaken by the Government department or agency. Under a contract management agreement, management is agreed between the two parties and may be undertaken jointly or by either party. Such agreements can be provided for the land to be used as a private conservation reserve, with or without public access – depending on the desired objectives of the parties. In New Zealand, one can enter into a covenant with the Department of Conservation, Queen Elizabeth II National Trust or local authorities. As the landholder, you retain ownership and the covenant is registered against the title, usually in perpetuity. Owners of Māori land can place areas under a *Ngā Whenua Rāhui kawenata*, (Reeves, 2011). Although this may be for protection in perpetuity, the terms and conditions can be reviewed every generation (not less than 25 years).

Not all land may qualify for conservation agreements and conservation covenants. Land qualifies for a covenant if it has conservation values that can be maintained in the long term and if its owners wish to protect the land.

The Federal Government of Australia introduced a scheme to provide tax concessions in respect of the management costs, to landholders who are required to or who voluntarily reserve land of conservation value for public good conservation reasons by placing a covenant on the land (Kelly & Stoianoff, 2005).

2.5.6 Subdivision for Conservation

In limited circumstances, the subdivision process may provide an opportunity to achieve conservation objectives. Subdivision is allowed only where there is no detrimental impact on the aesthetic, conservation or ecological values of the land and

where the objective of retention of these values of the land in perpetuity will be achieved. This assists the protection of environmental values, including remnant vegetation, and the implementation of catchment land management and rehabilitation through innovative subdivision design, such as consolidated cluster style development, that maximizes the long-term protection and management of these values, development and land management conditions, subject to the individual circumstances and merits of the proposal (Western Australian Planning Commission, 2010).

2.5.7 Land exchange

Existing public land with lower conservation and landscape values can be exchanged for privately owned land with higher conservation and landscape values (Fairfax, S. L., 2005). Land exchange is attractive for public agencies and units concerned about the amount of land under public ownership or with limited funding sources.

2.5.8 Acquiring land by purchase for inclusion into the public land stock

The State can acquire private land for re-inclusion in the public land category using the doctrine of eminent domain. Normally, this is done through negotiation with landowners. Acquisition of land for inclusion into a national reserve requires a suitable fund or government commitment to allocate funds via particular agencies. In Kenya the compulsory acquisition process is guided by the Land Acquisition Act Cap 295 Laws of Kenya. The Wildlife Management and Coordination Act, 2013 provides for the declaration of an area as protected land once acquired and owners fully compensated.

2.5.9 Revolving fund

The subject land would temporarily pass back to State ownership (i.e. a Government department or agency) after expiry of the lease before being re-sold to a private purchaser. The government department or agency would place a covenant on the title to the land before selling it – the purchaser buys the land knowing it has permanent conservation protection, (Department of the Environment, Community and Local Government, 2013). Subject to WAPC approval, the portion of a lot containing

conservation or landscape values may be created as a separate lot with covenants attached and subsequently re-sold.

2.5.10 Rate rebates (reduced local government rates)

Rate rebates are usually granted in exchange for a management agreement that binds the landowner to undertake specific active management such as weed and pest control or to cease activities such as grazing in certain parts of the property. Criteria can be set as environmental targets for landowners in exchange for rate rebates; for example, in Cape Town South Africa private property exhibiting sensitive ecological areas/features, identified by the City's Environmental Management Resources Department as such may be granted 100% rates rebate for the portion of land exhibiting these sensitive features provided that the land is either leased to the City for nature conservation purpose or there is a written agreement, approved by the City, for the conservation management of the relevant portion of land. Should privately owned property receiving the Conservation Land rebate be utilized in a manner that is detrimental to conservation purposes, all rebates granted will become repayable.

In Mitchell Shire, Victoria, for properties over 4 ha the 'targets' relate to weeds, feral animals, salinity, erosion and loss of native fauna and flora. Rate rebates can be used in conjunction with conservation covenants, which overcomes the disadvantage of rate rebates which is being that they do not run with the title of the land.

Proponents argue that using market forces, allows producers to choose between support innovations, production methods, and rewards those who exceed the standard, (Peter Davis et al).

2.6 Policies on Wetlands in Kenya

2.6.1 National land policy

The National Land policy (GoK, 2009) has a vision to guide the country towards a sustainable and equitable use of land. The land policy calls for immediate actions to addressing environmental problems that affect land such as degradation, soil erosion and pollution. For instance, the policy stipulates the principle of conservation and management of land based natural resources, the principle of protection and

management of fragile and critical ecosystems including wetlands and arid lands. The policy further calls for extensive overhauls to current policies and institutions in an attempt to address chronic land tenure insecurity and inequity. The National Land Policy designates all land in Kenya as public, private (freehold or leasehold tenure), or community/trust land, which is held, managed and used by a specific community. This land policy has thus been formulated to address the critical issues of land administration, access to land, land use planning, restitution of historical injustices, Environmental conservation, conflicts resolution, and unplanned proliferation of informal urban settlements, outdated legal framework, institutional framework and information management.

2.5.1.1. Implications of property regimes on wetlands management

As mentioned above the Policy designates all land in Kenya as Public, Community or Private. Most significantly, it identifies and guards customary rights to land. It also recognizes and protects rights to private land and provides for derivative rights from all land rights holding categories.

2.5.1.2. Public Land

Public land includes all the land that is owned by the Government and dedicated to a specified public use or availed for private uses at the Government's discretion.

2.5.1.3. Community Land

Community land can be referred to as land lawfully held, used and managed by a specific community. This therefore creates a strong system of land distribution regimes and a tenure system intended to preserve the asset base for both current and future generations. Traditionally communities see land and kinship in a genealogical map through which access to land is attained. Both individuals and families acquire rights to use the land in perpetuity, although only to effective utilization. The ultimate ownership (radical title) vests in the community.

2.5.1.4. Private Land

Private land refers to land lawfully held by an individual or other entity. It could either be under leasehold tenure or freehold.

i. Freehold Tenure

Freehold implies the largest quantum of land rights that an individual can be granted by the state. While it gives unlimited rights of use, abuse and disposition, it is subject to the regulatory powers of the State. In a country like Kenya such interests are held under the Land Registration Act (2012). This is the Act that replaced Registration of Titles Act (Cap 280).

ii. Leasehold Tenure

Leasehold involves derivation of rights from a superior title for a given duration, certain or can be ascertained and such rights are enjoyed in exchange for specific conditions which may include and not limited to payment of rent. Leasehold tenure provides a mechanism that is flexible for transacting rights in land and for land use control. It is a private contractual right subject to the conditions imposed by the owner and grants exclusive rights to the leaseholder.

Wetlands occur in all different categories of property. Wetland management is therefore closely related to the tenure system in place. For the wetlands that are in private property, their conservation and utilization is governed by the rights that private owners have over the land and how those rights are regulated.

In the regulation of private property rights the powers of eminent domain (compulsory acquisition) and the police power (development control) are two issues that have raised fundamental constitutional issues. These two are particular powers of Government which have not been exercised effectively or accountably.

The state has power to extinguish or acquire any title or other interest in land for public purpose, subject to prompt payment of compensation and is in the current constitution. This is referred to as eminent domain, or compulsory

acquisition. The Commissioner of lands exercises this power on behalf of the state. The Constitution allows a modified form of acquisition in the Trust Land case which may be activated by local authorities or by the President. This is known as “setting apart”. The laid down procedures for compulsory acquisition or eminent domain are either not adhered to or are abused leading to irregular land acquisitions. In addition, the local authorities and the President’s power to set apart Trust Land overlap.

The Police Power or development control is the power of the State to regulate property rights in land, and is derived from the State’s responsibility to ensure that the use of land is not injurious to the public interest. Hence, ‘police’ power seeks to limit the use of land in order to protect public welfare from any dangers that might arise from its misuse. In Kenya the ‘police’ power as an instrument of sovereignty is constitutionally derived. However, the Police Power has not been extensively used to control or otherwise regulate the use of land and to enforce sustainable land use practices throughout the country. Furthermore, the Police Power is exercised by various Government agencies whose activities are uncoordinated with the result that the attendant regulatory framework is largely ineffective.

2.6.2 National Policy Framework for Wetlands Management in Kenya

The government appreciates that there is need to involve more actors to ensure more integrated and harmonized conservation and management by the government and other affected key players. . The government has seen the need for a national policy framework. The Policy seeks to ensure that the activities and the plans of the government and wetland stakeholders encourage conservation and sustainable/ wise use of wetlands. The policy also provides a framework for actions to improve institutional and organizational arrangements, address government policies and legislation, increase knowledge and awareness of wetlands and their values, review the status of and identify priorities for wetlands in a national context, and address problems at particular wetland sites.

Upon understanding of the importance of wetlands nationally and Kenya's obligation under the Ramsar Convention, Kenya worked on development of this Policy. This policy factors the broader national environmental frameworks, particularly the Environment Management and Coordination Act (EMCA) 1999, the country's premier framework environmental law, the Water Act 2002, the Water Policy and the Forest Policy 2007. The policy clearly spells out eight purposes to achieve its aim. These are:

- i. Establish a legal framework and institution that is efficient and effective for integrated management and wise use of wetlands that provides an environment for participation for all stakeholders.
- ii. Improve and maintain functions and values resulting from wetlands to protect biological diversity and enhance important processes and life-support systems of wetlands.
- iii. Encourage, education, communication and public awareness among stakeholders encouraging and facilitating participation in wetland conservation.
- iv. Perform demand driven research and monitoring on wetlands. The aim being to improve scientific information and knowledge base.
- v. Improve capacity building for personnel involved in conservation management of wetlands and within relevant institutions.
- vi. Establish an information management systems on wetlands nationally and establish a database including tools and packages to targeted groups.
- vii. Encourage and promote innovative planning and integrated management approaches towards conservation and management of wetlands in Kenya
- viii. Promote partnership and collaborations at regional and international levels for the management of trans-boundary wetlands and migratory species.

2.5.2.1. Principles, Goal and Objectives

The challenges facing and affecting wetlands are impacting negatively on their ability to function at optimal levels, thereby hampering their sustainable use and

contribution to socio-economic development. To address these challenges, the following principles have directed the National Wetlands Conservation and Management Policy.

- i. **Wise use:** Wetlands have significant contribution to the health and well-being of Kenyans, therefore, wetlands must be incorporated into national economic planning for sustainable development, environmental management and wealth creation
- ii. **Precautionary principle:** the precautionary principle will apply where there is inadequate information for decision making. Implementation of measures to minimise/ manage wetland degradation should not be prevented due to lack of full scientific information.
- iii. **Collaborative and participatory approach:** Wetland conservation and management approached in an integrated way should include government, local community, civil society, and stakeholders in the private sector at all levels.
- iv. **The global dimension:** the global dimension of environmental impacts of actions and policies should be recognised and considered.
- v. **Polluter pays principle:** Persons who pollute wetland environments should meet the cost of the pollution to resource users as well as meet the cost of cleaning them up.

2.5.2.2. Goal

The goal of the National Wetlands Conservation and Management Policy is to ensure sustainable management and wise use of wetlands. This will enhance sustenance of both ecological and socio-economic functions of wetlands for the current and future generations of Kenya.

2.5.2.3. Objectives

- i. Establish a legal framework and institution that is efficient and effective for integrated management and wise use of wetlands that provides an environment for participation for all stakeholders.

- ii. Improve and maintain functions and values resulting from wetlands to protect biological diversity and enhance important processes and life-support systems of wetlands.
- iii. Encourage, education, communication and public awareness among stakeholders encouraging and facilitating participation in wetland conservation.
- iv. Perform demand driven research and monitoring on wetlands. The aim being to improve scientific information and knowledge base.
- v. Improve capacity building for personnel involved in conservation management of wetlands and within relevant institutions.
- vi. Establish an information management systems on wetlands nationally and establish a database including tools and packages to targeted groups.
- vii. Encourage and promote innovative planning and integrated management approaches towards conservation and management of wetlands in Kenya
- viii. Promote partnership and collaborations at regional and international levels for the management of trans-boundary wetlands and migratory species.

2.6.3 National Environment Policy 2012

This National Environment Policy targets to deliver a holistic framework that provide guidance on the management of the environment and natural resources in Kenya. It further ensures that the linkage between reduction of poverty and the environment is integrated in all processes of the government and other institutions in order to realize sustainable development at all levels. The policy makes reference to wetlands and highlights their importance thus wetlands and freshwater ecosystems are basic essentials in the provision of environmental goods and services. Provisioning services include the retention and storage of water for agricultural, domestic and industrial use. Regulating services include modification of water flows (hydrological flows), both recharging and discharging groundwater resources and diluting or removing pollutants. Wetland supporting services of the hydrological cycle are vital for soil formation and soil retention and cycling of nutrients. The ecosystems also provide

habitats for a great number of species. This promotes biodiversity which eventually triggers the resilience and productivity of ecosystems. They are also important for recreation (e.g. Lakes Nakuru and Naivasha). They also have spiritual and inspirational roles amongst different cultures. It laments their degradation by impoundment, land use changes, excessive abstraction and pollution. The pollutants tend to accumulate in rivers, lakes and wetlands causing much damage to wildlife. As rivers run to the sea, pollutants also end up in coastal and marine ecosystems such as lagoons, estuaries and bays.

Environment Policy Statements

It lists Government intentions to protect wetlands:

- i. Develop and implement integrated wetland and water resources management strategies and action plans.
- ii. Promote and institutionalize payment for environmental services schemes to support catchment protection and conservation.
- iii. Promote sustainable use of freshwater and wetland resources and the conservation of vulnerable river and lake ecosystems through development and implementation of river basin management plans.
- iv. Develop a national wetland policy and regulations.
- v. Map wetland areas countrywide.
- vi. Develop and implement catchment-based wetland management plans for all Ramsar sites through a participatory process.
- vii. Ensure restoration of degraded wetlands, riverbanks and lakeshores and, where appropriate, promote and support establishment of constructed wetlands.

2.6.4 Draft National Wetlands Conservation and Management Policy, 2013

The goal of this policy is to ensure wise use and sustainable management of wetlands. This will enhance sustenance of socio-economic and ecological functions of the wetlands of Kenya for the benefit of both present and future generations. This is based on the principles and values of, among others, precautionary principle, wise

use, public participation, devolution and ecosystem based management, taking cognizance of the national and international cooperation.

This policy therefore sets out policy statements on how the Government plans to address challenges facing management and conservation of wetland with the following objectives:

- i. To establish an institutional and legal framework that is effective and efficient for integrated management and wise use of wetlands.
- ii. To enhance and maintain functions and values derived from wetlands in order to maintain ecosystem goods and services protect biological diversity and improve livelihood of Kenyans.
- iii. To promote communication, education and public awareness among stakeholders.
- iv. To improve scientific information and knowledge base on Kenyan wetland ecosystems.
- v. To strengthen institutional capacity on conservation and management of wetlands.
- vi. To promote innovative planning and integrated ecosystem management approaches towards wetlands conservation and management in Kenya
- vii. To promote partnership and cooperation at county, national, regional and international levels for the management of trans-boundary wetlands and migratory species.

