# EFFECTS OF HUMAN ACTIVITIES ON RIVER KIPRANYE RIPARIAN AREA IN KERICHO COUNTY, KENYA

BY

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**A Thesis Submitted to the School of Arts and Social Sciences in Partial Fulfilment of the Requirements for the Award of the Degree of Doctor of Philosophy in Geography, Department of Geography and environmental studies of Moi University**

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# DECLARATION

**Declaration by the Candidate**

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# DEDICATION

This thesis is dedicated to my beloved wife, Angeline Kirui for her prayers and support during the entire period of my study. I also dedicate this work to my dear children; Shanice and Shelby for their understanding during my years of study. Lastly, I dedicate this study to my brothers and my late mother, Mary Chumo for her mentorship and immense prayers.

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# ABSTRACT

Governments and environmental conservationists agree that riparian resources need to be utilized sustainably to ensure the continued presence of riparian and their ecological goods and services. Ideally, sustainable use of riparian should be integrated into the national and local land use plans to ensure sustainable use and management of the resources. However, this is not the case as far as Kenya is concerned. Instead, there is rampant exploitation of riparian by individuals, organizations and even government agencies with no regard for environmental conservation. This can be done by promoting sustainability of utilization of riparian zones by ensuring that local and international regulations are in tandem with the community living in riparian zones. Therefore, the general objective of this study was undertaken to establish the effects of human activities on the River Kipranye riparian area. The specific objectives of the study were: To establish the effect of human activities on Kipranye riparian ecosystem, To assess the effect of agricultural activities on Kipranye riparian ecosystem, To find out the possible riparian policies and strategies on conservation of Kipranye riparian ecosystem. The study was grounded on by the Systems Theory and tragedy of common. The study was based on concurrent triangulation as the choice of research design which entailed combination of both qualitative and quantitative data. The target population for the study were 700 Households living upto 6km from the riparian area in the selected study area together with 1 national environment officers and 6 County environment officers that enforce regulation in the riparian zones in the study area. The sample size for the study area were 255 household members that were selected randomly with the aim of collecting quantitative data using questionnaires. Qualitative data was collected from the 6 county environment officers and 1 national environment officers through interviews. The study established that human activities such as farming, logging, construction, drilling, building and construction, and settlements were immense in the study area and they have hampered the conservation of Kipranye riparian. It also found that there is a gap in the integration of legal framework to manage the riparian is in the study area. From the findings, the study concluded that the Kipranye riparian ecosystem needs urgent redemption and reclamation. Consequently, the study recommends that the creation of awareness against these problems among local communities. Inclusion of the local communities in the conservation of the ecosystem will enable the people to take responsibility and own the solutions to the problem.

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## ACRONYMS AND ABBREVIATIONS

**BOM**:              Board of Management

**EFA**:              Education for All

**IWRM**              Integrated Water Resources Management

**KCO**               Kericho

**KINF**              Key Informant

**MDG**:              Millennium Development Goals

**MOE**:              Ministry of Education

**NACOSTI**:          National Commission for Science and Technology and Innovations

**NEMA**:             National Environment Management Authority

**NGO**:              Non-Governmental Organisation (NGO)

**SDG**:              Sustainable Development Goals

**SPSS**:             Statistical Package for Social Sciences

**UNESCO**:           United Nations Educational, Scientific and Cultural Organisation

**UNFPA**:            United Nations Fund for Population Activities

**WEMA**:             World Environment Management Authority

**WHO**:              World Health Organisation

## 1.10 Operational Definitions of Key Terms

**Biodiversity**:          The richness or variation of life forms in an ecosystem or biome.

**Riparian's Area**:    A riparian   area is   the   interface   between   land   and

a river or stream.

**Riparian   Zones**:   Consist   of   riparian   woodland, riparian   forest, riparian

buffer zone, riparian corridor, and riparian strip

**Riparian Conservation**: The adoption of deliberate measures and strategies to

preserve the riparian ecosystems, maintain their pristine state,

and control exploitation of the Riparian resources to ensure its

sustainability.

**Riparian Management**: Practices conducted in and around the Riparian ecosystems,

both natural and man-made, to secure, re-establish, control, or

conserve their inherent qualities.

**Effects**:    Negative consequences caused by human activities.

**Human activities:**    Human practices engage in an area for subsistence

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

The conservation of the riparian's has become a critical issue in contemporary society because of the exponential growth of the human population, thus constraining the capacity of existing natural resources. Riparian's deliver practical benefits to plants, animals, humans, and the overall ecosystem or bio-diversity (Roy, Barr, & Venema, 2018). The term riparian zone or riparian areas refers to the boundary sandwiched between land and a river or stream. These ecosystems consist of grasslands woodlands, riparian and other aquatic and organic lives. This area plays a significant role in ecology, soil conservation and home to diversity of habitat. Riparian zones play a critical role in conservation of environment and conservation of soil even as well as provide habitant to diverse species of fauna and flora.

The term riparian land is an original Greek word which means "river bank' (Osborne, 2012).That is the reason why riparian lands are considered as transition habitat of both terrestrial and aquatic ecosystems. The riparian zone consists of riparian woodland, riparian forest, riparian buffer zone, riparian corridor, and riparian strip. Riparian land ranges from stream, stream channel, and adjacent riparian vegetation. The most critical thing about riparian zones is that they help to slow down stream energy by helping create meandering curves along the river which when combined with vegetation and root covers end up slowing down the velocity of water hence reducing soil erosion (Versissimo, 2017).

Riparian's are critical to the survival of the human species and for the precinct of welfare activities of the communities living in the natural environment (Kipngeno, Omondi & Nunow, 2020). To ensure this, water sanitation, flow regulations, and management of critical water sources, a forestation for management of carbon blueprint, and water management are paramount. According to the Ramsar Convention international list, there are 1,952 riparian's, which cover a total surface area of 1.9 million $km^2$ globally and the United States (Gitay, Finlayson, & Davidson, 2011). These riparian areas provide a wide range of benefits to the bio-populations that directly or indirectly relate with it. They are a refuge for wildlife; remove sediment and pollutants, such as manganese, molybdenum, dissolved and suspended solids, nitrogen, phosphorus, and zinc from the soil and atmosphere, providing clean water for bio-populations that can also be used for other purposes like agriculture.

Given the ecological importance of the riparian's to bio-diversity and economic development, humans equally have growing threats because they depend on them and have the responsibility to conserve them. Globally as indicated by Postel, Daily and Ehrlich (1996), human related activities has taken over more than 54% of riparian land which have had significant impact on structure and functioning of riparian zones. Some of the drastic human effects of riparian include changes in hydrology of rivers and riparian areas, alteration of geomorphic structure, and removal of vegetation due to drastic decline of acreages across the riparian lands. Human activities such as construction of dams, irrigations and inter basin conversion normally end up disconnecting rivers from flood plains. Another major impact of human activities has to do with massive harvest of initial species in the riparian areas, which are normally introduced via activities such as forestry, agriculture, livestock grazing, human

settlements and urbanizations. Removal of original vegetation along riverbeds eroded the binding effects of rots upon soil, which causes reduction of bank of rivers and alteration of velocities of rivers that ends up as subsequent channel erosion (Horton, 2017).

The existence of riparian and wetlands is under threat due to alarming human infringement, and it is estimated that more than 50% of the world's inland riparian's have been lost (Ahti, 2013). Much of this loss of riparian and wetlands worldwide is attributed to agricultural activities and mining for commercial purposes. In a profound sense, it is estimated that the loss of 56-65% of existing riparian ecosystems in Europe and North America, 27% in Asia, 6% in South America, and 2% in Africa is due to agricultural activities (Zedler & Kercher, 2013).

Given the ecological importance of riparian's and the growing threats to environmental conservation today, various concerns have been raised globally and locally over the state and the need to conserve the natural environment, particularly the riparian's. Among these concerns and efforts are organizations like the Green Belt Movement, United Nations Environment Program, and the World Commission on Environment to preserve and rehabilitate the environment. Further, the Rio-de-Janeiro Conference (1992), the Kyoto Protocol of 1995, and the Copenhagen Climate Meeting of 2009; underlined that global and regional climate changes are a threat to land resources on which human survival relies (Rebelo, McCartney, & Finlayson, 2010).

In the US, Behemoth (2015) asserts that agricultural and industrial practices are the major source of pollution for most rivers, lakes, streams, and springs. The studies indicated that the US lost more than 360,000 acres of freshwater and saltwater to the

riparian ecosystem to severe storms, sea-level rise, and thriving development along with the coastal areas. Saltwater the found to cushion the riparian ecosystem from sea surges that cause flooding during great storms along the coastal regions. Understanding the status of a riparian involves three elements, first, exploring the current human and anthropogenic activities happening in the riparian, second, it involves estimating their effects, and lastly understanding factors that contribute to them (Binkley, 1984).

A study by Verhoeven and Setter (2010) has managed to portray the real risks of losing the riparian's as have been witnessed in New Zealand, with the loss of nearly 90.0% of its riparian, where the nation had over 2.4 million hectares and now only 250,000 hectares remains. This made the government come up with the riparian ecosystems Management Policy. The need for the Policy was driven by two factors. Firstly, the extent and quality of the riparian ecosystem in New Zealand had diminished. Secondly, the great number of agencies involved in the management of the riparian ecosystem had led to ineffective management of the riparian and wetlands.

A study by Ma et al (2014) explains that the riparian and wetlands in China, which support various biodiversity and provide the foundation for development in various areas, including fishery products, absorption of pollutants, enabling tourism and recreation, providing spawning and nursery sites for fish species have been adversely affected, with a decline of up to 58% from 1950–2014. This unfavorably affects ecosystems in the riparian and wetlands, which have also declined. For instance, the mangroves have declined by 69% from 1950–1997 negatively affecting snails, crabs, and insects that depend on them (Sun et al., 2015).

In India, a study by Ahidur (2016) found that the chemical fertilizers and pesticides in the agricultural fields around the riparian ecosystems as the major causative factor of riparian degradation and subsequent water pollution causing much harm to aquatic plants and animals, and other ecosystems. Other human activities that destroy the riparian and wetlands were found to be the construction of houses, roads, agricultural land reclaimed, and overfishing among others. The study concluded that the area cover of the riparian areas is going to decrease day by day due to human encroachment, pollution, overgrazing, and invasion of species that contribute to the preservation of the riparian ecosystems. Furthermore, since the area experienced riparian, there have been immediate effects on their ecosystems (ducks, flamingos, and spoonbills) where the Grand Lac of Djoudj has slowly been filled with sand over the years causing it to dry up (Seydina, 2017).

In Uganda, riparian degradation is mainly attributed to changes in land use and anthropogenic happenings like agriculture, industrial development, urbanization, pollution, and human settlements because of rural areas experiencing rapid and comprehensive land-use changes (Finlayson & Spiers, 1999). Most of these activities entail adjustment and even drainage of the riparian ecosystem, reducing their buffering capacity. Furthermore, the use of pesticides and agrochemicals in horticulture generates danger to the lake's biodiversity (Matabi, 2015). Research by Safari et al. (2012) on the valuation of the effects of human activities on riparian degradation in Nyaruzinga in Rwanda found that water quality is most affected by pollution, which ends up contaminating the riparian and affecting ecosystems.

In Kenya, the National Riparian Conservation and Management Policy developed by the National Land Commission (2015) recognized the significance of riparian

ecosystems and freshwater ecosystems. They are considered key providers of goods and services to humans and other ecosystems. The policy was meant to control riparian pollution, exploitation among others, and it recommended the government to harmonize the responsibilities of regulatory agencies whose mandate is the management of these natural and environmental resources. The same policy also recommends the rehabilitation of those riparian areas that have been exploited. Despite this, riparian misuse is still a reality.

Matunda (2016) indicate that Kenya's riparian land is under threat since they is no single law or regulation to protect them. Current laws exist as different statues under different department. However, the author noted that riparian areas are crucial elements, which is essential for sustainability of habitat and ecosystem across streams, rivers and shorelins.

A study by Mira (2014) upholds that changes in land-use patterns in Kenya are linked to a rapidly increasing population in rural areas, which necessitates the need for land. This population growth rate translates into increased pressure and demand for other land-related resources, especially in the watershed regions such as the Mau Forest region. This concurs with the study by Muchiri (2012), which pointed out the over-extraction of water using water pumps and encroachment of river banks for agricultural purposes as the main human activities contributing to the loss of Riparian water resources, which consequently leads to environmental degradation.

Muchiri (2012) further added that livestock and crop farming were other human activities that negatively affect water sources in Kenya. Human and animal migration into the riparian shows that many freshwater environments now experience seasonal fluctuations in water levels, which influence livestock grazing and other feeding

behaviors. Seasonal fluctuations in water levels permit the movement of herders with their livestock into riparian basins, where they utilize the available water and lush plant resources in those areas. This is evidenced by the mass destruction of the River Tana, River Nzoia, and River Kipranye riparian ecosystems for firewood, charcoal, construction material, irrigation and grazing.

Ichuloi (2018) argues that humans themselves severely, relentlessly, and undesirably destroy the earth ecosystems and biosphere in Kenya. These ecosystems and biodiversity are threatened to destruction and extinction, which equally affects the natural habitats and species, thus creating a general loss of biodiversity, including humans themselves. These sentiments were recaptured by Ahidur (2016), who claimed that the riparian are the world's most threatened habitats due to accelerated human activities like drainage, land reclamation, pollution, and over-exploitation of riparian species. While Matano (2015), argues that in Kenya, due to human settlements and other humans activities, the country's riparian encounter diminishing forest cover, erosion, decreased soil cultivation quality, loss of vegetation's and drying of rivers, all leading to ecological instability in the country.

There are several approaches of riparian management, which are classified depending on the balance between resource users, planners, and policymakers and the relationship between the riparian ecosystem, people, and existing human institution. The institutional approach is also referred to as the top-down method (Schwartzman, 2014). This is where the management of riparian is done through an institution that takes total control of riparian resources use, control, and management. However, the approach is often criticized as lacking space for participation of other stakeholders and thus alienating them from the resources and so may become an obstacle to

sustainable conservation initiatives. The method is also prone to institutional laxity, which is often instrumental factors behind riparian loss (Chidzonga2015). This is reiterated by Utsala (2014), who argues that the community should be the target of riparian conservation and management. Conservation efforts should equally take into account their indigenous knowledge and practices that are perceived to be friendly to the natural environment. Partnering with the local communities in riparian management ensures the wise and sustainable use of such lands and also empowers them to take responsibility for decisions and actions that restore and sustain the riparian.

Several studies underscore that it is impossible to fully understand the human exploitation of the riparian without considering factors that contribute to that exploitation. It is important to consider all integrated and interacting factors that contribute to the sustainable use of riparian (Jacobson, Sieving, Jones, & Van Doorn, 2003). Several pieces of the literature suggest that household size and farm size are related to willingness to adopt the riparian conservation program. Farmers with smaller than average household size and farms are more willing to adopt a riparian conservation program than those on larger than average farms (Dias & Belcher, 2015; Jacobson et al., 2003; Ichuloi, 2019)

Globally, regionally and nationally there exist policies and legislations that surround the sustainable management of riparian. The critical convection that is known globally is Ramsar, which seeks to promote the conservation of riparian while promoting the need to have trans-boundary coordination between the regions and contracting parties on trans-boundary the riparian (Finlayson et al., 2011).

The rationality behind this insatiable human incursion on the riparian, Ichuloi (2019) maintains, is the urge to continuously and egoistically acclimatizes the riparian areas

to accommodate human selfish interests, instead of adapting human interests to the riparian and their natural dynamics. The reality expressed in this background necessitated this study on the effects of human activities on Kipranye riparian, Kericho County, Kenya.

## 1.2 Statement of the Problem

Currently, the major global problem facing the conservation of riparian ecosystem is human encroachment into them and their related ecosystems, thus unfavourably affecting biodiversity. This inversion of the riparian's generates serious problems like global warming and other associated risks that threaten all forms of life on the planet earth (Ichuloi, 2018). On the global level, there are organizations like the Green Belt Movement, United Nations Environmental Program, and the World Commission on Environment to preserve and rehabilitate the environment.

The Kyoto Protocol (2008) contains a series of measures aimed at reducing greenhouse gas emissions, known as mitigation, most notably the Clean Development Mechanism (CDM). Environmental conservation agreements and treaties are ever signed, environmental declarations and different international organizations and environmental unions (Flint, 2014) enact laws. At the local level, the Kenya government, in its attempts to conserve riparian areas, has gone ahead to evict people in such areas. This is epitomized by the eviction of people in the Mau forest and other water catchment areas. All these measures at the international, national, and local levels are to create awareness of the need to care for and conserve the riparian.

However, despite the efforts, there are very few results. Furthermore, riverside the riparian are neglected in limnological research giving rise to increasing exploitation of such lands for other human purposes (Lawrence, 2015). There are still serious human

incursions into such lands. A review of literature has established that few systematic studies have been conducted to examine the effect of human activities on the riparian ecosystem in the Kenya context. This study sought to fill this gap by examine the Kipranye riparian ecosystem.

## 1.3 Purpose of the Study

The purpose of this study was to investigate the effects of human activities on Kipranye riparian, Basin, in Kericho County.

### 1.3.1 Specific Objectives

1. To establish the effect of human activities on Kipranye riparian ecosystem, Kericho County

2. To assess the effect of agricultural activities in Kipranye riparian ecosystem, Kericho County

3. To find out the effect of the possible riparian policies and strategies on conservation of Kipranye riparian ecosystem, Kericho County

## 1.4 Research Questions

The study was guided by the following research questions:

1. What is the effect of human activities on Kipranye Riparian ecosystem in Kericho County?

2. What is the effect of agricultural activities on Kipranye riparian ecosystem in Kericho County?

3. What is the influence of policies and strategies on Riparian conservation on Kipranye riparian ecosystem in Kericho County?

**1.6 Justification of the Study**

The study investigated human activities that were responsible for the degradation of the Kipranye riparian area. This benefits the local communities along the Kipranye river in that they can develop their indigenous cultural ontology that sees the importance of indigenous environmental knowledge (Ichuloi, 2018). They will come to the understanding that human life and riparian are intimately linked and therefore, cannot be treated in isolation. Thus, the study creates community awareness of the importance of riparian and their indispensable role in the conservation of the natural environment for sustainable development in the region.

