

**AN ASSESSMENT OF THE EFFECT OF IRRIGATION PROJECTS ON WETLANDS:  
YALA SWAMP, SIAYA COUNTY, KENYA**

**By**

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**DECLARATION**

I hereby declare that this project report is my original work and that it has not been submitted for examination in any institution of higher education for the award of any degree.

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## **DEDICATION**

To my parents

Mr. Stanley Nyakundi

And

The Late Billiah Bitengo,

My husband,

Seth Odongo

And

My daughter

Ariana Bitengo

Who have been my source of inspiration, motivation and encouragement throughout this period

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## **ABSTRACT**

The relationship that exists between irrigated agriculture and its effect on the wetland ecosystem has been depicted as one of the trade-offs between increased human demand for food verses the natural environment. This study aimed at examining the effects of irrigation projects on the status and functioning of wetlands particularly in Yala Swamp, Siaya County and the effect of the irrigation project on the local people's livelihoods. The specific objectives of this study included; examining the socioeconomic benefits of Yala Swamp; assessing how the Dominion Irrigation Project has affected Yala Swamp; and assessing how the Dominion Irrigation Project has affected the livelihood of the people of South Central Alego Location. The study adopted a cross-sectional and a descriptive research design. The communities of Kadenge Sub-location were the target population as they directly and indirectly relied on Yala Swamp for their household livelihoods. A non-probability sampling technique was adopted particularly the purposive sampling technique because the local administration (elders) approached individuals who were believed to have better information on the state of Yala Swamp, the activities carried out at Yala Swamp and how Dominion Farms has affected their livelihoods. The study identified Kadenge sub-location to be the most efficient in generating information concerning the irrigation project and Yala Swamp. 111 respondents filled the questionnaires willingly. The primary data collection instruments used included the use of questionnaires, interviews, focus group discussion and observations. The qualitative data from interviews was analysed using content analysis. The study found out the local residents relied on the socio-economic benefits obtained from Yala Swamp to maintain their livelihoods. Majority of the respondents (57.7 %) acknowledged that Yala swamp played an important role in providing fertile land for agriculture. Another 60% of the farmers reported that they practiced mixed farming and they acknowledged that the swamp was important as it provided foliage and pasture to their livestock. Further, it was found that the human activities carried out along Yala Swamp had adverse impacts on the Swamp thus its degradation. 73.9% of the respondents reported that draining and reclaiming the swamp for agricultural purposes was a major contribution to the degradation of the swamp, while 42.3% reported that flow alteration, diversion and construction of dykes had adverse impact on the swamp leading to reduced water in rivers downstream. It was evident that there were unresolved issues with regards to the sharing of the natural capital between the local residents and Dominion Irrigation. The conflict was because the local residents had difficulty in accessing the wetlands natural resources due to change in the ownership and management of the part of Yala Swamp that was leased to the investor. The study recommended continuous community participation in the decision making process to avoid conflicts. There is also need for education and creating awareness among the stakeholders to promote sustainable utilization of the natural resources and sustainable development.

## ACRONYMS AND ABBREVIATIONS

<b>CBD:</b>	Convention on Biological Diversity
<b>DFID:</b>	Department for International Development
<b>DFI:</b>	Dominion Farms Limited
<b>EIA/EA:</b>	Environmental Impact and Assessment/ Environmental Audit
<b>EMCA:</b>	Environmental Management and Coordination Act
<b>FAO:</b>	Food and Agricultural Organization
<b>GoK:</b>	Government of Kenya
<b>KWS:</b>	Kenya Wildlife Services
<b>LBDA:</b>	Lake Basin Development Authority
<b>LVB:</b>	Lake Victoria Basin
<b>MA:</b>	Millennium Ecosystem Assessment
<b>NEMA:</b>	National Environment Management Authority
<b>SL:</b>	Sustainable Livelihoods
<b>WRMA:</b>	Water Resources Management Authority

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

It has been estimated that wetlands cover about 6 percent of the total land surface worldwide (Maltby, 1986). Wetland ecosystems first received international recognition in 1971 through a convention held in Ramsar, Iran on Wetlands of International Importance and it defined wetlands as ‘areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters’ (Ramsar 2006).

Kenya’s framework environmental law (EMCA 2012), defines wetlands as ‘areas permanently or seasonally flooded by water where plants and animals have become adapted and include swamps, areas of marsh, peat land, mountain bogs, banks of rivers, vegetation, areas of impeded drainage or brackish, salt or alkaline; including areas of marine water the depth of which at low tide does not exceed six meters. It also incorporates riparian and coastal zones adjacent to the wetlands’

Wetlands have been recognized to be significant as they provide important ecological benefits including carbon sequestration; ground water recharge and discharge; and providing habitats to diverse species of plants and animals. Wetland ecosystems have been considered to have economic values because of their roles in sustaining local livelihoods through activities like subsistence agriculture, papyrus harvesting and fisheries. However, wetlands are increasingly being threatened through overexploitation and reclamation for economic development, increasing population and increased poverty incidences. Recent studies done by Thenya (2001), have acknowledged that agriculture has posed a major threat on the integrity of wetlands.

The developing countries are well known for their heavy reliance on the wetlands’ natural resources particularly in the Sub- Saharan Africa. This has been attributed to the fact that the rural populations solely rely on these resources to sustain their livelihoods. Further, economies in these developing countries are mostly based on agriculture, the fertile lands are becoming scarce and there is competition over these lands, a fact that has resulted to encroachment of wetlands thus their degradation. The soils in these regions are becoming exhausted and water is becoming very scarce.

According to Adams (1995), regions where water is scarce and lands are intensively and extensively cultivated, competition for the fertile farming lands is experienced forcing people to invade marginal areas including wetlands for agricultural purposes.

Despite the wide documentation on the wetland's ecological, biological and socio-economic functions, these ecosystems remain to be the most threatened ecosystems worldwide (Thenya, 2006). The transformation of wetlands has largely led to loss of natural habitats and biological diversity. The loss of wetlands has further affected people's sources of livelihood particularly in the developing countries where many solely depend on the wetland's natural resource base to sustain themselves.

The irrigation projects in the developing countries have been establishment to ensure food security, reduce poverty incidences among the rural poor communities as well as improve their quality of life. A report by FAO (2006), clearly indicate that 40 % of the food produced globally originates from the irrigation that takes place on the 20% of the world's arable lands and this has enhanced the livelihoods of more than one million people worldwide. However, these projects have significantly affected the ecological productivity of these wetlands. Excessive nutrients and organic matters from these irrigation projects have led to eutrophication, siltation from erosion, and contamination by toxic metals and organic compounds such as PCBs, and pesticides (FAO, 2006).

Wetlands in Kenya are under threat and they are increasingly becoming vulnerable because of the increasing population accompanied by the increased poverty incidences which has consequently resulted to increased demand for land and water to sustain the people's well- being. With the continued population trends some wetlands are at risk of becoming extinct if efforts to solve the problem are poorly implemented or do not work. The problem is also associated with this destruction of habitats hence loss of biodiversity.

Yala swamp, the study area, is experiencing population growth, escalating poverty incidences high illiteracy levels, ecological stress as well as limited productive resource base. The wetland is becoming scarce due to increased competition for access and utilization of the natural resources among various stakeholders.

The establishment of Dominion Irrigation Project has led to further reclamation of the swamp to improve food production and improve the living standards of the local community. The agricultural activities carried out include production of cereals, pulses, horticultural crops, seed bulking and massive upgrading of the local agricultural production technologies.

## **1.2 Problem Statement**

Many communities particularly in the Sub-Saharan Africa sustain their livelihoods through the exploitation of wetland natural resources. Yala swamp supports a wide variety of species as well as the livelihoods of the local people through activities like agriculture, papyrus harvesting, fishing, and construction material production hunting.

Yala Swamp occurs in an area that is densely populated and dominated by small-scale farmers who highly value the ecosystem services and goods. Maltby (1991), points out that the wetland ecosystem has been experiencing pressure from the rapidly increasing population and escalating poverty. Owiyo et al (2012), also pointed out other challenges that the swamp faces to include pollution from irrigation practices; overexploitation of natural resources; drainage and reclamation of Yala Swamp.

In the recent years, conflict among the different stakeholders has emerged over access of the wetland as well as the utilization of its natural resources. After 6500ha of Yala Swamp was leased to Dominion Farms Ltd, management and ownership of Yala Swamp and the local people felt that their livelihood was threatened as access the natural resources was limited and controlled. Further the ecology of the swamp was degraded particularly the water quality, fish population, vegetation cover and the ability for the swamp to control floods and soil erosion was diminishing. In addition, mechanisms that exist have not been strongly enforced to help conserve and ensure sustainable development and this has further contributed to conflicts among the different stakeholders and degradation of Yala Swamp.

Various research done on Yala swamp (Owiyo et al 2012; Thenya 2001;) acknowledge that the negative effects resulting from the degradation of these ecosystems, agricultural intensification and extensification are yet to be experienced and have further pointed out that there is need to manage the swamp's natural resources sustainably and come up with measures that ensure sustainable household livelihoods.

It is for these reasons that this research aimed at examining the socio-economic benefits of Yala Swamp, determining the effect of the irrigation project on the livelihoods of the people of South Central Alego location, and assess the effect of the project on the environmental conservation of Yala Swamp.

### **1.3 Research questions**

The study was guided by the following research questions:

- i. What are the socioeconomic benefits of Yala Swamp?
- ii. How has Dominion Irrigation Project affected Yala Swamp?
- iii. How has Dominion Irrigation Project affected the livelihood of the people of South Central Alego Location?

### **1.4 Research objectives**

#### *1.4.1 Main Objective*

To determine the effect of Dominion Irrigation Project on the household livelihoods and conservation of Yala Swamp.

#### *1.4.2 Specific objectives*

The specific objectives of the study were to:

- i. To examine the socioeconomic benefits of Yala Swamp
- ii. To assess how Dominion Irrigation Project has affected Yala Swamp
- iii. To assess how Dominion Irrigation Project has affected the livelihood of the people of South Central Alego Location.

### **1.5 Hypotheses**

The study tested the following hypotheses

- i. H<sub>0</sub>: There is no significant effect of the socio-economic benefits of Yala Swamp on the local people's livelihood  
H<sub>1</sub>: there is a significant effect of the socio-economic benefits of Yala Swamp on the local people's livelihood



- ii. H<sub>0</sub>: Human activities carried out at Yala Swamp have no significant impact on Yala Swamp  
H<sub>1</sub>: Human activities carried out at Yala Swamp have significant impact on Yala Swamp.

## **1.6 Justification of the study**

Human activities like flow alteration, diversion of river channels, drainage and reclamation of swamps, and over-exploitation of the swamp's natural resources have adverse effects on the general state of the wetland ecosystem. Wetlands serve a variety of functions in terms of supporting biodiversity as well as being a source of livelihood to the community and thus their importance cannot be overlooked. Despite being recognized to have environmental and economic functions, these wetlands are often viewed as waste lands and are increasingly being degraded. Their degradation has partly been contributed by the failure to account for their economic value.

In Africa, little scientific research has been done addressing these ecosystems particularly the swamps despite the increasing awareness and wide documentation of their importance in sustaining the local people's livelihoods. Studies done on land use change have majorly been done on the forest ecosystems and this has left a wide gap in the wetland ecosystem. Despite their recognition in supporting livelihoods, limited empirical research has been done to establish and understand the relationship that exists between wetlands and the livelihoods of the adjacent communities.

Recent studies (Thenya 2001; Mugisha 2002) on land use changes have acknowledged agriculture as the main human activities that pose threat on the wetlands. After the establishment of Dominion Farms Ltd in Yala Swamp for the purpose of agricultural production, the activities carried out at the swamp are threatening the integrity of wetland ecosystem health and the community. It is for these reasons the study sought to find out how Dominion Irrigation Project affects the people's livelihoods and the role it plays in the conservation of Yala Swamp and its resources.

## **1.7 Scope of the study and limitations**

The study was limited to Yala Swamp and its environs which lies within the equatorial line with rich biodiversity. Yala Swamp was the most appropriate study area because of the presence of a large scale irrigation farm in it. These agricultural activities in the swamp have interfered with the natural state of the swamp and conflicts have arisen because the local people feel that their

livelihoods have been threatened because of change in ownership and management of part of Yala Swamp. The study focused on the irrigation project activities carried out at Yala Swamp, their impact on the ecology of the wetland as well as the effect of the irrigation projects on the livelihood of the riparian community particularly the residents of South Central Alego location. The study limited itself to three social groups namely; the local residents particularly head of households, government officials and officials from the Dominion Farms Ltd. These groups were believed to have greater exposure to events taking place around the Yala Swamp.

The study faced some limitations which included language barrier between the researcher and the respondents in explaining some critical concepts. The rainy season made accessibility to some specific areas impossible because of the slippery and flooded roads. Hostility from some individuals was experienced during the one on one interviews and others did not understand that the research was academic and they expected incentives from the researcher after being interviewed.

## **CHAPTER TWO LITERATURE REVIEW**

### **2.1 Introduction**

Recognition of the environmental and socio-economic benefits derived from wetlands is a relatively new concept. This chapter focused on the researches already done related to this research study on the impacts of irrigation projects on wetlands as well as wetland conservation. This section further examined the extent and global distribution of wetlands, the ecological and socioeconomic benefits of wetlands, the effects of irrigation projects on wetlands and the linkages that exist between the wetlands and livelihoods. Human activities and unwise use which have threatened and negatively impacted the survival of wetland resources were also discussed in detail. This chapter also helped in understanding the research being studied in terms of theoretical and conceptual framework

### **2.2 Global Diversity and Distribution of Wetlands**

Wetlands are areas that are inundated by water and this characteristic creates an enabling environment to support the unique the plant animal life found there. The current global wetland area is estimated to be approximately 10 percent of the total surface area of the world, (Schuyt & Brader, 2004; Finlayson & D’Cruz, 2005). The difficulty experienced in accurately measuring the extent and number of wetlands globally has been attributed by the varying measurements and mapping techniques between countries and regions (Robelo *et al*, 2009). According to the estimates by Lehner & Doll (2004), wetlands cover approximately 131 million hectares and 286 million hectares in Africa and Asia respectively. In South America, the wetlands are estimated to cover approximately 179 million hectares.

Various researches done have observed that there is uneven distribution of specific types of wetlands although they are a common feature across all continents. For instance Mitsch *et al*, (1994), explains that the cool and wet climate of the temperate and sub-arctic areas favors the establishment of expansive areas of peatlands accounting for almost half of the world’s wetlands.

Kenyan wetlands transverse approximately 2 to 3 percent of the country's total surface area and they vary in type and distribution. The large wetlands in Kenya include lakes Nakuru, Naivasha, Kanyaboli, edges of Lake Victoria, Baringo, Lorian Swamp, Tana Delta, Yala Swamp, and the coastal wetlands.