2.6.5 Land Use Planning Bill, 2015

This bill seeks to give effect to Article 60, 66, 67, 68 and 261(1) of the Kenya Constitution 2010 and provide a legal framework for the planning, use, management, regulation and development of land and for connected purposes. Section 163(4) states that the National Land Commission may by notice of the Gazette declare a wetland as an important habitat or ecosystem for wildlife and cause its plans to be prepared and prescribe special conditions thereto.

Ramsar Convention

The government developed a national policy to address the wetland challenges, this was ratified by Ramsar Convention in 1971. Contracting parties are obligated to formulate and implement their planning so as to promote the conservation of wetlands this is according to article 3 of the Ramsar Convention.

2.7 Laws Governing Management of Wetlands in Kenya

In order to address the challenges facing wetlands in Kenya, the Kenyan government through various pieces of legislations has undertaken reforms aimed at conservation of new environmental resources including wetlands. The Constitution of Kenya reaffirms commitment to sustainable exploitation, utilization, management and conservation of the environment and natural resources and also ensuring that all the accruing benefits are shared equitably. Some of the legislations that have been enacted to this effect includes: Environmental management and coordination Act No.8 of 1999 (GoK, 1998), the Merchant Fishing Act of 2009, the Wildlife Conservation and Management Act of 1989, Forest Act of 2005, Fisheries Act (Cap 378) and the Water Act of 2002.

2.7.1 Constitution of Kenya 2010

The new constitution in chapter five though not expressly referring to wetlands provides for protection and conservation of the environment (natural resources) at large.

Section 69 of the Constitution states as follows:

1. The State shall—
 - a) Ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;
 - b) Encourage public participation in the management, protection and conservation of the environment;
 - c) Protect genetic resources and biological diversity;

- d) Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
 - e) Eliminate processes and activities that are likely to endanger the environment; and
2. Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

2.7.2 Environmental Management and Coordination Act, 1999

This is the framework environmental law governing management of the environment. Its purpose is stated as being “to provide for the establishment of an appropriate legal and institutional framework for management of the environment in Kenya...” The Act establishes the National Environment and Management Authority as the overall body with the duty of ensuring coordination in implementation of government policy and ensuring sound management of the environment.

This Act contains general principles and guidelines to ensure rational environmental management and thus promoting sustainable development of the country. These principles are useful for the management of all sectors of the environment, wetlands included.

Part V of EMCA deals with legal tools for the sustainable management of the environment and covers the protection of various components of the environment. Section 42 specifically contains provisions governing protection of wetlands. The section forbids the carrying out of several activities listed concerning wetland without prior approval of the Director General of NEMA, and approval of an EIA Report.

- Erection, reconstruction, placement, altering, extending, removing or demolishing any structure or part of structure on or under wetland;
- disturbing wetland or excavating, drilling, tunnelling;
- Introducing any animal both alien or indigenous in wetlands;
- introducing any plant or part of a plant specimen whether indigenous or alien, dead or alive in any wetland;

- Depositing substances that will or are likely to have adverse the environment effects on the wetland;
- Directing or blocking wetland from its normal or natural course; and
- Drainage of a wetland

EMCA requires an EIA to be carried out in situations where an activity being undertaken is out of character with its surrounding, any structure of a scale not keeping with its surrounding and major change in land use. The principle objective of EIA is to ensure that environmental considerations are incorporated into the planning, decisions and implementation of development activities. It assists in preventing, or where that is not possible, minimizing an activity's adverse impacts while maximizing its positive effects. By requiring an EIA to be carried out, the Act seeks to ensure that wetlands are protected and activities of the nature described above can only be carried out after a determination is made that they will not have adverse effects on the wetland. (UNISDR, n.d.)

The Act gives the Minister responsible for environment, power to, by a Gazette notice, to declare a wetland to be a protected area and impose such restrictions as he/she considers necessary to protect the wetland from environmental degradation. In the process of making the declaration, he should consider the geographical size of the wetland and the interests of the communities' resident around the lakeshore.

2.7.3 Physical Planning Act Chapter 286

The Physical Planning Act is an act of parliament whose principle purpose is to provide for the preparation and implementation of physical planning and the development of the country. The Act also regulates the physical planning and development in all parts of the country. It requires that before a development is undertaken, the proponent should make applications and get approvals for the same. One of the important functions of local authorities is the power to reserve and also maintain all the planned for open spaces, urban forests, parks and green parks according to the approved physical development plans. Although the section does not mention wetlands, it can be used by local authorities as a basis of reserving and maintaining wetlands as fragile ecosystems in cases where it is considered necessary.

The Act also discusses the powers of the Director of Physical Planning, the Commissioner of Lands and the responsible Minister in the process of approval and implementation of development plans.

In the process of designing and approving physical plans, the Act requires balancing of various interests. In cases where the local authority is of the view that the proposal for industrial development activities will have injurious impact on the environment, the Act calls for EIA to be carried out. In reliance of this provision and due to the unique nature of wetland ecosystems, EIA should be undertaken in all cases of proposed developments in a wetland. The development needs are then weighed against the environmental imperatives of the ecosystem.

2.7.4 The Water Act, 2002

This Act provides for the management, conservation, use and control of water resources and for acquisition and regulation of rights to use water; and to provide for the regulation and management of water supply and sewerage services. This Act has relevance for the management of wetlands in Kenya. The definition section of the Act clearly identifies the relevance of the Act to wetlands by including in its definition the term “swamp” which is the equivalent term for wetlands. According to Water Act (GoK, 2002), a swamp is defined as “...any shallow depression on which water collects either intermittently or permanently and where there is a small depth of ground water and a slight range of fluctuation either in the surface level of the water or of the ground water level so as to permit the growth of aquatic vegetation.

The Act deals with the ownership, control and use of water resources and also has provisions for the protection of water catchment areas. The institutional structure that it creates is also useful for the purposes of wetlands management. There is however potential for institutional conflict between NEMA through EMCA and legal stipulations under the Water Act. The Water Act empowers the minister to make rules for the better implementation of the Act. In reliance of these powers, there are draft regulations that, inter alia, seek to regulate the management of wetlands. Section 42 of EMCA on the other hand also empowers the minister in charge of environment to

make regulations for the management of EMCA. Arguments have been made that Water Act 2002 coming later after EMCA 1999 should prevail notwithstanding section 148 of EMCA.

2.7.5 The Wildlife (Conservation and Management) Act

This is the law that governs the protection, conservation and management of wildlife in Kenya. It is relevant to wetland management in Kenya due to the fact that after Kenya ratified the Ramsar Convention, it designated the Kenya Wildlife Service as the institutional focal point for the implementation of the Ramsar Convention. Operations of the KWS are governed by the Wildlife Act. This Act further empowers the minister to declare an area to be a protected area and accordingly to the Ramsar Convention, wetland sites of international importance can and should be declared protected areas to enhance their status and thus improve their conservation.

2.8 Information Gap

Most of the literature on Yala Swamp has dwelt on the socio-economic and ecological benefits of the wetland, the impact of human activities in and around the swamp on the wetland ecosystem; and ways of mitigating the negative impacts by use of sound environmental management plans. No study had looked at how land use planning could be employed as a tool to safeguard the wetland. This study was undertaken to examine the potential in land use planning as a tool to sustainably manage the Yala Swamp.

2.9 Conceptual Framework

Conceptual framework is the system of concepts, assumptions, expectations, beliefs and theories which support and inform a given research – the key part of research design. It is either a visual or a written product, it explains either graphically or in a narrative form the main things to be studied – the main concepts, factors or variables – and the presumed relationship between them. (Miles, M. B., & Huberman, M. A., 1994); (Robson, 2011).

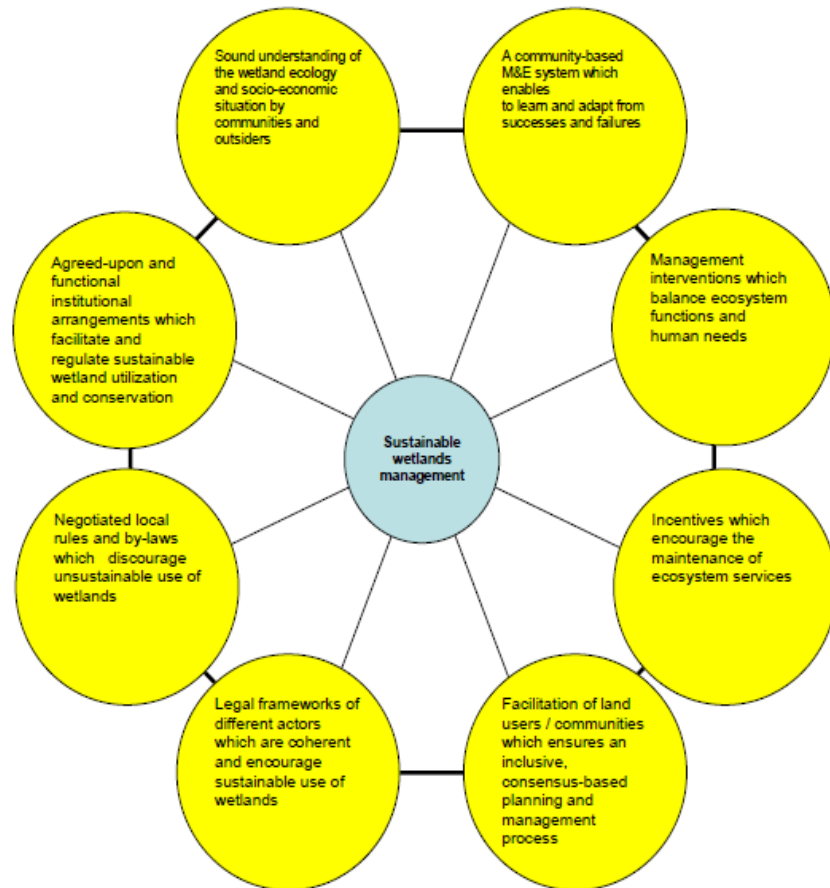


Figure 1: Conceptual framework for sustainable Wetlands Management

Source: Adopted from Edward, C., et al. (2012)

This framework is a guide for utilization and management of wetlands in particular those whose ecosystem services are used for livelihood purposes. It is important that a way be formulated on how to reconcile the value of ecosystem services that accrue to livelihoods and at the same time conserve these important resources in long term. The guide provides management solutions that are practical at stakeholder's levels; farmers and other users of natural resources, national management agencies and governments.

2.9.1 Description of pillars that frame sustainable management of wetlands

2.9.1.1 Pillar 1: Develop understanding by local community and external Stakeholders of the wetland ecology and the socio-economic situation process

For full understanding of the causes and dynamics of wetland change, understanding the relationships between wetland utilization, biophysical characteristics and socioeconomic factors is essential as it forms the basis for sustainable management of wetlands. The main purpose of obtaining information on wetlands is to improve the understanding by the community who most directly use wetlands and others to provide a basis for informed management decisions.

2.9.1.2 Pillar 2: A community-based monitoring and evaluation system which enables learning and support for adaptive responses from successes and failures

Community organizations need to be supported in developing and implementing programs to rehabilitate wetlands. This involves collection of baseline data and continuous monitoring in order to make ecologically sound management decisions which are based on knowledge of the success or failure of previous activities.

2.9.1.3 Pillar 3: Technical management interventions to balance ecosystem functioning and human needs.

Technical interventions refer to management of soils and water in wetlands. These two are vital aspects of sustainable utilization of wetlands. This pillar should guide the users on appropriate technologies and methodologies to be employed to ensure balance between productive use of wetlands and their conservation. Users of wetlands are also assisted to identify other options for livelihood that they can explore to utilize the wetland at the same time ensuring protection of the ecosystem.

2.9.1.4 Pillar 4: Legal frameworks of different actors and levels which are coherent and encourage sustainable use.

Sustainable management of wetlands is determined by having in place enforceable mechanisms in form of legal framework which regulate how wetlands should be used. The legal framework should reflect both characteristics of the community and the society in which the wetlands are found as well as the physical characteristics of the wetlands. This means appreciating that wetlands are used by different actors (for example women, youth, men), for different uses such as cultivation, domestic water

supply and grazing of livestock. These uses should be reconciled among the actors and in relation to other ecosystem services that wetlands provide.

2.9.1.5 Pillar 5: Locally negotiated rules and by-laws which discourage unsustainable use of wetlands

Rules and by-laws formulated by the State relating to wetland use technically cannot by themselves prevent un-sustainable use of wetlands. Community-based Natural Resource Management (CBNRM) has received policy development as a participatory approach to manage environmental resources. This approach increases participation by civil society in decision making and promote the sharing of rights and responsibilities in management of natural resources. (Plummer R. & FitzGibbon J, 2004).

2.9.1.6 Pillar 6: Agreed-upon and functional institutional arrangements which facilitate and regulate sustainable wetland utilization and conservation

This stems from the preceding pillar. Institutional arrangements are the policies, systems, and processes that organizations use to legislate, plan and manage their activities efficiently and to effectively coordinate with others in order to fulfil their mandate (UNDP) while Institutional environments "are characterized by the elaboration of rules and requirements to which individual organizations must conform in order to receive legitimacy and support". (Luckman, Peter L. & Thomas, 1967). Perspective on the creation of social reality is important in this area -- individuals invent distinctions or "typifications" that eventually become objective and external from their own actions. This might lead to the identification frequently broken rules and why this is so.

2.9.1.7 Pillar 7: Incentives to encourage maintenance of ecosystem services

Ecosystem services provided by wetlands are usually lost due to mismanagement of wetlands and lack of incentives or motivation to preserve them. Rural communities tend to favour short-term expediency in form of income and food over the long-term benefits. This results to over-exploitation of wetland resources. In the long-term, the capacity of these wetlands to provide services is undermined and the welfare of the communities dependent on wetland resources is affected adversely. A strategy linking sustainable management of wetlands to improved livelihoods at the onset is essential

for providing an incentive for long-term maintenance of the ecosystem services. Therefore there is need to identify explicit entry points to ensure that wetland users have some form of incentives to use the wetlands in a sustainable way (e.g. new knowledge, improved agricultural technologies, improved access to markets).