The salient features and ecosystem of the Kipranye river are likely to benefit scholars since the study opens up cogent areas for further research in biodiversity studies, which help to conserve and reclaim the riparian ecosystem. This corrects the erroneous, wide spread and conventional view that the riparian are wastelands that are non-productive. The riparian meaningfully contribute to the vitality of biodiversity, including human life. The findings of the study also inform environmental authorities and communities in the formulation and implementation of relevant policies that help to reverse wetland exploitation by humans, and in particular Kipranye riparians. This is a measure to protect and save biodiversity and riparian loss. A strong political and organizational option to protect wetlands based on sound wetland policies and encouragement for community participation in their management levels is paramount in the conservation process of such lands

The ability of the riparian and wetlands to recycle nutrients makes them critical in the overall functioning of the planet earth (Lawrence, 2015). Kipranye River basin the riparian ecosystem extends hundreds of kilometers towards Lake Victoria (87km),

which is the largest freshwater lake in the world. This river is one of the inlets to Lake Victoria and enables the adaptation of diverse plant species alongside it. Over the years, water levels in this river have been declining. Its destruction directly contributes to the destruction of Lake Victoria marked by the drop of its water levels. Furthermore, in the past, river Kipranye used to cover a larger area of Kericho County, but it water levels have dropped over time and it coverage has reduced rapidly due to overuse, which has resulted in biodiversity loss.

The natural resources of the planet earth are exploited at such a rate and speed that is no longer sustainable. What traditional Africa used to call nature myths has become a repertoire of exploitative practices under the technical rationality of material production that enhances the exploitation of the riparian ecosystem and related biodiversity. We are using the riparian's non-renewable resources faster than what those lands themselves can replenish.

## 1.7 Significance of the Study

The study investigates the effects of human activities river Kipranye riparian ecosystem. This benefits the local communities along the Kipranye River in that they can develop their indigenous cultural ontology that sees the importance of indigenous environmental knowledge (Ichuloi, 2018). They will come to the understanding that human life and the riparian ecosystems are intimately linked and therefore, cannot be treated in isolation. Thus, the study is likely to create community awareness of the importance of the riparian ecosystems and their indispensable role in the conservation of the natural environment for sustainable development in the region.

The findings of the study also are likely to inform environmental authorities and communities in the formulation and implementation of relevant policies that help to

reverse riparian exploitation by humans and in particular Kipranye riparian. This is a measure to protect and save biodiversity and riparian loss. A strong political and organizational option to protect the riparian based on Kipranye riparian policies and encouragement for community participation in their management levels is paramount in the conservation process of such lands.

The study benefits the entire population in creating awareness of the values and benefits derived from the riparian's, and to promote the understanding of the non-ecological causes of riparian loss and degradation; providing information on the importance of the riparian's and the dangers implied in the case of abuse.

## 1.8 Basic Assumptions of the Study

The research was guided by various assumptions:

i. The study assumed that all variables that cause detrimental effects on the riparian ecosystems are constant for the general and objective findings of the study.

ii. That the riparian's are not wisely used by the local communities and that institutions charged with the conservation of the riparian ecosystems are not properly dispensing their mandate.

iii. Riparian ecosystems provide various services, which include storm water detention, flood protection, water quality enhancement, climate regulation, biodiversity, food chain support, etc.

iv. Agricultural activities in the riparian ecosystems are carried out at the expense of the ecological character of the riparian's themselves, which equally risks the lives of humans.

To examine the above assumptions, the study hoped that the local community provides adequate information on their involvement in the exploitation of the riparian ecosystems and in finding solutions to the problem. In other words, the respondents, including government officials, are available to make their objective contributions to the study, giving their most genuine and unbiased feedback to meet the objectives of this research. Since, the destruction of the riparian ecosystems adversely affects the community, it was hoped that the respondents had sufficient information that would be representative of other riparian's and regions experiencing similar situations.

## 1.9 Scope and Limitations of the Study

### 1.9.1 Scope

The study was limited to investigating the effects of human activities on the Kipranye riparian ecosystem and it did not seek to look into other activities that are not riparian related. In its attempt to address the study problem, the research appropriated other studies or sources that are only related to the subject under study. The study population was strictly people residing along the Kipranye River basin area, especially those who undertake mixed farming (agricultural and livestock), residential, and public infrastructural activities.

### 1.9.2 Limitations

Since the study was limited to the river Kipranye river, it may not be ideal to generalize research findings. However, this limitation was solved by seeking a wider sample representation for the objectivity of the data and study findings. During the data collection phase, the researcher also experienced suspicion from some respondents, and also biases in giving information touching on members of the communities living along the river. The study tried to overcome this limitation by enlightening respondents about the value of the study and assuring them anonymity

and confidentiality. Since, the destruction of the riparian adversely affects the community, it was hoped that the respondents had sufficient information that would be representative of other riparian's and regions experiencing similar situations.

## CHAPTER TWO

## LITERATURE REVIEW

### 2.1 Introduction

This chapter presents a review of the literature relevant to the research problem. This was done based on the study objectives. The chapter further discusses the theories used and finally gives the conceptual framework that explains the symbiotic relationship between the study variables. The entire literature review takes into account the empirical studies aligned with the specific objectives that anchored this study.

### 2.2 Concept of the riparian

Several concept exist that define riparian areas or zones, one of the definition is from (Osborne ,2012) who relate riparian with gradients, biophysical conditions, ecological processes and biota. Therefore, riparian land in this case is areas via which surface and subsurface hydrology link with other water bodies upstream. The main purpose of riparian zones is to influence the exchanges of energy and matters other aquatic system (Versissimo, 2017). Several characteristics of riparian differentiate it from other bodies and make it unique and beneficial. One characteristics is that riparian can be found in wide variety of climatic, hydrologic geomorphic and ecological environments. Another characteristics is that riparian are by themselves ecosystem which include organisms-plants and animals (biotic part) and their immediate environment (abiotic part)(Versissimo, 2017). Riparian zones help all organisms to interrelate with each other and with prevailing environment, which has been created by local factors. Another characteristics is that riparian's are distinct and unique in nature when they are compared to neighbouring ecosystems this is mainly due to characteristics such as water, soil and vegetation. Riparian ecosystems

are also areas which are substantially dryer than the neighbouring aquatic ecosystem are inundated by water either year-round or for long periods of time and this explains why the areas are considered as transition zones with characteristics of both aquatic and upland ecosystems. Riparian areas provides benefits to society known as ecosystem services, which include habitats for fish, and birds and helps capture sediments, riparian lands supply food and water for diverse of animals serving and supporting migration routes. Riparian land provides water which is the most critical part for survival of riparian areas.

## 2.3 Empirical Literature

## 2.3.1 Human settlements activities and effects on the Riparian

The development of human settlements is considered a major concern for riparian conservation. A study by Hasan et al. (2017) asserts that the availability of land for settlement and its accessibility in most cases leads to intense competition among locals and other investors who may want to use such lands for construction purposes. Accessibility plays a significant role in the location of land use.

The view were also supported by Finlayson et al (2011), who explain the phenomena of water catchment attracting human settlements together with economics activities, the net effect is degradation of riparian lands. Another explanation is the one by Kiran & Ramachandra (2016) who states that riparian land stems from high degree of anthropogenic stress; this is a result of factors such as increasing population, poorly planned urban development. These is further complicated by weak government regulations, lack of financial support towards agencies that safeguard riparian lands as well as lack of adequate research on proper management of riparian lands. The effect of the poor coordination of management of riparian is manifested in terms of uncontrolled pollution, unregulated land management,

Understanding the status of a riparian involves three elements, first, exploring the current human and anthropogenic activities happening in the riparian, secondly, it involves estimating their effects, and lastly understanding factors that contribute to them (Binkley, 1984). In this section, the literature review covers, the human activities and their effects which include human settlements, grazing, farming, and pollution, then it covers factors that influence human activities which include; socio-economic, culture, and attitudes of people living near the riparian's.

A study by Agardy and Alder (2015) found that coastal population densities are estimated to be 100 people per square kilometre compared to only 38 people per square kilometre in inland areas. This not only causes damage to coastal riparian's but also to adjacent sea grass beds and coral reefs that are destroyed for other purposes that result from population increase and settlement in such lands. Human settlements gather substances such as fertilizers or pet waste that wash off lawns, untreated sewage from failing septic tanks, sediment from construction sites, and runoff from impervious surfaces like parking lots. A study by Nguyen et al. (2017), further adds that population increase and human settlement have led to exploitation and destruction of the natural resources found in the riparian's.

Human settlements and urbanization are also related to industrialization and consequently economic activities that directly or indirectly affect the surroundings including humans themselves (Binkley, 1984). Particularly when human settlements are built without consideration to the natural riparian cycles, in times of heavy flooding or weakened bedrocks due to more underground water, there are always cases of falling off buildings, people, and homes swept by floods, and so on. Denick (2014), asserts that over the last 100 years the riparian's and riparian areas have experienced significant human effects primarily because of the effects of human

settlement and industrialization, which modify the natural flow or cyclical patterns of water flow or water infrastructure.

Continued urbanization increases and stretches the ecological capacities beyond their natural sequences, hence complicating their ability to regulate and naturally maintain themselves. For instance, in Kenya, Nairobi's rapid urbanization does not resonate with its natural environment and ecosystems. Its rapid urbanization has adversely affected the Nairobi river, with massive pollution caused by garbage, overflowing sewers, and diversion of the river. Even though urbanization and industrialization have economic benefits, they also lead to massive environmental degradation, depletion, physical discomfort, and encroachment of the riparian ecosystems. If they are not well planned and managed concerning the natural environment, they could lead to ills like environmental degradation, depletion of natural resources like the riparian ecosystem, and human physical and health discomfort (North American Riparian Conservation Act, 1989). Mbereko (2014) opines that human settlements and industrialization should be well organized in a manner that provides stimulation of the economy as well as improving ecosystems for sustainable development. Mbereko (2014) commenting on the Ramsar Convention, explains that many urban settlements near the riparian ecosystems have encroached on those lands and cause pollution, poor waste spillage into those lands thereby negatively affecting these ecosystems.

### 2.3.2 Agricultural activities and effects on the riparian

Riparian ecosystems all over the world attract agricultural activities because they are regarded as rich and productive areas as compared to upslope areas. Many riparian ecosystems around the world are being severely affected by agricultural activities. Kinaro (2008) claims that in many African countries the riparian ecosystems have

been drained for agricultural activities due to their fertile soils. This means that when lands are created for agricultural practices, the riparian vegetation is continually removed and replaced by cultivated crops. Goudie (2005) maintains that households use furrow irrigation in an inefficient and wasteful manner, which leads to riparian destruction and wastage of water because crops do not bind or cover the soil.

Mbereko (2014) asserts that poor farming and poor drainage practices in the riparian ecosystem are the greatest problem that leads to the destruction of these ecosystems. In Mbereko's study, it is no longer sustainable to lose more the riparian ecosystem since they are crucial for maintaining water clean up, drainage, and the global cycle of nitrogen and sulphur which have devastating consequences. Bloom (2016) suggests that agricultural activities should be done sustainably to make it compatible with the need to preserve the economic balance of soil and water as well as secure food sustainability and community development.

A study by Wuver and Attuquayefio (2016) in Ghana indicated that farming is undertaken on both subsistence (62.2%) and commercial (37.8%) levels, and this has caused vegetation burning(96%), out of which 67.4% is deliberately set for agricultural purposes; specifically 7.9% of cleared vegetation was Riparian vegetation, thereby changing the riparian hydrology and composition of biological communities. The same study showed that fuel wood harvesting as the main source of energy for the people has led to 81.7% of the riparian ecosystems being used or cleared to meet the demands of the population. Another energy source related to riparian charcoal.

Matsa and Muringaniza (2011) argue that the poor communities burn land for agriculture because they did not have other means of survival. The lack of other means of survival makes the competition between them so uncompromising that they

fail to reach a consensus on the sustainable ways of conserving riparian resources. However, a study by Wakuru (2014), suggests the modernization of agricultural farming in Kenya, to reduce this unnecessary exploitation of the riparian resources and increase the economic power of the local population.

Technological farming can be a substitute for traditional forms of farming that have proven disastrous to riparian ecosystems and related biodiversity. In the same study, Wakuru (2014) further suggests the development of agricultural and riparian policies that address specific issues of riparian conservation for sustainable development.

The periodical exposure of good grazing lands within the riparian leads to mass feeding migrations of cattle, sheep, and goats herded by humans and this still occurs in some parts of the world, especially in pastoral communities. Livestock grazing on wetlands is often conducted on both subsistence and extensive bases, which puts more pressure on temperate wetlands. Baker (2013), found that uncontrolled grazing in the wetlands affects the feeding of plant biomass, crushing of biomass, nutrients and bacterial containment, dispersal of seeds, and destruction of ecological patterns. Removal of biomass usually in combination with the trampling of plants and soil frequently has deleterious effects on fauna and other riparian species. A study by Denick (2010), looked at the effects of grazing intensities on the total amount of biomass in a riparian riparian meadow in the USA and found that root biomass was only affected at the heaviest grazing intensity.

While the study by Frohb and Grettud (2010), shows that sedge meadows that were recovering from cattle grazing structurally changed into a dense shrub carr, while sedge meadows that had never been grazed had a different species composition to

grazed meadows but were still similar structurally (that is, they remained sedge meadows). It appeared that consumption of biomass and trampling of sedges, opened up the habitat allowing the shrub, Cornussericea to invade. This is reiterated by Rebelo *et al* (2014), who argue that in areas that are densely vegetated particularly by only a few species, grazing may increase habitat diversity increasing the abundance and diversity of fauna. Cattle grazing also facilitated a short-term proliferation of subordinate species that prevented sedges from expanding as a result of the introduction of seeds and prop gules and the creation of bare patches. Once cattle were removed the shrubs expanded to become the dominant vegetation type. Frohb and Grettud (2010), looked at how the nitrate buffering function of a riparian riparian might be affected by grazing using clipping in a microcosm study and established that a short-term (1 month) grazing did not affect the nitrate removal function. Despite the varying positions on grazing and riparian degradation, riparian management cannot ignore the management of herds and their grazing potential. Riparian ecosystems are important grazing lands to adjacent communities. Thus, the management of grazing activities should be an important component in the conservation and sustainable management of the riparian ecosystems.

Pollution is the chief destroyer of the riparian amongst other human activities such as livestock farming/grazing, settlements, and farming. It directly affects the water quality of the riparian such that in the process of pollution the water table is contaminated through pesticides, sediments, sewerage, and fertilizers (Binkley & Brown, 2012). A study by Kondoro (1997) analyzed water content and found that most concentrations of heavy metals within the Msimbazi River occur within a distance of 5-10 km along the river from the river mouth. The study adds that since most of the observed heavy metals are used in technological processes, industries are

linked to their presence in the river. It further postulates that due to the intensity of human activities within the Msimbazi valley, the concentrations of heavy metals could be higher than the registered values.

Kairu (2001), maintains that agro-based factories such as Muhoroni and Chemelil Sugar companies discharge effluents into the riparian through the Nyando river. Wastes from Chemelil, Muhoroni and Ahero townships also find their way into the wetland through the Nyando River Raburu (2003) explains that agro-based industries in the upper catchment of river Nyando basin contribute weighty nutrient and organic loads into the riparian. Owing to increased agriculture, agrochemicals are transported through streams into the lake and rivers where herbicides, pesticide residues, and fertilizers used in the large scale sugarcane farming plantations, rice, and horticultural farming in the lower catchment area of the river and contribute huge proportions of pollutant loads. Most of these wastes are untreated domestic waste, pit latrine effluents, and industrial effluents (Odada, 2010).

### 2.3.3 Effects of riparian policies and strategies on riparian conservation

Globally, regionally and nationally there exist policies and legislations that surround the sustainable management of riparian. The critical convection that is known globally as Ramsar, which seeks to promote the conservation of riparian while promoting the need to have trans-boundary coordination between the regions and contracting parties on trans-boundary the riparian's (Finlayson et al., 2011).

Ramsar Convection at the same time provides guidelines for sustainable use, management, and governance of riparian. Accordingly, seek to establish an intergovernmental treaty on riparian management as well as establishing a framework for international action and cooperation. It also seeks to endeavour to provide linkages

with local and national actions and international cooperation that can contribute towards the achievement of sustainable development.

The focus of the Ramsar Convention has been calling for international cooperation between contracting parties while encouraging individual Countries to domesticate national laws based on the ideals of the convention. While facilitating the convection, the players are alive to the fact that only synergies and cooperation between players are the keys to achieving sustainable management of the riparian's. The synergies strive to look for harmony between all the stakeholders to strive to ensure sustainable use and management of the riparian's and the entire ecosystem. Certain regional initiatives have been formed to try to manage the regional riparian ecosystems. For example, Ramsar Centre for Eastern Africa (RAMCEA). This initiative brings together seven states Uganda consisting of Kenya, Uganda, Burundi, Rwanda, Djibouti, and Kenya. The goal of the group is to support member states to improve and implement Ramsar Convection.

 Specifically, the group fundraises to support activities such as dissemination of information to communities that live within the Riparian areas on their relevance and means of having sustainable management of these areas (RAMCEA, 2013). Matunda (2016) indicates that Kenya riparian land is under threat since there is no single law or regulation that protect riparian ecosystems. The laws exist as different statues under different department including Environment Management and Coordination Act (EMCA) 1999, the Water Quality Regulations (WQR) (2006), Water Resources Management Rules (WRMR) (2007), the Agricultural Act (Cap318), Forest Act, 2005, the Land Act 2012, the Water Act, 2002 and the Wildlife (Conservation and Management) Act 2013 which create overlap and affect coordination and implementation.

RAMSAR always encourages member states to attempt to integrated riparian policies in a bid to maximize the economic and social welfare activities without affecting the sustainability of the critical elements of the riparian ecosystem. According to Finlayson et al (2011), developing an integrative or unifying riparian management policy helps the member state to overcome sector-based policy fragmentation, reduce bottlenecks associated with governance structures ensuring a rapid socio-economic and ecological development.

Another major challenge that affects developing countries as far as the effectiveness of international obligations on the Riparian management is the existence of weak, poor, nonexistence of enforcement procedures which makes protection of the Riparian ecosystem weak (Murata, 2014). An example cited is Kenya's legislative instruments touching on the Environmental Act of 2004, Land Act of 1999, and Forestry Act of 2002 about riparian destruction.  The problem is further exuberated by the fact that each of the key legislative instruments has obligated itself specific roles, which make sanctions, not to wholesome applicable. Some activities such as Kenya Land Act No 4, of 1999 (URT, 1999a), consider wildlife as the strongest sector that requires maximum rules and sanctions in protecting the riparian.

A study from Cambodia has noted that there is no particular piece of legislation that governs sectorial laws and regulations such as fisheries, forests, environment, and water. Each of these sectorial agencies has its laws, policies, institutional frameworks specific to their sectorial mandates. Crosscutting resources such as the riparian ecosystems are affected by these sectorial mandates (IUCN, unpublished report). This is notable in Kenya as well.