According to Katua & M'mayi (2001), there are 523 different kinds of wetlands that are linked to the lakeshore, flood plains, rivers and streams in the LVB. The many rivers draining the Kenyan side of the LVB and their tributaries support a number of wetlands, along their flood plains and at the river mouths. The shoreline and river mouth wetlands of Lake Victoria are the most expansive and are rich in both plant and animal diversity. For instance the Yala Swamp has been described as a biological museum because of its rich diversity of haplochromine cichlids, most of them threatened and thought to be extinct in Lake Victoria (Aloo, 2003).

The dominant vegetation found in the wetlands bordering Lake Victoria is *Cyperus papyrus*. These wetlands are commonly referred to as papyrus wetlands are the most dominant in the LVB as well as the inshore areas of the lake (Kansiime et al 2007). Osumba et al (2010), acknowledge these papyrus wetlands to be highly productive and they support the livelihoods of more than 10 million people.

Yala Swamp is the largest freshwater wetland in Kenya covering an area of 17500 ha (Abila *et al* 2004) and borders a large part Lake Victoria's shoreline. Yala Swamp is considered to be a biodiversity hotspot as it hosts a wide variety of plants and animal species including indigenous fish species. The wetland also consist of three satellite lakes namely Lake Kanyaboli, Sare and Namboyo which are also habitat to a variety of species of flora and fauna (Abilla 2002).

### **2.3 Wetland Services: Ecological and socio-economic Benefits**

Wetlands have been widely recognized to be valuable because of the benefits derived from them by the riparian communities who heavily depend on them to maintain their livelihoods. They also support different varieties of species of flora and fauna. The different services derived from these wetlands are important in sustaining life on earth, help in reducing poverty incidences, as well as improve quality of life for the poor population in the rural (Kenya Wetland Atlas, 2012)

According to the report by MA (2005), wetlands provide both direct and indirect goods and services including regulating, provisioning, supporting and cultural services. They support human well-being through regulating floods and soil erosion, provide fertile land for agriculture, source of fish and building, materials among others

### 2.3.1 *Provisional services*

Provisioning services are important in maintaining essential human needs and reducing poverty (MA, 2005). The provisioning services acquired from these wetlands include fish, water for domestic use, firewood, building materials, medicinal plants and fodder for livestock. For instance, Lake Victoria is well known for provision of fish protein like the tilapia and Nile Perch (Mergeay et al, 2004).

Yala swamp is a highly productive ecosystem and also provides habitat to a wide variety of fish species including the three species of tilapia: *Oreochromis esculentus*, *Oreochromis leucostictu* and *Oreochromis variabilis* and several haplochromine cichlids species (Abila et al, 2008). The critically endangered Sitatunga antelope (*Tragecephalus spekei*) still lives in the wetland system's papyrus vegetation (Abila 2005).

The Kingwal swamp in Kenya is important for its medicinal value. For instance, the water berry found in this swamp is traditionally used as herbal medicine and could also be used as charcoal and fuel wood. (Ambasa, 2005).

The mangroves found in the coastal wetlands are also used as construction materials by the coastal population (Rönnbäck et al 2007) while papyrus reeds are used to make handicraft materials such as mats, woven tables and chairs (Osumba et al 2010). Water for domestic, agricultural and industrial are also obtained from these wetlands. Wetlands also provide forage and pasture to the livestock and also sustain the wildlife populations found there (Keter, 1992).

### 2.3.2 *Regulating Services*

Human beings obtain acquire these services through the natural management of the diverse wetland ecosystem processes (Carpenter et al, 2006). According to MA, (2005), these services include climate regulation, water purification, nutrient retention as well as ground water recharge and discharge. These ecosystems are also important in climate regulation through carbon

sequestration, precipitation and evapo-transpiration (Gichuki2000). Yala Swamp biologically filters the pollutants and silt loads of the waters that flow into Lake Victoria from the Nzoia and YalaRivers (Aloo 2003)

According to Winter (1998), wetlands are important in recharging the ground water in areas with high topography. Wetland vegetation purifies water through the up-take of toxins and nutrients thus preventing eutrophication. The papyrus vegetation in Yala Swamp is important in nutrient retention as the swamp is prone to non-point pollution from the chemical fertilizers and pesticides originating from the farm plantations (Gichuki et al 2001).

The wetland vegetation and their dense roots help in controlling soil erosion. The retention of the fertile topsoil by the roots makes the swamp suitable for agriculture (Uluocha & Okeke 2004).

Yala swamp is referred to as a biodiversity hotspot as it hosts a wide variety of species of flora and fauna (Denny, 1994). Yala Swamp also hosts beneficial insects like the pollinators which are important in increasing food production through the process of pollination. For instance bees are important in improving maize production which in turn improves the livelihoods of the farmers (Kasina et al, 2009).

### *2.3.3 Supporting Services*

These services maintain the ecosystem services provided by the wetland ecosystems and they include soil formation, hydrological cycles and nutrient recycling. When these services are interfered with, they consequently affect the other services provided by the wetlands. For example, in agriculture, when the supporting services are disrupted, the provisioning services provided like food are affected because of decrease in food production and this consequently affects the livelihoods of those relying on the ecosystem. (Wood et al, 2008)

Wetland vegetation retains soil that has been transported by runoff and by doing so it helps in retaining nutrients too. Nutrient cycling and soil formation are important aspects in agriculture as it ensures food security particularly among the riparian community. When the soil is naturally fertile, there is no need of applying chemical fertilizers in the farms thus reduction in soil, water and air pollution. (Hood et al 2005)

#### 2.3.4 *Cultural Services*

Kenya's wetlands support a range of recreational activities including picnics, bird watching, hunting and sailing. For instance, Lake Nakuru is an important tourist attraction site for its contribution in the country's economic development as it earns the country a significant foreign exchange (GoK 2011). Ramsar Sites like Lake Bogoria, Elementaita and Naivasha are also tourist attraction sites in the Rift Valley because of their aesthetic beauty and value (UNESCO 2011).

The indigenous people and the riparian communities also associate themselves with these ecosystems traditionally. These communities' culture including food types, traditional arts, medicinal herbs and traditional religious practices have been influenced by the wetlands. The dominant lifestyle choices particularly for the fishing communities has also been determined by these wetlands. They even determine dominant livelihood choices especially for fishing communities (Thenya 2001). Some scientific research and education are based on these wetlands. For instance when studying the dynamics of migratory birds, lake Nakuru and Lake Bogoria are crucial in such researches (GoK 2010).

#### **2.4 Effects of Irrigation Projects on Wetlands**

According to O'Connell, (2003), in the last century and a half, more than half of the world's wetlands have been threatened, degraded, altered and lost. The Millennium Ecosystem Assessment, (MA, 2005) further reports that in the 20<sup>th</sup> century, more than half of wetlands of Europe, Australia, and New Zealand were reclaimed and converted for agricultural purposes. The MA further acknowledges that agricultural activities have significantly led to the degradation of wetlands. In its report, (MA, 2005), it was recognized that by 1985, 56 percent and 65 percent of inland water systems of Europe and North America respectively had been drained for intensive agriculture, and another 27 percent and 6 percent drained in Asia and South America respectively.

It is estimated that irrigation takes place in around 5 percent of agricultural land globally, with South Asia (35 percent), South-east Asia (15 percent) and East Asia (7 percent) showing a high dependency on irrigation. Sub-Saharan Africa and Oceania have less than 1 percent of their agricultural land irrigated (Wood, 2000). Irrigation accounts for approximately 70 percent of the water withdrawn from freshwater systems for human use. Despite the scarce water resources in the developing countries, agricultural demands are increasing thus greater water extractions from the fresh water systems. This has in turn had

greater and adverse impacts associated on wetlands (Matthews *et al*, 2000). Other developments reported to have had adverse impacts, include the diversion of water and construction of canals and weirs to divert water from wetlands for irrigation, poor agricultural practices including excessive application of chemical fertilizers and pesticides, destruction of the wetland vegetation leading to their degradation through habitat loss and biodiversity loss.

The MA (2005) report also concluded that these ecosystems are heavily being degraded through human activities including infrastructure and urban expansion; overexploitation of the swamp's natural resources like fisheries and agricultural activities. O'Connell (2003), reports that these anthropogenic activities have adversely affected the wetlands particularly activities undertaken by the poor riparian communities to sustain their livelihood have significantly contributed to the degradation of these ecosystems.

An assessment done on more than 200 major river basins indicated that more 30 percent of these kind of wetlands were degraded because of diversion of water flows in these river basins, (MA 2005). The report also indicated that about 35 percent of the mangrove forests worldwide, have been disappearing in the last 20 years because of aquaculture development

One of the global concern is ensuring food security for the growing population which is projected to reach 9.7 billion by 2050 (UN DESA report, 2015). Efforts towards achieving food security are underway and they include technological advances and expansion of cultivated areas to boost sufficient food production to meet the rising global food demand. According to Patriciah (2015), the developing countries lack the necessary requisite skills for development and the foreign investors with advanced agricultural technology end up investing in these countries and developing in these fragile lands including wetlands. According to the DFID (2002), the challenge that the government and the foreign investors face is how best they can effect these programs without interfering with the traditional agricultural methods used by the local communities in floodplain areas.

According to Wood & Halsema, (2008), the wetland reclamation and their conversion for agriculture is intensifying in many parts of Africa because of shortage of arable land and decline in the fertility of the upland areas. More people are therefore forced to encroach into the wetlands in search of fertile lands and increase food production. The wetlands are continuously and



increasingly being depleted because they face competition from both the local people and the investors who extensively and intensively use them for agricultural purposes. Oslon (2006), also shares the same sentiments that the search for fertile land by the local communities has been a major driver in the exploitation of wetland resources.

As much as 5% of the population in Africa depends wholly and partly on the fisheries sector for their livelihood. Wetland fishing is also an important sector in the economy of many African countries particularly seasonal floodplains (Bugenyi, 1991). Poverty among the poorest proportion of the world's population leads to increased pressure on protected areas to supply land water and other resources.

The unsustainable use of wetland resources is a big concern particularly in countries where the populations heavily and solely depend on the wetland resources to maintain their livelihoods. This issues is severe in countries with weak legislations and enforcement mechanisms geared toward ensuring managing and conserving these ecosystems sustainably

Swallow (2004) and NEMA (2005), acknowledge that the high population on the LVB of Kenya heavily relies on the wetlands for their household livelihoods. Maltby (1991) also observed that despite the recognition of the importance of the wetland by the riparian communities in maintaining their livelihoods, wetlands are still considered as waste lands by the more economically ambitious world. Gichuki (2003) and Thenya (2006) also hold that wetlands have become more vulnerable to degradation despite being acknowledged for the benefits they offer to the society.

In Kenya, a number of wetlands have drawn population by the rich alluvial soils and enough water for subsistence agriculture, livestock and household uses. According to Okeyo (1992), these wetlands are being used intensively and drained to improve agricultural production. Wetland drainage takes place due to the population pressure and associated food scarcity which has forced the development of new agricultural lands. The areas targeted for this are marshes and swamps with soils suitable for agricultural production.

Yala Swamp is important because of the benefits derived by neighboring communities (Kinaro, 2008). The swamp also continues to host a variety of species including those that have disappeared from Lake Victoria (Kenya wetlands forum, 2006).

An assessment exercise done by the Kenya Wetlands Forum established that Yala Swamp's ecology was being threatened by the irrigation projects carried out there. About 6 900 ha in the upper part of Yala Swamp was leased to private companies, (Dominion Farms) with detrimental environmental impacts. Dominion Farms Limited was engaged in intensive agricultural activities that included rice irrigation thus its encroachment. Kiluva *et al*, (2011), shared the same sentiments that the intensive agricultural activities carried at the swamp resulted in encroachment of wetland areas, eutrophication and pollution of water by the chemical fertilizers and pesticides. The introduction of large scale irrigation project and the privatization of more than one-third of Yala Swamp have adversely affected local communities. According to Waititu (2009), local communities' livelihood has been affected as they no longer have direct access to the natural resources like farming and grazing lands, fisheries resources, papyrus and building materials.

## **2.5 Wetlands, irrigation projects and livelihoods**

Wetlands are considered to provide habitat to different varieties of species. The adjacent communities maintain their livelihoods through the benefits derived from the ecosystem. These goods and services include flood and soil erosion control; ground water recharge and discharge; fisheries and food; medicinal herbs; building materials and papyrus; fertile land for agriculture as well as fodder and pasture for livestock (MA, 2005). For example, in Uganda, the population that is dependent on the natural resources of Pece Wetland obtain more than 50 percent of the monthly income (Opio et al, 2011). A study conducted at Mahakam Delta, Indonesia, by Bosma et al. (2012), reported that the livelihood of almost 40 percent of households depended on resources from mangrove wetland ecosystems

Wetland resources in Nepal support the livelihoods of more than 21 communities (IUCN 1998) including those communities that are most excluded from the society. The traditional knowledge of these communities play a significant role in protecting the environment and ensuring sustainable utilization of the wetland and its resources. There is also need for growing environmental awareness among the local communities on wise use of wetland resources particularly those that have been overlooked or underutilized due to lack of information on their socio-economic values.

The activity that is commonly associated with wetlands particularly in floodplains is agriculture because of its fertility. Ramsar Convention on Wetlands (2013), acknowledges that flat areas that are inundated with water with regular input of sediment are mostly found to be fertile.

However, wetland degradation is increasing because of the intense agricultural activities which interfere with the natural state and ecology of these ecosystems (MA, 2005). For instance, in South Africa, wetlands are being modified each year by the many forms of traditional smallholder agriculture. The European farmers were attracted to the wetlands on their arrival in southern Africa because of the moist condition of the moist conditions provided by the wetlands and the ease to plough these lands throughout the year (Whitlow 1990).

Economies in the developing countries are agricultural based and according to McCartney et al, (2010) 66 percent and 48 percent of wetlands in Africa and Asia respectively have been converted for agriculture. In addition, Wood (2009) points out that the uses of wetlands for agriculture in Africa has been increasing significantly. Most Ramsar sites in Africa are increasingly used for agriculture than for fisheries, while wetlands in Asia are used for Fisheries because of the nature of predominant wetland types vary in these continents.

The wetlands are increasingly being threatened because of the high population growth, overexploitation of natural resources, economic development and the need to maintain livelihoods (Wood & Halsema 2008). Most African countries are supportive of wetland agriculture to ensure high food production, reduction in poverty incidences and encourage livelihood shift and transition. According to GoK, (2009), agriculture has accounted for about 21 percent of the country's GDP with approximately half of agricultural produce being exported. Further, the agricultural sector has provided about 18 percent of total formal employment in the country.

The riverine and lacustrine wetlands are widely used by farmers in Kenya to ensure increased food production. However, poor farming practices and over-abstraction of the wetland waters have significantly contributed to the degradation of these fragile ecosystems by interfering with their natural ecological service of water purification, sediment retention and ground water recharge and discharge (Kenya Wetlands Atlas, 2012).

Yala swamp communities are increasingly harvesting wetland resources to enhance and improve their livelihoods. Yala Swamp sustain commercial and subsistence fisheries. Its importance as fish nursery grounds and for replenishing natural stocks in Lake Victoria is well recognized. Fish farming within wetland areas is increasingly becoming an important alternative to natural production. Wetland plants are harvested to provide materials for construction and thatching, the cottage industry, canoes, fishing baskets and traps. Wetland plants are also used for medicinal purposes and as a food source.