2.9.1.8 Pillar 8: Facilitation of land users or communities which ensures inclusive consensus based planning and management process

Sustainable wetland management is possible through the implementation of community developed wetland management plans that result from a facilitated participatory land use planning process. Participatory land use planning is the systematic assessment of physical, social and economic factors in such a way as to encourage and assist land users in selecting options that increase their productivity, are sustainable and meet the needs of society (FAO 1993). It focuses on the capacities and needs of local land users and is done by the community for the community and therefore provides an opportunity to formulate highly sustainable wetland use systems for development etc.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Overview

This chapter presents the methodology that was used for collection, analysis and presentation of data for the study based on the outlined objectives. The chapter covers the research design, the target population, sampling plan, data collection procedures, data analysis and presentation.

3.2 Research Design

The research process is sequential and is summarized into the following major steps

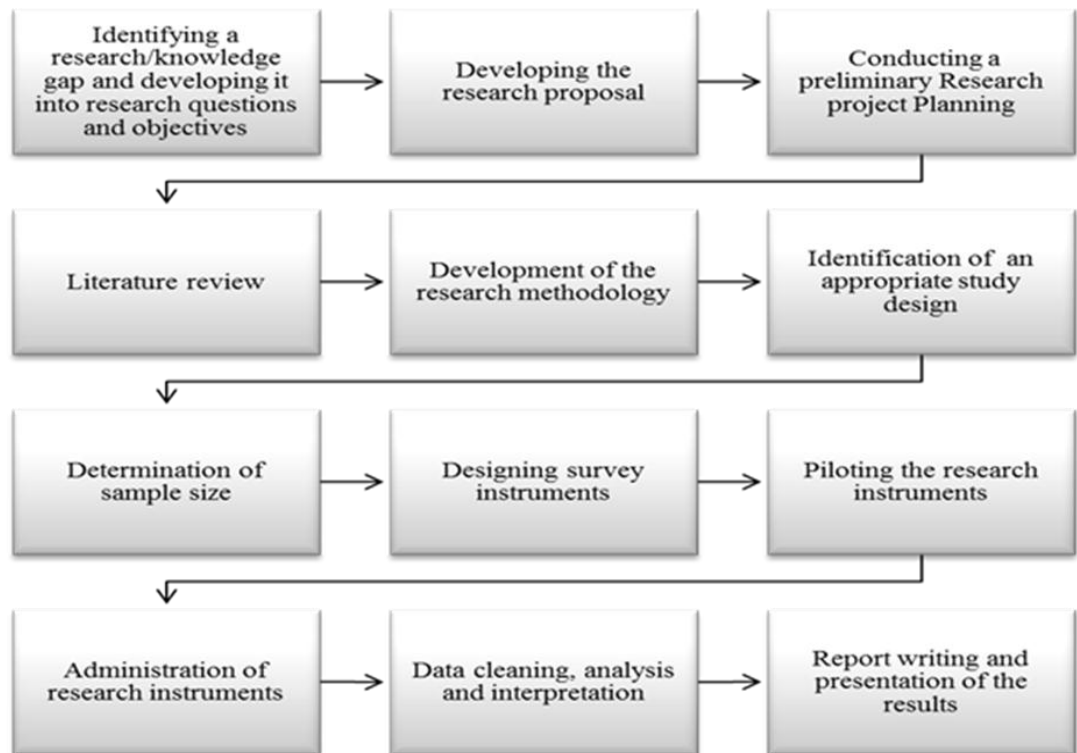


Figure 2: Shows a summary of the research process Source: Author, 2016.

3.3 Research Population

The research population consisted of different stakeholders with varying levels of claim and interest over Yala Swamp (Kinaro Z. , 2008). The different groups gave out varying views on the study questions regarding the use of the wetland which largely tended to favour their perceived interests. Dominion Farms (K) Ltd has assumed full control of the leased land of the swamp including the parcels acquired from the community.

The local community forms the largest stakeholder group in the wetland where. They have used it for small-scale farming, fishing, collection of building materials and medicinal herbs both for subsistence and small-scale trading in the local market. They also obtain water and graze animals in the wetland. They are connected to the area under Dominion Company by a reservoir.

The other key stakeholder at the Yala Swamp is the Siaya County government which is the custodian of the whole wetland as a trust land. The county government benefits from the swamp in terms of the revenue they get from the leased land to the Dominion Farms (K) Ltd. The company has also set aside 150 acres each for both Siaya and Bondo sub counties for agricultural purposes.

The other stakeholder with interest in the swamp includes environmentalists who include both local and international NGOs and also both local and international researchers interested in wetlands and natural resources research.

Table 1: Yala Swamp stakeholders according to their use/benefits of the wetland

Direct Users	Benefits	Indirect users	Benefits
Dominion Company	Intensive agriculture and water abstraction	Researchers	Educational use, research
Small-scale farmers	Extensive agriculture, livestock grazing, water abstraction	National Government	Foreign exchange and Improved rural infrastructure
Fishermen	Fishing, food and income	Conservationists/ NGOs	Nature/biodiversity conservation
Papyrus collectors	Building, furniture, artefacts, income	Tourists	Tourism, ecosystem preservation
County Government	Agricultural activities, revenue	Surrounding community	Recreation, cultural sites, less flooding
Surrounding community	Settlement, hunting, water, recreation, medicinal herbs		

Source: Author, 2016.

3.4 Sampling Plan

A multistage purposive sampling procedure was used in the selection of the survey sample. The main sampling unit of the survey was the household. The study relied on the opinion of the local leadership to select truly representative but feasible samples, given the limited time frame and coverage of the exercise. Purposive sampling of the study areas was used (from Location, Sub-Location and up to the village level). The purposive sampling method used in this survey was based on the understanding that communities are not homogenous particularly in terms of levels of wetland utilization, conservation challenges, socio-economic values attached and development concerns and threats.

The following steps were used in identifying respondents;

- i. Purposive selection of 2 locations, one in Siaya sub county (Central Alego) and the other in Bondo sub county (East Yimbo) was done to explore a variety of different circumstances within the wetland (e.g. variation across an environmental gradient from dry land to standing water).
- ii. Purposive selection of 4 sub locations within the above mentioned locations was further done to represent differing facets of the particular patterns of resource use being examined in these locations. The four sub location include Kadenge and Obambo (Central Alego location) and Nyamonye and Bar-Kanyango (East Yimbo location).
- iii. Livelihoods sample survey comprising 45 households in each location, thus typically 90 households in the wetland/Ramsar site.
- iv. Stratification of sample by wealth groups in order to bring out clearly the critical constraints experienced by poor households in particular.

3.4.1 Location Selection

This implies establishing a set of criteria for choosing areas within wetland sites to undertake the assessments. The following criteria were followed;

- Representative livelihood patterns for the Yala Swamp;
- Presence of particular livelihood features considered important to understand for conservation, management and policy purposes;
- Geographical spread and agro-ecological or habitat variation
- Logistical feasibility (organisation, distances, budget etc)

Locations that were highly atypical in terms of the types of livelihoods and circumstances they represent were avoided.

3.4.2 Sub-location Selection

Having made a choice of locations, the next stage was sub-location selection. Here again purposive choice of 4 sub-locations was made.

- Sub-location selection had in mind relative poverty /wealth considerations, given the typical poverty reduction focus of livelihood assessments.
- the sub-locations differed from each other in some important aspects, for comparative purposes e.g. varying degrees of remoteness from infrastructure and services e.g. on a main road, on a dry season-only feeder road, lacking proper road access or in the degree of their reliance on the wetland resource e.g. heavily reliant on direct use of wetlands, less reliant, and not very reliant. That is to say that just because livelihoods of people who live in or near wetlands are under investigation, this does not mean that all households interviewed need to rely heavily on that resource for their livelihoods. What is crucial is the way families combine wetland resource use with other activities in a variety of different ways, and for various strategic reasons, and the extent to which a division of labour occurs so that some families specialise in natural resource use, while others do not (e.g. those providing services to others).

3.4.3 Village and Household Selection

Random sampling was done in identified sub-locations to select households to participate in the survey as respondents. Two sub-locations in each sub-county of consideration had already been identified for the survey. On reporting to the sub-locations sampled, the study team held discussions with the sub-location leadership who provided a list of villages that are adjacent to the wetlands. After purposive selection of a village, a list of all households within that village was obtained from the village headman (Mlango). Using the lottery method of random sampling, 45 households were selected from the two sub-locations in each district under consideration.

Overall, a total of two (2) sub-counties, two (2) locations, four (4) sub-locations, ninety (90) households were considered representative enough for the socio-economic survey in the two districts of Yala Swamp footprint.

3.5 Types and sources of data

Both quantitative and qualitative data collection methods were collected from both secondary and primary sources. The qualitative analysis included the description of uses of the wetland by community and investors, effects of the uses on the wetland and conservation measures from the perspective of the different stakeholder. The quantitative techniques included frequencies, means, percentages and modes.

3.5.1 Secondary data

Secondary sources of information provided very important information about this study. The information was obtained by reviewing recorded (secondary) sources that are relevant to the topic and area of the study.

3.5.2 Primary data

This involved administering structured questionnaires to the target population i.e. the local community (fishermen, farmers, weavers etc.) as well as direct interviews with key informants such as Dominion Farms Ltd, NEMA, Nature Kenya, Siaya County Government among others.

3.6 Methods of data collection

3.6.1 Secondary data collection

Secondary data collection involved reviewing existing information in the form of documents, text books, published and unpublished articles, newspapers, journals, government policies and legislations as well as by-laws.

3.6.2 Primary data collection

The main instruments that were used in the collection of primary data included: interviews, observations, focus group discussions, mapping and photography.

(a) Interviews

Interviews are direct engagement to obtain reliable and valid measures in the form of verbal responses from one or more respondents. This technique helped in acquiring important information from the respondents' i.e. key informants and households.

(b) Focus group discussions

Focused group discussions (FGD) were also conducted as a follow-up to the content analysis and individual interactions in interviews. FGD were conducted at the community level mainly with people who depend largely on wetlands. This helped the researcher to identify, enumerate and analyse occurrences and developments in the wetlands sub-sector in addition to corroborating information in the different reports reviewed. There were two (2) focus group discussions conducted in each of the two sub-counties with the number of participants ranging from 10-15 persons comprising of both male and females members and included the youth, fishermen, peasant farmers, papyrus collectors and village elders.

(c) Observation

The study also used observation and interpretation skills to obtain some important information in the study area. This technique proved the study with nonverbal but observable characteristics of the study area. Some of the observations made include high rate of land subdivision, encroachment of the wetland, destruction of wetland vegetation and pollution among others.

(d) Mapping and Photography

This technique helped record imagery data which was very vital during data analysis stage. The imagery data collected also helped in verifying the data collected through interviews.

3.7 Data processing and analysis

A data code sheet was developed by the researcher, and used to code the data uniformly for data entry purposes. The data was then entered and analysed using the

SPSS program. MS Excel was also used for data analysis. The researcher also identified the most crucial questions that needed further analysis. Some of the survey questions allowed the respondent to give more than one response. The advantage of this method of inquiry is that it allowed the respondent to give all possible responses to the issue in question.

3.8 Data presentation

Upon completion of data collection and entry, the analysed data was presented in form of pi-chart, graphs, sketches, pictures and narrative report writing. This allowed for easy interpretation and understanding of the report findings.

3.9 Ethics

Surveys and research works are guided by ethical guidelines that govern any research activities. This research ensured that the guidelines were strictly adhered to thus protecting the integrity and meeting the threshold of the research work. Some of the guidelines that guided the research include the following:

3.9.1 Anonymity

Owing to the fact that the topic of research was a very sensitive issue in the area, the research ensured that the identity of the respondent was not disclosed especially where very sensitive information about a specific respondent was about to be revealed. To achieve this, respondents were assigned pseudo names and also codes to avoid revealing them.

3.9.2 Voluntary and informed consent

Prior to the interviews, the respondents were informed about the purpose of the research before any information was sought from them. Every respondent was therefore told the truth and provided with all the facts in order to make them give an informed decision on whether to participate or not. The questions also remained within the scope of the stated purpose of the research. To achieve that, the following information was made available to the respondents:

Purpose of the research study

- i. A guarantee of confidentiality and anonymity.
- ii. Identification of the researcher
- iii. Any foreseen risk
- iv. Benefits and compensation or lack of them

3.9.3 Use of vulnerable or/ and special populations

As an ethical standard, consent and permission was obtained from the guardians of any disadvantaged or special before any information was collected from them. This category includes children, disabled, or even the sick. The principle of informed consent therefore guided collection of information from this category of population.

3.9.4 Confidentiality and privacy

The respondents were informed of the confidentiality of the responses that they provided. Any piece of information they gave will therefore be protected by keeping it confidential. Before concealing any information deemed sensitive, their consent will always be sought.

3.9.5 Physical and psychological harm

Prior preliminary background check was done in order to avoid imparting any harm to the respondents especially the psychological harm. Any actions and statements that could lower self-esteem and self-worth of a respondent were therefore avoided.

3.9.6 Dissemination of findings

Findings from the research will be made public and there will be no concealing of findings under any circumstances. The published findings will be availed for use by all relevant authorities i.e. Siaya County Government, the National Government, institutions of higher learning and other interested organizations.

3.9.7 Limitations

Like many other surveys, the study faced some limitations based on the data collection methods adopted and willingness of the respondents to give precise and

accurate responses. The following are some of the methodological limitations that are commonly faced in the course of collecting data:

- a) The enumerator bias - During interviews or in the process of administering questionnaires, the opinions of enumerators and their supervisors may skew the results by trying to influence the type of response to get from a respondent. In order to avoid the bias, the enumerators were advised to strictly capture the responses as provided by the respondent without manipulation.
- b) The respondent bias – The respondent may deliberately decide to give a misleading or incorrect response or in order to achieve some unknown objective.
- c) Privacy bias – A respondent may give misleading information owing to the privacy of the answer required.
- d) The no response bias – Due to the nature of the question or the ambiguity of a question, a respondent may not be in a position to give an appropriate response or may simply fail to provide a response at all.

To avoid, address or reduce the risks of bias, the survey team leaders ensured that:

- i. The research assistants explained to the respondents the objectives of the study well and the assurance of confidentiality of the information provided.
- ii. In order to address ambiguity of some questions that could have led to wrong data being collected, the researcher carried out a pre-test and all the ambiguous questions were addressed by restructuring them.
- iii. All the questionnaires were keenly being verified by the researcher each day and feedback provided to the enumerators before conducting fieldwork on the following day.
- iv. Very experienced enumerators familiar enough with the study area were selected to do the survey

CHAPTER IV

BACKGROUND OF THE STUDY AREA

4 Overview

This chapter provides a summary of the locational context of the project site, its historical and background context, analysis of the project site according to the physical aspects, natural environment characteristics and their resultant effects on the study area, the population and demographics and nature of land use.