Studies spanning globally have largely concluded that good practices of management of the riparian ecosystem are only plausible when there is a combined effort of resources users, planners, and policymakers who are in uniformity and understand the relationship between the riparian, people, and existing human institutions (Finlayson, 1999).

According to Finlayson et al.(2016), the implementation of the riparian laws is also undermined by high incidences of extreme deprivation in the society, political interference, inadequate human resources, and financial constraints. Several regulations have been enacted in Kenya that deal with the riparian ecosystems that span through different sectors such as mining, settlements, agriculture, livestock, wildlife, fishery, water, forestry, and land. According to Turner and Jones (2016), there exist several gaps and complex policy overlaps about the riparian ecosystem caused by the fact that interrelated sectors are governed by different specific policies. The net result is that Kenya has numerous uncoordinated provisions in riparian's management. The same observation made by Kote (2014) lamenting how Kenya needs to come up with a single comprehensive or unifying policy or legislation on the Riparian's use, conservation, and management. The effects of this segmentation, fragmented and uncoordinated provisions provide a very skeletal guide on the general management of the riparian.

There are several mechanisms of addressing the effects of degradation of the riparian which include community participation, environmental iimpact evaluations, environmental land easements, concessions and transfer agreements, natural protected areas, and international agreements such as the Ramsar Convention and the North American Wetlands Conservation Act. The notable challenge of the riparian

management range from failure to domesticate the policy fully, gaps in enforcement of existing legislation, lack of verification of requirements for development projects, to low economic penalties for wetland modification or destruction. However, it has been found that some of the legislation and policies do not provide for a comprehensive coverage of management and conservation of the riparian because they are limited in scope and coverage.

Globally abuse of the wetlands continues to be driven by human encroachment. By the year 2030, Mega, (2012) has noted that virtually all the wetlands in the world will have been influenced and altered by patterns of intense human activities. It also implies that more than ever Countries all over the world are finding themselves without an alternative, other than developing policies and strategies that could help in sustaining riparian. However, the complexity of riparian means that no single government agency can govern the entire ecosystem constituting of fisheries, forests, grazing lands, watersheds, wildlife, protected areas, and other resources, which requires a joint action of multiple parties.

There is a growing understanding that for the riparian management to be sustainable there is a need for the utilization of low-cost measures that supplement the government initiatives in the management of the wetland resources. The common low-cost strategies are the use of a community-based organization or integrating the local community in  the wetland management.

A study by Pimbert and Gujja (2016), carried out in Pakistan revealed that there is a need to integrate the site-specific knowledge and innovations of local communities with more general ecological principles on which management plans are usually based.  Moser et al (2018) assert that for local community participation in

conservation of the wetlands to be successful there is a need for utilization of low-cost solutions for the wetland restoration, development of low technology and utilization of local environmental knowledge. The benefit of community participation strategy in the riparian management is that it helps in the development of human capacity for the management and utilization of the wetland resources in a sustainable way. The views are also echoed by findings by a survey by EANHS (2020), which concluded that the involvement of local communities in the wetland management can contribute significantly to maintaining or restoring ecological integrity and improving community well-being. Community participation plays a vital role in the development of human capacity for the management and utilization of the wetland resources in sustainable ways.

Gawler (2014) expound the fundamental of the idea that the riparian conservation and management outcomes are best achieved when community-based resource management is utilized. This stems from the fact that humans are part of the ecological system, and not separate from it. Today is riparian, including those considered to be the most pristine, are the result of complex interactions among physical, biological, and human forces over time. Human cause is the beginning of all earth's wetland alteration which somehow affects the pattern or alter it course. Gawler (Ibid), Gawler (Ibid), underscored that incorporation of indigenous and local knowledge, values, and management practices is critical to the wetland conservation. A study by Assma and Gardono( 2012), established that a lack of community involvement brought to detriment of one of Mexico's largest wetlands. The authority was not able to cope with unsustainable use of water due to overexploited aquifers and decreasing flows in rivers and coastal lagoons. Also, little progress has been made to control water pollution.

This concurs with Utsala (2011), who argues that the community should be the target of the wetland conservation and management, which should equally take into account their indigenous knowledge and practices that are perceived to be friendly to the natural environment. Partnering with the local communities in the wetland management ensures the wise and sustainable use of such lands and also empowers them to take responsibility for decisions and actions that restore and sustain the wetlands. Utsala (Ibid), adds that the community is an important stakeholder in the establishment of ecologically balanced use of available land and water resources and for extenuating the problems related to the wetlands.

However, Gawler (2002), adds that it is also important to note that the degree of community participation in the wise use of the wetlands varies with the local context: from high levels of empowerment, to effective partnerships between government authorities and local communities, to situations where the government remains firmly in control and stakeholders are consulted on decisions. According to Bahir (2010) community involvement enables the creation of awareness to raise their level of participation, which consequentially captures the attention of stakeholders and stimulating interest, improving public knowledge and understanding, enhancing social skills and competencies for change, increase capacity to implement change and finally to implement change and evaluate progress. Ramsar Convention Secretariat (2010) in support of awareness indicated that awareness is an agenda-setting and advocacy exercise that helps people to know what is and why an issue is important, the aspirations for the targets, and what is being and can be done to achieve holistic solutions to the problem. Thus, communities' awareness links nature exposure to communities' ecological reverence.

For instance, some communities are known to have traditional resource management arrangements that regulate how, and the extent to which the riparian could be used and exploited. The riparian could either remain in near-pristine conditions or the people may use them in an appreciably sustainable way where such resource management arrangements are strong enough to check their destructive exploitation by economically desperate and uncaring individuals. This is not to say that exploitation of the riparian by wealthier members of a community is necessarily sustainable. This simply means that such regulatory controls could significantly lessen the devastating pressures to which a substantially large and predominantly poor community could subject these fragile resources to if they were open to unlimited access (Bloom, 2011).

Ichuloi (2019 explains that the loss of traditional knowledge about resource use is one of the central problems of our times. Local people often have an understanding of the wetland ecology in their particular context; an understanding that cannot be underrated in the attempts to conserve the wetlands. Local community knowledge on the wetland conservation contains obligations and traditional practices that are mandatory for community members in the use of natural resources. Such practices and obligations are invaluable tools for the riparian management

Another important aspect of community involvement is that of monitoring the management and usage of the wetlands. Chalkley *et al* (2002), describe the Water-watch program in Australia. The water watch is an environmental education and awareness program that promotes and supports water quality monitoring, to create awareness and ownership of ethical land and water management by the Australian people. Involving local people in monitoring is not only a cost-effective solution,

drawing on local knowledge, but it also has many potential positive spin-offs. Participatory monitoring provides a powerful learning element and a tool for village environmental management plans which gives the locals a sense of ownership. Communities' involvement in monitoring enables them to appreciate the importance of the wetland management initiatives and recommend corrective actions if necessary. Community monitoring programs are one of the most effective ways to enhance community skills in resource management at local levels.

**2.4 Theoretical Perspective**

The study was informed by two theories: Theory of Tragedy of Common and Systems theory.

**2.4.1 System Theory**

The main theory that guided the study was the system theory, which emanated in 1940's by author and biologist Ludwig von Bertalanffy and later extended by Ross Ashby (Manyari, 2007). The major observation by these authors is the idea that real systems are open, react, and interact with impulse of the environment.

Interruptions help systems toqu alitatively develop themselves. It is an interdisciplinary theory about the nature and the complexity of systems in society. The theory argues that everything is interconnected and it is therefore important to take into account the interconnectedness of players in specific systems for its holistic understanding or regard/consideration.

In the context of this study, the systems theory seeks to understand a more complete picture of the riparian ecosystem, human involvement as interconnected rather than looking at the riparian and humans as isolated and antagonistic entities. This is because human actions do affect in one way or another the natural environment. Humans should be mindful of what they do to the natural environment since what they do to it are the very things that they do unto themselves because they are part of the natural environment.

The systems theory helps to highlight ways of the interconnectedness of humans and the riparian as specified in the study objectives for a more reciprocal manner that benefits both humans and the natural environment. The theory attempts to explain the

totality of human interactions with the riparian and how humans should symbiotically cooperate to ensure that the riparian ecosystem are protected and conserved. The theory further underscores the collective manner of regard to the riparian ecosystem, looking out for the good of the whole (humans and the riparian ecosystems) rather than pursuing the good of only human. For humans cannot exist outside of the natural environment; humans mutually depend on the natural environment and the natural environment needs the cooperation of humans for its survival. The theory also proposes the involvement of community knowledge and participation to ensure the success of riparian conservation, which would lead to the maximization of the potential use of the riparian ecosystems. Mele and Polese (2010) asserts that a phenomenon is seen as a whole and not as simply the sum of its unrelated elementary parts.

The study underscores that it is impossible to fully understand the human exploitation of the riparian ecosystems without considering other factors that contribute to that exploitation. It is important to consider it all an integrated and interacting union of factors where all factors are to be treated with the seriousness they deserve. This is where the key players, particularly the political community and policy formulators should be brought on board when it comes to matters related to riparian exploitation. Sometimes the local communities exploit the riparian ecosystems not because they want, rather because they do not have any other alternative. Therefore, they do it for survival. Systems theory questions the conventional closed socio-economic systems that treat social matters independent of economy and politics. There should be a shift when handling social environmental issues since they are attached to other series of related ones that cannot be treated in isolation from each other.

Another important aspect of the theory is that of adjustment; all systems do adjust themselves to adapt new ways for meaning. Humans, therefore, should adjust themselves concerning the way they regard and use the riparian ecosystem (Ward & Stanford, 2010). Environmental policies should be adjustable to feet and address new upcoming contexts of local communities' relation to the riparian ecosystem for proper conservation and management of such lands.0723-176235

## 2.4.2 Theory of the Tragedy of Commons

The study also adopted the theory of the tragedy of commons, which originated from the British economist Forester William dating back to 1833 (Battersby, 2017). The scholars illustrated phenomena in which humanity has over the years grappled with involving making choices in situations involving individual's needs and needs that involve wider societal good. In this scenario, the author suggests reasons as to why shared resources are always depleted by humanity who are confronted with needs to address their individual needs (Frischmann et al., 2019).

The idea of William Forster were further illustrated by ecologist Garret Hardin who delved further into the original idea by arguing on power of individual short term interest when compared to resources that are shared by the society. Hardin (1968) say that only proper regulations can manage to tame the human drive so that it can work in competition with community interest. When these competition is not managed properly the competition always work against society as a whole, this is what constitute as the phenomena of the tragedy of commons (Battersby, 2017). As long as individual interest, overwhelm society attention when dealing with communal resources, the society, as a whole will always come lose.

The theory also suggests the power of supply and demand of shared resources with assertion that when demand of shared resources overshadow the supply, resources eventually become unavailable (Frischmann et al., 2019). In conclusion, Hardin (1968) proposes solution of avoiding tragedy of commons, to begin with to arrest the problem there is need to assign ownership of resources of common to custodian, which can be state or government agency. The benefit of this suggestion is the fact that government or state agency can be able creates boundaries towards management of shared resources. Another suggestion of Hardin is Countries signing treaties with international, which bound common authority and create jurisdiction and restrictions with either local jurisdiction or intra nationals or international.

## 2.5 Conceptual Framework

The conceptual framework shows the relationship between independent variables and the dependent variable. The first independent variables was human settlement measured in terms of settlement patterns, population growth, number of settlement, and household size. The second independent variable was agricultural activities and focused on livestock farming and crop farming while the third independent variable was policy and strategies including local and international regulations and strategies for managing Riparian. The dependent variable is effects on Kipranye riparian ecosystem including the hydrology and vegetation of the area. This relationship is shown in Figure 2.1.

**Independent variables**          **intervening variables**          **Dependent variable**



**Human Settlement and Effect**
- Number of people settled in wetland
- Settlement patterns
- Industrial and urbanization
- Population size
- Household size

**Agricultural Activities**
- Crop farming
- Livestock farming

**Existing Policies**
- Stakeholder involvement
- Civic education
- Regulations
- Riparian policy

**Effects of kipranye riparian**

Hydrology of kipranye

Vegetation

Geomography

**Figure 2.1: Conceptual Framework**
**Source: Author, (2020)**

## 2.6 Knowledge Gap

The literature review has shown that the riparian's are very important for the conservation of water and its purification, which is vital for ecosystems and biodiversity that directly and indirectly depend on water. The most notable gap is that, despite efforts made on conservation and management of the riparian, there still exists exploitation of such lands. This gap warrants this study to find out why society seems not to heed the measures put by the authorities. However, there are other gaps in the literature review:

First, there is a notable gap between the massive theoretical literature and praxis or economic activities of the local communities when it comes to riparian conservation and management. The communities seem not to embrace the directives for riparian conservation and management. The literature fails to address this gap with other aspects of local communities like economic opportunities and legal frameworks that are intimately united with the riparian. Effective efforts to conserve the riparian should take into account the real socio-economic and political context of the communities involved. This is what the reviewed literature has undermined. Poor communities have to rely on nature, the riparian for their livelihoods, and as much as there are no alternatives to improve their livelihoods, such communities will continue to exploit the riparian and the environment in general. The connection between peoples' economy and the riparian ecosystem is what the literature completely undermined.

## CHAPTER THREE

## RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter presents the research methodology that was employed in data collection, analysis, and presentation. This entails research methodology, design, study area, target population, sampling and sampling techniques, sample size, data collection instruments, validity and reliability of the study, data analysis and presentation, and finally ethical considerations of the study.

## 3.2 Research Methodology

The study was based on mixed methods approach, which combined both qualitative and quantitative research methods. The justification of combining the two approaches is explained by Berry and Wood (2015) who state that, this aid is making the phenomena being studied to be in-depth in nature as well as helping to manage extrapolation of data. The benefit of qualitative approach is that it makes it easier to study subjects that are considered difficult to quantify while in converse the quantitative approach is justified in studies which focuses more on subjects that need to be enumerated and measured. Therefore as defined by Creswell (2009), mixed methodology is critical where research need to be embedded at design stage as the case of the current research. The researcher adopted the design in which, both qualitative and quantitative data were collected concurrently but the latter played a supplemental role in the overall design thus the analysis outcome was treated and presented in a descriptive data analysis. The mixed research design was a choice of

the researcher with the goal of making it possible for qualitative data to be strengthened by use of quantitative data making entire research more reliable.

## 3.3 Research Design

The researcher's choice for the study was a concurrent triangulation research design approach, which was found to be fitting in this study since it provided an opportunity for the researcher to identify the characteristics, frequencies, trends correlations, and categories of the data collected (Creswell, 2009).

In this study, the design entailed the collection of quantitative data and open-ended questions for qualitative data. The quantitative data and qualitative data were then analysed separately and then combined. By mixing the data, the researcher compared and contrasted the findings thus, using the qualitative data set to strengthen the quantitative findings (Creswell, 2009). The two data sets produced results that converged during the interpretation stage. The model enabled the production of valid results and conclusions that substantiated the phenomenon at hand fairly well.

## 3.4.1 Study Area

The study ecosystem is Kipranye riparian ecosystem in the Kericho County region, considered to have more human encroachment activities and water pollution. This trans-boundary riparian ecosystem has a surface area of 13,835 $km^2$ and lies between latitudes 0°21'S and 1°54'S and longitudes 33°42'E and 35°54'E in Kenya (65%). It extends hundreds of kilometres towards Lake Victoria, which is the largest freshwater lake in the world. This river is one of the inlets to Lake Victoria and enables the adaptation of diverse plant species alongside it. Its destruction directly contributes to the destruction of Victoria marked by the drop of its water levels in the recent past. Furthermore, in the past, the river Kipranye used to cover a larger area of Kericho

County, but overtime with its overuse, which led to the drop in its water levels, it has rapidly reduced in coverage, resulting in biodiversity loss among others.

The Kipranye river emanates from its source, which is Enapuiyapui Swamp, a major river that trace its source on the Eastern Mau Escarpment, Kenya. The river has two major tributaries namely Amala and Nygangores rivers. The two rivers meander through Mau forest complex. The might of the two rivers converge to form the Kipranye river. The Kipranye River runs across the rich forested and two internationally renowned conservation areas namely Masai Kipranye National Reserve (MMNR) in Kenya (1718 km$^2$) and the Serengeti National Park (SNP) in Tanzania (1741 km$^2$). It is inside the protected area that two main tributaries the Talek River later join Kipranye River and the Sand River joins the mainstream Kipranye River (Figure 3.1).

Kipranye River can be divided into two sections, which are the lower side that flows amidst grasslands and small –scale agricultural fields that then forms the basis of the Serengeti region section in the republic of Tanzania which empty into Lake Victoria through extensive Kipranye swamp. Then there is the mountainous and hilly topography of northern and eastern side of Kipranye River, this is the elevated side of Kipranye riparian which stand at height of 3070M above sea level

Generally, the temperature around the Kipranye riparian is 25ºC, but normally it ranges between 20ºC and 27ºC depending on the month of the year (Gereta et al., 2018). In terms of rainfall, it fluctuates often but the average rainfall that has been registered in the region ranges from 1600 mm/yr (Gereta et al., 2018; Ogutuet al., 2007; Sombroek, 2014). In addition to the spatial variability in rainfall, the catchment also common temporal climatic changes. This variability tends to change as one move

from one region to another along the riparian (Ogutuet al., 2007). In terms of geology, the regions can be described as volcanic zones since there are plenty of quaternary and tertiary volcanic deposits. The main soil found in this region is Cambisols occurring at the middle and upper section of the riparian as well as vertisol that are at the lower part (Sombroek, 2014).

Cambisol is renowned to be rich in nutrients that make it ideal for agriculture since it has good porosity, water holding power, structural stability, good drainage ability, a lot of fertility (Nyang'au et al., 2014). Vertisols on the other hand is the soil commonly referred to as "black cotton soil". The main characteristic of this soil is poor draining ability because of high concentration of clay. The soil is not suitable for agriculture (Nyang'au et al., 2014).