## **2.6 Regulative and Legislative Framework**

### *2.6.1 International Policy and Legal Framework*

The first global treaty that came into existence was the Ramsar Convention on Wetlands whose aim was to guarantee protection and viable use of the wetland's natural resources. The rate at which wetlands were disappearing including habitat and biodiversity became a global concern and this convention was held to bring attention to the disappearance and degradation of these ecosystems. There was little awareness and understanding on the ecological, biological and economic importance of these wetlands to the society thus need for Ramsar Convention to create awareness. The governments that joined the convention made a commitment to reverse the rates at which wetlands were being degraded (The Ramsar Convention Manual, 2013)

Kenya was one of the parties that signed the treaty in 1990. there were a number of obligations that were inflicted into the member states including ensuring sustainable utilization of wetlands and their resources through domestication of the wetland conservation measures into the country's laws and integrated development plans; ensuring capacity building in wetland conservation and management as well as establishing reserves on wetland ecosystems.

Other relevant international treaties on wetland management that Kenya is party to include the Convention on Biological Diversity (CBD). The main goals of CBD is to ensure conservation of biological diversity; and sustainable utilization of the components of biodiversity. The convention emphasizes on the conservation and protection of natural ecosystems including wetlands which are considered to be biodiversity hot spots as they host a number of species including indigenous and threatened species.

The Convention on the Protection of the World Cultural and Natural Heritage came into existence in order to protect the world's cultural or natural heritage of outstanding value for the benefit of humankind as a whole. In addition, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) focuses on conserving aquatic, terrestrial and avian migratory species, their migratory routes and habitats. Wetlands are commonly used by migratory birds as feeding sites, and shelters from harsh weather.

## *2.6.2 Domestic Policy and Legal Framework*

### *2.6.2.1 The Constitution*

The Kenya's Constitution has incorporated environmental provisions that are potentially used to ensure management and conservation of wetlands. Chapter five of the constitution relates to land and environment. Article 42 provides that every person is entitled to a clean and healthy environment which needs to be protected to benefit both the present and the future generations. Article 70 provides if these rights have been threatened or violated then the person has the rights to apply to court for redress.

Article 64, provides for the sustainable management and protection of land resources including ecologically sensitive areas. Article 69 obligates the State to ensure sustainable utilization, exploitation, management of the environment and natural resources, ensure equitable sharing of benefits acquired from these ecosystems; encourage public participation in the conservation and management of the environment; ensure protection of biological resources and genetic resources, eliminate any activities likely to destroy the environment; and establish EIA/ EA systems to monitor and conserve the environment. Article 72 obligates Parliament to enact legislation to give full effect to the provisions of chapter five of the Kenya's Constitution.

### *2.6.2.2 EMCA Wetland Regulations 2009*

One of the objectives of this regulation is to ensure conservation and sustainable utilization of wetlands and their resources. Other objectives include ensuring protection of the wetlands as they are habitats for a wide variety of species of plants and animals; prevent pollution of these ecosystems; and encourage public participation in the management of wetlands. Regulation 5 emphasizes on the need for EIA/EA before major project developments are carried out. Regulation

6 states that NEMA shall be advised by the Standards and Enforcement Review Committee on the wise use, management and conservation of wetlands (NEMA, 2011).

Section 42 of EMCA (2012), Under Regulation 8, provides that the Minister for the environment can declare a wetland as a protected area on an account of its biological diversity, ecological importance, aesthetic value or natural heritage. The minister can also prohibit all the activities taking place in the wetland areas apart from those touching on research, ecotourism, restoration or enhancement of the wetland or the activities identified in the management plan.

Regulation 9 provides an elaborate procedure that must be followed before a wetland is declared a protected area while Regulation 10 obligates NEMA to develop and maintain a national wetland inventory. Regulation 11 lists the permitted uses of wetlands and includes harvesting of papyrus, medicinal plants, trees and reeds on a subsistence scale; collection of water for domestic use and fishing (EMCA, 2012)

In Regulation 14, owners, occupiers and users of land which is adjacent to wetlands have a duty to prevent its degradation or destruction. The regulations are evidently comprehensive and their enforcement would help to address many of the issues that bedevil wetland management in the country (EMCA 2012)

## **2.7 Theoretical Framework: Sustainable Livelihood Approach**

Wetland ecosystems have been widely recognized in sustaining the livelihoods of the adjacent communities. The concept of sustainable livelihoods was the most appropriate tool that was used to guide understand how livelihoods have been achieved through access of the different assets of the wetland ecosystems. The framework was also important in pointing out how institutions, policies and structures can be used to achieve livelihoods. The Yala Swamp Wetland has always ensured sustainable livelihoods for the riparian community of South Central Alego. This study looked at the concept livelihood sustainability in the context of sustainable wetlands management.

The Institute of Development Studies (IDS), defines livelihood as an asset, capabilities and activities that are required to support human well-being. The SL framework illustrates how people's livelihoods are affected and shaped by different factors including vulnerability context, livelihood assets, structures, processes and institutions as well as livelihood strategies.

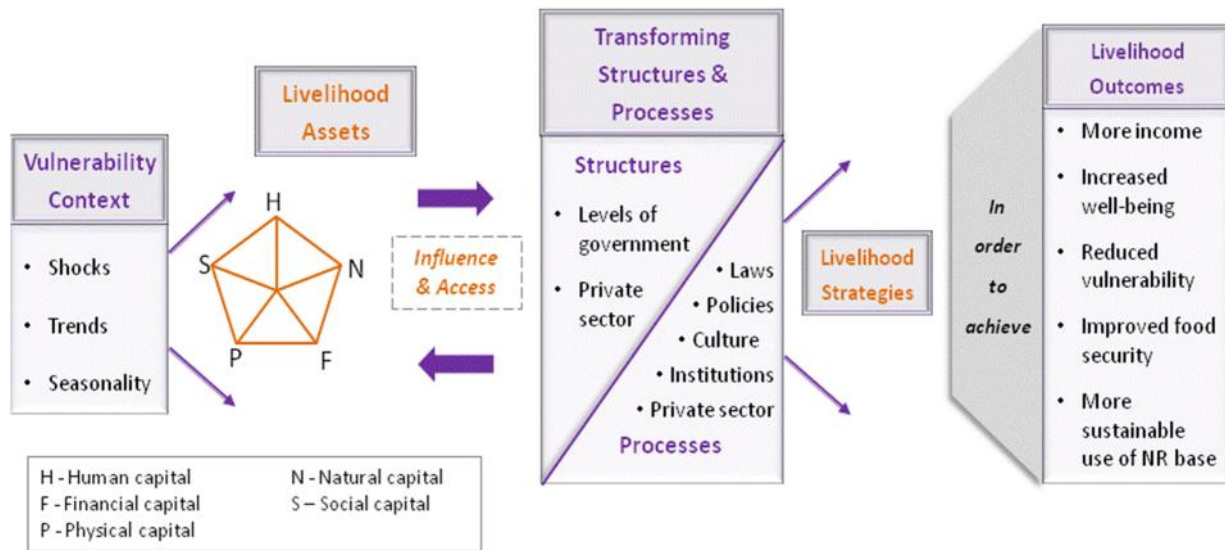
As illustrated in Figure 2.7.1, the arrows show how different factors interrelate and influence one another. The figure illustrates how SL can be realized by acquiring a variety of assets including natural, financial, physical, human, and social capital. For instance wetlands provide natural capital like water and fertile land and therefore food security can be achieved through cultivation and irrigation on these land.

The framework also illustrates how people can also operate within a vulnerability context modified by factors like seasonality including seasonal shifting of prices, food availability and employment rates and opportunities; shocks including changes in the rates of exchange; and trends.

Structures, processes and institutions have been highlighted to manage resource accessibility and mediate conflicts that arise from resource utilization. Proper mechanisms and policies put in place by institutions are important in realizing sustainable livelihoods among the rural poor populations. The framework further highlights three livelihood strategies that can be used to achieve the desired livelihood outcomes. These strategies include livelihood diversification, agricultural intensification and extensification as well as migration.

Livelihoods are affected by the diversity and amount of assets which are latter transformed into livelihood outcomes induced in the five broad elements of more earnings, improved living standards, improved food production, reduced vulnerability and sustainable utilization use of the natural resources.

Figure 2.7.1 Sustainable Livelihoods Approach



Source: DFID, 2002

## 2.8 Conceptual Framework: Ecosystem services and human well-being

Humans and wetland ecosystems interact in different ways. People are able to sustain their livelihoods through the socio- economic and ecological functions of the wetlands derived from the swamp. Consequently, human activities particularly the agricultural and irrigation activities can adversely affect the ecological functioning of the wetlands. Figure 2.8.1 shows the importance of wetlands in supporting livelihoods of the local communities. People can derive benefits from Yala Swamp both directly and indirectly. The direct benefits include pasture for livestock grazing, fisheries, firewood, construction materials, and land for cultivation while the indirect benefits include water purification nutrient cycling climate regulation, and soil formation.

The framework also illustrates how both the direct and indirect drivers of change affect the ecosystem's integrity as well as human well-being. The primary indirect drivers of Yala swamp loss are due to population growth, weak institutions and legal frameworks, and increasing economic development. For instance, population increase means an increase in the demand for fertile land for irrigation leading to encroachment into the wetlands and thus its degradation. The direct drivers of change have been influenced by indirect and they include land conversion to



agriculture; infrastructure development; water, land and air pollution; overexploitation of the natural resource base; and introduction of invasive species. The institutions and structures are important as they regulate the indirect drivers of change in affecting the direct drivers of change. For instance the family planning policies and measures are important in managing population growth among the local communities and therefore less people are forced to encroach into the wetlands

Poverty related issues also tend to increase the rate of extraction of wetland resources in Yala Swamp. Activities such as cutting down of trees to create room for agriculture and to improve food security is common. The poor people will often seek to destroy their immediate environment in order to survive. Increased population growth is also another issue that if left unchecked among the poor will lead to over exploitation of wetland's resources and eventually its degradation. The presence of structures and institutions are important to manage and mediate access and utilization of the natural resources to ensure a balance between economic development and improved living standards for the local people. The framework assumes health, good social relations, security, and materials for good life, freedom and choice to be components of human well-being.

- **Dependent variable:** included human wellbeing which is dependent on the ecosystem services. Human wellbeing constitutes of the availability of basic materials for good life, more income, food security as well as good relations
- **The independent variables**

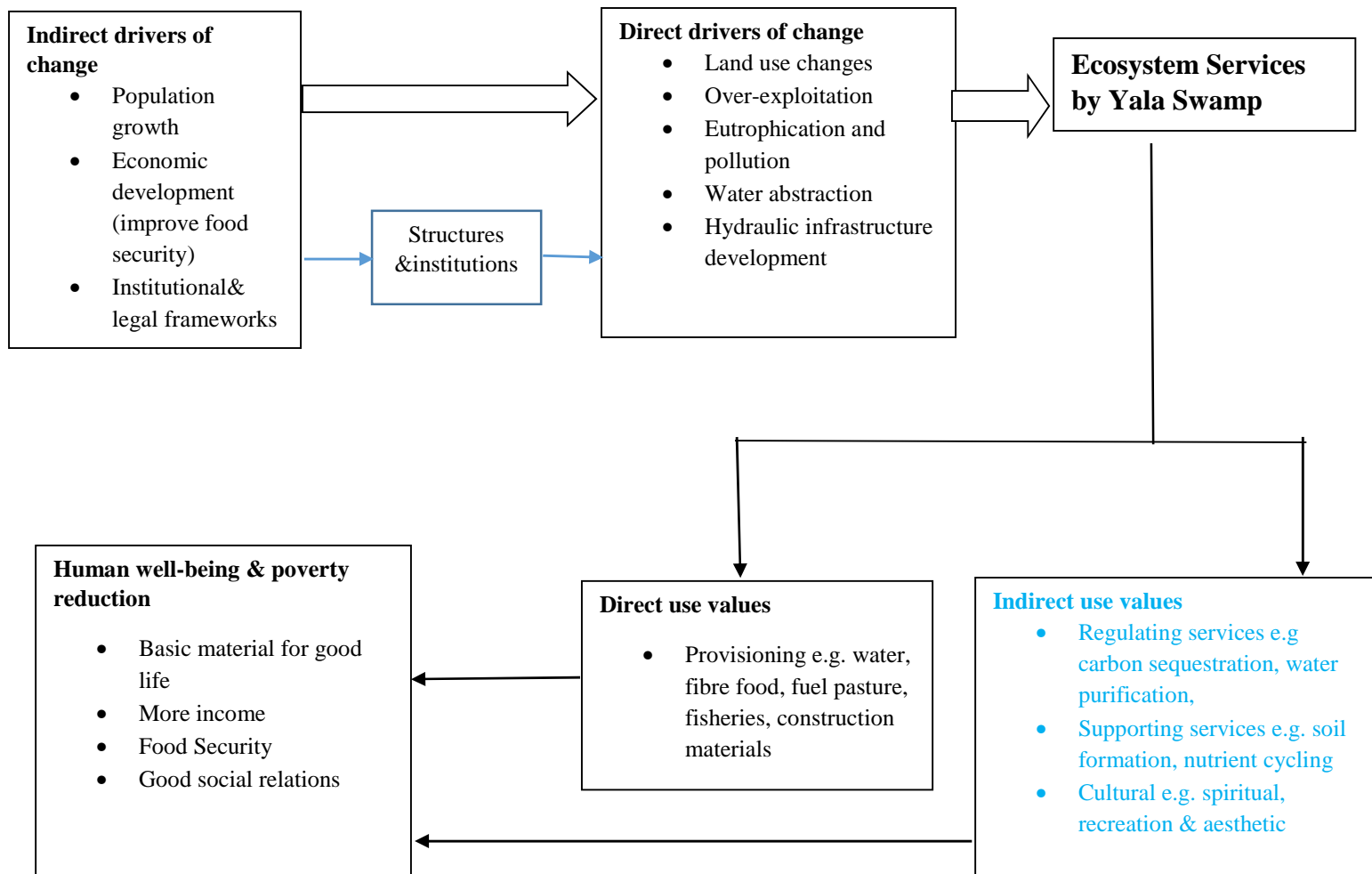
**Ecosystem services:** which include provisioning, supporting, regulating and cultural services

**Indirect drivers of change:** demographic characteristics including population; economic development; institutions, governance and legal frameworks

**Direct drivers of change:** over-exploitation of natural resources; introduction and removal of species; pollution and eutrophication; land use changes

- **Intervening Variables:** included structures and institutions.

**Figure 2.8.1 Linkages between ecosystem services and human well being**



Source: Modified from Millennium Ecosystem Assessment (2005)

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The chapter vividly described the study area, the methods employed during data collection, data analysis and the data presentation. The research was carried in the regions surrounding Yala Swamp.