4.1 Description of the study area

Yala swamp wetland is a trans-boundary wetland lying between Siaya and Busia Counties, located on the north-eastern, shoreline of Lake Victoria. It is a biodiversity conservation habitat for indigenous and endangered fish, bird and mammal species. It is one of the most important riparian and floodplain wetlands around the lake, and indeed the third largest in Kenya after Lorian Swamp and the Tana Delta Swamp. It covers an area of approximately 17,500 hectares.

The swamp forms the mouths of both rivers Nzoia and Yala and is a freshwater wetland arising from backflow of water of Lake Victoria as well as the rivers' floodwaters. The swamp contains three freshwater lakes. These are Kanyaboli, Sare, and Nyamboye. Yala Swamp contributes significantly to the ecological and hydrological functions of the Lake Victoria basin as well as to the economy of the rural communities, who have traditionally extracted water, fish, medicinal plants, transport and building materials amongst other products for their livelihood and subsistence economy.

The swamp is a highly productive ecosystem as characterized by its general biodiversity richness and provides habitat for refugee populations of certain fish species which have otherwise disappeared from the lake. Despite the great potential depicted above, Yala Swamp has continued to experience a myriad of problems such as over exploitation of swamp resources by local communities and private enterprises, poor road networks within the swamp, destruction of natural breeding

grounds in the ecosystem, perennial flooding, and human- wildlife conflict among others.

4.2 Locational Context of the Study area

4.2.1 Regional Context

As stated above, the study area lies on the north-eastern shoreline of Lake Victoria at about 0° 02' 10.80" north of the Equator and 34° 04' 0.60" east of the Greenwich Meridian. It stretches between Siaya and Busia counties and covers approximately 17,500 ha (175 square kilometres). The swamp falls at an altitude of between 1,150m and 1,135m above sea level.

4.2.2 Local Context

Narrowing further, the swamp covers two (2) sub-counties in Siaya county i.e. Siaya and Bondo sub-counties and about (8) locations which include; South Central Alego, South Alego, South West Alego, Usonga, Central Yimbo, East Yimbo, North Yimbo, West Yimbo, and West Sakwa locations.

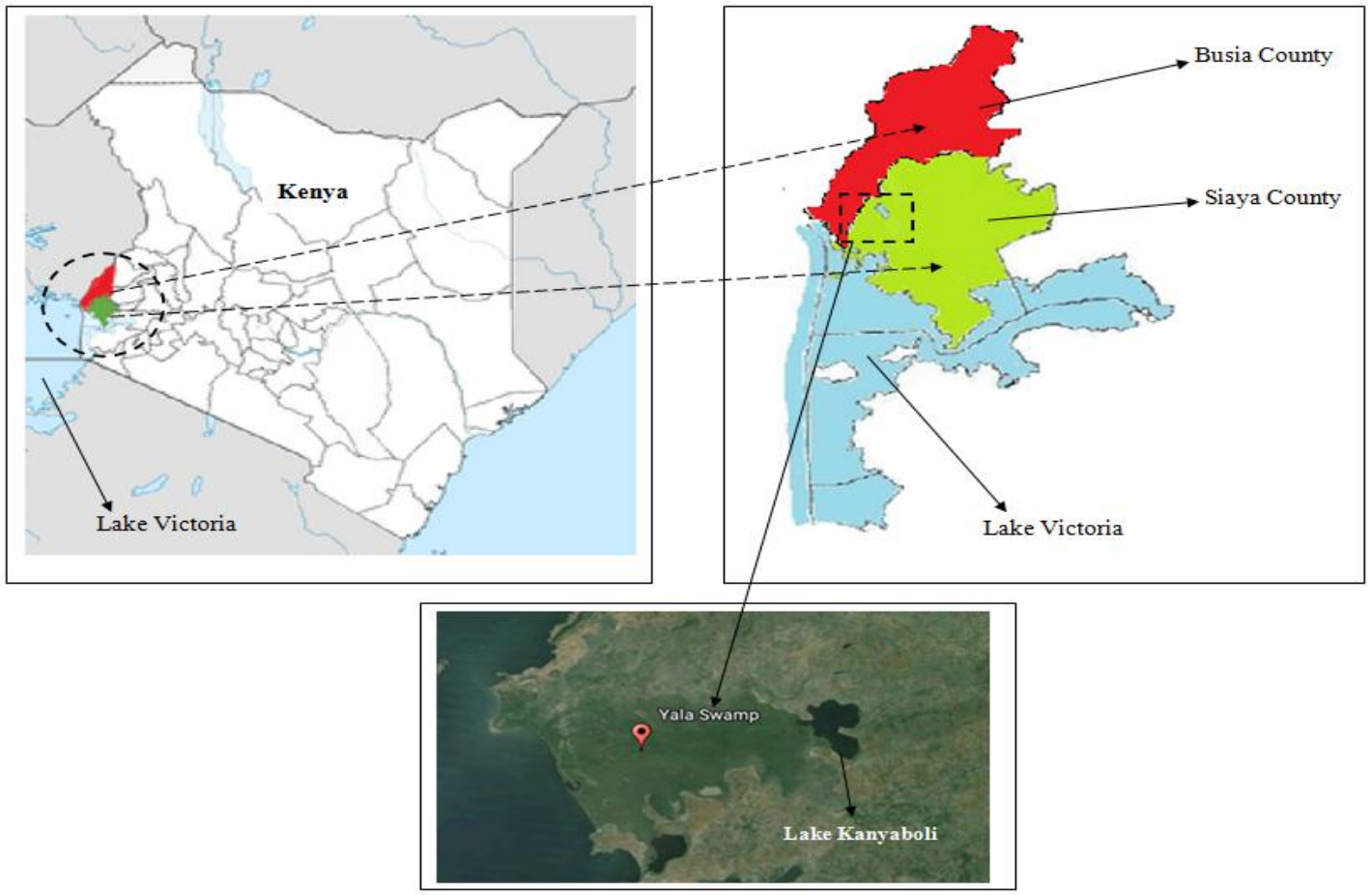


Figure 3: Shows the location of the study area Source: Author, 2016.

4.3 Site Analysis

4.3.1 Physiographic Characteristics

4.3.1.1 Topography

The study area is nearly flat with minor irregularities in topography due to accumulation of soil deposits after reclamation and old gullies. The altitude varies between 1,150m and 1,135m in the East and West of the swamp respectively. The immediate surrounding is however characterized by gentle slopes that steadily rise as one moves away from the swamp.

4.3.1.2 Vegetation

The study area is a rich habitat for various macrophytes with the predominant vegetation being papyrus, *Cyperus papyrus*, *phragmites mauritianus* and swamp grasses. The natural vegetation at the edges of the wetland is heavily affected by human settlement, widespread cultivation and cutting of wetland vegetation for fuel-wood, crafting and construction.

4.3.1.3 Soil condition

The soils of Yala Swamp are mostly alluvial clays derived from both lacustrine and river deposits. The soils are generally fertile and can support a variety of crops and vegetation.

4.3.2 Climatic Conditions

4.3.2.1 Rainfall

The study area falls within Lake Victoria Basin which experiences a bimodal annual rainfall pattern with 'long rains' from March to June and 'short rains' from September to December. Yala/Nzoia catchment has high precipitation in the Northern highland (1,800-2,000 mm per annum) and low in the south-western lowlands (800-1,600 mm per annum) with the average rainfall around lowland Yala Swamp being approximately 760 mm.

4.3.2.2 Temperature

The mean annual temperature in the study area is 22°C and varies between 15°C in July to 30°C in February and March.

4.3.2.3 Humidity

Humidity in the swamp is relatively high with the mean evaporation ranging between 1800 mm to 2,200 mm per annum.

4.3.3 Population and demographic characteristics

4.3.3.1 Population profile

According to the Kenya Population and Housing Census 2009, the population of the study area (eight locations where the study area stretches across) is 75,675 people (38,621 males & 37,054 females). There are 19,639 households in the eight locations occupying an approximate area of about 372.8 square kilometers. The average population density of the area is 350 persons per square kilometer (KNBS, 2012 Population projections).

4.3.3.2 Socio-economic profile

This area is associated with people from the low scale economic level. The local communities highly depend on Yala Swamp from which they have traditionally reclaimed land for farming, extracted water, fish, medicinal plants, building and crafting materials amongst others for their livelihood and subsistence economy.

4.3.4 Land use evolution of the study area

Prior to the promulgation of the Constitution in 2010, the Swamp was under a trust land held by County Councils of Siaya, Bondo and Busia in trust for the public and local communities. Before, 1970, the County Council of Siaya allocated its portion of the Swamp equivalent to 2,300 hectares to the Lake Basin Development Authority (LBDA) for agricultural development mainly to produce cereals, pulses and horticultural crops.

In 1975 the Swamp was divided into three main development sites; area I (2,300 ha), area II (9,200 ha) and area III (6,000 ha). In 2003, area 1 was leased to Dominion Farms Ltd, a subsidiary of Dominion Group of Companies for rice production (ACC, 2011). Area III was earmarked for conservation. In the 1960s, a diversion canal of seven kilometres together with a retention dyke and a feeder canal for Lake Kanyaboli were built. The weir was raised by Dominion by 1.8 meters with considerable increase on flooded area. The process of allocating this land has remained contentious with local communities. Figure 4.2 shows the swamp in 1986 and 2009.

Over the period 1986-2009, the wetland vegetation shrunk by about 10% as a result of expanded agricultural activity. The decline would also have been due to reduced water supply of rivers Nzoia and Yala following the damming upstream and clearing of catchment vegetation for cultivation and settlement.

The swamp is an unregistered community land and as yet still within the control of the Siaya and Busia County Governments. Upon survey and registration, the land will revert to community land once the Community Land Act becomes operational. During the last decade land formally used by LBDA was leased to Dominion Farms Limited for a period of 25 years for commercial agricultural production and aquaculture. This encouraged local communities to start encroaching and cultivating onto the drying swamp land.

Recent studies reveal multiple uses of land in the swamp. An ecosystem services assessment carried out in the Swamp revealed that about 64% of the Swamp area is under papyrus dominated vegetation, while local communities cultivate about 11.5 %. Large scale rice production under dominion farms occupy 9.4 % (Muoria, P., *et al.*, 2015).

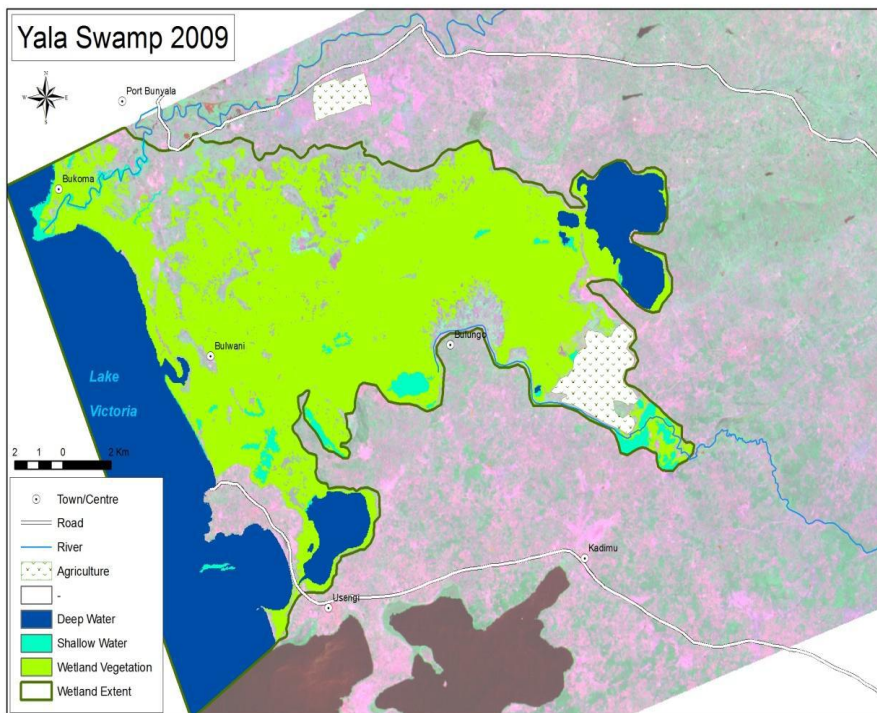
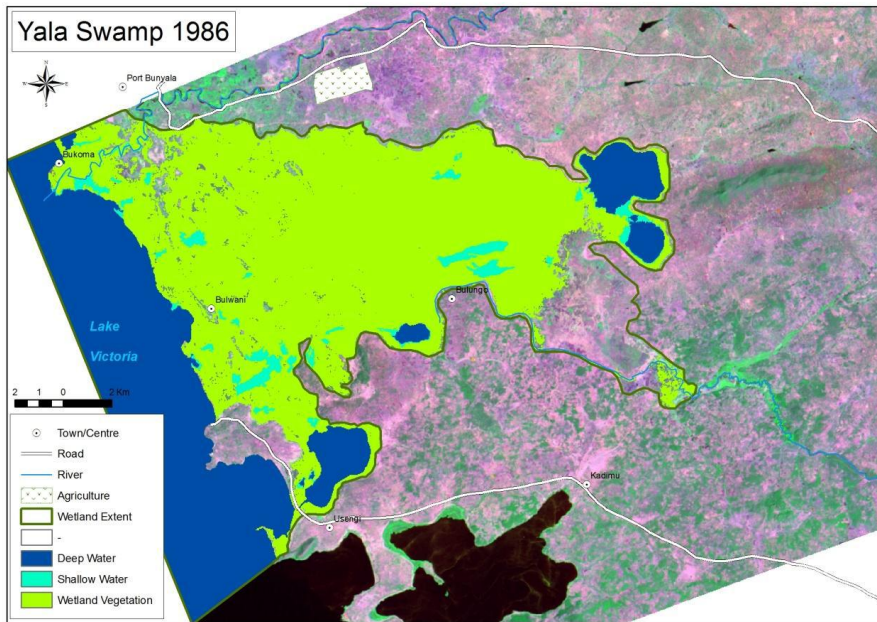


Figure 4: Yala Swamp in 1986 and 2009 Source: Nature Kenya Reports

Table 2: Current Land Cover within the Yala Swamp boundary

Land use/Land cover category	Current		
	Area (hectares)	Area (acres)	%
Abandoned land	220.4	544.3	1.1
Village Cultivated	2,380.8	5880.7	11.5
Rice Cultivated	1,951.0	4818.9	9.4
Papyrus	12,693.1	31352.0	61.2
Degraded papyrus	350.4	865.5	1.7
Burnt papyrus	204.0	503.9	1.0
Settlements	320.9	792.6	1.5
Scrub/woodland	349.5	863.3	1.7
Open water	2,101.0	5189.5	10.1
Floodplain	184.9	456.6	0.9
Total	20,755.9	51267.2	100.0