According to the 2019 population census the combined population of the Kericho-East Sub-County was 78,000 people. It was estimated that there were 100,000 cows, 300,000 goats, and 120,000 sheep (KNBS, 2010). Kipranye riparian ecosystems were important for this study for their perennial waters that attract many human activities that give the surrounding communities their main sources of livelihood in the Western and the Rift Valley regions. It is located within latitudes 00˚23'S and 01˚10'S and longitudes 34˚46'E and 35˚45'E. This is illustrated in Figure 3.1 (Nyang'au et al., 2014; KNBS, 2010).
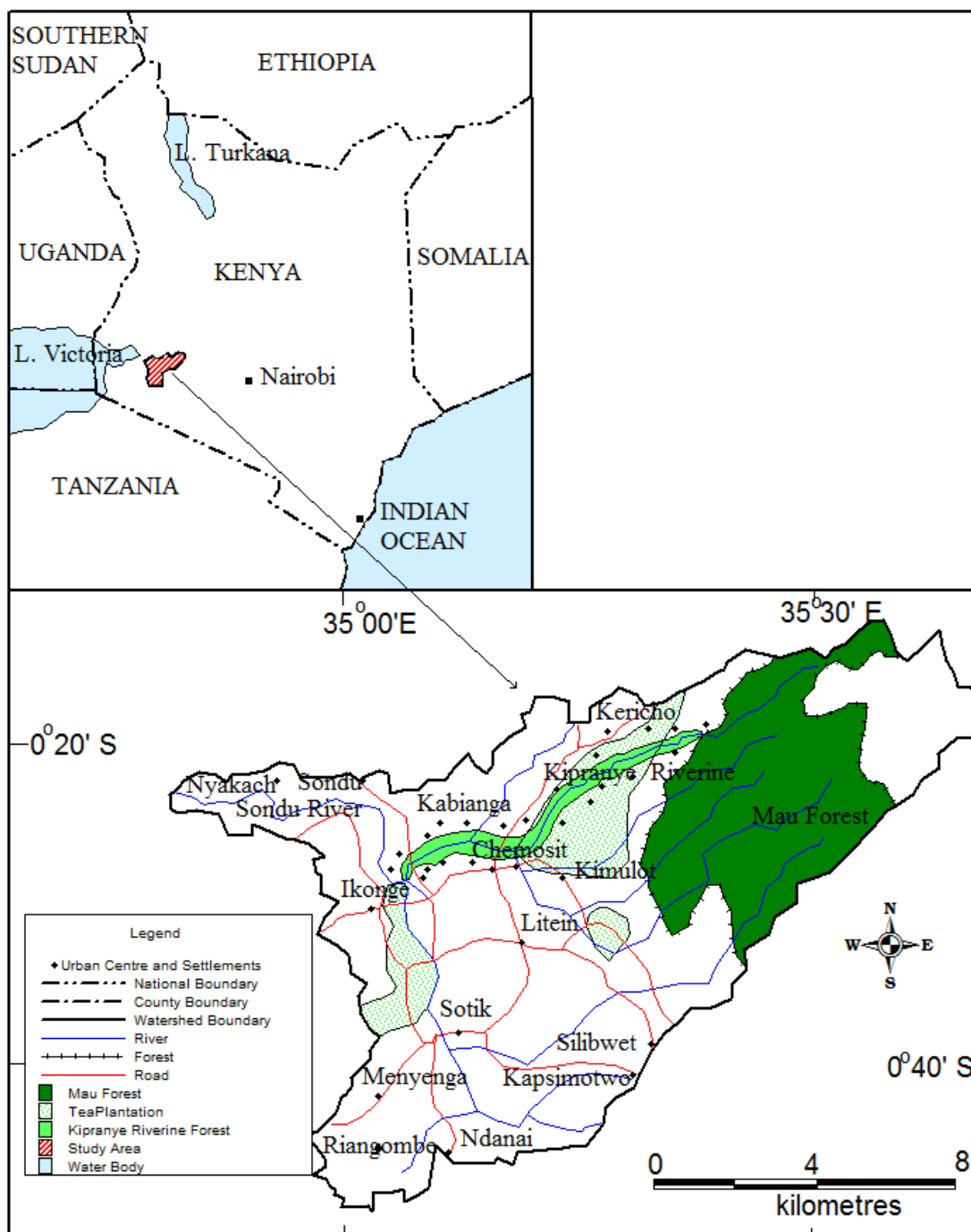
**Figure 3.1: Map of River Kipranye riparian**

*Source: Moi University Geography & Environmental Studies Department GIS Lab*

# Amap showing human activities and land use
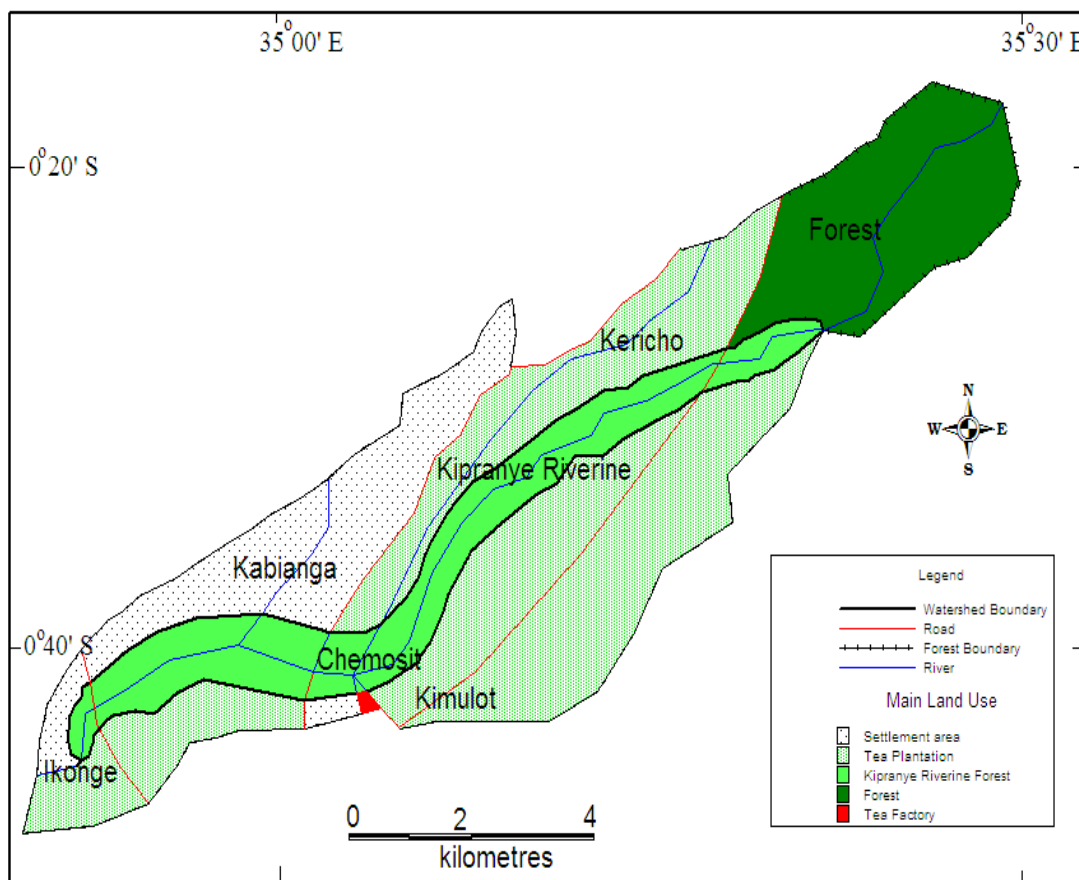


**Figure 3. 2: Map showing Human Settlement on River Kipranye Riparian**

*Source: Moi University Geography & Environmental Studies Department GIS*

**3.5 Target Population**

The study target population were household heads living within Kipranye catchment together with Kericho County environment officers. Therefore, in this research the target population included all sets of data of all cases related to households together with environment officers at the national and county level, out of which a sample was made.

According to Belgut Sub-County Census Data (Belgut Sub County office), 700 households had settled in Kipranye riparian ecosystem by the year 2020 who are involved in various human activities (Belgut Sub County office, 2020). The study also targeted environmental officer's in-charge of environmental management at the national level (National Environmental Management Authority) as the main key informant. This was necessary to identify the level of implementation of national and international policies and strategies for sustainable use of riparian and the gaps.

The study also targeted environmental officers at the County level in charge of environmental matters since this is a devolved function in the Country. Therefore since Kipranye riparian is a trans-boundary riparian which has a catchment of Bureti, Belgut, Ainamoi, Kipkelion East and westwhich are part of Kericho County, it was necessary to have a representative of each of the sub-county. As shown in Table 3.1, the study target population were 1 national environment officers, 6 County environment officers, and 700 households.

**Table 3.1: Target Population**

| Cluster | Target Population |
|---|---|
| National Environmental Officers (NEMA) | 1 |
| County environment officers | 6 |
| Households | 700 |
| **Total** | **707** |

**Source: Author's Field Data, (2020)**

**3.6 Sample Size and Sampling Procedures**

**3.6.1 Sample Size**

Oso and Onen (2009) observed that a sample is a smaller group drawn from the target population selected procedurally as a representation. The main aim of sampling is to get accurate empirical data by using a smaller representative group leading to a reduction in the cost of the study.Target Population consisting of 1 national environment officers and 6 County environment officers were used for the study since each represented a unit of analysis that provided information targeted by the study.

For community members, 700 households were subjected to sampling. The researcher used the Krejcie and Morgan sampling table. Research advisors as the most convenient and effective have adapted this sampling approach sampling table to get a sample without the complexities of formulas. From the Krejcie and Morgan sampling table shown in (Appendix III), 700 target populations yielded 248 households as a sample. This was at a 95% confidence interval, which implies there was the appropriate margin of error of a maximum of 5% that is recommended for social studies. Therefore, in this study, Krejcie and Morgan's sampling table was employed to ensure that the numbers of the samples are relative to the size of the population for accurate inferences. The final sample is as shown in Table 3.2.

**Table 3.2: Sample Size**

| Target group | Sample |
|---|---|
| Environmental Officers (NEMA) National | 1 |
| County government officers | 6 |
| Households members | 248 |
| **Total** | **255** |

**Source: Author's Field Data, (2020)**

**3.6.2 Sampling Techniques**

Purposive sampling was done to select the Environmental Officers (NEMA) domiciled in the County together with environmental officers in charge of Bureti, Belgut, Ainamoi, and Kipkelion East and west. This was necessary since Kipranye is categorized as trans-boundary riparian and therefore, they were in a good position to provide useful data about the state of Kipranye riparian, human activities, and their effect. Firstly, the households were numbered from 1-700, since that was the target population. Each was identified using a number and written in a piece of paper, which was later folded and inserted inside a plastic box. The papers were mixed thoroughly and finally then 248 set of numbers were selected randomly. Thus, randomness ensured that each household in Kipranye settlement had equal chance of being selected as part of the sample. Only one individual, nominated by the rest of the household members, 248 represented a household.

**3.7 Data Collection Instruments**

Informed by Kumar (2014), the tools of data collection in this study considered the socio-economic aspects of the study population. The study adopted three tools of data

collection namely: questionnaires, interview schedule, and secondary data – photography, survey, and mapping.

### 3.7.1 Questionnaire for Households Members

The researcher utilized a semi-structured questionnaire to gather data from community members as the main unit of analysis. Household members were perceived to have direct engagement with activities that affects Kipranye riparian. The questionnaire was divided into sections. Section one contained questions on the background or personal information of the community members who have settled in the riparian for the last 10 years. Section '2-3' had questions addressing the three objectives of the study thus: human settlement patterns on the riparian, agricultural activities riparian, and awareness of policies and strategies used to manage the riparian. The questionnaire contained both open and closed questions. Respondents were requested to fill the questionnaires, which were then collected for analysis.

### 3.7.2 Interview Schedule for National and County Government Environmental Management Officers

The interview was vital for this research because the researcher was able to ask probing and supplementary questions as well as develop a good relationship with the respondents. The researcher was also able to make a goal-directed attempt to obtain reliable and valid verbal responses from interviewees. The interview schedule had two sections. Section "A" had items on the background information of the respondent; Section "B" had items research questions.

The interview schedule was tailored towards the objective of the study. The interview was vital for this research because the researcher was able to ask probing and supplementary questions as well as developed a good relationship with the

respondents. The researcher was also able to make a goal-directed attempt to obtain reliable and valid verbal responses from interviewees.

## 3.8 Validity and Reliability of Research Instruments

The data collection instruments were subjected to both validity and reliability test to ascertain their effectiveness regarding the information concerning human activities and their effects on the Kipranye river.

### 3.8.1Validity of Data Collection Instruments

The research instruments were thoroughly subjected to validation procedure to ensure that the tool had ability to measure the content of the research matter completely. This was based on two authorities in research matters, the Kothari (2007) who explains validity as ability of research instruments to measure what it is required to measure while Orodho (2009) quantify validity as ability of research instruments to obtain accurate, meaningful and believable data before the tools can be subjected to actual data collection procedure. In this case, in connection with the current research, the researcher sought opinion of the colleagues and department supervisor in Geography, School Arts and Social Sciences.

### 3.8.2 Reliability of Data Collection Instruments

When the instruments were ready, they were presented to a sample that shared the same characteristics as the actual sample (Mugenda,& Mugenda, 2003). The researcher carried out a pilot study in the Nakuru County office including environmental officers, county government officers, and administrative officers who were not part of the main study. This enabled the researcher to find out the reliability of data collected using the instruments. The instruments that had a Cronbach's alpha coefficient of less than 0.7 were adjusted. As clearly explained by Mugenda and

Mugenda, (2003), as a rule of thumb, a relauditability of 0.7 and above is considered sufficient and therefore recommended. The researcher ensured that all measures exhibit internal consistency of above 0.7. Thus the researcher accepted the instruments with Cronbach's alpha coefficient of 0.7 and above as reliable. This was because reliability is part of the internal consistency techniques where Cronbach's Alpha formula was utilized and which normally takes a range of 0 and 1 with relauditbility said to be more confirmed as the coefficient increases.

## 3.9 Data Collection Procedures

The procedure of data collection required that the research had to seek  letter of introduction from the faculty at Moi University which facilitated the issuance of research permit from National Commission of Science Technology and Innovation.. After obtaining the research permits, the research recruited the research assistant which also involved training to help them acquire skills to make the acquinted with research skills and quality control expertise. The role of the research assistant was to administer the questionnaire using the face-to-face approach rather than leaving the questionnaires with the respondents. The choice of this approach of questionnaire administration was informed by the need to overcome literacy barriers given that the questionnaire was in English language. The choice was also informed by logistical concerns associated with the vastness of the Kipranye riparian ecosystems that made it difficult to apply the drop-off and pick-up method that would have necessitated numerous return revists. The socio-demographic characteristics of the target population also made it difficult to deploy email or post methods of administering the questionnaires.

## 3.10 Data Analysis and Presentation

Two procedures of data analysis were used based on the data that was collected. The initial data was quantitative in nature and therefore the choice of data analysis was descriptive requiring tabulation of frequency and percentage to describe the pattern and trend of the data set. Creswell (2009) suggest the choice of descriptive statistics as the one which has ability to describe, summarises sampled data

Effects of various human activities towards the Kipranye riparian were determined by assessing the views and opinion of community members through the survey questions. On the other hand, thematic analysis was done on the data that was collected qualitatively. This involved data classification of various responses into themes as was guided by the study objectives. The data was presented in prose and was meant to reinforce the quantitative findings to elaborate on the obtained concepts.

## 3.11 Ethical Considerations

The research observed the research ethics through series of steps. To begin with the research made choice to seek informed consent from the participants of the study. This was done by ensuring that participants are explained fully the purpose of study to win their confidence and engage them in participating to find solutions in relation to the human activities and their effect in the study area. This was paramount because voluntary and informed consent of the respondents is an essential component of research ethics.

Another procedure was ensuring privacy and confidentiality of study participants, which was ensured throughout the study process. The idea was to ensure that there was no coercion or undue pressure which was meted on the study participants. By so doing, the researcher managed to remain impartial throughout the research process.

The researcher also ensured that their participants were allowed to withdraw from the research at any stage of the process with a total assurance that information obtained from them would not be used for any other purpose apart from academic. Lastly and most important was the fact that the researcher obtained the research permit and authorization from the agency that deal with research matter which enabled application of research standards and ethics throughout the process of research.

# CHAPTER FOUR

# DATA ANALYSIS, RESULTS, AND DISCUSSIONS

## 4.1 Introduction

This chapter presents the response rate and demographic distribution of respondents: age, occupation/activities, gender and, duration of stay in the region. It further presents the study findings based on three objectives: to evaluate the effects of settlement patterns on the riparian ecosystems in the study area, to assess the effect of agricultural activities on the riparian ecosystem, and to find out the effect of policy and strategies in the conservation of the riparian ecosystems in the study area.

## 4.2 Response Rate

For the response rate, the study considered the responses from two data collection tools that were used, which included a questionnaire and interview schedule guide as shown in table 4.1 below. The main data was collected from the heads of households residing in the Kipranye riparian ecosystem, who comprised peasant farmers, village elders, youths, and thatch and papyrus collectors. Additional data was collected from the NEMA officer stationed in the study area and the county government environmental officers. Table 4.1 gives the breakdown of the participation rate per respondent category.

**Table 4.1: Response Rate**

| Cohort | Sample | Response | Return Rate (%) |
|---|---|---|---|
| Environmental Officers (NEMA) | 1 | 1 | 100% |
| County Government  Environmental officers | 6 | 5 | 83.0% |
| Household  members | 248 | 195 | 78.7% |
| **Total** | **255** | **200** | **79.0%** |

**Source: Author's Field Data (2020)**

From Table 4.1, out of 248 questionnaires issued to heads of households, 195 were filled and returned. This represented a response rate of 79%, which is above the minimum response rate of 60% recommended by Fincham (2008) as appropriate for analysis. A response rate of 100% was not possible as some questionnaires were spoilt; others were incomplete to meet the threshold for data analysis consideration. In addition, five out six county government environment officers and one national government officer availed themselves for an interview marking a response rate of 83% and 100% respectively.

## 4.3 Social Demographic Characteristics of the Heads of Households Residing in Kipranye riparian

The composition of heads of households was diverse in various dimensions such as; age, gender, and level of education

### 4.3.1 Distribution of Respondents by Gender

The study sought to classify the distribution of respondents by gender as shown in table 4.2 below.

**Table 4.2: Distribution of Respondents by Gender**

| Demographic Information | | Frequency | Percentage % |
|---|---|---|---|
| Gender | Male | 113 | 58.0 |
| | Female | 82 | 42.0 |
| | **Total** | **195** | **100** |

**Source: Author Field Data (2020)**

From Table 4.2, male heads of households settled in Kipranye riparian were 113 (58%), while females were 82 constituting (42%) of the sampled study population. The reason for gender consideration in the study was to ensure a heterogeneous and all-inclusive study for balanced results.

### 4.3.2 Distribution of Respondents by Age

The study sought to organize the distribution of respondents by age as shown in table 4.3 below.

**Table 4.3: Distribution of Respondents by Age**

| Demographic Information | | Frequency | Percentage % |
|---|---|---|---|
| Age | 18-35 | 103 | 53.0 |
| | 36-50 | 65 | 33.0 |
| | >51 | 27 | 14.0 |
| | **Total** | **195** | **100.0** |

**Source: Author's Field Data, (2020)**

The majority of the heads of households who participated in the study (53%) were young adults aged between 18 and 35 years. Approximately 33.0% of the respondents had their ages in the range of 36-50 while the older members of the society with their ages above 51 years only constituted 13.0%.