#### **3.2 Study Area**

##### *3.2.1 Geographical location*

Yala swamp is geographically situated in the Western Kenya, Siaya County, along the North-Western shores of Lake Victoria with coordinates Latitude:0°02'10.80"N and Longitude: 34° 04' 0.60" E. Yala swamp covers an area of 17500ha and extends inland for 25 km in an east-west direction and 15 km in a north-south direction along the lake shore. Being the largest freshwater wetland in Kenya, Yala Swamp supports the livelihoods of the adjacent communities and also hosts a wide range of animal and plant species (Gichuki 2003).

According to the report by GoK (1994), the altitude in the study area ranges between 1,140m and 1,500m above sea level. The formation of the swamp was as a result of backflow of water from Lake Victoria as well as flooding of the rivers Yala and Nzoia. Yala swamp is mainly fed by the River Yala, which flows through the swamp. The Yala swamp ecosystem encompasses three small lakes, namely the Lakes Kanyaboli, Sare and Namboyo.

Papyrus *Cyperus* is the dominant vegetation in this swamp. Other vegetation in the swamp include the *Phragmites mauritanus* which is found in the shallower areas and swamp grasses found around the periphery. Both Lake Kanyaboli and Lake Sare are surrounded by a thick fringe of Papyrus. Nasirwa & Njoroge 1997, describe the Yala Wetland to be the largest papyrus swamp in the Lake Victoria Region as it makes up more than 90% of the total areas of papyrus.

The swamp is a highly productive ecosystem and a biodiversity hotspot as it hosts for various species including fish species which have disappeared from Lake Victoria. These include three species of and several haplochromine cichlids species which include (Abila et al, 2008). The swamp hosts the critically endangered Sitatunga antelope and is also dominated by the species of the genus *Cyperus* (Abila 2005).

### 3.2.2 Climatic and hydrological characteristics

The area around Yala Swamp experiences a bimodal equatorial climate with two rainy seasons; the long rains in the months of March-May and the short rains falls in the months of October to December. According to Hughes and Hughes, (1992), the northern highlands, which form the catchments of Rivers Sio, Yala and Nzoia, receive an average rainfall of between 1,800 mm and 2,000 mm per annum, while the lowland is characterized by low rainfall levels of between 800mm and 1,600 mm per annum. The average rainfall around the lowland Yala swamp is approximately 760 mm per annum, which is inadequate for rain fed farming.

### 3.2.3 Demographic and socio-economic aspects

Siaya County's total population was estimated to be 885,762 people as at 2012 with a population density of 350 persons per Km<sup>2</sup> (KNBS 2012 Population projections). The area around Yala swamp particularly south Central Alego Location is estimated to have a population density of 174 persons per Km<sup>2</sup>.

Table 3.2.1 Population of South Central Alego Location;

Total Population	11,321
Number of Households	2,954
Population Density Per Km <sup>2</sup>	174
Location Area (Km <sup>2</sup> )	33.24

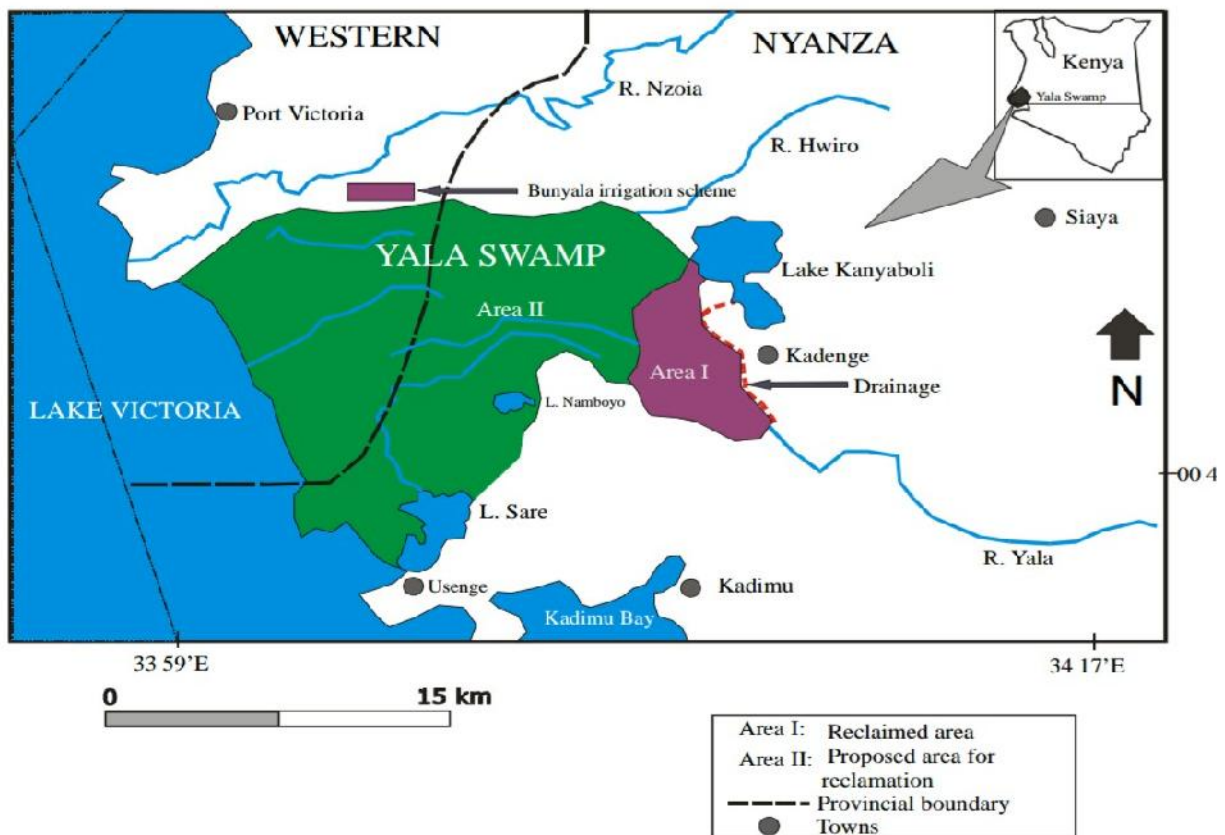
Source: CBS, 1999 census data

The increasing human population and human activities in South Central Alego Location have increased pressure on the existing natural resources. About 80% of the adjacent communities derive their livelihoods from subsistence agriculture (GIWA, 2006). The high dependency of these populations has been attributed by the fact that most of these households are generally poor. Because the rainfall received around the lowlands of Yala Swamp is low, the local communities cannot rely on rain fed agriculture to sustain their livelihood, instead they acquire land at the swamp for agriculture because of the availability and closeness of water.

Reliability on the swamp has also been increasing because of growing population with small land sizes coupled with decreasing soil fertility. However, the increasing incidences of poverty has hindered sustainable utilization of the natural resources and this has significantly contributed to swamp's degradation.

Other sources of livelihood include fishing, and papyrus harvesting (Gichuki et al., 2001; Abila, 2002). Fishing activities mainly take place in the Yala Swamp and Lake Kanyaboli with cichlids fish species dominant at Yala Swamp.

Figure 3.2.1 A map of Yala Swamp, Dominion Farms and Kadenge Sub-Location



Source: Abilla et al 2004

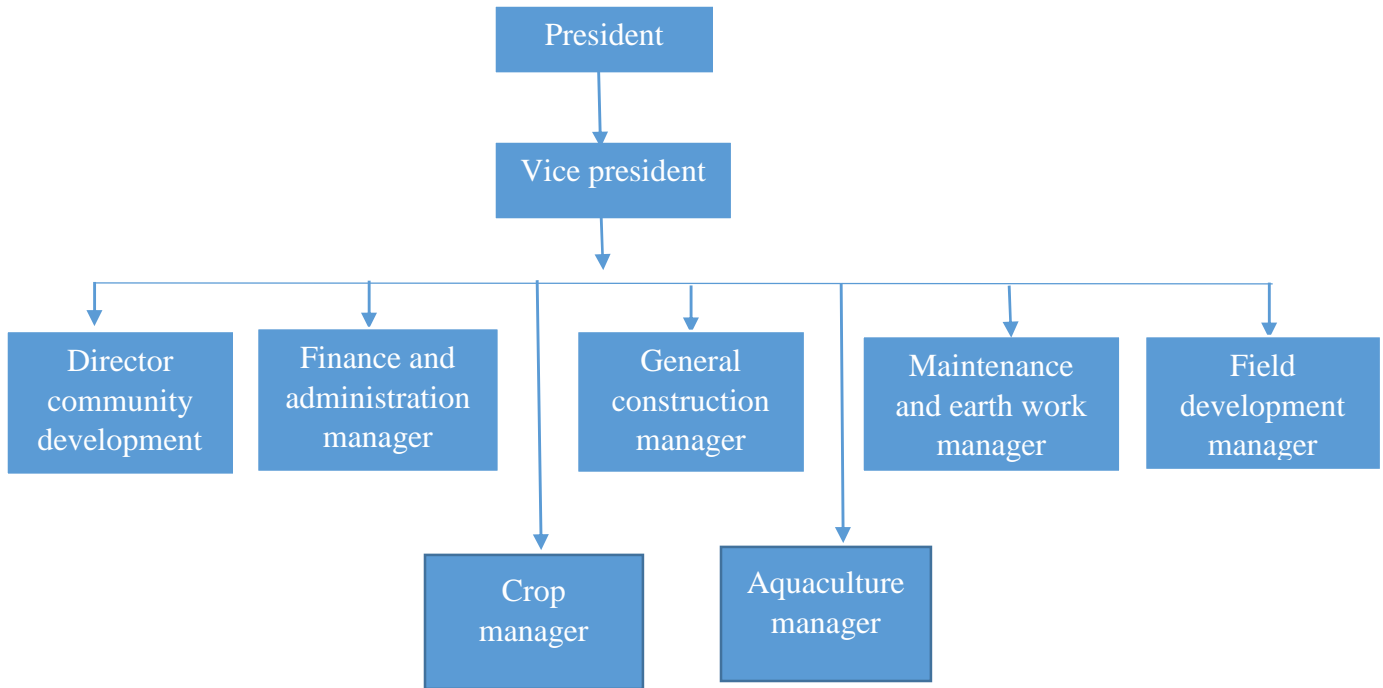
### **3.3 The history and structure of Dominion Farms Limited**

Part of Yala Swamp, 6500ha, was leased to Dominion Farms Ltd for 25 years by the county councils of Bondo and Yala through an arrangement by the Lake Basin Development Authority (LBDA) in 2002. The farm came into operation in 2003. It produced rice which covered an area of approximately 2300ha. Initially, LBDA reclaimed Yala Swamp for cereals, horticultural and pulses production. Dominion Farms further ventured into other large scale agricultural activities and developments like rice mill construction, water drilling and construction of dykes and weirs. The DFL was established to ensure food security for rapidly growing rural population and it majorly targeted those within the low income earning bracket.

Fish production particularly tilapia became another major activity at the farm. There were eight trio fish ponds with each consisting of a population of over 80,000 fish. In addition, large scale production of soya beans was in place as the soya beans were used as ingredients in the production of chicken, fish and dog feeds. The farm employed over 1000 workers both skilled and unskilled. In the rice plantations, the local employees would weed the rice field by hand and fill in any gap where rice did not germinate by transplanting rice seedlings, and scaring away birds. However, the more skilled jobs were to the college educated citizens who came from outside the local areas.

As illustrated in figure 3.3.1 on the management of DFL, the president coordinates and oversees the farm management and administrative activities. Other seven managers have been appointed to be in charge of the respective departments for effective management and running of activities in the farm.

Figure 3.3.1 Structure of Dominion Farms Ltd



Source: Dominion Farms Ltd website, 2010

### 3.4 Research Design

The study adopted a cross-sectional survey research design because it aimed at analyzing data obtained from the representative subset once. The design involved gathering information from the respondents through semi-structured questionnaires and interviewing key informants as well as conducting focus group discussions (Orodho, 2003 This design was the most ideal as it explored the different views and opinions of the head of households in South Central Alego Location on issues regarding conversion of Yala Swamp for large scale agriculture, the impacts of Dominion Farms Ltd in the livelihoods of the local community and the conservation and general state of Yala Swamp.. The questions constructed were able to extract the desired information.

### **3.5 Target Population**

The study targeted the community of Kadenge Sub-location because of their closeness to the swamp and Dominion Farms, the local community also directly and indirectly relied on the swamp to sustain their livelihoods. The population from which the sample was selected from comprised of the majorly the head of households. The aim of this research was to assess how Yala Swamp has improved the livelihoods of the local people out of irrigation projects. The information collected from the various groups of people focused on the uses of Yala swamp, how livelihoods changed after the establishment of Dominion Farms Ltd in the swamp and status of Yala Swamp with the various activities carried out at the swamp.

The study further identified key informants who were interviewed to give information on the socioeconomic importance of Yala Swamp and how the livelihoods of the residents have been affected by the agricultural projects. Those interviewed included government officials from the county of Siaya, NEMA and WRMA as well as the administration of Dominion Farms Ltd. Two focus group discussions each comprising of 10 people was conducted at different sites with different people with basis on gender balance, age and occupation

### **3.6 Sampling technique**

Purposive sampling, a non-probability technique, was used in this study because the researcher interviewed the respondents that were available at that particular time and targeted individuals who could readily give information without being hostile or asking for incentives from the researcher. A reconnaissance survey was done on the first two days to identify the villages that were most the suitable for selecting the respondents. Kadenge sub-location was given priority because of its closeness to the swamp and the irrigation farm. Further, with the assistance from the local administration, four villages were selected because it was assumed that the locals from these villages were the most affected by the irrigation project carried out at the swamp.

Assistance was sought from the local administration who readily provided a sampling frame of Kadenge Sub-location which had a total of 1,124 households. The sample size was found to be 286 respondents from the formulae by Krejcie & Morgan (1970):

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$



$$S = \frac{1.92^2 \times 1124 \times 0.5(1-0.5)}{0.05^2(1123) + 1.96^2 \times 0.5 \times 0.5} = 1079.4896 / 3.7679 = 286.49$$

Therefore the sample size equals 286 people.

Where;

$S$  is the sample size.

$X^2$  refers to the desired confidence level at 1 d.f=3.841

$N$  is the population size.

$P$  is the population proportion (assumed to be 0.50).

$d$  is the degree of accuracy expressed as a proportion (0.05).

The village elders made an appointment with the respondent, explained to him/ her the aim of the research and sought an approval from each to conduct the interview. Three research assistants were also trained to assist in data collection. The respondents who were assumed to represent different households were purposively selected while considering their occupation, age and gender. The research managed to interview 111 respondents using semi-structured questionnaires as shown in appendix 1.

One focus group discussion was conducted Mama Jane Anyango's compound, Konyango village. Members of the focus group discussions were selected on consultation putting an emphasis on gender balance, occupation and age.