Source: Nature Kenya Reports

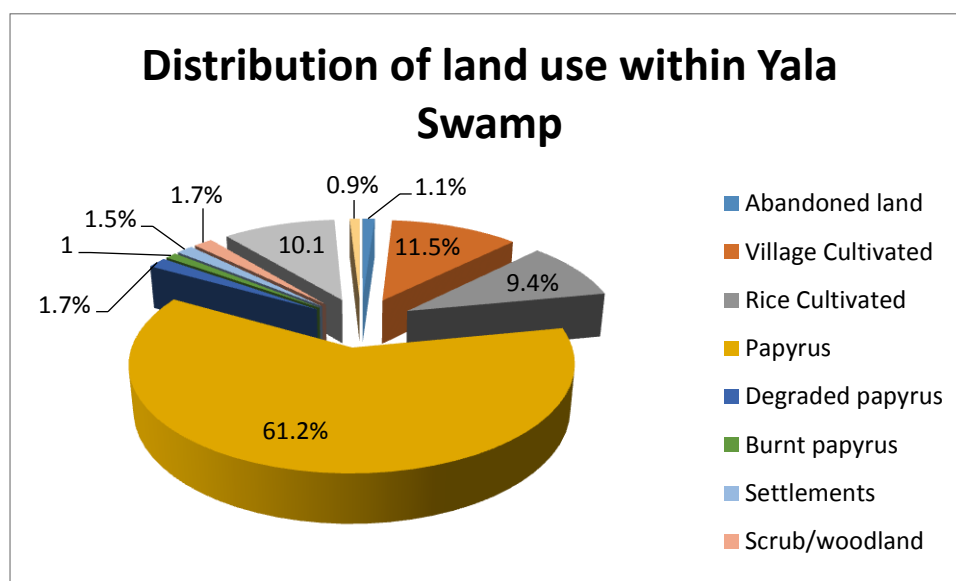


Figure 5: Distribution of Land Use at Yala Swamp

Increase in population and poverty levels within the surrounding communities are the main driving forces for land use changes in the Yala Swamp. These drivers act as proxy for a whole range of factors, in particular the demand for farming land and high dependence of the local community on the swamp resources for their livelihoods. This inevitably has led to increased encroachment and exploitation of wetlands' resources mainly at the expense of wetlands biodiversity. Land use evolution in the study area therefore indicates that farming is an important activity and takes a large share of the wetlands land holdings. Most areas of Yala-Nzoia Swamp are under small scale arable farming comprising of food crops such as maize, cassava and sweet potatoes.

CHAPTER V

RESULTS AND DISCUSSION

5 Overview

This chapter presents findings of the study. The chapter highlights the type of land uses, effects of the land uses on wetland conservation and suitable swamp restoration strategies. It also presents the impact that the swamp has had on the livelihood of the communities in Siaya and Bondo Sub-counties as well as Busia County. It gives detailed findings on the effects of human activities on the swamp and the. The findings to the different research are presented in different themes under the objectives, as discussed below.

5.1 Participation Rate

In total, the research assistants were able to conduct two (2) focus group discussions in each of the two sub-counties. The groups comprised of both male and females members and included the youth, fishermen, peasant farmers, papyrus collectors and village elders. The study area covered four sub locations within two locations in Siaya County (Central Alego and East Yimbo locations). Two sub-locations, one from each location were selected for data collection. A total of 90 households (100% target) were interviewed. This enabled the research to adequately address the research objectives. The table below gives the breakdown of the participation rate per catchment area.

Table 3: Participation rate

	Central Alego		East Yimbo	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Participating households	45	100%	45	100%
Not Reached	0	0%	0	0%
Total	45	100%	45	100%

Source: Author, 2016.

5.2 Demographic characteristics of participants

The composition of participants was diverse in various dimensions such as; age, gender and level of education. Of all the participants who participated in household data collection, 61.8% were males while 38.2% were females. Table 4 below gives the gender distribution of the household participants.

Table 4: Gender distribution

Gender	Percentage (%)
Male	61.8%
Female	38.2%
Total	100%

Source: Author, 2016.

The majority of participants (47.4%) were youth with their ages ranging from 19-34. Approximately 46.1% of the respondents had their ages in the range of 35-60 while the older members of the society with their ages above 60 only constituted 6.6%. Majority had formal education varying from primary education to university level of education. Only 2.6% of the respondents had no formal education at all. The table below gives a breakdown of the respondent's level of education.

Table 5: Respondents' level of education

Level of Education	Percentage (%)
None, Nursery/Kindergarten	2.6%
Primary	35.5%
Post-primary, Vocational	18.4%
Secondary, A-Level	34.2%
College	9.2%
Total	100.0%

Being largely rural, the questionnaires were administered in Dholuo with very few exceptions where those interviewed were not familiar with Luo dialect. In such cases, the questionnaires were administered in English or Kiswahili.

5.3 Economic activities engaged in by households

Majority of the residents do engage in farming as the main source of income as reported by 48.7% of the residents. Another 19.1% and 15.4% are engaged in casual employment and fishing respectively. Crafting accounts for 7.0%. Majority of the residents engaged in farming practise arable farming at 66.7% while 33.3% practise mixed farming.

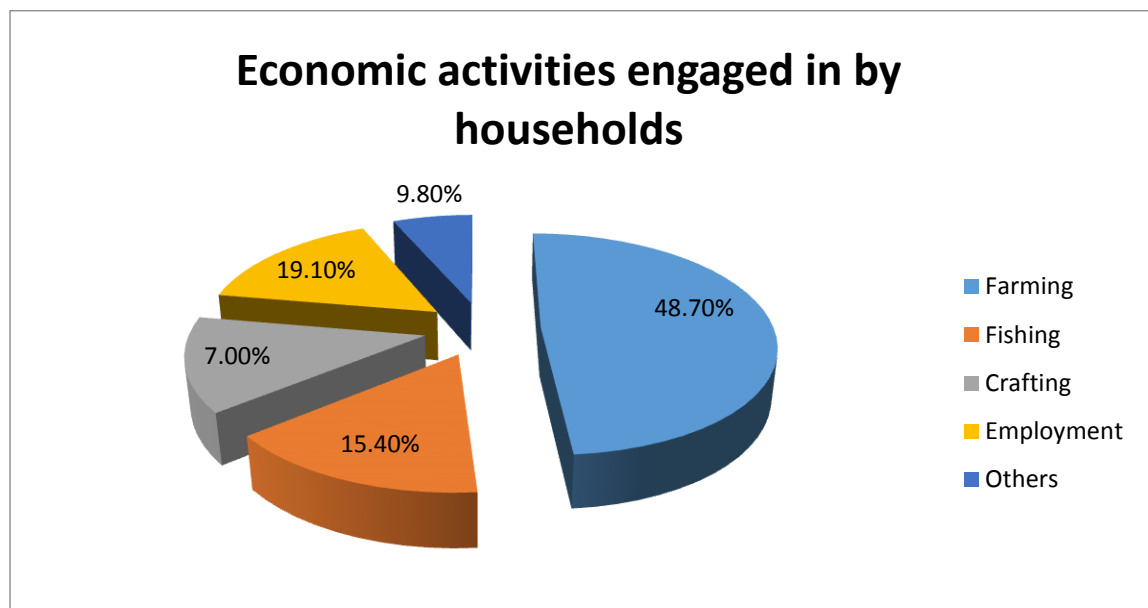


Figure 6: Shows economic activities engaged in by households

Source: Author, 2016

Land ownership

Ownership of the land is a very important aspect of development as it determines the availability of spaces where any specific development can take place. From our discussions, majority of the respondents were the original natives of the area and could therefore be relied upon to provide useful information about land, land ownership and use of land in the area. Findings show that 95% of the residents own the land they currently live on. Only 5% of the residents do not own the land they live on. The findings further show that 93% of the residents acquired the land through inheritance

and therefore have some cultural attachment to the land. Only 7% of the residents bought the land they live on. . The implication of this is that people have the authority to be able to use their land for various socio-economic activities thus increasing the ability to sustain their lives. The table below gives a summary of how land was acquired by the residents in the study area.

Table 6: Shows mode of land acquisition in the study area

Mode of Land Acquisition	
Method of acquisition	Percentage
Inheritance	93.0%
Buying	7%

Source: Author, 2016.

The study further shows that majority of the residents own five acres and below accounting for 76% of the residents. Only 24% of the residents own land above five (5) acres. The size of land owned by residents is a clear manifestation of intensive subdivision of the land adjacent to the swamp. This therefore raises questions about the economic viability of the land in terms of production. Of the 94.7% of the residents who own the land they live in, the study shows that all have absolute rights on how to use their lands as they own them under freehold tenure. This again raises the prospect of investments as well as the flexibility in utilization of the land. Land ownership and distribution in the area can be summarized as illustrated below:

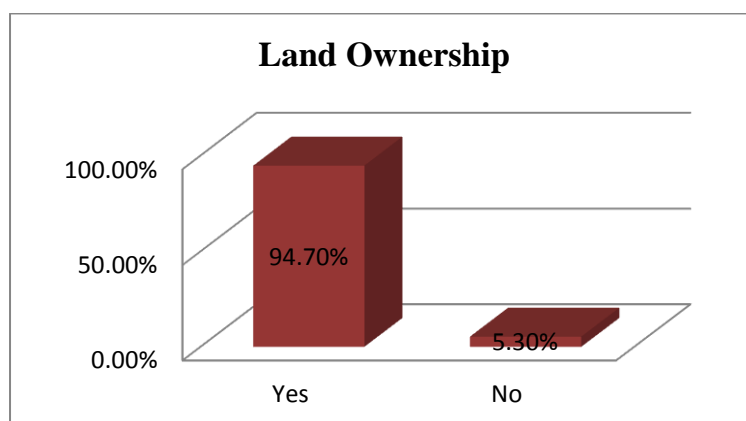


Figure 7: Shows land ownership

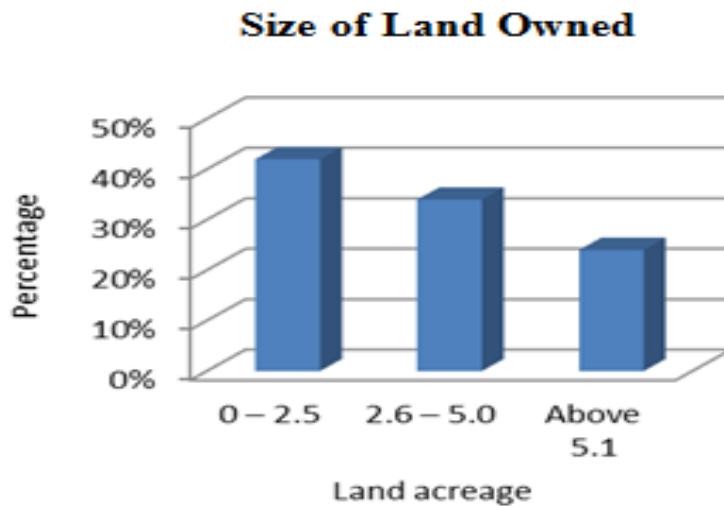


Figure 8: Shows acreages owned

5.4 Dominant land uses in Yala Swamp.

5.4.1 Land use activities

The study found out that there are a number of activities taking place in and around the swamp that are likely to impact on the conservation processes being undertaken. The land uses range from crop farming, fishing, harvesting of swamp resources for mat making, grazing, damming, tourism etc. Some of the most dominant land uses in the study site include:

a) Papyrus

Papyrus reeds which are the dominant swamp vegetation are used as a raw material to make a variety of products. In Siaya and Bondo sub-counties, mats are very popular bedding materials as well as drying products. The mats can also be used as roof ceiling materials as well as temporary doors for houses. As a result, the mat making industry is largely reliant on the swamp vegetation and the local community has made use of it as a source of livelihood. It should be noted that 4.2% and 2.8% respectively of the residents harvest the papyrus reeds and other wetland vegetation for mat making and crafting respectively.



Plate 1: Papyrus reeds in the swamp

Source: Field survey, 2016.

b) Livestock keeping/grazing

Although livestock is not a major economic activity in the area, members living at the swamp tend to harvest swamp vegetation for their small number of livestock. This therefore makes grazing to be an important activity that takes place on the swamp. According to the environmental officer of the Dominion farm, grazing has been a major source of conflict between the locals and the farm owners. Grazing in the farm is considered as trespass. From the interviews conducted with the locals, approximately 17% of the residents said that they rely on the swamp for pasture. Local communities have free access to Yala Swamp and it is very important especially during droughts. Grazing has however been forbidden on the wetlands occupied by Dominion Farms Company and any form of grazing within the farm is always considered trespass. This has always led to conflicts between the company workers and the community. The activity therefore has ecologically weakened the swamp as unabated harvesting of the vegetation takes place.



Plate 2: Shows pasture within the swamp

Source: Field survey, 2016.



Plate 3: Shows cattle grazing within the swamp and soil erosion along cattle paths

Source: Field survey, 2016

c) Agriculture/Crop Farming

Agriculture is a very popular economic activity in areas adjacent to the swamp. The Dominion Farms Limited grows rice at large scale level and has therefore employed a considerable number of locals in the farms. According to the Environmental Officer of Dominion Farms limited, the farm employs about 2000 locals at different times to do various jobs. This has benefited the locals largely as they work in the farms. The farm also does cultivate bananas and rear poultry. The study shows that most of the land (94.7%) adjacent to the swamp is privately owned by members of the community with a freehold tenure system.

The study also shows that 49% of the residents rely on farming as their main economic activity. Out of this, the majority practise arable farming accounting for 66.7% while 33.6% practise mixed farming. The study equally found that on average, the households have a large number of persons with 26% of the residents having at least 6 persons per household. Coupled with the fact that most households rely on farming as their main economic activity, the demand for food has significantly increased thus leading to encroachment of the wetland riparian reserve. This threatens the existence of the swamp. The summary of household sizes and the main sources of income are summarized in the figures 9 and 10 below:

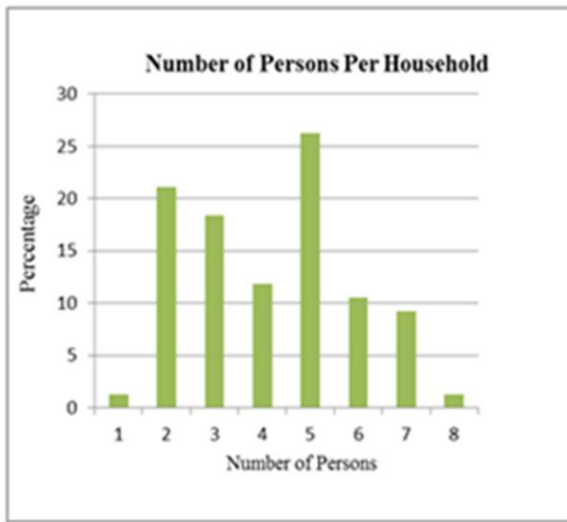


Figure 10: Shows number of persons per household
Source: Field survey, 2016

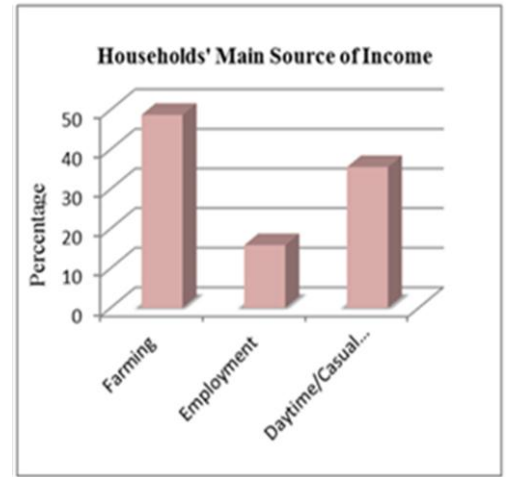


Figure 9: Shows households' main source of income
Source: Field survey, 2016

Since cultivation/ farming are the major economic activities for most of the residents living adjacent to the wetland, this is a confirmation that pressure on the wetland resources is high.