### 4.3.3 Distribution of Respondents by Duration of Residency

The study sought to catalog the distribution of respondents by the period of residency in the study location. The period the respondents have lived in the area of study is critical because of the experiences they have of riparian exploitation. The findings are as indicated in Table 4.4 below.

**Table 4.4: Distribution of Respondents by Duration of Residency**

| Demographic Information | | Frequency | Percentage % |
|---|---|---|---|
| Duration of Residency in Kipranye area and Locality | <than 1 Year | 21 | 11.0 |
| | 1-5 Years | 39 | 20.0 |
| | 6-10 Years | 47 | 24.0 |
| | 10 Years | 88 | 45.0 |
| | **Total** | **195** | **100.0** |

**Source: Author's Field Data, (2020)**

Table 4.4 shows that 88 respondents (45%) had been residents of the study area for over 10 years, 47 (24.0%) had lived in the area for 6-10 years, 39 (20.0%) indicated

to have lived in the study area for a period of 1-5 years and 21 (11.0%) had lived there for less than a year. They were able to recount their lived experiences of the various activities that adversely affect the conservation of Kipranye riparian ecosystem, thereby giving authentic information to the study.

### 4.3.4 Distribution of Respondents by Levels of Education

The study sought to categorize the distribution of respondents by levels of education as shown in Table 4.5.

**Table 4.5: Distribution of Respondents by Levels of Education**

| Demographic Information | | Frequency | Percentage % |
|---|---|---|---|
| Education Level | University | 12 | 6.0 |
| | Secondary | 21 | 11.0 |
| | Primary | 53 | 27.0 |
| | Non-Formal | 109 | 56.0 |
| | **Total** | **195** | **100.0** |

**Source: Author's Field Data, (2020)**

Table 4.5 indicates that 109 (56%), which formed the majority of respondents had no formal education which was followed by 56(27%) of the respondents were educated up to primary level. Minority, 12 (11%) were either educated up to secondary level with a qualification of Kenya Certificate Secondary Education as well as seven (6%) who had attained post-graduate qualifications. It was deduced that majority of people living in the Kipranye riparian ecosystem had no formal education. Education and knowledge systems influence the way resources are used or are to be used. Indigenous environmental knowledge systems and formal education are important for the conservation of riparian ecosystems.

## 4.3.5 Household Income of Respondents

The research sought to find out the household income of people residing in the Kipranye riparian area. This was necessary as an indicator of the social economic status of the people in the area. The findings are as shown in Figure 4.1
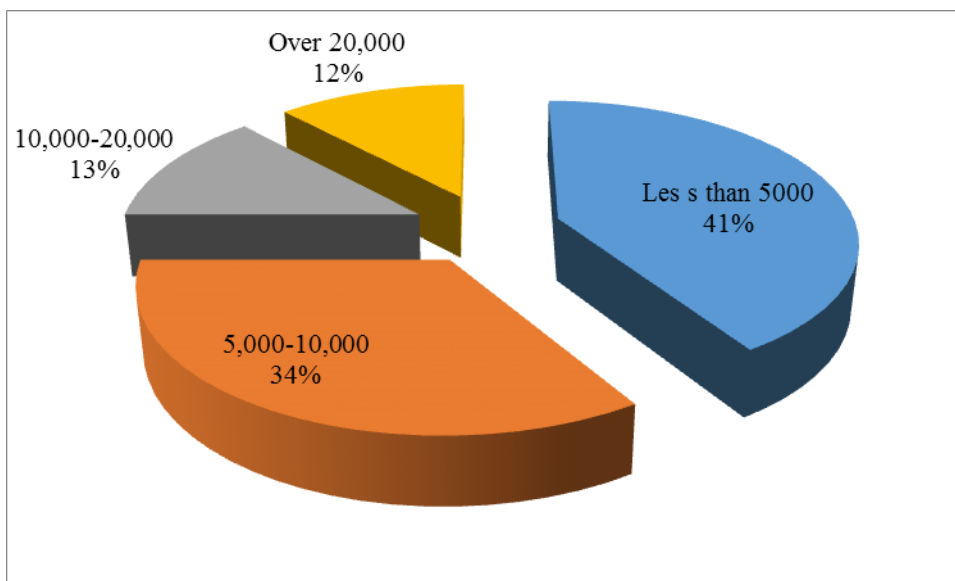
**Figure 4.1: Household Income of People Living in Kipranye**

The study further shows that the majority of the residents household income is less than 5000 and below accounting for 41% of the residents. Those earning between 5-10,00 were found to account to 34% of the residents, the least earned income of either 10,000-20,000 with 13.0% and over 20,000 with 12.0%. The household income indicates that majority of resident in the study area can be classified as low income earners.

**4.3.6 Size of Land Owned by Residents**

The research sought to find out the size of the land owned by residents living in the Kipranye riparian area. This was necessary as an indicator of the intensity of land subdivision due to population growth, which has effects on the ecological stability of the riparian ecosystem. The findings are as shown in Figure 4.2.
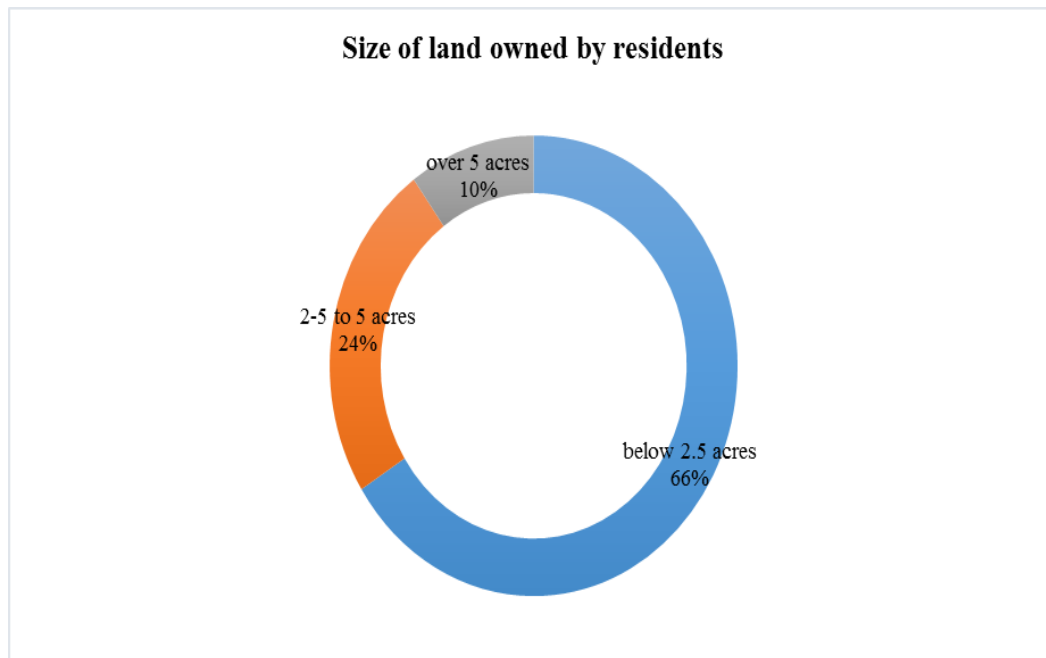
**Figure 4.2: Size of land owned by residents**

The study further shows that the majority of the residents own 2.5 acres and below accounting for 66% of the residents. Only 24% of the residents own land above five (3) acres while 10% own above 10 acres. The size of land owned by residents is a clear manifestation of intensive subdivision of the land inside the Kipranye riparian ecosystem. This, therefore, raises questions about the economic viability of the land in terms of production.

**4.3.7 Number of children**

The research sought to find out the household size. This was necessary as indicators of population growth, which has effects on the ecological stability of the riparian ecosystem. The findings are as shown in Figure4.3.
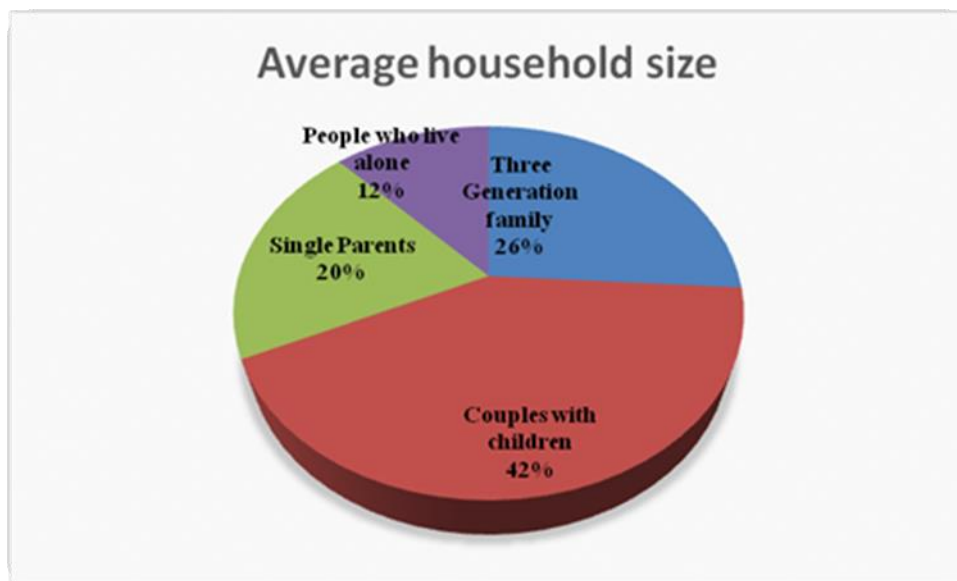
**Figure 4.3: Average household size**

The study found that the majority of household settled in Kipranye catchment area have an average of 4-6 children as accounted for by 39.0% members, followed by more than 6 members, the least was found to be the household size with either 1-2 and 2-4 family members.

## 4.3.8 Occupation

The research sought to find out the occupation of household members. This was necessary as indicators of social economic of resident in the riparian land. The findings are as shown in Figure4.3.
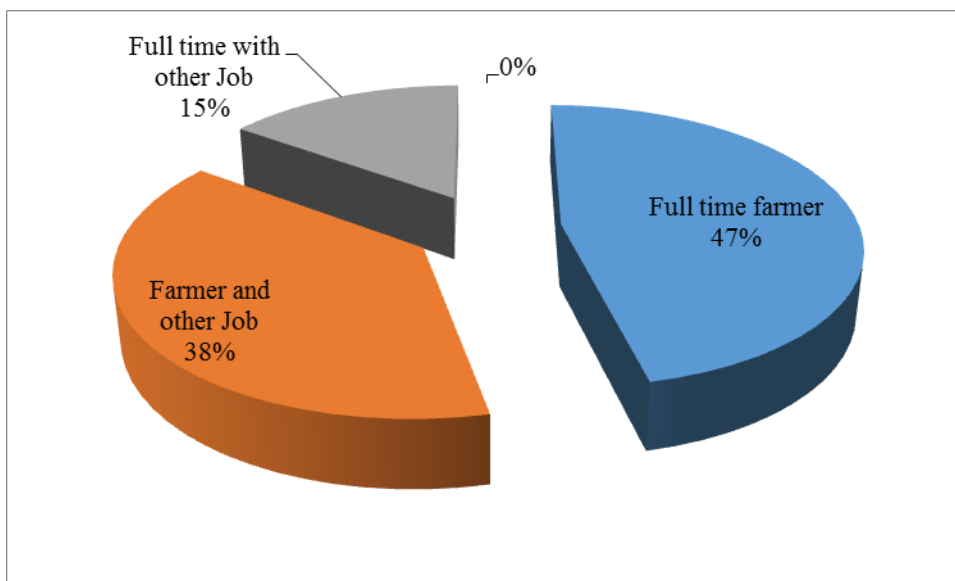
**Figure 4.4 Occupation of Farmers**

The study further shows that the majority of the residents are full time farmers as accounted for by 47% .this is followed by 38.0% of farmers who indicated that they famers but they have other occupation while the least are the one who indicated that they have another full time job but they have settled in the area.

**4.4Types of Human Settlement Patterns on Kipranye riparian Ecosystem**

The first objective of the study was concerned with the evaluation of the effects of human settlement on the Kipranye riparian ecosystem.

**4.4.1 Reasons for Settling along Kipranye River**

The research sought to find out from each household, reasons that necessitated them to settle in Kipranye Riparian ecosystem. This information is summarized on Figure 4.5
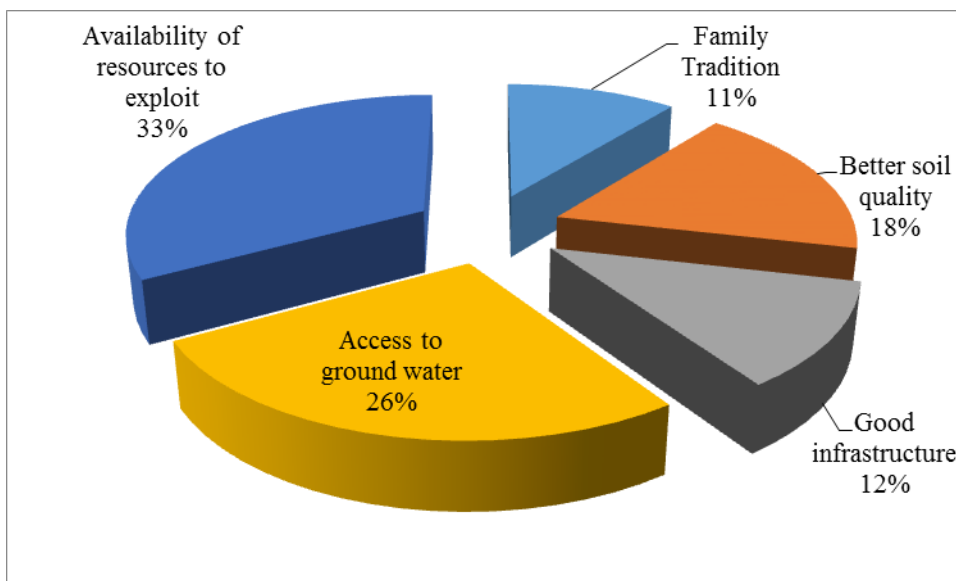
**Figure 4.5: Potential Reasons of setting along Kipranye Riparian**

The findings in Figure 4.5 shows that 33% of the households settled in Kipranye riparian ecosystem because of availability of resources to exploit while 26.0% of respondents who mentioned better quality of ground water led them to Kipranye riparian. Further, 18.0% of the respondent said better quality of soil attracted them to the riparian while 11.0% said it is part of their tradition to settle along riparian land.

**4.4.2 Infrastructure in Kipranye Riparian Ecosystem**

The study sought to evaluate the human activities associated with human settlements. This is because human activities influence the physical environment. The findings are as shown in Table 4.6 below.

**Table 4.6: Infrastructure in Kipranye**

|  | The year 2017 | The year 2018 | The year 2019 |
|---|---|---|---|
| Number of roads | 4 | 6 | 8 |
| Number of medical facilities within a KM | 1 | 3 | 6 |
| Number of places of worship within a KM | 1 | 3 | 5 |
| Number of education facilities within a KM | 1 | 3 | 4 |
| Number of recreation facilities within a KM | 3 | 3 | 6 |

Results in Table 4.6 shows that the number of schools, medical facilities, entertainment, and place of worship have increased over the years. This is a reflection of the magnitude of human activities been undertaken in the study area.

**4.4.3 Type of Housing in the Kipranye Riparian**

The study sought to find out the types of housing structures in the riparian areas. This was necessary to understand the nature of human activities and the pattern of settlement, whether they were permanent, semi-permanent, and temporary.
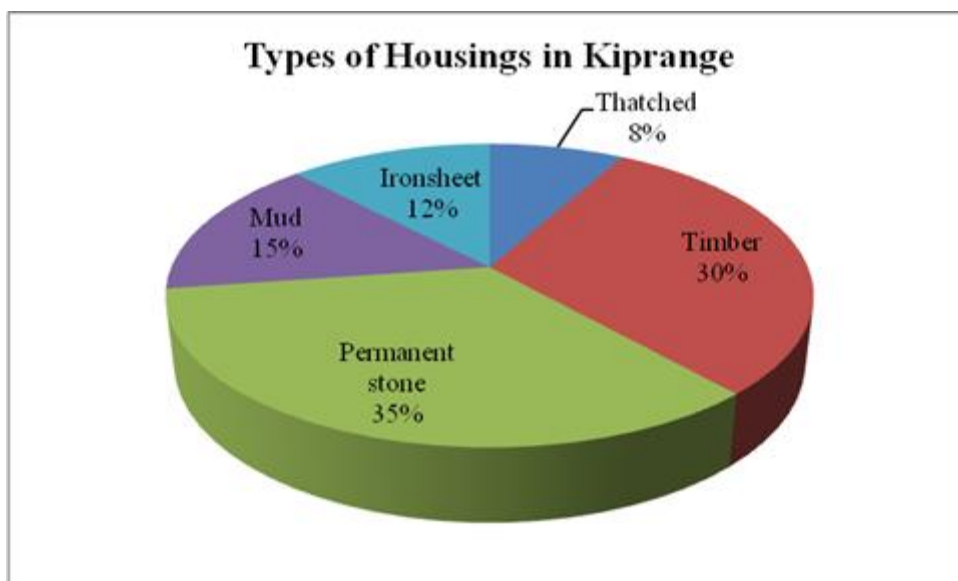
**Figure 4.6: Type of Housing in the Kipranye riparian**

The study found that the majority of people who have settled in Kipranye riparian have permanent houses made using stones accounting for 32.0%, followed by semi-permanent structures using timber and iron sheets as accounted for by 30.0% of the respondents, 15.0% said that they had used mud and iron sheet while 12.0% had constructed houses using thatch and mud. Therefore from the findings, it could be deduced that majority of people living in Kipranye had settled there permanently. These findings are reinforced by pictorial data presented in Plate 4.1.



**Plate 4.1: Human Settlements along Kipranye River Riparian**
**Source: Authors' Field Data, (2020)**

Plate 4.1 affirms that the majority of people who have settled in Kipranye riparian have permanent houses while the minority were semi-permanent. This is not only a dangerous trend to the environment but also affects the large water bodies, the streams, and the entire riparian where people derive a livelihood.