### **3.7 Reliability and Validity**

The study questionnaires were pre-tested to ensure their reliability and validity. The questionnaires were administered to 5 percent of the total number of the sample size who were randomly selected from the target population. The population size that was used for the pre-testing did not participate in the actual study. This is meant to avoid bias during the main study. The pre-tested questionnaires were then be edited to ensure that the final questionnaires were capable of obtaining the required information.

### **3.8 Sources of Data**

The two major sources of data that were used to achieve the objectives were the primary and secondary data.

#### *3.8.1 Primary data*

The primary data was gathered directly from respondents particularly those at household level at Kadenge through questionnaires, interviews, focus group discussions, and observations.

##### **3.8.1.1 Questionnaires**

With the help of the research assistant questionnaires were administered to the respondents at the household levels and were filled giving information about the knowledge they have and their opinion about activities around them and their effect on Yala Swamp and their livelihoods. The questionnaires used both close ended questionnaires and open ended unstructured questionnaires.

The open-ended unstructured questions were useful in providing detailed information on the benefits of Yala Swamp to the society, how the local people's livelihoods have changed since the establishment of Dominion Farms Ltd and how human activities have led to the degradation of the wetland.

##### **3.8.1.2 Interviews**

Information was obtained through semi- structured interviews conducted to individuals who acted as key informants. These key informants included officials from Dominion Farms Ltd, the county government, NEMA, WARMA, and Ministry of Natural Resources. A one on one interviews was conducted on these key informants to gather critical information and pertinent issues revolving around the community, Yala Swamp and Dominion Irrigation Farms. Semi structured interviews were guided by the interview schedule with contained list of questions and topics that required response during interviews.

##### **3.8.1.3 Focus Group Discussions**

A focus group discussion was important in gaining an in-depth understanding on the issues revolving around the swamp, irrigation project and the livelihoods of the local community. One focus group discussion that was conducted with 10 participants comprising of both male and

female members all drawn from the community at household levels including, fishermen, peasant farmers, pastors, village elders, business people among others.

The FGD enabled production of in-depth information within a limited time and was significant in exploring people's beliefs and perception on the state of Yala Swamp as well as the impact of the irrigation project on the livelihoods of the local residents.



Plate 3.8.1.1 Focus Group Discussion at Mama Jane's compound

#### **3.8.1.4 Observations**

This instrument was important as it provided information about the actual behavior. Direct observation were useful in collecting information on the respondents' activities and physical environment of Yala Swamp and its environs. Observations were made regarding the different activities taking place at the swamp in relation to earning a living, and infrastructural improvements.

#### *3.8.2 Secondary data*

The study made use of the existing information, including published and unpublished data. The study obtained data and information from publications, electronic media and internet sources, documents and journals from libraries; local and regional offices of the county offices and NGOs,

from the print; as well as from literature reviews on relevant library materials, earlier research journals and periodical.

### **3.9 Data Analysis**

The qualitative data from interviews was analyzed using content analysis and descriptively using percentages and frequencies. Data was obtained from purposive samples and therefore inferential statistics cannot be appropriately applied to them. It is for these reasons that the study aims at answering the research questions and not test the hypotheses. Therefore data obtained from the field was analyzed using content analysis. It is a technique that makes inferences by objectively and systematically identifying specified characteristics of messages. It is a systematic replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding. Content analysis is a tool can make comparison between previous empirical studies and the current study.

It will assess the different socio-economic benefits derived from Yala Swamp, the effect that the irrigation activities have on the state of Yala Swamp and how the irrigation projects have affected the people's livelihoods. Frequency distribution tables and percentages were used in the analysis of socioeconomic variables. Presentation of the data was done descriptively using pie charts and bar graphs

## CHAPTER FOUR RESULTS AND DISCUSSIONS

### 4.1 Introduction

The chapter presents the results that were collected from the field based on the questionnaire filled by the respondents, interviews carried out and the focus group discussions conducted by the researcher. The study was carried out at Kadenge Sub-location particularly in the four villages of Gendro, Kanyamaji, Konyango and Komollo. 111 questionnaires were filled by the respondents; 15 others were interviewed as key informants who represented officials from Dominion farms Ltd, NEMA and Ministry of Natural resources. The results are presented by use of tables and graphs. The hypotheses of the study have also been tested.

### 4.2 General characteristics of respondents

This section is a representation of information on demographic and socio-economic characteristics of respondents collected from the field. This included data on gender, age, marital status, educational level and their occupation

#### 4.2.1 Gender

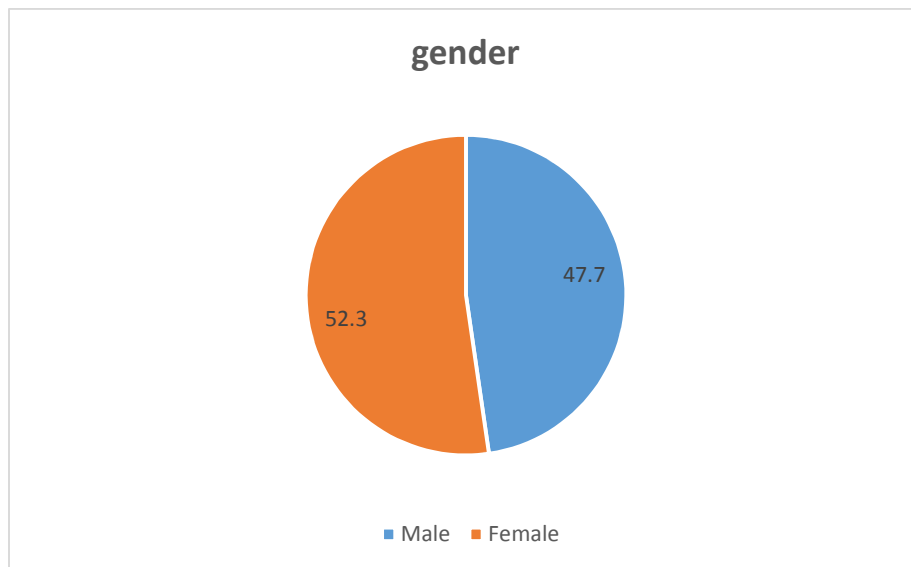
Information on gender distribution of the respondents has been represented in table 4.2.1. Out of the 111 respondents 53 (47.7%) were male while 58(52.3%) were female based on their willingness and availability. The female respondents were high in numbers because they remained at home to do house chores while their men would go out to look for an income to support their families. Further, women had more knowledge on farming activities carried out at the Dominion Farms as they were the most employed and were the most affected since the establishment of the Dominion Farm.

Table 4.2.1 Frequency distribution of respondents by gender

Gender	Frequency	Percent
Male	53	47.7
Female	58	52.3
Total	111	100

*(Field data, 2018)*

Figure 4.2.1 Percentage of respondents by gender



(Field data, 2018)

#### 4.2.2 Age

The study sought information on the ages of the respondents represented in table 4.2.2. Majority of the respondents were found to be between the age bracket of 20- 35 which was 47.7% of the respondents. The respondents were mainly comprised by the youths because of dropping out of schools at a young age, early marriages and they are the most employed in the farm because they are energetic. The study assumed that these age groups represented the people mostly affected by the changes taking place at Yala Swamp as a result of irrigation projects.

Table 4.2.2 Frequency distribution of respondents by age

Age bracket	Frequency	Percent
20-35	53	47.7
36-51	25	22.5
52-67	20	18.0
68 and above	13	11.7
Total	111	100.0

(Field data, 2018)

#### 4.2.3 Marital Status

The study sought information on the marital status of the respondents as shown in table 4.2.3. Majority of the respondents, 77.5%, were married followed by the 16% who were widows/widowers. Those who were single and separated accounted for 4.5% and 1.8 % respectively. The marital status of an individual affects access and utilization of the swamp and the kind of work an individual do in order to earn an income and maintain his/her household livelihood.

Table 4.2.3 Frequency distribution of respondents by marital status

Marital status	Frequency	Percent
Married	86	77.5
Widow/widower	18	16.2
Single	5	4.5
Separated	2	1.8
Total	111	100.0

(Field data, 2018)

#### 4.2.4 Educational level

The respondents were asked whether they attended school and to what level and their responses are in table 4.2.4. The respondents who went to school accounted for 90.1% while those who did not attend school accounted for 9.9%. The study also found out that majority of the respondents had elementary education at 71.2% followed by those who reached the secondary level at 14.4%. The respondents who had reached university and tertiary college level were represented by 1.8% and 2.7% respectively.

Table 4.2.4 Frequency distribution of respondents by educational levels

Educational level	Frequency	Percent
None	11	9.9
Primary	79	71.2
Secondary	16	14.4
Tertiary college	3	2.7
University	2	1.8
Total	111	100.0

(Field data, 2018)

#### 4.2.5 Occupation

Information on the respondents' livelihood activities was also investigated and represented below in table 4.2.5. Table 4.5 shows that 64.9% of the respondents practice subsistence farming as a way to sustain their livelihood. They have ventured into either crop farming, livestock keeping or both. In particular, 18.9% have invested in businesses while 5.4% are fishers particularly at Lake Kanyaboli. Those employed by the government were represented by 2% while those who were employed by Dominion farms were represented by 3%, the 4% who did nothing for a living were either housewives or they were prevented from working due to sickness.

Table 4.2.5 Frequency distribution of respondents by occupation

	Frequency	Percent
Civil servant	2	1.8
Farmer	72	64.9
Employed	7	6.3
Entrepreneur	21	18.9
Fisher	6	5.4
None	3	2.7
Total	111	100.0

(Field data, 2018)

### 4.3 Objective 1: Socio-economic Benefits of Yala Swamp

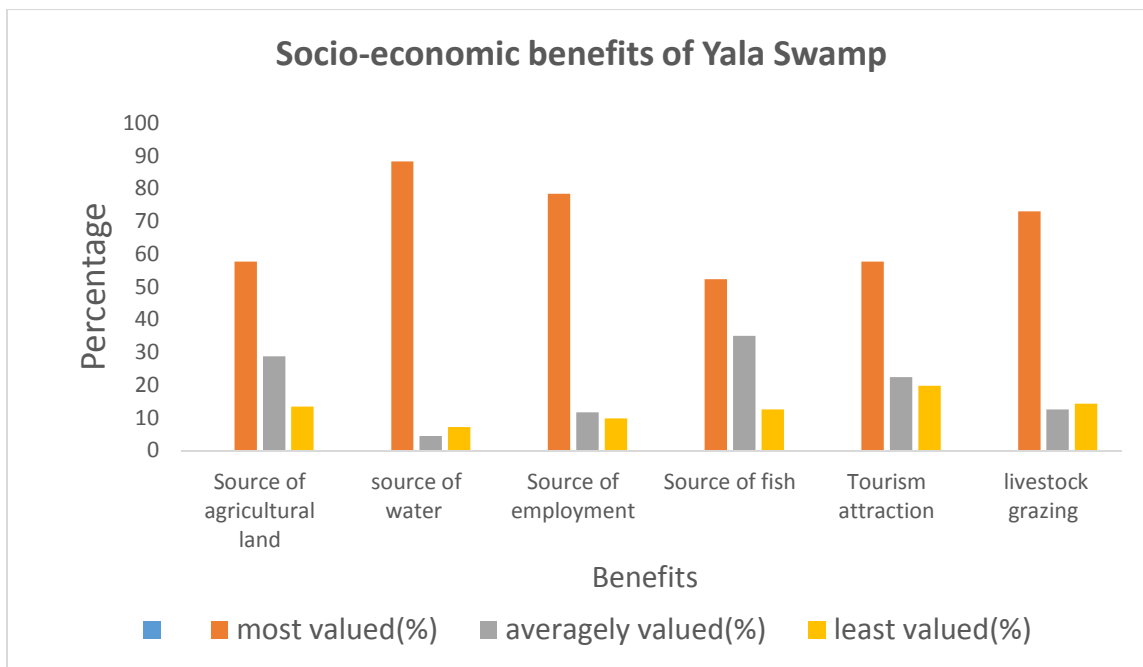
This section addresses objective one of the study that descriptively describes how the local people's livelihoods are influenced by the socio-economic benefits derived from Yala Swamp. The socio-economic benefits derived from Yala Swamp included provision of water for domestic and agricultural use; fertile land for agriculture; source of fisheries; source of charcoal, papyrus, building materials and medicinal plants; as well as grazing field for livestock. These were the most valued with regard to maintaining the livelihoods of the local community

The study sought to find out if Yala Swamp was of any value to the community. The respondents were further asked to rank the values of the swamp as 1 to represent the most valued functions; 2 as the averagely valued; and 3 as the least valued. The responses are represented in figure 4.3.1. Majority of the respondents were farmers and they benefited from the swamp through practicing agriculture and acquiring water from the swamp for domestic and agricultural use accounted for



57.7% and 88.3% respectively. The swamp is also considered to be a suitable grazing field for the livestock and was accounted for 73%. Both Yala Swamp and Lake Kanyaboli (Satellite Lake) are sources of fisheries to the adjacent community being represented at 52.3%. Yala swamp was also acknowledged by 78.4% of the respondents to be a source of employment to the riparian community through activities like papyrus harvesting, brick making, fishing and agricultural activities. Yala swamp is also an important site for tourist attraction being accounted for 57.7%.

Figure 4.3.1 Socio-economic benefits of Yala Swamp



(Field data, 2018)

#### 4.3.1.1 Fertile land for agriculture

For a long time, the local community has highly depended on Yala Swamp and its resources for farming. Majority of the respondents (57.7 %) acknowledged that Yala swamp provides fertile land for agriculture. The various crops grown across the seasons include maize, beans, millet, groundnuts, kales, cowpeas and cassava. People get casual employment to work on other people's farms to earn a living. This is emphasized by the studies done by Thenya (2001) who acknowledges that wetland agriculture in developing countries to be the main activity among the adjacent communities. A research done in the LVB by Mugo et al (2001) point out land to be an important capital with regard to food security and earning an income.

#### **4.3.1.2 Source of water for domestic use and irrigation**

Yala Swamp is an important source of water to the adjacent community. While 88.3% of the respondents claimed that they relied on water from Yala swamp, 21.7% said that they acquired water from Lake Kanyaboli and River Yala. The area around Yala Swamp experiences low rainfall of about 760mm throughout the year limiting the rainfed farming. This characteristic has forced people to find fertile land in the swamp because of availability of water for irrigation as well as a favorable climate for farming.

#### **4.3.1.3 Source of fisheries**

Yala Swamp is also important as it sustains commercial and subsistence fisheries. 52.3% of the respondents said that the swamp and its satellite lake (Lake Kanyaboli) was an important source of fish to the local community. Fish farming within the swamp and Lake Kanyaboli has been important in sustaining the livelihoods of the locals as they enjoy a wide variety of fish species than those relying on fish catch from Lake Victoria. Previous studies by Abilla (2006) acknowledge fishing to be the leading economic activity that supports the livelihoods of the fishers and depending on the fish catch and the availability of buyers a proportion is taken to the market and the rest at home.