Plate 4: Shows a rice godown within the swamp
Source: Field survey, 2016



Plate 5: Shows a kale farm within the swamp
Source: Field survey, 2016

d) Fishing

Observation revealed that fishing as an economic activity takes place in Lake Kanyaboli which is part of the swamp. From the focus group discussions, it was reported that the use of illegal fishing methods have destroyed some of the fish breeding sites thus

lowering the production levels. Fishing is mainly done for domestic purposes although some few households do it for commercial purposes.



Plate 6: Fisherman at the swamp holding a bunch of mudfish

Marginal increase in fishing is therefore likely to impact on the wetland by degrading its value. According to the locals, fishing is regulated both by village monitoring mechanisms and the department of Fisheries. Fishermen are prohibited from using the nets as these tend to catch even the fingerlings hence lowering the population of mature fish. Those who defy are normally prosecuted.



Plate 7: A fishing boat by the shores of Lake Kanyaboli waiting to ferry harvested fish

e) Tourism

The swamp is increasingly becoming a tourist attraction. The swamp is known as the bird watchers paradise and has been classified as among Kenya's Important Bird Areas. Some of the bird species found in the swamp include blue breasted bee-eater, the papyrus gionolek and papyrus canary. Various species of wildlife that are very rare and some endangered can be found in the wetland e.g. the Sitatunga (*Tragecephalus spekii*) species of antelope. Lake Kanyaboli is an important refuge for Lake Victoria cichlids, many of which have been exterminated in the main lake by introduction of the Nile Perch (*Lates niloticus*). Indeed a number of recreational developments are coming up in the area in anticipation of more visitors in the area. The County Government in partnership with Athletics Kenya (AK) have in the past organized Lake Kanyaboli Half Marathon with the aim of raising awareness on the conservation of the lake and promotion of community based tourism enterprises. The Kenya Rowing and Canoe Federation have also enquired about development of water sports at L. Kanyaboli from the county government.



Plate 8: An upcoming recreational establishment at Lake Kanyaboli

5.4.2 Land activities that have negative impact on the wetland

According to the local residents, a number of human activities are directly to blame for the shrinking and drying up of the wetland. A majority (43%) were of the opinion that uncontrolled grazing on the wetland is dangerous and harmful to the existence of the swamp. Slightly lower number of the respondents (23%) felt that the clearance of vegetation and over harvesting of the papyrus reeds poses danger to the swamp. A further 19% viewed encroachment of the wetland for agricultural purposes as the major threat to the wetland.

These activities have had very negative impacts on the wetland, animals and local residents. Some of the negative impacts that were reported by the community include drying up of the wetland (49.3%), shrinking of the wetland (15.1%), and depletion of wetland vegetation (16.4%), death of biodiversity (9.6%) among others.



Plate 9: Cattle grazing on an area of the swamp cleared by burning for cultivation.



Plate 10: Banana plantation within the swamp area

Figure 11 below gives a summary of the residents concern on activities that may have negative impacts on the swamp.

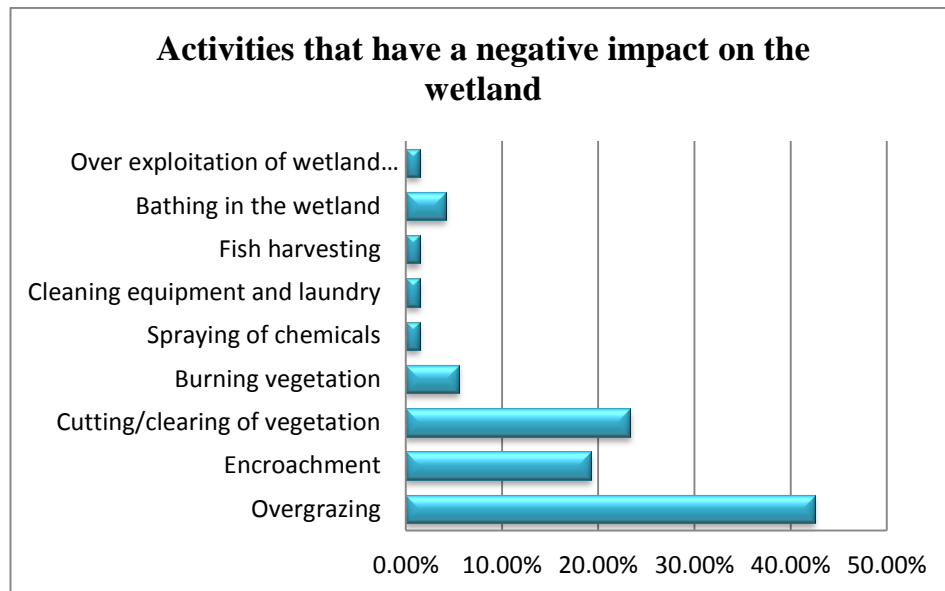


Figure 11: Shows land activities that may impact negatively on the wetland

Source: Author, 2016

5.5 Effects of current land uses on wetland conservation

The various land uses and activities adjacent to the swamp have had a number of negative impacts on the wetland as described below:

5.5.1 Land degradation

Land degradation entails alteration of all or many aspects of the biophysical environment by human activities. This is likely to have negative impacts on vegetation, soil, landforms, general ecosystem as well as water. According to Hennemann (2001), land degradation is a collective degradation of different components of land such as water, biotic and soil resources. The concerns on land use and settlement trends affecting the communities settled in Yala Swamp area indicate high levels of land degradation as manifested in the turbidity of the water and land cover change in the area. This is further compounded by rapid population growth, increased poverty levels and limited institutional capacity to deal with land use challenges. Tests on soil and water samples taken from the Yala River and sections of the swamp, carried out by the government chemists in 2009, at the request of Action Aid International found the existence of heavy metals and presence of chemicals in the water. For instance the analysis revealed the presence of dieldrin, a chemical in pesticides linked to breast cancer that

was banned in the USA (1987) by the Environmental Protection Agency.

5.5.2 Poor water management

There are a number of human activities that have led to various destructions of the swamp. Water pollution was cited by the community as a major concern due to constant chemical spraying and release of contaminated water by the Dominion Farm Limited into the river and lake.

From the focus group discussions it was noted that chemicals have had direct effect on human beings, livestock and even fish. Dominion Farms Environmental Officer however says that they no longer carry out aerial sprays following these complaints, and that it is the Ministry of Agriculture doing it as part of the government policy to protect crops. A majority of the residents said they use water of the swamp for domestic purposes that includes drinking, cooking and for animal consumption.



Plate 11: Shows chemical spraying within Dominion Farm

Source: Field survey, 2016.

5.5.3 Loss of sources of livelihood

Yala Swamp has been very useful to the community in a number of ways including: as a source of fish, pasture for livestock and wild animals, water for domestic use, and trees for building as well as materials for crafting. The benefits have however reduced since the swamp was reclaimed. Despite the disruption on the source of livelihood, the community still depends on the wetland to get a number of resources. Majority (69%) of the residents still depend on the wetland to be their main source of water for domestic

use. Other important uses highlighted by the community as being important to them include: Obtaining building and crafting materials like the papyrus and trees (7.6%), grass for thatching (8%), fishing (15.4%).

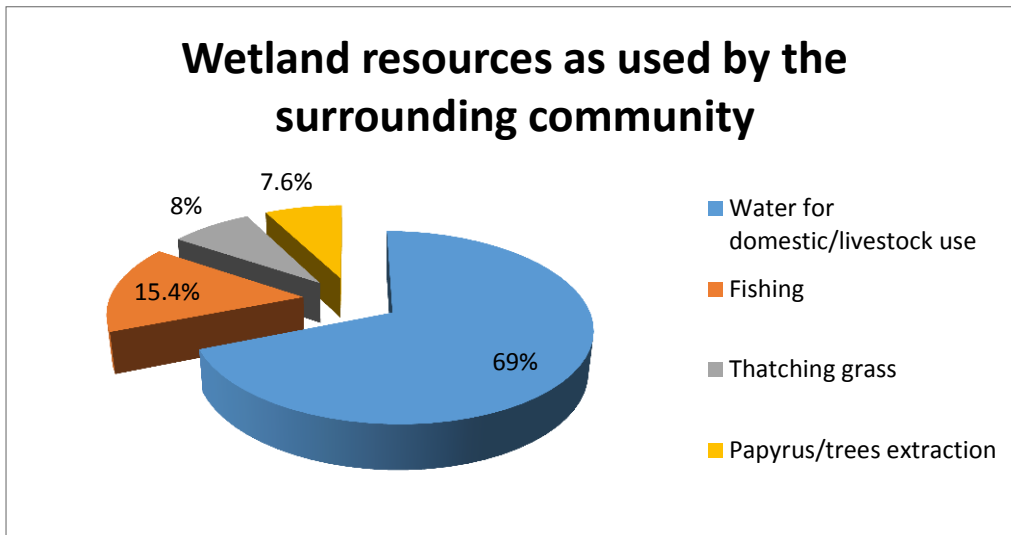


Figure 12: Wetland resources as used by the surrounding community

Source: Author, 2016.

5.5.4 Loss of biodiversity

With the ongoing human activities in the swamp and adjacent area, it was observed that important biodiversity is being lost. The ecology is being distorted completely. For instance, the papyrus which is among the most dominant swamp vegetation and a useful resource for making mats, handcraft and also as animal feeds is slowly disappearing. A joint committee report of County Assembly of Siaya (2015) on Agriculture, Tourism, Water and Delegated Legislation that focused on Yala Swamp also found that the *sitatunga*, a reedbuck and a bird called *gonolek* which used to inhabit the wetland, are also decreasing in number as reclamation of the wetland continues.

Furthermore, some fish species like *mbiru*, *fulu*, *kamongo*, *okoko*, *nyamami*, *ningu*, *fwani*, and *adel* have ceased to exist as a result of the chemical discharge into the lakes due to aerial spraying and other activities. Destruction of the swamp has also led to migration of some bird species.

5.5.5 Conflict over land resource

The use of land currently occupied by Dominion Farm Limited has been a major source of conflict between the community and the company. According to Focus Group Discussions held in the two sub-counties, the conflict is attributable to many factors. First, the company breached the agreement (MoU) that was intended to guide use of the land. According to the MoU, the company was to compensate the local community by giving them a total of 1500 bags of rice every year as a payment for using their 300 acres of land. The bags were to be distributed equally between Siaya and Bondo. This reportedly took place for only a few years and not in the agreed proportions thus causing major conflicts between the community and the company.

Unfavorable flooding cycle purportedly caused by Dominion is one of the major issues causing conflict between the investor and the people. Due to its unpredictability, this artificial flooding has been a major hindrance to farmers realizing their harvest. This flooding destroys crops and thus jeopardizes food security. They blame this flooding on the investor constructing a weir to a height above the 5.5m recommended by the government.

The community also decries lack of grazing land and water point for their animals. They claim that Dominion has fenced off their pasture land. Dominion on the other hand claim that the locals have their own community land which they have failed to maintain and have time and again tried to trespass into the company`s land. Indeed from the focus group discussion with the community it was evident that the major threat to community land maybe the community itself as they practically do not have local mechanisms for access, control and resource utilization. Everyone is free to enter the wetland and carry out any activity they deem right.

There is also the issue of closure of the access road directly connecting Yimbo in Bondo to Alego in Siaya making the journey tedious as the locals have to use longer routes to reach the two destinations. The company acknowledged this fact but cited safety concerns as heavy machinery are deployed along the areas bordering the closed road.

Another major source of conflict according to the residents is lack of public participation

when their community land was being leased to Dominion Farms. They say that the land belongs to them, only held in trust by the county governments and their views must be taken into account whenever major developments are proposed. As it is, there is already a major concern among the people that a second investor, Godavari Enterprises, a sugar factory, has been offered 6,000 acres without public involvement.

5.5.6 Encroachment of the Wetland

Land encroachment was also identified as a major problem. In order to effectively conserve the wetland, the communities living around may have to give their lands or be settled in some other places in order to allow for conservation. From the survey, it came out that a majority (60.5%) of the communities living adjacent are resistant to the idea of acquiring their lands for conservation purposes. Only 39.5% supported the idea thus making it difficult to carry out conservation of the wetlands. In order to effectively conserve the wetlands, the government may have to reclaim adjacent lands from the community an idea that is likely to meet resistance from community owing to the cultural attachment to their lands. In the interest of conservation, the County government may have to compulsorily acquire the lands adjacent to the wetland for conservation purposes. The table below shows the opinion of the residents on whether their lands should be acquired for inclusion into conservation area.

Table 7: Shows respondents' opinion on whether their lands should be maintained as wetlands or not

Do you think your area should be acquired for conservation?	
Yes	39.5%
No	60.5%

Source: Author, 2016

5.6 Suitable restoration and conservation strategies based on current use and the value attached to wetlands

The third objective of the study was to explore suitable restoration and conservation strategies based on current land use and the value attached to the wetland. The respondents were required to state their opinion on conservation, involvement in conservation of the swamp and state the measures they use to conserve the swamp. An interview with the community through Focus Group Discussions, key informants at

Siaya County Government (Lands and Environment departments), and Kenya Wildlife Service revealed that there is need to conserve the wetlands. However their respective approaches seemed not synchronized. The following sub-sections outline the results obtained from the interviews with respondents.

5.6.1 Siaya County Government

According to the County Government of Siaya, the sustainable use of the swamp will be achieved when there is a land use plan for the wetland that clearly outlines the activities that are allowed to take place on the swamp. The County Government of Siaya currently does not have spatial plans to guide development activities within the wetland and its influence zone.