### 4.4.4 Dependency on Riparian for Water and Fuel

The study sought to establish extent to which people who had settled in Kipranye riparian were depending on it resources for sustenance, including water, firewood's, and building materials
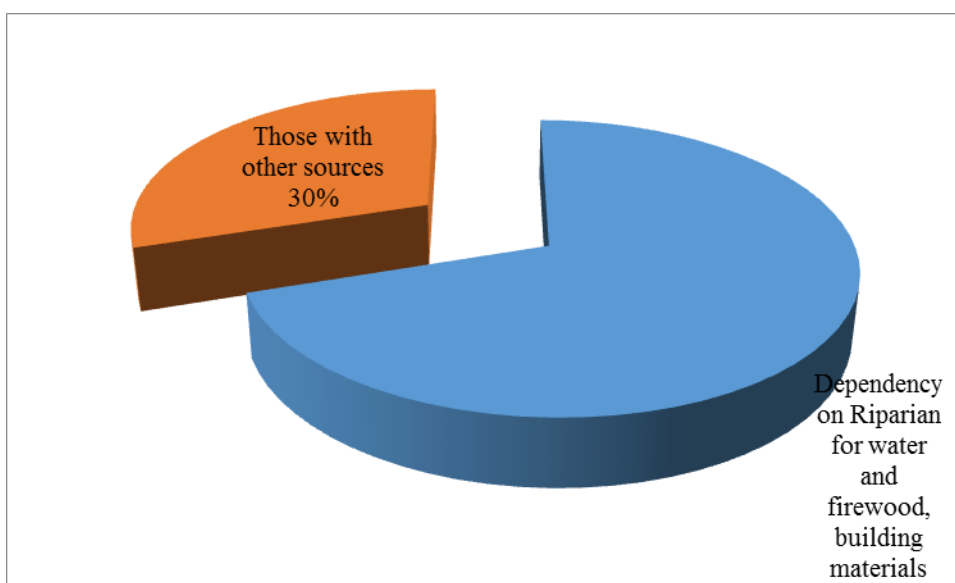


**Figure 4.7: Dependency on Riparian for water and fuel**

The findings in Figure 4.8 show that 70.0% of people who are living in the Kipranye riparian were depending on it for fuel and firewood on daily basis

### 4.4.5 Dependency on Riparian for Building Materials

The study sought from resident who had settled in Kipranye on extent to which households were depending on the riparian land for building materials including sand, bricks, reeds, thatch, poles to build houses
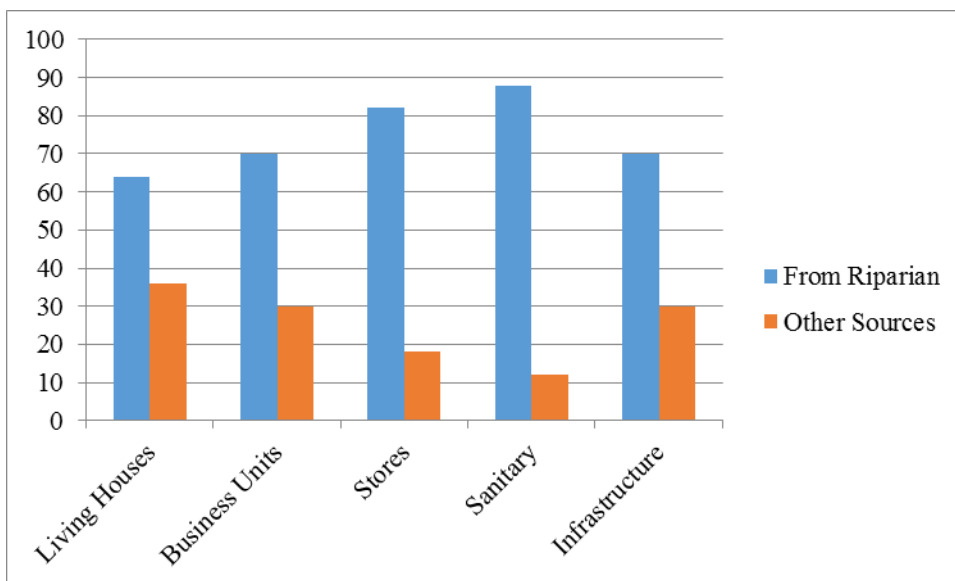
**Figure 4.8 Dependency for building materials**

The study found that 60.0% of residence living in Kipranye riparian were relying on the surrounding to get building materials including sand, bricks, reeds, thatch, poles to build houses while 70.0% depend on riparian to get materials to build stores and business units. Similarly, 70.0% of respondents said that materials to build infrastructure across the region is sourced in vicinity of the riparian

**4.4.6 Effect of Human Settlement Patterns on Kipranye riparian Ecosystem**

The informants cited that human settlement patterns in the riparian ecosystem have caused water pollution, dumping of household sewage and solid waste into waterways as a result of deficient basic sanitation services and disposal sites, which reflects lack of community hygiene development, and irregular occupation of waterways, which have destructively affected river Kipranye riparian. These views are supported by pictorial data presented in Plate 4.2.

**Plate 4.2: Waste Dumping into Kipranye River**
**Source: Author's Field Data, (2020)**

Plate 4.2 illustrates that River Kipranye was experiencing water quality degradation. The community is engrained in the age-old practice of dumping wastes into or along the rivers and streams. The results revealed that this pollution occurred at many locations of the river posing danger from water-borne diseases. The finding is in agreement with Ocheri, Mile, and Oklo(2008), who posit that contamination of surface waters represents a growing environmental health challenge in several regions around the globe. But then, this increases the quantity and frequency of solid waste generated and dumped in the river, which should be an issue of local and public concern. It denied the rest of the community access to clean water naturally provided by the river since there were no piped water supplies in the area, and so by necessity must end on river Kipranye water.

## 4.5 Agricultural Activities and State of Kipranye riparian Ecosystem

The second objective of the study was concerned with the evaluation of the effects of agricultural activities on the Kipranye riparian ecosystem. This involved descriptive of the Riparian and then testing hypothesis on whether agricultural activities have affected the Riparian.

### 4.5.1 Cultivated Area Surface (Acres)

The study sought to find out the cultivated area around the Kipranye riparian ecosystem, which was an indicator of intensification of human activity in the riparian. The findings are as shown in Table 4.7.

**Table 4.7: Cultivated Area Surface (Acres)**

| Cultivated area (acres) along Kipranye River | F | % |
|---|---|---|
| Over 10acres | 16 | 8 |
| 5-10acres | 39 | 20 |
| 0-5 acres | 140 | 72 |
| N=111 | 195 | 100 |

**Source: Author's Field Data, (2020)**

Table 4.8 shows that 140 respondents representing 72% of the sample had small parcels of land ranging 0-5 acres. About 39 respondents (20%) had between 5-10 acres while 16 (8%) had over 10 acres. These findings imply that the majority of the farmers who have settled in River Kipranye riparian ecosystem are smallholder farmers.

### 4.5.2 Comparing Size of Land Inside and Outside Kipranye riparian Ecosystem

The study sought to find out the cultivated area around the Kipranye riparian, which was an indicator of intensification of human activity in the riparian. The findings are as shown in Figure 4.9.
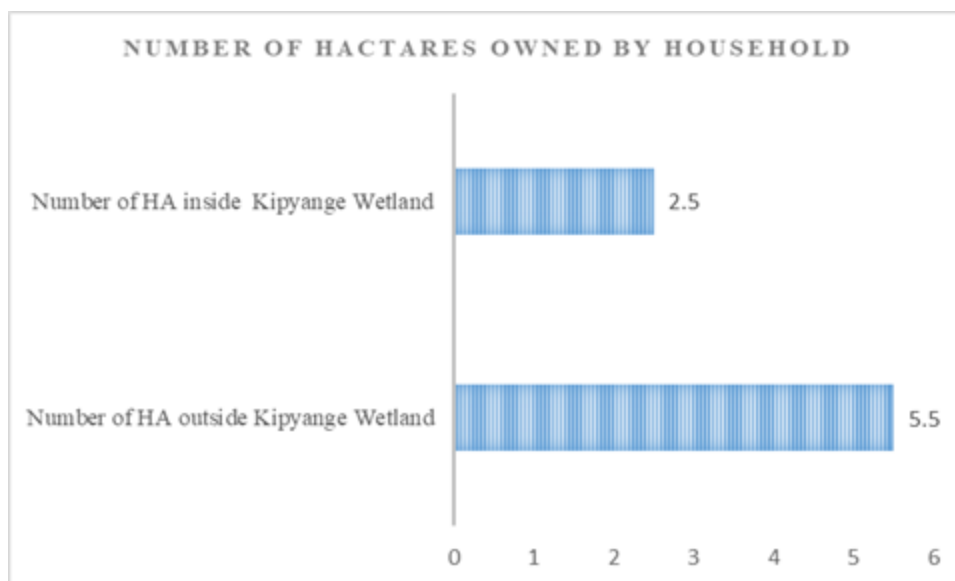
**Figure 4.9 Number of Hactares owned by household**

The study sought to find out whether the size of land between the household when comparing the size of land outside the Kipranye riparian ecosystem as compared to the parcel of lands outside the riparian. The goal was to evaluate the extent of fragmentation of land, which is an indicator of intensification of settlement in the area. The findings in Figure 4.10 show that the size of land for the majority of households outside Kipranye riparian is an average of 5 hectares as compared to 2.5 acres in the riparian, the ANOVA test indicates the differences are statistically significant with (P-Value of 0.00 at 95% confidence interval).

### 4.5.3 Types of Crops Cultivate in Kipranye riparian

The study sought to types of crops cultivated in the Kipranye riparian to find out the nature of agricultural activities practiced in the study area. The findings are as shown in Figure 4.10.
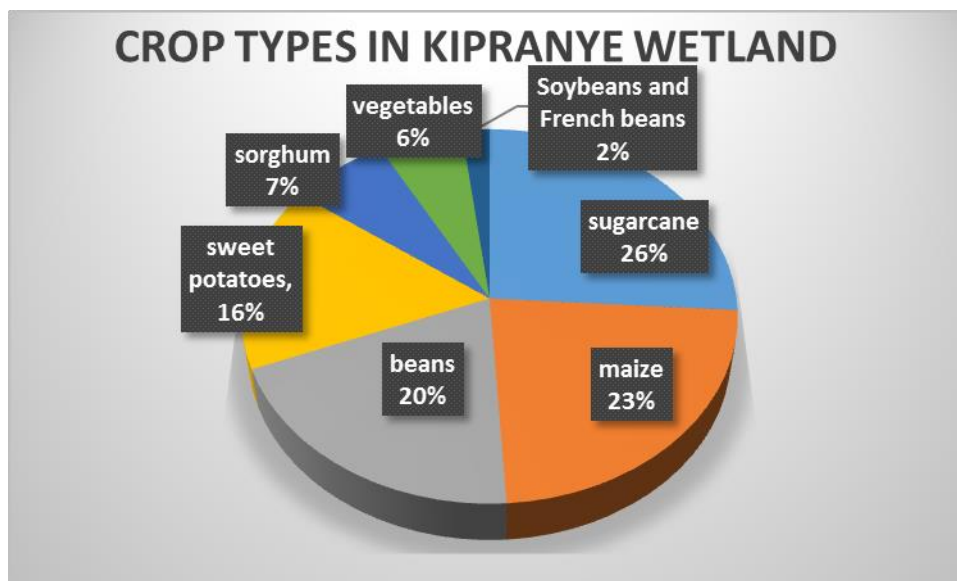
**Figure 4.10: Types of Crops Cultivate in Kipranye riparian**

The findings indicate that different crops are grown in the riparian with 26% of the respondents indicating that they grow sugarcane. Other popular crops that are grown in the region include maize (23%), beans (20%), sweet potatoes (16%). On the other hand, vegetables (6%), sorghum (7%) and soybean (2%) are grown by less than 10% of the farmers. According to communities living near Kipranye riparian, there is intensive cultivation around Kipranye riparian in the following order, majority grow maize, beans, sweet potatoes, sorghum vegetables, and soya beans, and French beans (5%). Agriculture is the primary economic activity in Kipranye riparian.

People have colonized part of the riparian by planting eucalyptus trees, which are known for their huge capacities to drain water. Indiscriminate draining of the riparian for cultivation and grazing makes it lose its capacity to filter and purify water. This condition is slowly eating up in the areas previously occupied by the riparian and may lead to its eventual disappearance. Gardens can be observed right next to the riparian crops like coffee, groundnuts, cassava, maize, and mangoes are seen grown there. Pesticides and insecticides are used in the coffee and mangoes fields.

**4.5.4 Exploitation of other Resources in Kipranye riparian**

The study sought to find out other socioeconomic activities practiced by people living

near the Riparian. The findings are as shown in Figure 4.11.
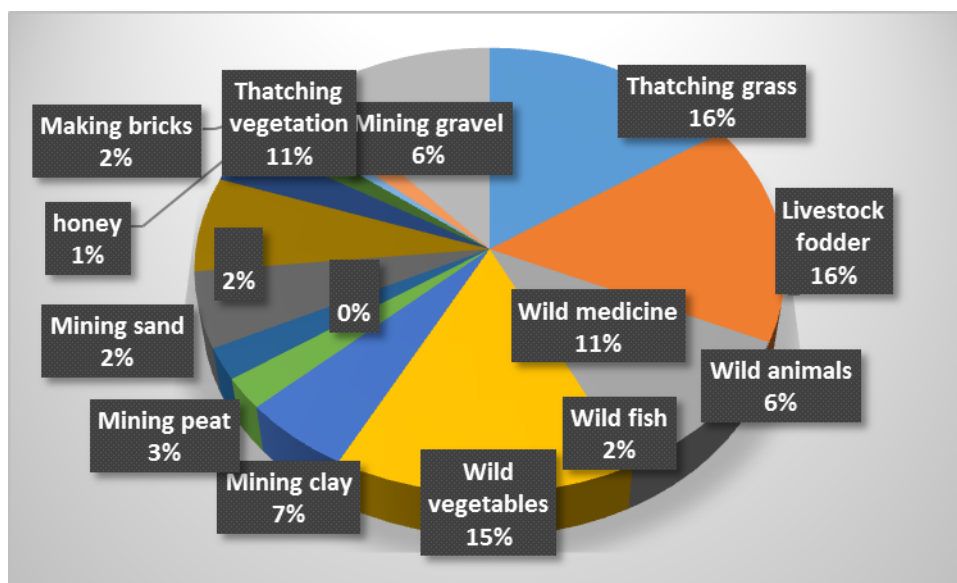


**Figure 4.11: Exploitation of other resources in Kipranye riparian**

Figure 4.11 indicate the people living in Kipranye riparian ecosystem engage in a

myriad of other economic activities.  About 27% of respondents mentioned that they

were involved in harvesting thatching grass, 16.0% indicated involvement in mining

clay for pottery and construction materials, another 16% reported harvesting livestock

fodder, while 15% acknowledged being involved in the harvesting of wild vegetables.

Other dominant economic activities include mining of clay, peat, and soil.

**4.5.5 Reasons for Exploiting Kipranye Wetland for Agricultural Production**

The study sought to establish the reasons that motivate farmers to use wetland for

food production. The findings are as shown in Figure 4.12
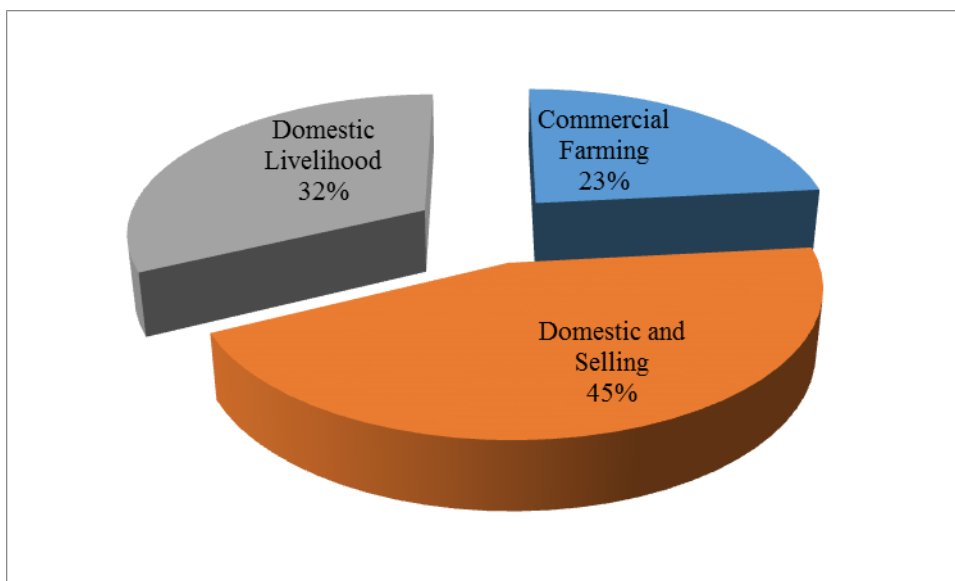
**Figure 4.12: Reasons for Exploiting the wetland**

From the findings majority of farmers indicated they are involved in the riparian to produce food for private and domestic use at home accounting to 40.0% of the farmers, 29% indicated that they exploit riparian because of domestic use and selling while 11.0% use the riparian land to do farming for commercial purposes

### 4.5.7 Frequency of Deriving Resources from Kipranye in a Week

The study sought to establish the frequency by which people living in Kipranye riparian exploits resources in a week. The findings are as shown in Table 4.8

**Table 4.8: Frequency of deriving Resources from Kipranye in a Week**

|                | Frequency | Percentage |
|----------------|-----------|------------|
| Every Day      | 127       | 65.0       |
| After Two Days | 41        | 21.0       |
| After 5 Days   | 27        | 14.0       |

**Source: Author's Field Data, (2020)**

The study found that majority of farmers in Kipranye wetland exploits available resources in the wetland daily as accounted for by 65%, followed by those who said they exploit resources after two days accounting to 21.0% and lastly 14.0% who said the exploit resources every after 5 days.

### 4.5.8 Farmers application of Green Agricultural Practices

The study sought to establish the extent to which farmers are involved in application of green agricultural practices; practices that conserve the environment by minimizing consumption of non-renewable resources and pollution. The findings are in Table 4.9

**Table 4.9: Level of application of Green Agricultural Practices by Farmers**

|  | Frequency | Percentage |
|---|---|---|
| **Always** | 127 | 18.0 |
| **Sometimes** | 41 | 42.0 |
| **Not at all** | 27 | 30.0 |

**Source: Author's Field Data, (2020)**

The study found that 42% of farmers in Kipranye riparian ecosystem apply green agricultural practices sometimes while 30% do not engage in these practices at all. About 18% of the respondents said that they always apply green agricultural practices. These findings suggest that at least more than half of the farmers in Kipranye riparian ecosystem apply some green agricultural practices that help to conserve the ecosystem.