#### **4.3.1.4 Source of employment**

The riparian community of South Central Alego have always relied on Yala Swamp to sustain and maintain their livelihood through the resources and the benefits they acquire from that particular ecosystem. Majority of the respondents (78.4%) pointed out that the wetland vegetation particularly the papyrus and reeds are mostly used for construction and handcrafts and the papyrus products include papyrus mats, papyrus tables and chairs, stools and fishing baskets. They also relied on the swamp for employment through activities like agriculture, fishing and brick making.

#### **4.3.1.5 Habitat for plants and animals**

Majority of the respondents (88.3%) reported Yala swamp to provide habitat for different kinds of plant and animal species including endemic, endangered and migratory species. It's also considered to be a site for East Africa's papyrus endemics like the Papyrus Yellow Warble. The

respondents reported that there are a number of wildlife living in the swamp such as waterbucks, sitatunga, hippos, mongoose, squirrels and wild pigs. Reptiles reported to be present included crocodiles, monitor lizards, and snakes,; birds observed during the study included the Great White Egret, waterfowl and the kingfisher Kenya Wetland Forum (2006), recognizes Yala Swamp to host a variety of bird species including the papyrus endemic species including the Papyrus Yellow Warbler and the White Winged Warbler. Insects identified to bring challenge to the humans that settled near the swamp included the tse tse flies and mosquitoes. A study done by Kasina et al (2009) in Kakamega acknowledges that wetlands found there are important habitat for bees which play significant roles in pollination thus improving maize production among the local community.

#### **4.3.1.6 Tourism and recreation attraction**

The tourism sector is important in Kenya because of its contribution to the economic development. 57.7% of the respondents pointed out that the presence of a wide range of wildlife in Yala Swamp and its aesthetic value makes it unique for attraction of tourists thus a source of income to the local community. This statement is supported by the sentiments of Thenya (2001) that wetlands bring out the dominant livelihood choices especially for the fishing communities. Yala Swamp is an important site for scientific research and education. A number of research has been done in Yala Swamp on areas like ecology, agriculture, geology among others. Wetlands have a role in conservation education and are also important areas for research (Fanshawe & Bennun, 1991)

#### **4.3.1.7 Grazing field and forage for livestock**

Cattle grazing around Yala Swamp is another important socio-economic activity among the adjacent communities. 73% of respondents said that they depended entirely on the wetland for foliage and water. Majority of the farmers (60%) practiced mixed farming and they acknowledged that the swamp provided foliage and pasture to their livestock. The area around the swamp offered a dry season grazing area with the grazing taking place along the edges of the wetland.

#### 4.4 Objective 2: The effects of Irrigation Projects on Yala Swamp

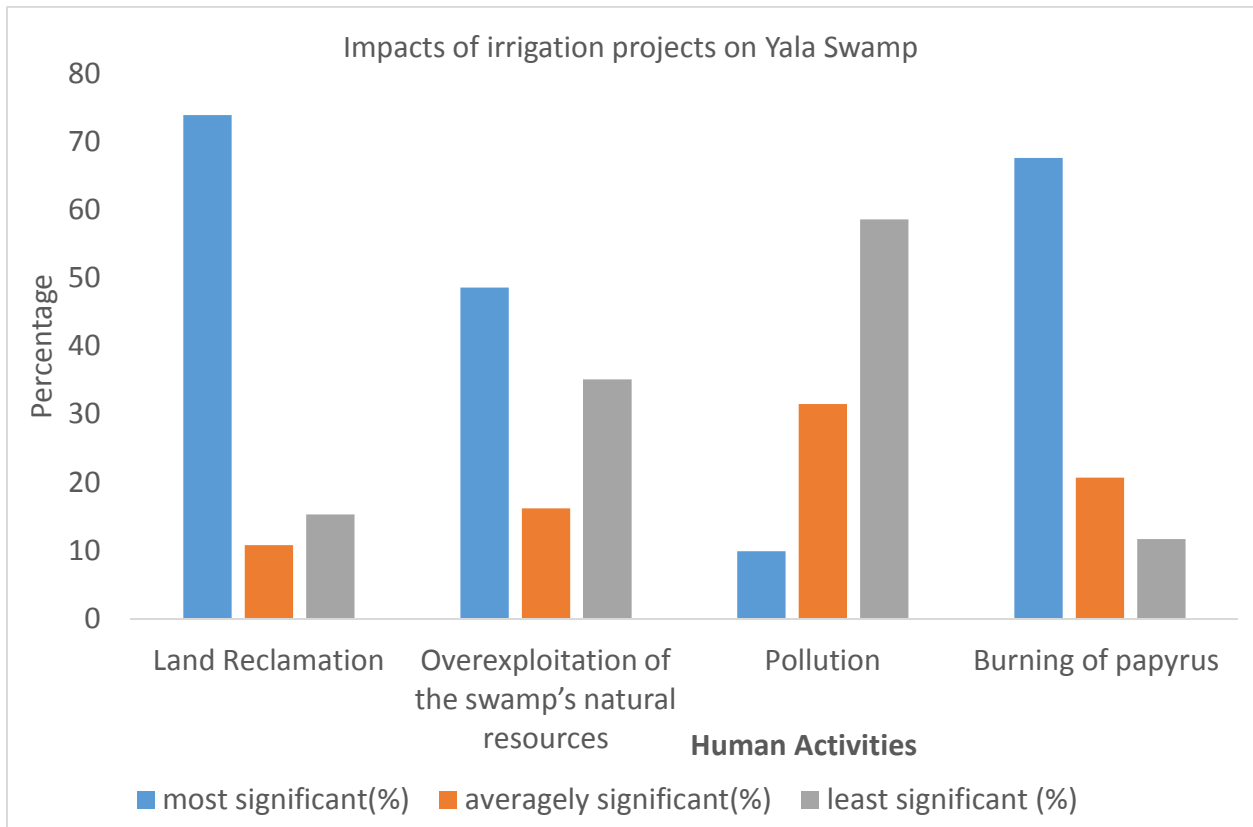
This section addresses objective two of the study that describes how irrigation activities have affected the status of Yala Swamp. The study sought to understand if there were any signs indicating that Yala Swamp and its resources were being encroached and extracted for commercial and household purposes. While 78.4% of the respondents agreed to the statement above, 21.6% of the respondents did not agree that the swamp was being encroached or degraded. The respondents also pointed out that those who were majorly involved in the extraction of these resources were those who practiced small scale and large scale farming and they accounted for 54.1% followed by the local residents at 13.5%. 22.5% of the respondents reported that the state of the swamp was not interfered with nor encroached anybody. This data has been represented in table 4.41

Table 4.4.1 Those involved in encroaching Yala Swamp

	Frequency	Percent (%)
Local residents	15	13.5
County government	11	9.9
Local small scale and large scale agriculture	60	54.1
None	25	22.5
Total	111	100

Yala swamp being a fragile ecosystem, the study sought to find out how the irrigation projects by Dominion Farms Ltd have affected Yala swamp. These irrigation activities were to be ranked by the respondents according to their perceptions as 1 being the most significant; 2 for the averagely significant; and 3 for the least significant. The responses have been represented in figure 4.4.1. Majority of the respondents (73.9%) reported draining and reclaiming of the swamp for agricultural purposes to be the major contributor to the degradation of the swamp, while 48.6% reported that over-exploitation of the swamp's natural resources had adverse impact on the swamp integrity. Pollution which included runoff of chemical fertilizers and pesticides from agricultural field into the swamp, direct disposal of domestic and industrial discharges to the swamp as well as introduction of alien species into the swamp ecosystem were mentioned to have the least negative impact to the swamp and accounted for 58.6%. Burning of papyrus was accounted for 67.6% as this activity destroyed the natural habitat of the wildlife population.

Figure 4.4.1 Impacts of irrigation projects on Yala Swamp



(Field data, 2018)

#### 4.4.1 Effect of Irrigation project on Yala Swamp

The conversion of Yala Swamp for agricultural purposes entailed different activities which has interfered with the ecological status of the swamp and the habitats of different species. According to Thenya (2001), irrigated agriculture has been identified to be a major factor that has contributed to the conversion of wetlands. A research done by Balirwa (1998) in Sub-Saharan Africa points out that increased poverty incidents among the riparian communities has resulted into unsustainable utilization of the wetland's natural resources through pollution, over-exploitation and drainage and reclamation of these ecosystems. Muyodi et al (2011), also notes that the intensive agriculture and irrigation done by Dominion Farms Ltd has led to pollution through flow of the chemical fertilizers from the agricultural fields into the ecosystem.

#### **4.4.1.1 Effect on wildlife**

It is evident that Yala Swamp ecology is gradually being distorted. The Swamp has been partially reclaimed and dykes constructed through the swamp thus destroying the permanent natural state of the swamp and converting it to agricultural land. 67.6% of the respondents agreed that cutting down and burning of papyrus to prepare land for agriculture has led to destruction of natural habitats for various species found in the swamp. The wildlife population in Yala Swamp is declining including the sitatunga, reedbuck and a bird species called gonolek; the filtering effect of the swamp of pollutants has also been tampered with; and the breeding as well as the nursery grounds for fish and birds has ceased to exist

#### **4.4.1.2 Effect on fisheries**

The fish population in Yala Swamp and Lake Kanyaboli has been declining over time because of the interference of these ecosystems from human activities. 9.9% of the respondents noted that the chemical fertilizers from the farms adversely affected the fish populations at Lake Kanyaboli. There are two types of fish found in Lake Kanyaboli; *Oreochromis esculentus* a type of tilapia which disappeared from Lake Victoria and the haplochromines. The study identified fishers represented by 5.4% who complained that they have been experiencing low fish catch since the entry of Dominion Farms. They reported that the aerial spraying of chemical pesticides and fertilizers in the rice plantations adversely affected the reproduction rates of fish as the male fish became sterile.

During a focus group discussion, some members also agreed that the livelihoods of the fishers were affected as Dominion Farms Ltd also introduced fish farming in their farm which led to construction of several fish ponds. Retention dykes and fish cages were created to partition Yala Swamp and Lake Kanyaboli without taking into consideration that fish movement and breeding between Yala Swamp and Lake Kanyaboli would be interfered with. Construction of dykes and weirs to divert water from River Yala had an effect on the downstream ecosystem and fish dynamics such as the upstream movement. Further, the disappearance of some fish species from Lake Kanyaboli is a clear indication that the fisheries in this ecosystem has been interfered with.

6.3% of the respondents also claimed that the introduction of alien species into the swamp by Dominion Farms also affected the fish populations in Yala Swamp and Lake Kanyaboli. The fishers further reported that some of the challenges they face include overfishing since these activities are not restricted and use of wrong fishing gears. The invasion of the hyacinth in Lake Kanyaboli has also affected the fish populations. This sentiment conveys those of Balirwa (1998), who acknowledged that the increasing human population accompanied by over-exploitation of resources in Sub-Saharan Africa have depleted the wetland natural resources particularly the fisheries resources.



Plate 4.4.1.1: Water intake Point at Dominion Farms

#### **4.4.1.3 Effect of pollution on Yala Swamp**

When Yala Swamp was leased to the Dominion Farms Ltd by Siaya and Bondo county councils for agricultural projects, ownership and management of a large part of Yala Swamp (6500ha), accessibility to the swamp's natural resources by the riparian community became difficult. For the land to be prepared, the 6500ha leased had to be prepared and it entailed cutting down and burning of shrubs, trees, grasses and papyrus which provided habitat to different species of plants and animals, and this consequently led to air pollution. Pollution has become a major issue in conserving Yala Swamp because the project entailed releasing effluents and pollutants into the environment in form of chemical fertilizers and pesticides, introduction of invasive fish species,

noise pollution through aerial spraying of chemicals, pungent smell and discharges from farm machineries and equipment. The large rice plantations in the farms became difficult to manage manually and this resulted to practicing aerial spraying of fertilizers and pesticides. During a Focus Group Discussion, members said that some individuals started complaining of the death of their animals, destruction of their crops particularly tomatoes and vegetables due to the chemicals spills during the aerial spraying and this process would scare away birds because it was environmentally unfriendly. There were also several reports on the health complications by the locals who used the contaminated water for drinking and cooking purposes. Studies done by Thenya (2006) and Ong'ang'a, (2005) at the LVB also observed how nutrient loading has led to pollution of the adjacent water bodies, Lake Kanyaboli in particular due to chemical application on agricultural lands.

#### **4.5 Objective 3: The Effect of Dominion Farms on the livelihoods of the local community**

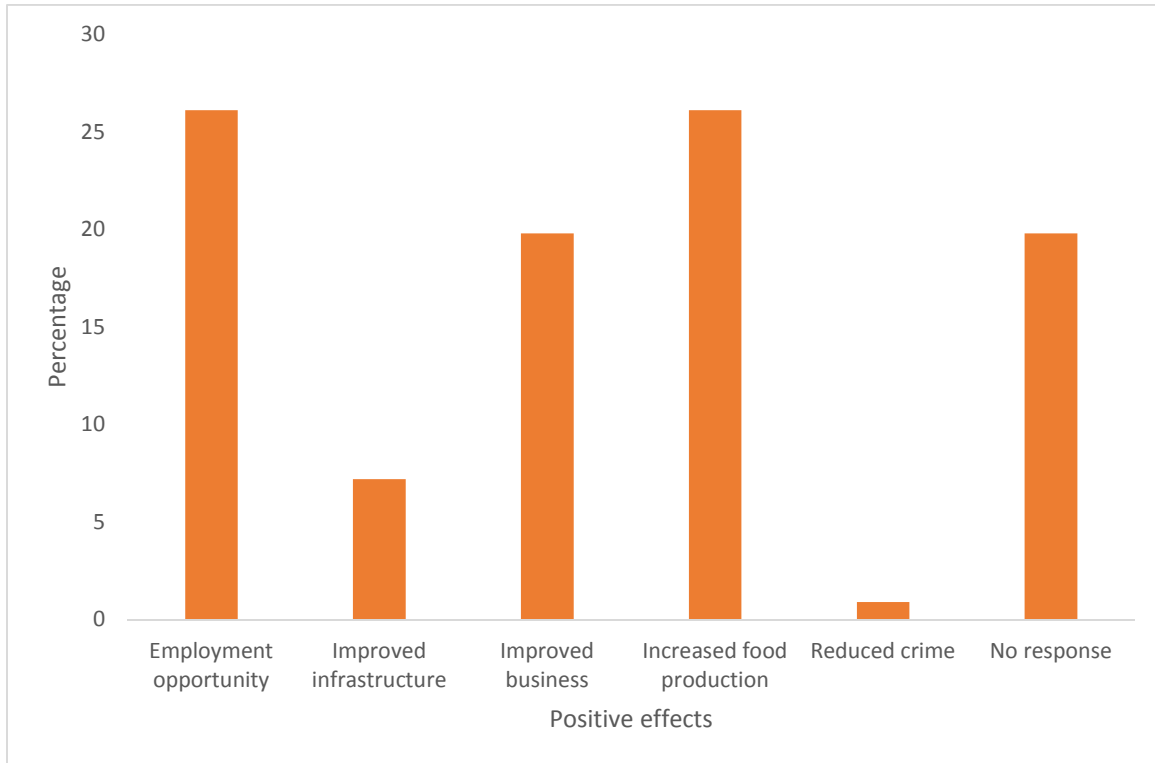
The study sought to find out if the local people's livelihoods had changed since the entry of Dominion Farms Ltds at Yala Swamp. Majority of the respondents, 79.3%, said that their livelihoods had changed positively while the other 20.7% reported that their livelihoods never changed. This section discusses both the positive and the negative impacts experienced after the establishment of Dominion Farms Ltd.