As the custodian of the land on behalf of the people, however, the county government in collaboration with Nature Kenya is in the process of developing a land use plan whose purpose would be to balance the needs of a rapidly increasing local population and private commercial agricultural interests with environmental conservation. Yala Swamp Land Use planning is intended to be multidisciplinary and multi-sectoral so as to involve all stakeholders and sectors that will either be affected, influenced or have interest in sustainable development of the Yala Swamp. During the inception stage, consultative meetings will be held between county governments of Siaya and Busia, physical planning technical team, national government agencies and community leaders to create awareness of the intended preparation of land use plan. The Director of Environment at Siaya County Government indicated that alongside the land use planning process, a Strategic Environmental Assessment will be conducted as required by the revised Environmental Management and Coordination Act (EMCA) Act 2015. ***“All Policies, Plans and Programmes at national and county level likely to have significant effect on the environment shall be subject to SEA”***. This is also intended to assist in the process of demarcation of the swamp boundaries. According to the Director of Lands at the Siaya County Government, aerial survey has already been concluded but physical demarcation cannot proceed without consulting the local community who also stake claim to sections of the wetland. Indeed the county government has set aside budget for ground survey in this financial year awaiting conclusion of stakeholder involvement.

5.6.2 Dominion Farms

Dominion Farms Limited have time again been singled out as the single largest contributor to environmental degradation at the swamp, through the discharge of chemicals into the lake and river, a position that they do not agree with. They maintain that the best way to achieve conservation at the swamp is to clearly demarcate the swamp areas so that the communities know exactly their limits. This position is shared by the local KWS officers who assert that locals are fast invading the wet land and destroying the plantation (papyrus) responsible for the survival of the Lake

The investor claims that this coupled with low levels of education has led to the members of the community venturing into areas that are leased to Dominion Farms causing constant friction. In their opinion, a land use plan would also help address this as different uses will be assigned different areas.

5.6.3 Kenya Wildlife Service

On their part, the Kenya Wildlife Service (KWS), as the Ramsar Convention authority in Kenya, have reason to believe that the swamp is currently in an ecological crisis. They single out the wanton destruction of the papyrus reeds which they say leads to natural calamities including floods, drought and high temperatures, as the same hold carbon dioxide. They also lament the decreasing number of endangered animal species as a result of unrestricted access and utilization of the wetland services.

Their position is that the entire wetlands should be declared a Protected Area and sound environmental management plans drawn. Indeed in 2010 the wildlife agency declared some 4,200 hectares (41.42 sq km) of the swamp covering Lake Kanyaboli and the adjoining areas a National Reserve vide legal notice No. 158.

However, only two years later in 2012, the local community filed a Notice of Motion and sought the setting aside of the legal notice and subsequently an Order of Certiorari was issued to quash the decision and a further Order of Prohibition issued against the County Government and the Kenya Wildlife Service not to effect changes on the swamp land. The High Court ruled that lawful procedures were not followed. The Wildlife Act in Section 33 provides that (1) “The Cabinet Secretary shall, on recommendation of the Service, in consultation with the National Land Commission, by notice in the Gazette, declare a wetland that is an important habitat or ecosystem for wildlife conservation a protected wetland”. (2) “As soon as practicable, after declaring it a protected wetland,

the Service shall, in collaboration with the person or community who hold a legal or communal interest in the wetland and the relevant lead agencies, prepare an Integrated Wetland Management Plan for the conservation and management of the protected wetland through a public consultative process. Indeed there was no evidence of involvement of the Land Commission nor an Integrated Management Plan prepared.

5.6.4 Local Residents

Majority of the residents (45.9%) felt that fencing the wetland would be the best way of ensuring sustainable use. According to them, over exploitation of the wetland's resources is due to the physical exposure of the wetland. The table below highlights a summary of the opinion of the residents on how best the wetland can be used sustainably.

Table 8: Shows residents' opinion on sustainable use of wetland

Measures that should be taken to ensure sustainable use of the wetland	
Action	Percentage
Fencing of wetland	45.9%
Regulating use of wetland resources	33.8%
Sensitizing the community	13.5%
Prohibiting the use of wetland resources	2.7%
Employing guards to protect wetland	2.7%
Arresting and prosecuting encroachers	1.4%

Source: Author, 2016.

From the above it would appear that the community is keen to have the boundaries of the wetland determined vis a vis theirs to avoid situations of inadvertent encroachments. The next important step in their view, at 33.8% is to regulate utilization of the wetland resources to ensure sustainable use.

This may appear contradictory as the community has already successfully overturned the legal notice No. 158 of 2012 that declared Lake Kanyaboli a National Reserve, an instrument that would have addressed sustainable resource utilization. The possible explanation to this is that even though they see need to conserve the wetlands; they want to be fully involved so that their rights are defined and documented.



Plate 12: Focus Group Discussion Session in Central Alego

CHAPTER VI

SUMMARY OF FINDINGS

6 Introduction

This chapter deals with summary of main findings, conclusions, and the recommendations of this study and areas for further research. The main objective of this study was to identify land use strategies for sustainable wetland conservation and development at Yala Swamp. The summary of findings, conclusions and recommendations outlined in this chapter were based on this primary objective.

6.1 Summary of main findings

The first objective of the study was to establish the dominant land uses in Yala wetland. The study results have shown that the main uses of the wetland is farming with almost 49% of the respondents indicating that they are involved in it. Out of these, 66.7% are involved in arable farming while 33.3% practice both arable and livestock keeping. Indeed there is also large scale commercial farming by Dominion Farms on 6,900 acres. This looks to increase considerably if yet another private firm is allowed to grow sugar on the swamp as is currently being reported, on another 6,000 acres. Commercial mat making has also meant that a large part of the wetland is under papyrus. Fishing on the lake is also a major land use activity in the area so is tourism which is steadily picking up as evidenced by the putting up of beach hotels in the area and planned annual awareness races at Lake Kanyaboli.

The second objective of the study was to determine the effects of current land uses on wetland conservation. The study results have shown that the current land uses have brought issues of land degradation as is manifested by turbidity of the water and land cover; poor water management as is clear from cases of water pollution leading to animal and human diseases; loss of sources of livelihood as over harvesting of papyrus is threatening its very survival; loss of bio-diversity as can be seen in the dwindling number of some endangered plant and animal species. The uncoordinated land use has also caused conflicts especially between the small scale farmers and the Dominion Farms due to encroachment

The third objective of the study was to explore suitable restoration and conservation strategies based on current land use and the value attached to the wetland. The study

results have shown that virtually all the stakeholders are aligned towards sustainable utilization of the wetland but vary on the approach. While the Siaya County Government believes that a participatory land use planning process that recognizes various past and on-going initiatives on sustainable management of the swamp and community participation from both counties, informed by a Strategic Environmental Assessment (SEA) to be undertaken as per the National Environment management Authority (NEMA) regulations, is the panacea to the wetland survival, the Kenya Wildlife Service seem to proceed on the basis that there is immediate danger to the wetlands and urgent drastic action must be taken. Hence the 2010 declaration of a section of the wetlands a National Reserve.

The community on the other hand sees demarcation and fencing of the wetland, a costly and ambitious affair, to be a quick gain. They also suggest measures such as regulating use of wetland resources, sensitizing the community on the importance of the wetlands, outright prohibition of unsustainable use of wetland resources, employing guards to protect the wetland and prosecution of offenders.

However the study also shows that any activity planned must involve the community to achieve legitimacy.

CHAPTER VII

CONCLUSION AND RECOMMENDATIONS

7 Overview

This chapter concludes the discussion made in this report and presents a number of propositions that could be implemented to ensure sustainable development and protection of Yala Swamp.

7.1 Conclusion

Yala Swamp, like many other wetlands in developing countries, supports a wide array of flora and fauna. This study results have indicated that the local community living around the wetland continue to depend on the swamp for their livelihoods which include papyrus harvesting, farming, fishing, grazing and water, amongst many other benefits.

However, these activities carried on the swamp are degrading the ecosystem and if left uncontrolled or unregulated may cause further irreversible damage. For example the clearance of papyrus beds for agricultural activities (farming) renders the swamp less suitable for the plants and animals that are adapted to the ecosystem, and grazing ground for cattle at times of drought. The papyrus reeds are also very important as they hold carbon dioxide and their destruction leads to increased carbon dioxide in the atmosphere which in turn leads to global warming associated with increase of natural calamities.

Degradation is a serious issue that requires urgent attention especially due to threats of a growing population and poverty levels. This calls for a strategy for sustainable management taking cognizance of the levels of degradation and restoration challenges like cost and logistics, so that proper scoping is done. This strategy should integrate the technical, socio-economic, environmental and legal aspects of the wetland resources management and must involve the local community at all levels.

7.2 Recommendations

The study has shown that Yala Swamp wetland is the primary source of livelihood to the surrounding communities. It is however evident that the continuous unplanned utilization of the wetland's resources is a great threat to the existence of the fragile ecosystem. It is therefore important to embrace a balanced wetland management strategy that will ensure that Yala Swamp wetland not only continues to benefit the local

community and investors but also conserves the endangered biodiversity. As aforementioned, this study proposes several measures that should be given priority. They include;

7.2.1 Development of land use plan

Yala Swamp lacks a comprehensive land use plan. As indicated earlier, there`s a collaborative effort between Siaya and Busia County Governments to come up with a land use plan for the Yala Swamp. Due to the poverty levels around the wetland, the considerations in the preparation of Yala Swamp land use plan should include an element of social justice to address the distribution and kind of benefits, so that even the socially weak participate in the process.

Long-term sustainability of natural resources must be designed to ensure that the natural basis of living is sustained in the long-term run, i.e. the use of the land should correspond to its natural potential. This should be determined by prior elaborate ecosystem services inventory. The measures applied should be desirable, supported and largely carried out by the community to ensure social compatibility and cultural suitability, taking into account local knowledge and capacities. The measures planned should be designed to contribute to the long-term security of the economic basis of living of the people. Therefore, the measures should be self-financing and thereby economically justified. In this way, they contribute to the improvement of the living conditions and to the overall economic development. To be viable, the planned measures should consider the level of tolerance of the local population in terms of technology, economy and organization.

The planning process should culminate in the following deliverables:

- **Land use plan and regulations:** This is a map or a set of maps with supporting documents that show and describe the nature and intensity of land uses permitted in different zones in the planning area, areas reserved for particular uses, areas where development is restricted, and guidelines for the design and construction of structures. It is common practice to also show any proposed road network and other transportation networks on the same maps. Supporting documents include draft regulations and/or ordinances that must be approved legislatively in order for the plan to be put in force and

implemented. The regulations should include sanctions that penalize non-compliance with the plan.

- **Physical plan:** This is a map or set of maps that show the proposed layout of the road network, alignments of various other infrastructure networks, and locations of major facilities.
- **Set of project briefs:** This is a list of projects, each one with a brief description, cost estimate, and implementation strategy. Projects to include capital investments as well as other interventions, such as public awareness or capacity building.
- **Implementation plan:** This a detailed work plan that assigns roles and responsibilities, describes the design of programs for capacity building where required, and explains the strategy for monitoring plan implementation.

The outcome is allocation and zoning of **land for specific uses, regulation of** intensity of use, and formulation of legal and administrative instruments that support the plan.

The two counties should move with speed and conclude the SEA Report which is a prerequisite to the implementation of a land use plan with such a large geographical footprint.

7.2.2 Completion of Survey of Yala Swamp

Even though aerial surveys are complete, the physical boundaries of Yala Swamp are not defined due to the continuous encroachment of the swamp by both the surrounding communities and private enterprises. The county government has set aside funds for the cadastral survey but is yet to move to the site to do the beaconing. This is because an exercise of this magnitude would require public participation as some land owners may raise objections when they discover that they have encroached into the swamp land. The County Government should ride on the Strategic Environmental Assessment (SEA) that is underway to reach to the local community and agree on boundaries. Any land that is found to be illegally occupied should be recovered and protected.

7.2.3 Eminent Domain

This is provided for in the Land Acquisition Act (cap 295 of the laws of Kenya). This Act empowers the Commissioner of Lands upon due notice in the Kenya Gazette and upon the payment of full compensation to the persons having proprietary interest in the

property to proceed and acquire any piece of land which the Minister is satisfied is required for public use.

The land so acquired can be used as a buffer zone around the swamp. Buffer zones are strips of land along environmentally sensitive areas such as swamps and rivers that are established to protect such areas from the adjacent human activities. A vegetative buffer (greenbelt) is established and maintained around the wetland by planting trees and other types of vegetation to maintain a natural vegetation state.

Compulsory acquisition of land may however prove unpopular due to the fact that most of the land is inherited (ancestral) and detaching the people from them may meet resistance. It is therefore important to undertake in-depth consultations with the stakeholders before the process is undertaken.

7.2.4 Land Exchange

Land exchange is the provision of alternative land to affected persons in exchange for ecologically sensitive land in the hands of the public. As has already been alluded to in this study, prospects for protecting crucial biological and ecological values are usually better when the land is in public ownership than when privately owned, especially when the private owner is in the business of resource extraction or other types of development. While public ownership in no way guarantees protection, it does have the advantage over private ownership of allowing for the application of environmental laws and regulations and public involvement processes.

The County Government of Siaya does not have a land bank and this call for collaboration with the National Government and other interested stakeholders to acquire land in other areas within the county on which to relocate land owners closest to the swamp. However, as the area is largely ancestral land, this method may prove unpopular as local communities tend to be culturally attached to such land. Lindy Heineken, Hardy Prozesky (2010) note that due to the long process of living together in the same habitat, members of an ethnic group develop territorial consciousness in the area in which they live. Such consciousness is closely related to the history of the ethnic group which evolves within their own native land so that the group's attachment to its homeland with its unique resources often fosters bonds of patriotism among the members. This land, they conclude, forms part of the physical, spiritual, religious and

cultural mindset. Extensive pacification and consultation with the stakeholders is therefore very critical in this process.

7.2.5 The Government to Regularize the Protected Area

As has been seen in this study, the National Reserve status accorded to Lake Kanyaboli was overturned by the High Court citing lack of consultation and concurrence by the Siaya County Government as the Trustee on one hand, and lack of public participation on the other. This indeed had been a big step towards protection of the swamp. The government should re-launch this effort by getting clearance from both the Siaya County Government and the National Land Commission; engage the community accordingly and follow up with the development of a Management Plan as required by the Wildlife Act.

For the above mentioned strategies to yield fruits there is need to promote effective communication, education and public awareness among stakeholders on wetland resources to encourage understanding and participation of the public, private sector, local authorities, NGOs and other interested persons.

Finally, the County Government in collaboration with other agencies should empower the local communities on alternative livelihood opportunities such as recreation, eco-tourism, and agro-forestry among others. It is hoped that this will help meet the needs of an increasing population while reducing pressure on the already overburdened wetland ecosystem.