### 4.5.9 Livestock Keeping

The study further sought to establish livestock activities in the study region. Secondary data regarding the number of livestock in the ecosystem for the last 20

years was obtained from the Kericho County Government Environment offices. This
data is summarized in Figure 4.13
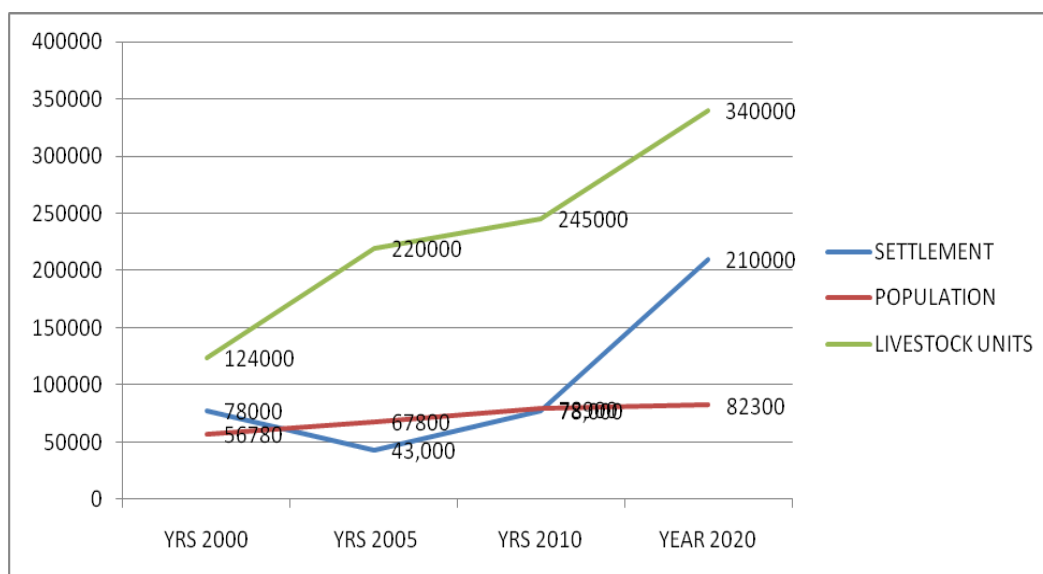


**Figure 4.13 Statistics of Livestock Farming in the Study Area**
**Source: Author's Field Data, (2020)**

Figure 4.13 shows that there has been a proportional increase in the number of
livestock in the Kipranye riparian ecosystem in the last 20 years.  The increase is
proportional to rise in the number of human settlers in the study area.  The majority of
community members have a large flock where they graze in the natural pasture while,
some practice zero grazing where they harvest the fodders from the riparian.

Livestock grazing along Kipranye riparian often lead to the spread of non-native
species as shown in Plate 4.3. Furthermore, livestock often use the forested areas
mainly as shelter from the heat. Within the forests, they heavily feed on the little grass
or herbaceous vegetation leading to death of shrubs, young trees, and the lower
branches of tall trees.

**Plate 4.3: Overgrazing and Destruction of riparian Species**
**Source: Author's Field Data, (2020)**

The finding is consistent with Raymond and Vondracek (2011) who maintain that overgrazing is a major environmental problem where groups of animals feed excessively from one area of land without letting the vegetation in that area fully recover. Without proper livestock farming management, the animals feed on young plants, thereby reducing their growth and endurance capabilities.



**Plate 4.4: Loss of Vegetation Cover of Kipranye River the riparian**
**Source: Author's Field Data, (2020)**

### 4.5.10 Effect of Crop Farming on Kipranye Ecosystem

The effect of crop farming on the study area was assessed using pictorial data presented in plates 4.5 and 4.6.



**Plate 4.5: Deforestation along Kipranye River**
**Source: Author's Field Data (2020)**

Plate 4.5 shows continuous growing of a single food crop (maize) and the neglect of producing other crops that hold the soil together, negatively influence soil fertility and infrastructure, since it tends to increase the removal of plant nutrients in runoff, affecting productivity, while contributing to surface and groundwater contamination. Furthermore, this exposed structurally fragile soil to harsh environments, leaving the soil under the dangers of erosion.

The study also found out that the cutting down of trees along the river for the creation of agricultural fields had the potential to alter the long-term composition and character of the Kipranye river indigenous trees and soil, and thus the structure and function of the implied trees. The total removal of riparian indigenous trees witnessed in the region for farming increases the amount of solar radiation reaching the river water surface, which consequently increases water temperatures that equally affect aquatic species. Besides, this alteration of vegetation along Kipranye river changes the

quantity and quality of food resources for aquatic biodiversity that depend on indigenous plants. Most of this soil contains contaminants from the fertilizers and pesticides used in the farms to boost firm produce.



**Plate 4.6: Use of Pesticides along Kipranye River**
**Source: Author's Field Data, (2020)**

Despite being used to protect crops against insects, weeds, fungi, and other pests, they equally contain toxic materials that pose both environmental and human risks, particularly when the same river water is used for domestic purposes, like drinking and washing. Improper use of fertilizer and pesticides, when they dissolve in surface water runoff, drain-tile flow, or seepage to groundwater had adverse consequences to the soil and water ecosystems. Irrigation and chemical use increase the ability for nutrient and pesticide transport to nearby surface waters and groundwater below agricultural fields near the river. The study found that local farmers used fertilizers and pesticides without knowledge on how they should be used. KINF 1 informed:

> *Most farmers, without agricultural knowledge on the use and application of fertilizers and pesticides, buy these substances and use them on their farms. Some even excessively apply them to the height that crops get burnt. Such chemicals remain in the soil and when heavy rains come, and since the farms are along the river, they are washed into the river.*

**Plate 4.7: Pesticide Application along Kipranye River**
**Source: Author's Field Data, (2020).**

Poor application of fertilizers and pesticides puts at-risk humans, animals, aquatic organisms, and the proliferation of plants that reduces the oxygen content in water and eliminates other sea life (OECD, 2016). The finding is in tandem with the study by Withers et al.(2017), which found out that in the UK, around 60% of nitrates and 25% of phosphorous in water bodies are estimated to have farming origins. The same opinion is shared by OECD (2012), which upholds that agriculture affects water quality by releasing into water bodies nutrients and other chemicals.

Because of the complexity and risks contained in an improper use of fertilizers and pesticides and the farmers' inability, a KINF 2 noted:

> *We need to go back to our traditional crops that are resistant to diseases and weather changes as a measure to limit or avoid the use of pollutants that run downstream to destroy water ecosystems.*

The traditionally reclaimed riparian were either individually or family-managed, and farmers selected their crops. Sometimes, informal groups were formed where farmers helped each other with agricultural tasks in both the riparian and upland fields' management. The flipside of this is that today, the situation is different; crops/seeds

and cropping systems are selected through consensus by the seed company, which also requires other economical inputs that the local farmers are not able to afford.

According to UNEP (2016), agriculture pollutes water resources as a result of the use of agrochemicals, organic substances, saltwater drainage, and pollution, which threatens aquatic ecosystems and human health. The local communities were challenged to better manage the use of fertilizers and pesticides to safeguard the water quality of river Kipranye. But the study noted that this requires more in-depth enablement of farmers in the region on how to adapt other forms of ensuring better agricultural produce.

## 4.6 Policies and Strategies on Riparian Conservation and Kipranye Riparian

The third objective of the study was concerned with the effects of policies and strategies related to the conservation of riparian ecosystems on the Kipranye riparian ecosystem.

## 4.6.1 Local Community's Awareness of riparian Policies and Legislation

The study sought to find out the extent to which the local community were aware of existing policies and legislation governing the use of riparian ecosystems. The findings are as shown in Figure 4.14
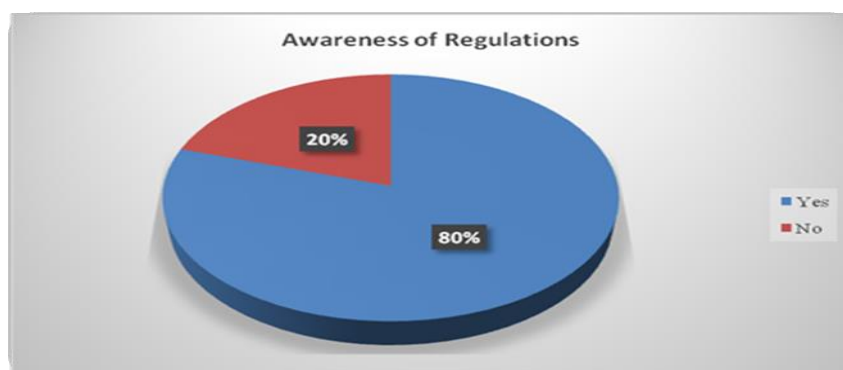


**Figure 4.14: Existing policies and regulation governing the riparian**

The study established that the majority of household respondents (80.0%) were not aware of the existence and laws (excluding traditional customary laws) governing the use and conservation of the Kipranye riparian.

**4.6.2 Major Policies Governing Kipranye riparian**

The study sought to find out the type of polices local community were aware of, that govern the use of resources at Kipranye riparian ecosystem. The findings are as shown in Figure 4.15.
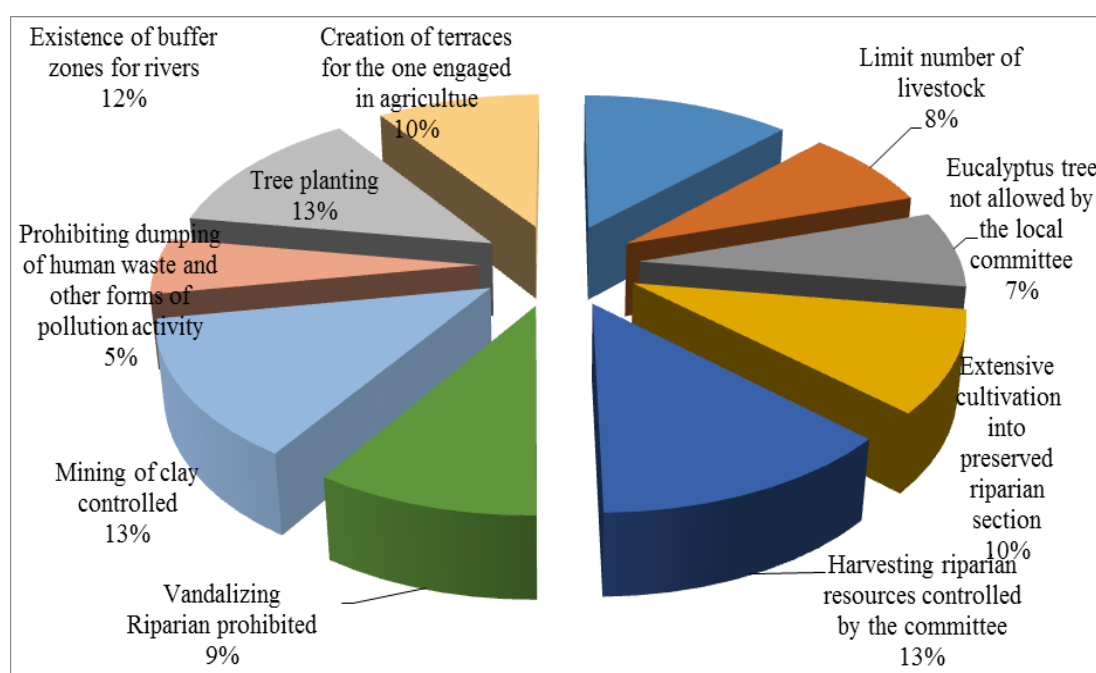


**Figure 4.15: Local Policies governing Riparian**

The study found that out of 20.0% of the local residence of Kipranye riparian who were aware of existence of laws and regulations governing Kipranye riparian area, 13.0% knew about tree planting laws as well as laws limiting harvesting of resources. About 12.0% knew about existence of regulations on buffer zones for rivers and laws managing clay harvesting, 10.0% indicated to be aware of laws limiting extensive agriculture in the riparian and creation of terraces in the fields. Few knew existence of laws on dumping of human waste and other pollution, limiting

on livestock and vandalizing on riparian land. Prohibiting dumping of human waste and other forms of pollution activity, people caught dumping human waste are penalized by traditional leaders and riparian committee, people caught vandalizing the Riparian are penalized by traditional leaders and riparian committee, Eucalyptus tree not allowed by the local committee, they are normally uprooted. Mining of clay controlled while harvesting Riparian resources controlled by the committee.

### 4.6.3 Reasons for Communities' Poor Knowledge of Riparian Law

The study sought to find out the reasons why members of the community had poor knowledge of riparian laws. The findings are as shown in Table 4.10.

**Table 4.10: Reasons for communities' poor knowledge of Riparian law**

|  | F | % |
|---|---|---|
| Insufficient Information from the government agencies | 23 | 12 |
| Lack of interest in matters related to the environment. | 35 | 18 |
| Waste of Time | 29 | 15 |
| Conserve this riparian as it was destroyed beyond repair | 21 | 11 |
| Issue of exclusion of stakeholders in the deliberations during meetings | 21 | 11 |
| Rarely are outcomes of such meetings implemented | 41 | 18 |
| Gender and disability exclusion | 29 | 15 |
|  | N=195 | 100 |

**Source: Author's Field Data, (2020)**

Table 4.10 shows that 12.0% of the respondents mentioned the reasons as a problem of insufficient information from the government agencies about the existing laws, which was because awareness campaigns were rarely conducted by agencies such as the National Environmental Management Authority. Another reason why members of the community had poor knowledge as cited by 18.0 % of respondents was a lack of interest in matters related to the environment. They regarded such matters as a waste of time as they were busy pursuing other matters related to livelihood.

About 11.0% of respondents indicated that they no longer think it is possible to conserve this riparian as it was destroyed beyond repair. A total of 18.0% mentioned that they do not find any direct benefits when they attend such meetings in the past. A total of 11.0% complained of the issue of exclusion of stakeholders in the deliberations during meetings as the reason why they no longer attend. A cross-section of 10.0% of community members cited that rarely are outcomes of such meetings implemented so there is fatigue and feeling that they are public relation exercise. A total of 15.0% of respondent indicated that there is gender and disability exclusion in the organization of such meetings which mean that.

### 4.6.4 Source of Information on Laws and Policies governing Kipranye Riparian

The study sought to find out how respondents get information about riparian laws and regulations is. The findings are as shown in Figure 4.16.
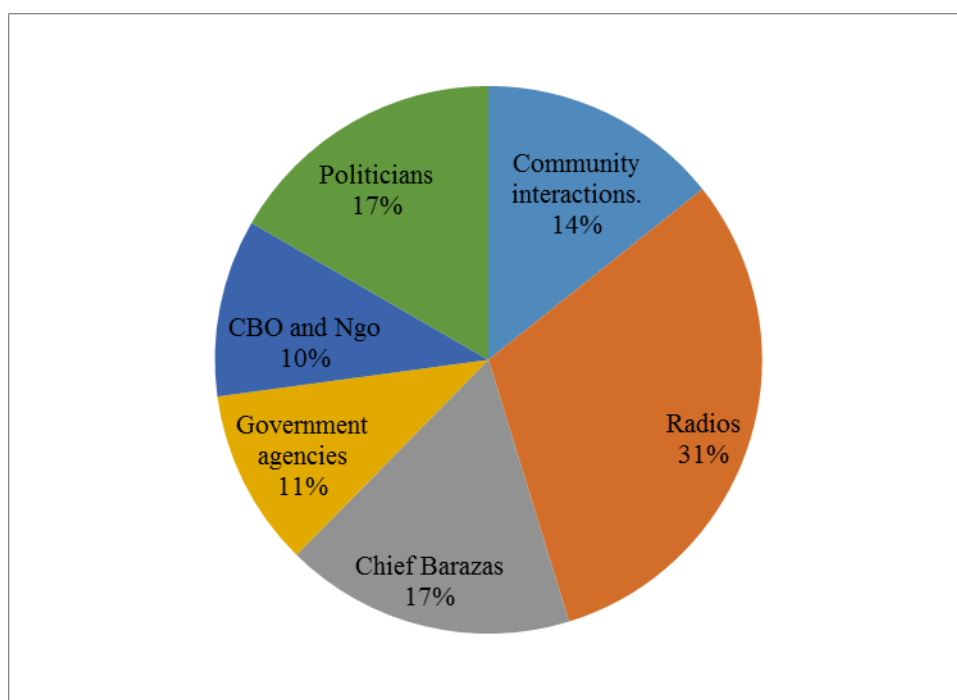


**Figure 4.16 Diffusion of information on Riparian Law and Policy in Kipranye Riparian**

A cross-section of 31.0% of the households said they have learned on riparian law and policies through radios, total of 17.0% of the households have learned about riparian law and policies through chief barazas, 17% acquired the information from politicians while 14.0% got it from community interactions. Information was normally shared during field operations in the riparian, at funerals, at gatherings to receive relief food aid, and even during informal chatting. The least have learned about such laws through government agencies and civil society group domiciled in the region.

### 4.6.5 Willingness of Residence to adapt Laws that Govern Riparian in Kipranye

The study sought to find out the extent to which the local community were willing to adapt laws that govern riparian in Kipranye Wetland. The respondents were presented with major issues covered by existing laws including planting tree and keeping buffer zones amongst other. The findings are as shown in Table 4.11.

**Table 4.11: Willingness of Residence to adapt Laws that Govern Riparian Use**

|  |  | F | % |
|---|---|---|---|
| Willingness to Adapt laws that Govern Riparian in Kipranye Riparian | No | 49 | 25 |
|  | Yes | 146 | 75 |
| Dumping of waste |  | 18 | 9 |
| Preparing terraces |  | 12 | 6 |
| Changing farming practices |  | 35 | 18 |
| Planting trees |  | 25 | 13 |
| Keeping buffer zones |  | 47 | 24 |
| Planting drought resistance crops |  | 33 | 17 |
| Reducing over exploitation of resources |  | 18 | 9 |
| Limiting number of livestock |  | 8 | 4 |

**Source: Author's Field Data, (2020)**

The study found that 55% of participants were not willing to adapt laws that govern riparian in Kipranye. However, the proportion varied depending on type of the law. About 24.0% of the respondents were willing to adapt laws on Keeping buffer zones, 18% were willing to adapt laws on Changing farming practices, and 17.0% on

Planting drought resistance crops. About 9% were willing to keep laws on dumping of waste and planting drought resistance crops, 6% on preparing terraces while 4% were the only one willing to keep laws of limiting livestock in the riparian.

**CHAPTER FIVE**

**SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS**

**5.1 Introduction**

This chapter provides a summary of the findings, conclusion, and recommendations, which were done as guided by the themes in the entire research. The chapter finalizes with suggestions for further study.