##### *4.5.1 Positive effects on the livelihoods of the local community*

The respondents were further asked to highlight the positive changes brought about since Dominion Farms Ltd came and their responses have been represented in figure 4.6.1. Majority of the respondents (26.1%) reported that there have been positive impacts experienced since dominion farm came into their area through creation of employment opportunities while 26.1% and 19.8% of the respondents said that they benefited from Dominion Farms through increased food production and improved business respectively. Another 7.2% of the respondents reported that there was an improvement in infrastructure including schools, roads, market and dispensary. 3.6% of the respondents who were employed at Dominion Farms reported that the Farm has been playing an important role in improving the Dispensary facility as well as provision of medicine to the local community; sponsoring top students for further learning and distribution of books to schools; and maintaining the road conditions of the location. These opinions have also been pointed out by studies done by Abilla (2003).



Figure 4.5.1 Positive effects brought about by Dominion Farms Ltd



(Field data, 2018)

- **Natural capital**

As DFID (2002), posits, in order for people to maintain their livelihoods, they should have access to the livelihood assets. The natural capital includes assets like land, soil, water, wildlife resources and genetic materials. The local community relies on Yala Swamp for agricultural purposes, water for irrigation and domestic use, grazing land and pasture for livestock, fish resources and papyrus harvesting. The area around Yala Swamp experiences low rainfall of about 760mm per annum and this has limited the local community to rein-fed farming forcing them to acquire farming land near and in the swamp due to water availability. However, with the increasing population and high poverty incidences, people have been forced to acquire more land from the swamp to increase their crop production and improve their living standards. However, the high poverty levels in the study area make people more vulnerable to shocks and this affects accessibility to the livelihood assets by the local people in achieving the desired livelihood outcomes. Studies conducted by Ong’ang’a (2005) share the same sentiments. 21.6% of respondents stated that since the establishment of Dominion Farms, there has been increased food production. The local community benefited from

the farm as food was sold to them at affordable prices and sometimes through donations made by the farm. Dominion Farms Ltd was able to control floods from reaching the people's farms and destroying their crops thus improving food production by the local community.

- **Financial capital**

This refers to the kind of resources available for people in terms of cash, savings and credit. Yala Swamp has always maintained the livelihoods of the adjacent community through provision of different products and services as well as income earned from the sale of crops grown in the swamp, papyrus products, sand harvesting and brick making. Yala Swamp is located in an area that is densely populated with people living in low standards thus making the wetland the most ideal source of income. People earned an income through the job opportunities for the local residents by Dominion Farms. 19.8% of the respondents reported that their businesses had improved since entry of Dominion Farms. There was improved money circulation because people would promote their own and houses would be rented out to those who came to work to Dominion Farms from other counties. Dominion Farm had established a market center for the local community where business transactions would take place.

- **Human capital**

The investor (Dominion Farms Ltd) established a residential vocational training center in the farm to train youths on modern agricultural practices in rice farming, dairy and poultry farming and small scale aquaculture. The program targeted youths who had dropped out of school and farmers to advance their capacity to improve their living standards and develop them into agricultural entrepreneurs. This way the local people were able to acquire knowledge and skills to improve food production.

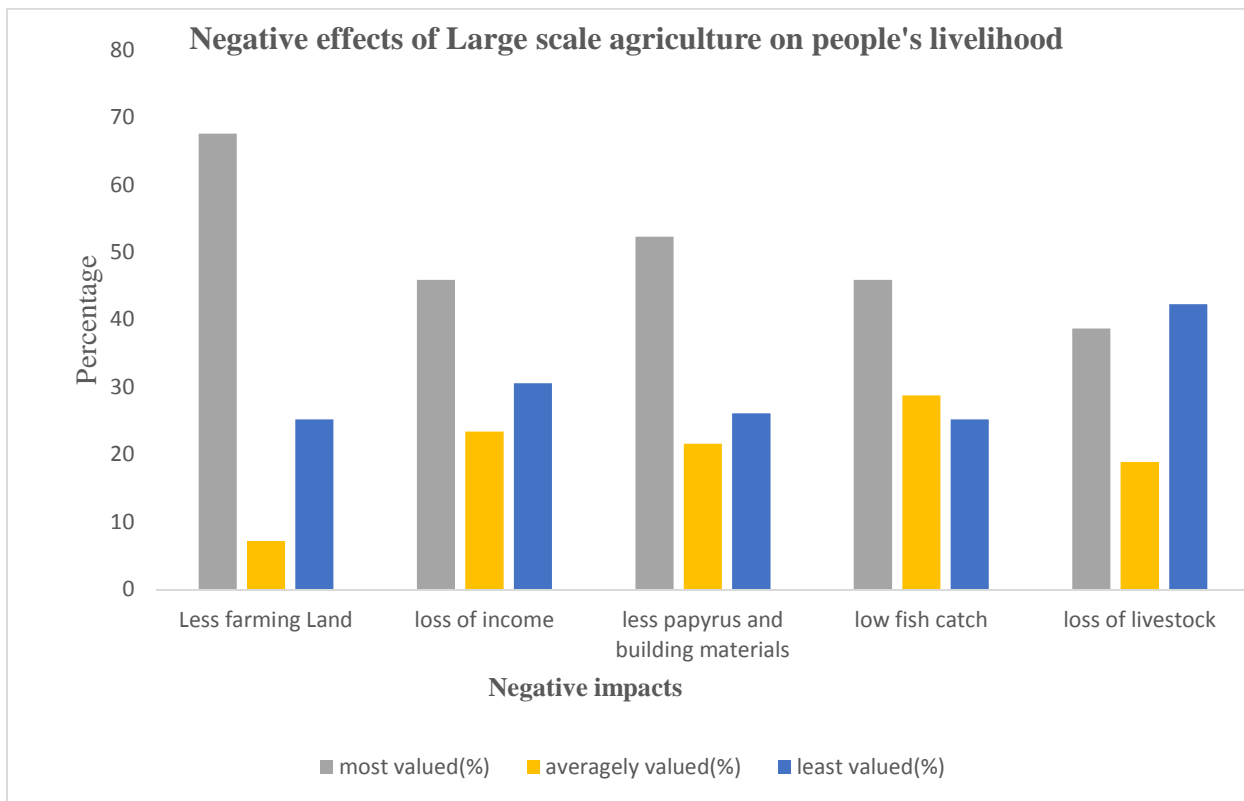
- **Physical capital**

7.2% of the respondents said that there was improved medical care as Dominion Farms constructed new facilities at the infrastructure (roads, electricity, market and schools). There was a general conclusion made by members of the focus group discussion on the infrastructural improvements including the state of roads, health facility and schools. This emphasizes the sentiments of Farrington et al (2004) on improvements of the physical capital in achieving the desired livelihood outcomes.

4.5.2 Negative effects on the livelihoods of the local community

Majority of the respondents (67.6%) reported that there was less farming land set aside for the community to cultivate in order to earn a living. 52.3% of the respondents complained of acquiring less papyrus and building materials from Yala Swamp because Dominion Farm had fenced their land making accessibility to the swamp difficult. Another 45.9% of the respondents reported that Dominion Farm interfered with the movement of fish from Yala Swamp to Lake Kanyaboli as cages were built to restrict the movement of fish while 37.8% said that loss of livestock was another negative impact brought about by Dominion Farms Ltd.

Figure 4.5.2 Negative effects since entry of Dominion Farms Ltd



(Field data, 2018)

- **Natural capital**

With the entry of Dominion Farms Ltd, ownership and management of Yala swamp changed making accessibility to the swamp by the community difficult. 37.8% of the respondents complained of lacking grazing land for their livestock as Dominion Farms had put perimeter fences around the areas where the animals used to graze. The need for people to have access to grazing land has been a source of conflict between Dominion Farms Ltd and the local community. The local people were forced to trespass the property to look for greener pastures for their livestock thus disrespecting the property rights conferred to Dominion Farms Ltd. In return, Dominion Farms retaliated by chasing away the livestock and poisoning grass and water near the perimeter fences leading to deaths of many livestock. The study shares the same sentiments as of Waititu (2009), that the privatization of part of Yala Swamp for agricultural development have negatively affected the local community because they have limited access to the wetland's resources including water, grazing land, fisheries and papyrus.

The study also came across individuals whose land had been taken from them without compensation and claimed that this had significantly contributed to the loss of their income. Other respondents reported that although they were compensated, they felt that the money was not enough. A report by the County Assembly of Siaya joint committee on agriculture, tourism, water and delegated legislation on Yala Swamp (2015) acknowledged the fact that the sizes of lands of the local people were reducing in size because of the frequent floods and the forced evictions by the activities carried out in the farm. During the focus group discussions, it was clear that the local community never understood the transition process including the governance of the swamp. Land ownership resulted to conflict and the issue has remained unresolved up to date with most of the individuals blaming the local authorities and political leaders for their current state.

The responses from the fishers (5.4%) who relied on the fisheries resources (*Oreochromis esculentus* and the haplochromines) of Lake Kanyaboli said that they experienced losses because the lake was being polluted by the aerial spraying of chemicals on the rice plantations. They explained that the chemicals led to a decrease in the male fish populations making them sterile resulting to decrease in the reproduction rates and the total fish populations in the lake. The fish catch was low and consequently their income was affected. The fishers further said that because

accessibility to the swamp was limited, those who used to acquire their fisheries from Yala Swamp had been forced to move Lake Kanyaboli and this exerted a lot of pressure to the lake due to over-exploitation.

- **Financial capital**

For a long time, the riparian community has had direct access to the swamp and its natural resources and used it differently to maintain their livelihoods. Despite 6500 ha of Yala Swamp being leased to Dominion Farms Ltd, people living near swamp were displaced. This was clearly reflected in the responses given during the individual and group discussions where most of the respondents complained that the investor, Dominion Farms Ltd, had deprived the local residents their sources of livelihood. During a focus group discussion held at Konyango Village to seek their views on the disputed land boundaries between the community and Dominion Farms, individuals complained that the increased height of weirs at the swamp resulted to floodings at their upland farms making cultivation difficult. They further said that when Dominion Farms would open the flood gates, the nearby farms would be flooded destroying their crops thus forcing them to sell their lands to Dominion Farms and others forced to flee without compensation.

67% of the respondents said that they rely on the wetland for agriculture and another 38.7% said that they heavily depend on the wetland for grazing. The loss of agricultural and grazing land has negatively affected the livelihoods of the local community. For the fishers, the degradation of the wetlands which is a habitat and breeding ground for various species of fish has also had adverse impacts on their livelihoods.

Before Dominion Farms came into operation, an MoU between the local community and Dominion Farms was signed stating that 300 acres of land was to be set aside for farming by the local community. Because this MoU was not fulfilled to the later, Yala Swamp Group of Farmers Committee entered into another community agreement with the Dominion Farms who agreed to give 1500 bags of rice per year to the community. This took place in a few years and not in the proportions stated in the agreement leading to a major cause of conflict.

- **Human capital**

19.8% of the respondents said that the jobs available for them were temporary and of unskilled nature majority of which majority were offered to the women. They further reported of being exposed to inhuman and harsh working conditions. For instance women would stand in cold water in the rice plantations for long hours and be paid Ksh 205 or less per day. The farm did not provide protective gears such as gum boots and gloves to its worker yet they would handle corrosive chemicals. They further complained that there were no compensations for injuries arising from such activities; people contracted diseases some of which would lead to their deaths. The investor later on introduced aerial spraying of chemicals on the rice plantations and this meant retrenchment of workers and sustaining livelihoods became difficult. This study shares the position of Cultural Survival (2007) that the construction of water reservoirs and rice irrigation have led to increased incidences of diseases such as bilharzia and malaria. The local community also complained of having to travel longer distances from South Central Alego to Yimbo during emergencies because the public road linking the two locations was closed down the investor when he fenced the farm.

#### *4.5.3 Perception*

Some respondents (45.9%) reported that Dominion Farms took their lands and they were never been compensated and this greatly affected their way of sustaining their livelihoods and earning an income. 45.5% of the respondents claimed to have experienced income loss since the establishment of Dominion Farms. They complained that the crops that they grew in the land that was set aside for them to cultivate on was destroyed by dominion Farm using tractors. Further, they complained that their livestock was taken from them when they took them to the farm to graze, and when the owners tried to reclaim them back, they were fined or the cattle were sold to them. Low fish catch was accounted Chemicals that found their way to Lake Kanyaboli due to the aerial spraying done by Dominion Farm on the rice plantations interfered with the reproductive system of the male fish leading to decline in fish population thus low fish catch.

## **4.6 Conservation and Management Policies**

The residents were asked to give their views about the conservation of Yala Swamp and their responses are represented in table 4.6.1 Majority of the respondents (63.1%) said that it was difficult to seek permission to extract natural resources because they believed that the swamp is a

common resource pool and that it was also unclear whom to ask for permission from. While 38.7% of the respondents reported that there have been rules and regulations to guard against extraction of resources, 76.6% reported that there are no initiatives put in place by the community to conserve the swamp.

The 22.4% of the respondents who agreed that the community had put in place initiatives to conserve the swamp highlighted them as encouraging people to plant trees and discourage deforestation; seeking an alternative source of income apart from farming along the swamp; creating temporary dykes to control floods from reaching people’s farms; and people advised to avoid trespassing through the Dominion farms property but instead go round to discourage people from extracting resources due to long distance which is approximately 8 km.

Table 4.6.1 Measures for conserving Yala Swamp

<b>Measures taken to conserve the swamp</b>	<b>Yes (%)</b>	<b>Not sure (%)</b>	<b>No (%)</b>
Seeking permission to extract resources from Yala Swamp	29.7	7.2	63.1
Existence of any rules and regulations to guard against extraction of Yala Swamp and its natural resources	36.9	24.3	38.7
If initiatives have been put in place by the community to conserve the swamp	22.4	0.9	76.6

*(Field data, 2018)*

#### *4.6.1 Sustainable development*

During the focus group discussions, members agreed that nothing had been done to conserve the general environment of Yala Swamp. Members insisted that the establishment of Dominion Farms Ltd at Yala Swamp contributed significantly to its degradation. Apart from an EIA study done on the rice production project, the study found out that no proper EIA process was undertaken in the other projects carried out in the farm. For instance, Dominion Farms was not in possession of a license to breed fish according to the regulations 27 of the Fisheries Act. It was also noted that the construction of the retention dykes at Lake Kanyaboli hindered the breeding and free movement of fish from both inland and foreign water bodies. Dominion Farms presented documents to NEMA for consideration including the annual EA reports, EIA project reports and ESIA study

report for the proposed sugarcane plantation and processing mills. However, implementation of these projects had started before NEMA giving a notification for the project to commence. The main focus of Dominion Farms Ltd was ensuring increased food production through agricultural intensification and extensification without considering the long term and short term effects of these activities.