7.3 Other Areas of Study

In order to improve Yala Swamp management and conservation, more studies need to be done in the following areas.

A comprehensive study of the swamp should be done to establish the wetland biotic inventory. This will contribute immensely to the understanding of the species diversity and distribution of Yala Swamp fauna and flora and provide data with which to evaluate the biogeographic, climatic and biotic factors. The use of this knowledge of species diversity will inform conservation decisions and help to monitor local, national and regional conservation efforts.

Research on potential responses of species and ecosystems to development activities, particularly in relation to habitat fragmentation should be done so as to establish conservation thresholds for land use planning.

APPENDICES

Appendix I: Household Questionnaire



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

This questionnaire is intended to gather data geared towards assisting **Fredrick Ochieng Okech**, a Masters Student in the School of the Built Environment, University of Nairobi for his Research Thesis titled: “*Land Use Strategies for Sustainable Wetland Development and Protection: SA Case Study of Yala Swamp*”

NB: The information provided will be treated with confidentiality and only for the research purpose.

HOUSEHOLD QUESTIONNAIRE

Questionnaire No _____

Name of Interviewer Date.....

Place of interview Time of interview.....

SECTION A: GENERAL INFORMATION

- 1) Name of Respondent
(Optional).....
- 2) Telephone number.....
- 3) Area of Residence?
 - a) Location.....
 - b) Sub-location.....
 - c) Village
- 4) Gender of the respondent
 - a). Male
 - b). Female
- 5) Age of the respondent in years
- 6) Marital Status of the respondent.
 - a) Married
 - b) Single
 - c) Separated
 - d) Widowed
- 7) Respondent's highest level of education
 - a) None, nursery/kindergarten
 - b) Primary
 - c) Post-primary, vocational
 - d) Secondary, A-level
 - e) College
 - f) University
 - g) Other (specify).....

SECTION B: ECONOMIC ASPECTS

8) i) What is your family's main source of income?

- 1. Farming
- 2. Employment
- 3. Daytime/ Casual employees
- 4. Seasonal/Contract
- 5. Others, specify

ii) If your answer to 8 (i) above is farming, please indicate the type of farming.

- a) Arable farming
- b) Livestock farming
- c) Mixed farming

9) i) Do you engage in any other economic activities?

- 1) Yes 2) No

ii) If the answer above is yes , which other economic activity do you engage in?

.....

10) What is your family's range of gross monthly income?

- 1. 1 - 10,000
- 2. 10,000 - 20,000
- 3. 20,001- 40,000
- 4. 40,001- 60,000
- 5. 60,001- 80,000
- 6. 80,001 and above

11) How many persons live in your household?.....

12) What is the composition of your family in terms of gender?

- i) Male..... ii) Female.....

SECTION C: BENEFITS AND CHALLENGES OF BENEFIT UTILIZATION

13) What benefits does the community derive from the wetlands? (list/rank them)

.....
.....

14) Does your household experience any problems related to the existence of wetlands in this area?

1) Yes 2) No

15) If yes, list them.

.....
.....

16) Which wetland-based enterprises are profitable in this area?

.....
.....

17) i) Do you think your area should be maintained as a wetland?

1) Yes 2) No

ii) Give reasons for your answer

.....

SECTION D: ACCESS, USE AND OWNERSHIP OF WETLANDS

18) i) Do you own land in this area?

1) Yes 2) No

ii) If yes, how many acres?

19) How much of the land is not wetland?

.....

20) How much of the land is wetland?

.....

21) How did you acquire the land?

1. Inherited
2. Bought
3. Rented
4. Squatter
5. Other? (Specify).....

22) Under what land tenure do you own the land which is not under wetland?

- a) Freehold
- b) Leasehold
- c) Customary
- d) Public land
- e) Squatter

23) Under what land tenure do you own the land which is under wetland?

- a) Freehold
- b) Leasehold
- c) Customary
- d) Public land
- e) Squatter

24) Which wetland resource does this household use?

1. Water for domestic use
2. Water for irrigation
3. Water for brewing
4. Water for livestock
5. Land/pasture for grazing livestock
6. Fish Farming
7. Land for settlement

- 8. Building poles
- 9. Papyrus
- 10. Hunting
- 11. Crafts materials
- 12. Grass (specify use)
- 13. Wild fruits
- 14. Medicinal herbs
- 15. Palm Leaves
- 16. Bee Keeping
- 17. Clay
- 18. Firewood

25) Is the use commercial, subsistence or both?

- a) Commercial
- b) Subsistence
- c) Both

26) Would you give up your land for conservation if you were to be compensated in kind or financially or materially?

.....
.....

SECTION E: VALUES AND SUSTAINABLE UTILIZATION OF WETLANDS

27) What are some of the practises in this area that may impact negatively on the wetlands?

Activity/Practise	Impact

What is your community doing to minimize the negative impacts?

.....
.....

28) What alternative resources to wetlands are available for use by the community?

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

29) What does your household require to engage in the alternative activities? (list them)

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

30) What can your household do to develop the alternative activities?

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

31) i) What can be done to ensure sustainable use of wetlands? (list)

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

ii) Do you think people need training to use wetlands?

1. Yes 2. No

32) Which category of people should be trained on how to use the wetlands?.....

.....

.....

...

33) What kind of training should they be given?

.....

.....

Appendix II: Interview Schedule for Dominion Farms (K) Limited



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

INTERVIEW SCHEDULE FOR DOMINION FARMS (K) LIMITED

This Interview Schedule is intended to gather data geared towards assisting **Fredrick Ochieng Okech**, a Masters Student in the School of the Built Environment, University of Nairobi for his Research Thesis titled: “*Land Use Strategies for Sustainable Wetland Development and Protection: A Case Study of Yala Swamp*”

1. Write a Brief History of the company in Yala Swamp?

.....
.....

2. How do you use the wetland under your management?

.....
.....

3. How have you contributed to the standard of living and general conditions in the local area?.....

.....

4. How many employees (Both fulltime and part-time) do you have?

5. Where do they come from?

6. What changes have occurred to livelihood opportunities?

.....
.....

7. What can you comment about the effect of your land use activities on the environment?

.....

8. What environmental challenges have you encountered in your farming activities?

.....
.....

9. If any, how have you gone about them?

.....

10. In your own views, what is the future of Yala Swamp under Dominion farm (K) Ltd?

.....
.....

11. Do you have any general comments regarding Yala Swamp.

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

Appendix III: Interview Guide for Siaya County Government Lands Department



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

INTERVIEW GUIDE FOR SIAYA COUNTY GOVERNMENT

This Interview guide is intended to gather data geared towards assisting **Fredrick Ochieng Okech**, a Masters Student in the School of the Built Environment, University of Nairobi for his Research Thesis titled: *“Land Use Strategies for Sustainable Wetland Development and Protection: A Case Study of Yala Swamp*

1. As the Trustee of the Yala Swamp land, what obligations does the Siaya County Government have towards the sustainable management of the wetland?

.....
.....

2. What land use strategies has the County Government put in place to ensure protection of Yala Swamp?

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

3. Land exchange has been suggested as a suitable conservation strategy. Does the county government have sufficient land stock to exchange with landowners whose lands are abutting the swamp?

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

4. There have been suggestions that the community living around the swamp be facilitated to start enterprises that have little impact on the wetland. Does the County Government have such plans?

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

Appendix IV: Interview Guide for NEMA, Siaya and Bondo Sub-Counties



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

**INTERVIEW GUIDE FOR SIAYA COUNTY ENVIRONMENT
DEPARTMENT**

This Interview guide is intended to gather data geared towards assisting **Fredrick Ochieng Okech**, a Masters Student in the School of the Built Environment, University of Nairobi for his Research Thesis titled: *“Land Use Strategies for Sustainable Wetland Development and Protection A Case Study of Yala Swamp*

1. In your view what are the real and potential environmental effects of land uses around and associated with Yala Swamp?

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

2. What measures are in place to forestall environmental harm to the wetland?

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

3. The swamp ecosystem covers areas of Siaya and Busia Counties. How do you coordinate conservation efforts with your counterpart in Busia?

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

4. In recent times there have been concerns especially by environmentalists about potential harm to Yala Swamp by activities of the Dominion Farms. What are your comments?

.....
.....

5. What is your opinion on the future of Yala Swamp with reference to the environment?

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

6. Do you have any closing comments on environmental issues of Yala Swamp?

.....
.....

Appendix V: Focus Group Discussions Guide



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

FOCUS GROUP DISCUSSIONS GUIDE

- (1) What are the main regulations on wetland resource access that the village understands to apply to their activities? Do people comply with these regulations?
- (2) How are the regulations monitored? What is the penalty for non-compliance?
- (3) Does the village have its own structure for regulating seasonal, spatial or personal access to natural resources and permitted harvesting equipment (e.g. fishing gears), and how does this work?
- (4) Are there conflicts between the way the village authorities would like to manage access to resources, and the rules that are imposed from outside by government departments?
- (5) Do the rules (whether village-based or imposed from outside) mean that some individuals have permanent rights to use natural resources while others are always excluded?
- (6) What effect have Dominion Farms had on the state of the resources (abundance, distribution, ease of harvest)?

Appendix VI: Interview Guide for Kenya Wildlife Service (KWS)



University of Nairobi

School of the Built Environment

Department of Urban and Regional Planning

INTERVIEW GUIDE FOR KENYA WILDLIFE SERVICE

1. What specific role does KWS play at Yala Swamp wetlands?

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

2. Recently the government declared Lake Kanyaboli and the adjoining areas all totalling 4,200 hectares as National Reserve. What are the implications of this in terms of access and usage by surrounding community?

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

3. Did KWS experience any challenges in the process of converting the status of the acquired area from Trust Land/Community Land to National Reserve either from the community or the county government?

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

.....
.....

4. Does the KWS have an Integrated Wetland Management Plan for Yala Swamp wetlands?

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

5. Are there plans to eventually gazette the entire wetland (17,500 hectares) as a National Reserve?

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

6. Do you any other comments on this subject?

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

Appendix VII: Research Work Plan

RESEARCH WORK PLAN

The time frame for completing the research project is outlined below

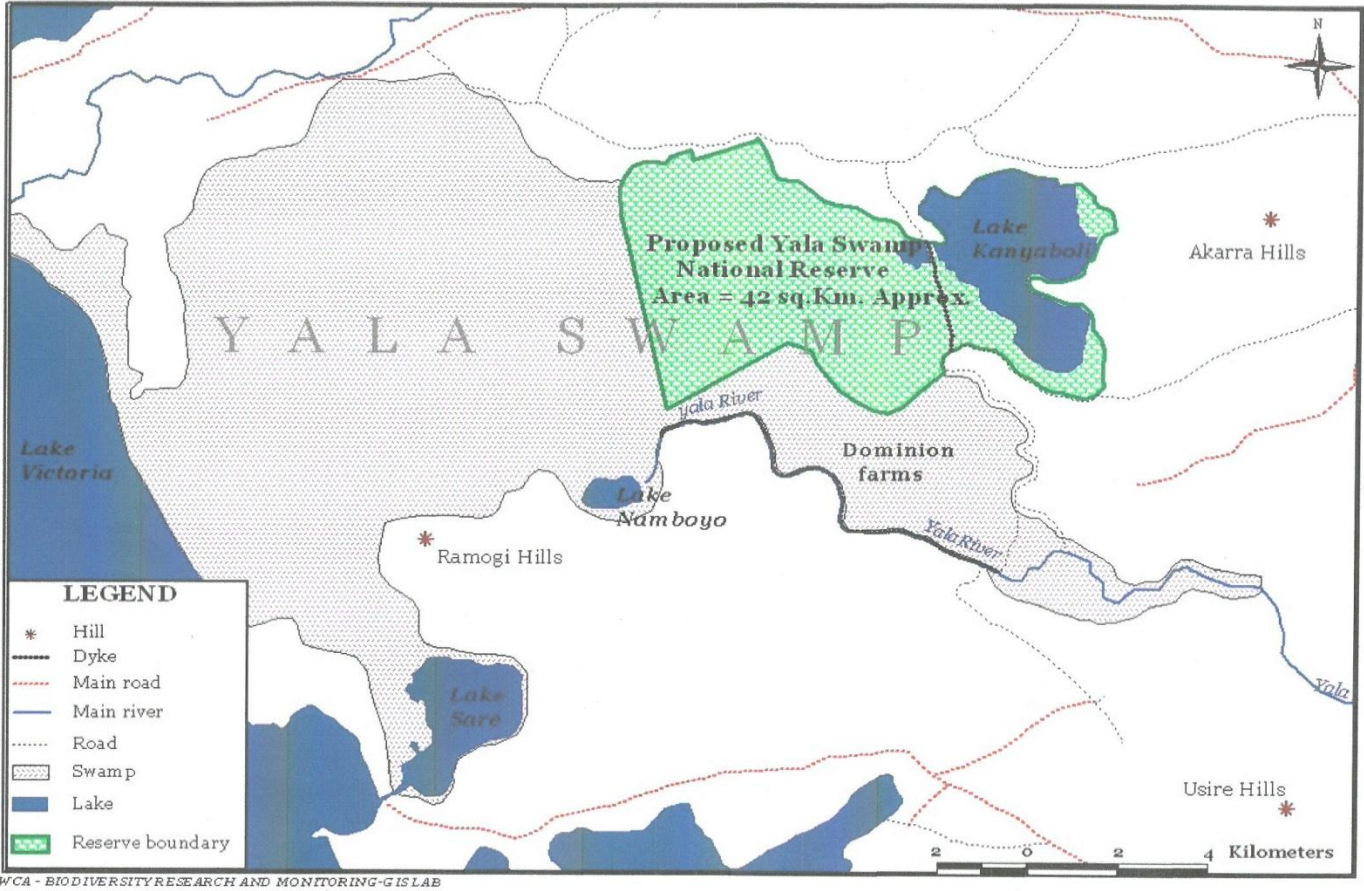
ACTIVITY	FEB	MAR	APR	MAY	JUNE
Study plan preparation					
Data collection					
Data pre-processing					
Data analysis					
Report writing					
Presentation					

Appendix VIII: Research Budget

RESEARCH BUDGET

No.	Activity	Units	Cost per unit	Total Cost (Kshs)
1	Concept paper production	6	300	1,800
2	Questionnaire development	100	100	10,000
3	Travelling	10	10,000	100,000
4	Enumerator trainings	4	5,000	20,000
5	Enumerator allowances	4x12 days	500	24,000
6	Thesis printing, photocopying, binding	4	5,000	20,000
Total				175,800

Appendix IX: Map Showing the Gazetted Area



WCA - BIODIVERSITY RESEARCH AND MONITORING-GIS LAB

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