Plate 4.6.1.1 Rice mill at Dominion Farms

#### *4.6.2 Existing legal frameworks*

KWS prepared a draft policy to ensure the protection, management, restoration and sustainable use of wetlands while sustaining their socio-economic benefits to the riparian community. Yala Swamp being a non-protected area also lacks a proper wetland policy thus making it vulnerable. The study observed that the local community was not involved in any initiatives or wetland management activities due to lack of awareness of the high potential of Yala swamp and its natural resources. Although the KWS had been established to manage the Yala Swamp, implementation of policies regarding conservation and management of wildlife as well as the general ecosystem of Yala Swamp was difficult because they met resistance from the local community and they lacked support from the political leaders.



#### *4.6.3 Community participation and stakeholder involvement*

There is need for transparency, community participation and stakeholder involvement to avoid conflict with regards to Yala Swamp which is a common resource pool. The primary stakeholders of Yala Swamp include the local residents, Dominion Farms Ltd, and the county council. Appropriate consultations and community participation in decision making is necessary in avoiding conflicts. Poor communication between the local community, County council and Dominion Farms Ltd has had adverse effects regarding the conservation of Yala Swamp. Non-Governmental Organizations play a crucial role in supporting community based initiatives and developments geared towards conserving the environment, empowering communities, putting pressure on the government to participate in such activities as well as formation of networks to conserve and sustainably use the natural resources

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter is divided into three sections. The first section makes a summary of the study findings in relation to the study objectives. Section two makes a conclusion of the study while section three makes recommendations on how best Yala Swamp can be conserved while developing sustainably.

#### **5.2 Summary of findings**

The study sought to examine the effects of irrigation projects on the wetland ecosystems, the various socioeconomic benefits derived from Yala Swamp, as well as the effects they have on the livelihoods of the local community. From the interviews conducted it was evident that the local people sustained their livelihoods through the benefits they derived from the swamp. These benefits included habitat for plants and animals (88.3%) and water for domestic use and irrigation (88.3%), grazing land for livestock (73%) and source of fisheries (52.3%). Yala swamp has been used by the adjacent communities over the years to earn an income and thus improve their well-being. Yala Swamp like other swamps provide habitat to various species of plants like Papyrus Cyperus and animals like the sitatunga and fish species like tilapiines and the haplochromines, support the livelihoods of the adjacent communities through activities like fishing, agriculture and papyrus harvesting among others

The study assessed how irrigation activities have affected natural integrity of Yala Swamp. It was evident that agricultural activities carried out in the swamp significantly contributed to its alteration. These activities included land reclamation (73.9%), burning of wetland vegetation (67.6%), over-exploitation of natural resources (48.6%) and pollution (9.9%) The natural habitat of fish, wild animals and birds have been destroyed. The cutting down and burning of papyrus to prepare land for cultivation has resulted to loss of biodiversity like the sitatunga antelope and quails. The aerial spraying of chemical fertilizers and pesticides affected the fish populations at Lake Kanyaboli. With the increasing population and the escalating poverty incidences, the swamp has become vulnerable and faces threats from the local residents as well as from the large scale agricultural projects. The residents agreed to the fact that Yala Swamp has never remained stable over the years because it is continuously being reclaimed for agricultural purposes.

While examining the effect of the Dominion Irrigation Project on the local livelihoods, it was also evident that the livelihoods of the local community had changed both positively and negatively since the establishment of Dominion Farms Ltd. The positive impacts highlighted included employment opportunities (26.1%), improved infrastructure (7.2%) including schools, markets, roads and dispensary, improved business (19.8%), increased food productions (26.1%). Some of the negative impacts highlighted by the respondents because of change in ownership and management of Yala Swamp was difficulty in accessibility of the swamp and its resources, less farming land (67.6%), low fish catch (45.9%), less papyrus and building materials (52.3%) and loss of income (45.9%). Members of the focus group discussion also complained that the casual workers were exposed to harsh working conditions with little wages. They were at higher risks of contracting diseases because the farm did not provide protective gears to its workers. Other respondents complained that their lands were taken from them and were never compensated and it significantly affected their way of earning an income and sustaining their livelihoods.

It was clear that there was conflict between the local residents, the investor, the politicians and the local authorities and the county government. The local people felt that they had rights to have access to the swamp and utilize its natural resources because they have always relied on it to maintain their livelihoods. However, with the conversion of the swamp into large scale agriculture, their rights were infringed and this has been the cause of conflict between the different stakeholders. Part of the community blame the local politicians for their current state.

No proper conservational and management measures have been put in place by both the national and the county government to conserve the swamp and ensure sustainable utilization of its natural resources. It is evident that the few policies that have been put in place by KWS have faced resistance and challenges from the local community during the implementation and enforcement process. There is little awareness that has been done among the community on the need to protect and conserve the wetland. From the interviews conducted, it was evident that the local residents acknowledge the importance of the swamp because of the benefits they obtain from the swamp but no initiatives have been set up by the community and with conjunction with other stakeholders on conserving the environment.

### **5.3 Conclusion**

Yala Swamp plays a significant role in sustaining the local community's livelihoods. It is evident that the human activities carried out at the swamp are adversely affecting the integrity of the swamp. Clearing and burning the swamp's vegetation to prepare land for agriculture has led to loss of habitats and biodiversity. The aerial spraying of chemical fertilizers in the rice plantations has led to decline of the fish population in Yala Swamp and Lake Kanyaboli. It is also evident that the conflicts that are emerging between the stakeholders of Yala Swamp are as a result of existence of inadequate laws and regulations to control use and accessibility of the swamp and its resources among these stakeholders. The study found out that the livelihoods of the local people had been positively and negatively affected since the establishment of Dominion Farms Ltd. The positive impacts included increased food production, employment opportunities, and improved infrastructure while the negative impacts included loss of farming and grazing lands for the local people, low fish catch and loss of income.

### **5.4 Recommendations**

The results obtained from the field clearly indicate that the community living around the Yala Swamp highly depend on the swamp for sustain their livelihood. The study also revealed that there were several unresolved issues concerning Yala Swamp that needed to be addressed to enhance coexistence between the community and other interested stakeholders. Therefore there is need for the stakeholders to work together and come up with measures to enable the sustainable utilization of the swamp and its resources.

#### *5.4.1 Significant policy*

- i. There is need for policy options geared towards poverty eradication strategies. When the local people are trapped in the vicious circle of poverty, the swamp remains to be the only option for people to sustain their livelihoods.
- ii. One of the livelihood strategies identified in analyzing sustainable livelihoods was livelihood diversification. In order to maintain the environmental functioning of Yala Swamp, alternative sources of livelihoods need to be promoted and other alternative sustainable methods of wetland utilization need to be pursued. For instance creating conducive environment for small scale businesses; poultry keeping; and aquaculture

development. Family planning practices also needs to be encouraged in order to reduce the household sizes.

- iii. The study also observed that there is little knowledge about the need to conserve the wetland. The various environmental department in the government, NGOs, and the civil societies need to create awareness and educate the local community on the importance of conserving Yala Swamp.

#### *5.4.2 Suggestions for further research*

The following areas are recommended for further research:

- i. Studies on economic valuation of the ecosystem values of Yala Swamp ecosystem. This will assist in coming up with measures to mitigate resource use conflict and control the conversion of the wetland into other uses.
- ii. Studies on the role of women and culture in conserving the Yala Swamp and its resources. This way the indigenous knowledge on wetland utilization is well understood with regard to conserving Yala Swamp.

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## APPENDICES

### Appendix I: Questionnaire

**UNIVERSITY OF NAIROBI**

**DEPARTMENT OF GEOGAPHY AND ENVIRONMENTAL STUDIES**

**NAME: NYAKUNDI LYDIA KEMUNTO**

**Year 2018**

Dear respondent,

I am a student at the University of Nairobi conducting a research on “An assessment of the effect of irrigation project on wetlands. A case study of Yala Swamp, Siaya, Kenya” which is a requirement for the award of Master of Arts (MA) in Environmental Planning and Management. Your answers and views will be treated with confidentiality and only used for research purposes.

#### **Section 1: General Information**

Date.....Questionnaire number.....  
Name of interviewer.....  
Name of respondent.....  
Name of your Location..... sub-location.....  
Village.....

Please indicate the option correctly and diligently by putting a tick ( ) against options provided in the boxes for each question. For the questions which require your suggestions/comments, use the space provided for each question. Kindly respond to all questionnaire items.

1. Gender                      Male [ ]      Female [ ]
2. Age (years)                20-35 [ ]      36-51 [ ]      52-67 [ ]      68 and above [ ]
3. Marital status            Married [ ]      Widow/widower [ ]      single [ ]      separated [ ]
4. Attended to school      Yes [ ]      No [ ]
5. Educational level        None [ ]      Primary [ ]      Secondary [ ]      Tertiary college [ ]      University [ ]

**6. Occupation /economic activity**

- a) Civil servant [ ]
- b) Farmer [ ]
- c) employed [ ]
- d) Business [ ]
- e) Fishers [ ]
- f) None [ ]

**Section 2: Wetlands use information (socio-economic benefits)**

7. Do you consider Yala Swamp to be of any value to your society? Yes [ ] No [ ]

8. Which of the following function/values of wetland natural resources are appreciated in your area of residence? Rank attributes below according to considered importance, where; 1 = the most valued; 2 = averagely valued and; 3= the least valued.

- a) [ ] Control of flooding and soil erosion
- b) [ ] Habitat of various species of animals and plants
- c) [ ] Water Purification and Nutrient retention
- d) [ ] Source of agricultural produce, medicinal herbs, building materials, wildlife products
- e) [ ] Reliable source of water for domestic usage and irrigation
- f) [ ] Source of income and employment
- g) [ ] Source of fish
- h) [ ] Source of charcoals/timber/papyrus/Firewood
- i) [ ] Tourism and Recreation attraction
- j) [ ] Religious and Cultural Significance
- k) [ ] Provide grazing field and forage for livestock

9a. Are there visible signs indicating that Yala Swamp resources are encroached and extracted for household or commercial purposes? [ ] Yes [ ] No

9b. Who is involved in extraction/usage of Yala Swamp resources? (Tick in the box)

- [ ] Local residents
- [ ] County government
- [ ] Local small-scale and large scale farming
- [ ] None of the above

**10.** Which of the following human activities have adverse impacts on Yala Swamp? Rank the attributes below according to considered importance, where; 1 = the most significant; 2 = averagely significant and; 3= the least significant.

- a)  drainage and reclamation of Yala Swamp for agriculture
- b)  flow alteration, diversion, construction of dykes
- c)  overexploitation of the swamp's natural resources
- d)  runoff of chemical fertilizers and pesticides from agricultural field into the swamp
- e)  burning of papyrus to clear land for agriculture
- f)  direct disposal of domestic and industrial discharges to the swamp
- g)  introduction of alien species

**Section 3: Changes in livelihoods**

**11.** Has your livelihood changed since the establishment of DFL in this area?  Yes  No

**12.** Highlight some of the positive changes brought about since the entry of Dominion Farms Ltd?

.....  
.....

**13.** Rank the following negative impacts brought about by the presence of Dominion Farms according to considered importance, where; 1 = the most valued; 2 = averagely valued and; 3= the least valued.

- a)  Less farming Land
- b)  loss of income
- c)  less papyrus and building materials
- d)  low fish catch
- e)  loss of livestock

**Section 4: Environmental policy**

**14.** Do people seek permission to extract natural resources from Yala Swamp?

Yes       Not sure       No

**15.** Are you aware of any rules and regulations to guard against extraction and exploitation of Yala Swamp and its natural resources?    Yes [ ]            Not sure [ ]            No [ ]

**16.** Do you agree that Yala Swamp is of less value and could be converted to better economic activities beneficial the neighboring community?    Yes [ ]            Not sure [ ]    No [ ]

**17.** Has Yala Swamp remained stable and secure over the years? Yes [ ]    Not sure [ ]    No [ ]

**18.** Are there any initiatives put in place by the local community to conserve Yala Swamp and its natural resources? Yes [ ]    Not sure [ ]    No [ ]

If yes, highlight such initiatives.....  
.....  
.....  
.....



## **Appendix II: Focus Group Discussions Guide**

- 1.** Socio-economic benefits of Yala Swamp
- 2.** food security status before and after dominion irrigation farms
- 3.** employment and other sources of income
- 4.** crop, livestock and fish production
- 5.** infrastructure and social amenities before and after dominion irrigation farms
- 6.** land use changes
- 7.** human induced impacts on Yala swamp
- 8.** conservation measures and initiatives

### **Appendix III: Interview Guide for Dominion Farms (K) Limited**

1. Brief History of the company?
2. How does the company use the swamp?
3. How has DFL contributed to improving the living standards of the local people?
4. What are your comments on the status of Yala Swamp and the environment in general?
5. Has there been any EIA/EA that has been conducted since the introduction of this farm?  
How often is it conducted?
6. What kind of measures have been put in place to ensure the sustainable utilization of resources and the conservation of Yala Swamp?
7. Are there any challenges that you have encountered? If any how have you gone about them?
8. In your own views, what is the future of Yala swamp under Dominion farm (K) Ltd?
9. Are there any policies that have been put in place to govern sustainable use and conservation of Yala Swamp?

## Appendix IV: Research Authorization



### NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,  
2241349, 3310571, 2219420  
Fax: +254-20-318245, 318249  
Email: dg@nacosti.go.ke  
Website: www.nacosti.go.ke  
When replying please quote

NACOSTI, Upper Kabete  
Off Waiyaki Way  
P.O. Box 30623-00100  
NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/82195/23421**

Date: **17<sup>th</sup> July, 2018**

Lydia Kemunto Nyakundi  
University of Nairobi  
P.O. Box 30197-00100  
**NAIROBI.**

#### **RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on "*An assessment of the effect of irrigation projects on wetland; case study of Yala Swamp*" I am pleased to inform you that you have been authorized to undertake research in **Siaya County** for the period ending **17<sup>th</sup> July, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Siaya County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit a **copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

  
**BONIFACE WANYAMA**  
**FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner  
Siaya County.

The County Director of Education  
Siaya County.

## Appendix V: Research Permit

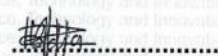
**THIS IS TO CERTIFY THAT:**  
**MISS. LYDIA KEMUNTO NYAKUNDI**  
**of UNIVERSITY OF NAIROBI, 287-40400**  
**MIGORI, has been permitted to conduct**  
**research in Siaya County**

**Permit No : NACOSTI/P/18/82195/23421**  
**Date Of Issue : 17th July,2018**  
**Fee Received :Ksh 1000**

**on the topic: AN ASSESSMENT OF THE**  
**EFFECT OF IRRIGATION PROJECTS ON**  
**WETLAND; CASE STUDY OF YALA**  
**SWAMP**

**for the period ending:**  
**17th July,2019**



  
.....  
**Applicant's**  
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