**5.2 Summary of the Study**

The study has shown that most development and land-use activities have cumulative effects on the Kipranye riparian area . Understanding the factors that cause changes in river Kipranye ecosystems is essential for the design measures that enhance positive and minimize its negative effects. This is because Kipranye riparian ecosystem support abundant diverse plant communities in the area, and provide the foundation for the economic development of the local communities. Human choices for sanitation systems, water abstraction, and Riparian management all influence each other.

The study sample was 255 households, which showed that despite the benefits of the river, various human activities cause its degradation. Among them are human settlements, livestock rearing, crop farming, and pollution of the river by the communities around it. From both the questionnaire and the interviews, the study found that excessive farming near the river banks ultimately destroyed Kipranye riparian ecosystem. Vegetation alongside the river is destroyed or deforested by human activities. This leaves the river soil exposed to other agents of destruction. Human activities alter the nature of the Kipranye River causing serious destruction to the river in terms of human settlements, farming activities and related effects, and pollution of the river.

### 5.3 Summary of the Findings

### 5.3.1 Human Activities in River Kipranye Riparian Ecosystem

. The growth in settlements shows that the pressure from a growing population along the river presents a potential threat for Kipranye riparian ecosystem and other ecosystems.

Human settlements are erected along the river, which causes other problems. There is no comprehensive and consistent monitoring of human establishments along the river by those institutions mandated to do so.

The study found that Kipranye riparian provide rich soil for agricultural activities. The study established that Kipranye riparian has enormous benefits to the entire natural ecosystems; they protect the water quality for domestic use, increase groundwater recharge in the region, forested areas reduce soil erosion, it acts as a habitat to most biodiversity. Unfortunately, these riparian lands have been converted into agricultural farming lands and subjected to uncontrolled exploitation.

The study demonstrated that uncontrolled livestock grazing is detrimental to Kipranye river land cover since all vegetation is consumed leaving the soil exposed to either water or wind erosion. There an overall collapse or destruction of river banks as a result of livestock trampling, destruction of biological soil crusts, compaction of underlying soils, which all cause more erosion and sediment pile up in the river which reduces the river water levels.

### 5.3.2 Effects of Human Activities on Kipranye River riparian

Human settlements are responsible for the verge of extinction of many river species of plants, birds, fish, and other biodiversities. They dump into the river waste that leads to the pilling up of sediments that are destructive to riparian ecosystems.

When land is subjected to agriculture, the vegetative cover is reduced. This removal of riverside vegetation consequently has led to the removal of the binding effects of roots upon the soil, the casing also hydraulic roughness of the bank, and overflow velocities near the banks as witnessed in the recent flooding in the region. Farming activities have caused changes in the natural hydrologic disturbance regimes and patterns of sediment transport of the river Kipranye water reserve.

Kipranye riparian is under pressure due to crop farming and related activities like irrigation, drainage, deforestation to create land for agricultural farming. Kipranye riparian has been fragmented into farming paddocks that are found right at the river banks, exposing the soil to quick erosion. The main surface of the Riparian is covered by agricultural land, located along the edges of the river.

Grazing on Kipranye river riparian lands also led to the removal of native riverside vegetation, particularly herbaceous plants, shrubs, and other young trees. This has weakened the root biomass along river channel banks and the resistance to overbank flow has been seriously reduced such that water channels have become unstable. Livestock farming activities were perceived as a serious degrading source of water quality leading to river water pollution.

### 5.3.3 Policy and Strategies in Conservation of the riparian

The raising of awareness, capacity building, and mainstreaming of the local community strategies is paramount. More specifically, there is a need to highlight the different scales of linkages of community activities and the consequences of those activities on the Kipranye river basin. This is where practical guidelines are developed that ensure sustainable and participatory riparian management in the area. The

participatory approach ensures that all stakeholders from local users through to county and national decision-makers, planners, and managers at different scales are involved.

## 5.4 Conclusions

The study concludes that the Kipranye River riparian is undergoing tremendous pressure due to human activities associated with the rapid exponential growth of the local population. This has led to intensive agricultural use of the available riparian ecosystems to feed the growing population, which alters the ecological character of the riparian; also the growth of crops and raising of livestock necessitate reclamation measures such as drainage or tillage. This affects severely and negatively on the riparian to the height that they no longer qualify as the riparian. Where there are low-intensity agricultural activities in the riparian without the use of fertilizers or pesticides, the diversity of the riparian ecosystems was found to be high, and the species composition and setting differ strongly from lands using fertilizers and other contaminants.

Riparian degradation affects environmental quality and leads to major alterations in the composition of biodiversity that directly depends on it. For the conservation of the Kipranye river water basin, all stakeholders should seriously link biodiversity water requirements and service provision to community local scale users. However, it is unfortunate that the local community is usually under-represented in the conservation processes. The tendency of the authorities and responsible conservation bodies like NEMA is to focus more on direct water use by the local population. Equally some conservation links between ecosystems and people's livelihoods are not fully recognized by the County water department charged with local water planning, use, and environmental authorities. These bodies only focus much of their efforts on

identifying and protecting biodiversity-rich the riparian, failing to sufficiently admit that the maintenance of these ecosystems can only be sustainably achieved through an all-inclusive engagement process, where involved communities equally take care and responsibility of their available resources.

The raising of awareness, capacity building, and mainstreaming of the local community strategies is paramount. More specifically, there is a need to highlight the different scales of linkages of community activities and the consequences of those activities on the Kipranye river basin. This is where practical guidelines are developed that ensure sustainable and participatory riparian management in the area. The participatory approach ensures that all stakeholders from local users through to county and national decision-makers, planners, and managers at different scales are involved. From the study, this inclusive approach was never seen, rather the community and NEMA were seen as spot-checking each other. This is a critical barrier to improving the riparian ecosystem conservation and community livelihoods in the area.

In the area, a common characteristic of communities using the riparian is that they have limited formal knowledge of the resources they use, even though those resources are critically important to their livelihoods. This lacuna largely contributed to their inconsiderate use of the water resources at their disposal. Because of this, they are not considered the focus of water and environmental management institutions or bodies. Their socio-economic needs appear to matter less to concerned authorities. But without the assessment of the relationship between socio-economic and Kipranye river resources, then any projects and programs developed at the local, County, and national levels cannot give deep solutions to the problem of Kipranye river Riparian exploitation.

## 5.5 Recommendations

To overcome the environmental problems such as the destruction of water resources that we are facing, there is a need to aim at improving awareness against these problems. There is a need for education related to environmental issues. Education definitely can effectively contribute to struggle with the environmental problems and is a key instrument for raising awareness. Sand mining should be done in a way that limits environmental damage during exploitation and restores the land after mining operations are completed. Water birds are the best indicators of Riparian ecosystem health. Their population and distribution can directly demonstrate the quality of riparian ecological conditions and integrity. Thus, the disappearance of birds along the river implies that the Kipranye water reservoir and ecosystem are deteriorating. However, to achieve this, human activities in the area should be contained.

Local communities be helped to find other alternatives that substitute their everyday incursion of Kipranye riparian area. As the study demonstrated, the incursion of Kipranye is associated with economic reasons. Wetlands are ecological sensitive systems and provide many significant services to human populations; they are the communities' sources of livelihood and therefore, given an alternative, then they are able to contain river exploitation

Provision of facilities that avert pollution of the riparian. Sensitizing the community through civic education programs on the importance of the riparian's. The abandoned clay mine areas left behind as waterlogged areas can be used for productive purposes such as fish farm ponds. Suitable guidelines should be framed to streamline the sand and brick clay mining activities in the riparian on an eco-friendly basis. For example,

the depth of mining should be demarcated to regulate mining concerning the water table condition.

The evaluation of the riparian is with a multidisciplinary perspective is very important. It increases the understanding of the reasons, processes, and problems associated with their use, including economic reasons and processes. Informed by the systems theory, the study recommends that the basic requirements for sustainability of Kipranye riparian are to institutionalize and strengthen the capacity for local community response as a measure to reduce direct and indirect exploitation of the river that entail negative forces that affect the environment and jeopardize the ecosystem services and human well-being.

Government institutions like NEMA and KWS are inadequate to ensure all the riparian in the country are maintained. National or regional environmental conservation institutions have more control over many national or regional environmental matters, and may not directly be informed of local environmental issues. Adequate solutions to the exploitation of the Kipranye riparian cannot be achieved when the community itself is outside the influence of a decision-making process. The empowerment of the local community in addressing their local environmental problems and inadequacies is therefore paramount. This can be done through community engagement in the planting of trees and cleaning the river to ensure its cleanliness, free from contamination, which also requires the community cooperation in the demolition of all the structures within the riparian that cause pollution.

The entire requirement of community involvement is to ensure a dialogical relationship between the environmental officers and the local communities in the

attempts to address the Kipranye river basin problems for the well-being of both humans and the natural water reservoir. Riparian conservation policies should take into account the grassroots empowerment of communities involved directly with the use of the riparian ecosystems.

Informed by the Integrated Water Resource Management (IWRM) theory, the study also recommends better waste management systems to contain and help in cleaning up the water that is already contaminated. The community and other agents need to work in a more integrated way to achieve this goal. The contamination of the riparian ecosystems, especially from human settlements is because of poor or lack of waste management systems as was noted by the study. As it was observed by the study, close to the riparian, there are virtually no cites, systems, and authorities that manage waste disposal. Human populations around directly channel or dump the waste directly into the river. Environmental bodies like NEMA should ensure the application of the principles of efficiency in the use (as water is a finite resource), equitable sharing of water resources for all stakeholders, environmental sustainability, and valuing water as an economic good; also ensure that community local needs related to the riparian are sustainably met.

The study also recommends for community traditional riparian knowledge systems. Against the backdrop of unprecedented riparian degradation and reduction in biodiversity and ecosystem services along the Kipranye river water basin, there is an urgent need to get back and incorporate traditional ways of regard to the natural environment that was perceived to be of mutual benefit to both humans and the environment. This is a grey area that the local communities should engage themselves in for sustainable development. They cannot live in an exploitative relationship with

their natural environment. Traditional communities have always lived in a relationship of mutual respect, harmony, and reverence with their environment (Acheampong, Ozor, & Owusu, 2014). This is something the communities around river Kipranye riparian are challenged to reconsider. Most African traditional societies had conserved locations, which include sacred groves, woodlots, riverbanks, rice valleys, and fallow land (Miller, 2004). These areas were conserved by their distinctive and peculiar contribution to the socio-economic, cultural, and environmental well-being of communities and households. The groves were regarded as a place to find rare plants and animals used for medicinal and ritual purposes (Tengoet al., 2007).

Finally, the study recommends training of farmers and the local communities on the relevance of the riparian ecosystem and the employment of better modern technologies that are friendly to the natural environment. The riparian are valuable environmental assets that play a vital role in controlling floodwaters, reducing erosion, improving water quality, and serving as habitats for diverse species of plants, animals, and micro-organisms. Their indiscriminate use, with no consideration of their ecological functions, results in irreversible damage to Riparian ecosystems. Furthermore, large-scale use of land by farmers that have more than 5 acres of plantations involves higher costs for drainage and the construction of irrigation networks. This necessitates economic capital and proper training of farmers and local communities.

Proper choice and utilization of modern technologies minimize the exploitation of the depletable riparian's resources. The community cannot live with traditional livestock and crop farming that are today detrimental to the sustainability of the riparian.

Technologies enable the use of minimum resources for a much bigger output than traditional methods, which employed so much input with very little output. It is about the value addition and environmental consciousness of peasant farmers and local communities. Farmers need to make an agricultural shift from traditional systems to modern ones. Effective agricultural renovations focus on the farming approaches that provide opportunities for farmers to earn a better income. This necessarily implies raising farm productivity or shifting the mix of production to include higher-value crops and livestock. However, the use of modernized systems of agriculture raises challenges of flexibility and capacity for the local farmers to adopt new methods of farming that add value to their invested farming efforts.

There is an urgent need to map, zone, and plan for the riparian. Without knowledge of the riparian in the country, their location, characteristics, which land regimes affect them, their size, etc. it is indeed difficult to attain sustainable use and management of the riparian. Time has come to action a National the riparian Inventory to finally give recognition to these critical environments. The inventory can indicate the riparian size, its functions and ecological aspects, where it is located, the uses of the riparian, management and institutional frameworks surrounding the riparian, economic value of the riparian amongst other themes. Research should be supported to ascertain what other functions the riparian can perform and thus attract funding for projects. This will have the ripple effects of having training opportunities, employment opportunities for the communities within the research areas, growth of education institutions amongst other benefits.

The study also recommends active and aggressive community-based participation in the management of the riparian. The communities should be taken through training

and sensitization forums for them to understand their role in the management of the riparian ecosystem. They should also get educated on alternative measures to ensure that there is sustainable management and use in the area and integration between all the relevant stakeholders and actors in the riparian sector from the Country Governments to National government to local institutions and the everyday users.

## 5.6 Suggestions for Further Research

The study highlighted various gaps that inform other future research. Such gaps included the following:

Information about Local community and cultural practices for riparian conservation is paramount in the identification of specific cultural features that correspond to the Kipranye river ecosystems. Indigenous environmental cultural ontology can be of great help and can contribute to the Kipranye river riparian conservation measures. Having looked at community interactions with Kipranye river ecosystems, there is an urgent need to integrate traditional values and knowledge systems in the environmental assessment of Kipranye riparian ecosystems.

Gender roles and conservation of Kipranye Riparian another grey area. This is because the study noted gender differences in the management of the Kipranye riparian ecosystem. Gender determines different ways in which humans relate to their natural environment.

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# APPENDICES

## APPENDIX 1: LETTER OF INTRODUCTION

Dear Respondent,

I am a student pursuing a Ph.D. degree in Geography at Moi University. I am currently undertaking academic research on matters related to the effects of human activities on riparian conservation in Kenya with a special focus on River Kipranye riparian area, Kericho County. This structured questionnaire seeks to find out from you your opinions, perceptions, and experiences on the objectives of the study which are the Effects of human activities which include farming, pollution, grazing, and livestock practices on the river Kipranye riparian Conservancy.

I take this opportunity to kindly ask you to attempt to answer the questions provided in the spaces given in the questionnaire.

Your response will be treated with the utmost confidentiality it deserves and no name will be disclosed without your consent.

Thank you in advance.

Yours faithfully,

**JaphetKipngeno**
**SASS/DPHIL/GEO/03/2018**

**APPENDIX II: QUESTIONNAIRE FOR COMMUNITY MEMBERS**

This questionnaire is intended to gather information to assist in analysing the effects of human activities on the Kipranye river riparian. Kindly help me out to fill in this questionnaire accordingly. Thank you in advance.

**Part One:  Demographic Information**

1.  Kindly indicate your Gender?

Male          ( )

Female          ( )

2.  What Age group do you belong to in (years)?

Less than 18        (   )

18- 35              ( )

36-50              ()

Above 51          ( )

3.  Could you indicate your Highest Educational Qualification?

Primary      ( )

Secondary      ( )

Diploma        ( )

Bachelors        ( )

Others ( )

4.  How long have you lived in this area?

Less than 1 year   ()

1– 5 years ( )

6 – 10 Years          (   )

10  +  years          (   )

5.  What is your occupation?

Agriculture ( )

Business ( )

Civil servant ( )

Other (   )

6. Which Economic activities are you engaged in inside Kipranye riparian?

[ ] Making bricks [ ] honey [ ] Mining sand [ ] Mining peat [ ] Mining clay [ ] Wild vegetables [ ] wild fish [] wild medicine [ ] wild animals [ ] livestock fodder [ ] thatching [ ] gravel [ ]

**PART TWO Human settlements**

7.0  How long have you been settled in Kipranye riparian?

[a] One Year  [b] 2-5 Years [c] 5Years [d] 5-10 Years

8.0 Which economic activities are you engaged in the Riparian?

[ ] Making bricks [ ] harvesting honey [ ] mining sand [ ] mining peat [ ] mining clay, [ ] harvesting wild vegetables, [ ] [ ] livestock fodder [ ] thatching [ ] gravel

9.0 How much land do you own in the Riparian?

[A] Below 2.5 Acres [B]  2 acres [C] 2-5 acres [D] 5 acres [F] 5 acres and above

10.0 What is the proportionate size of your household?

[A 1 Person [B] 2 persons [C] persons [D]  persons [E] over 5 people

11.0 How can you describe the type of your family?

[A] Single parents [B] people who live alone [C] three-generation family [D] couples with children

12.0 What category is your house as compared to others in this Riparian?

[ A] Temporary [B] Semi Permanent [C ] Permanent [D] Leased

**PART THREE: AGRICULTURAL ACTIVITIES IN THE RIPARIAN**

13.0 Which crops are you involved in cultivating?

[a] sugarcane [b] bananas [c] maize   [d] beans [e] sorghum  [f] sweet potatoes

14.0 Which types of resources do you exploit in this Riparian?

[A] thatching grass, [B] mining clay for pottery  [C]  construction of materials, [D] harvesting livestock fodder  [E]  wild vegetables, [F]mining of clay, peat, and soil

15.0 How can you describe the Income generated from agricultural farming in the Riparian for the current year 2021 as compared to the year 2020 and 2019?

| Crops cultivated in Kipranye Riparian | Income Between 2017-2019 | Income year 2019-2021 | P value |
|---|---|---|---|
| Sugarcane | | | |
| Maize | | | |
| Beans | | | |
| Sweet potatoes, | | | |
| Sorghum | | | |
| Vegetables | | | |
| Soybeans and French beans | | | |

16.0 How many livestock do you keep in the Riparian?

[a] 100-300   [b] 300-500  [c] 500-1000 [d] over 1000

**PART FOUR: POLICIES AND STRATEGIES**

17.0 Are you aware of Traditional Conservation policies and legislations?

Yes [ ] No [  ]

18.0 The following are common policies that govern this Riparian, which one are you aware of its implementation in the management of this Riparian

**National Policies Governing Kipranye Riparian**

| | Yes | No |
|---|---|---|
| Prohibited use of the Riparian in 10-meter riparian land | | |
| Exclusion of agriculture intensification | | |
| Allow traditional use of the Riparian | | |
| regulations of fertilizers and pesticides use | | |
| Exclusion of extensive  irrigation | | |
| Prohibition  use of the area with natural vegetation, considered as a buffer zone | | |

19.0 The following are community-based regulations and Riparian policies which are utilized in Kipranye riparian

|  | A | B | C | D |
|---|---|---|---|---|
| Use of ploughs prohibited |  |  |  |  |
| Limit number of livestock |  |  |  |  |
| Eucalyptus tree not allowed by a local committee |  |  |  |  |
| Extensive cultivation into preserved Riparian section |  |  |  |  |
| Harvesting riparian resources controlled by the committee |  |  |  |  |
| Vandalizing Riparian prohibited |  |  |  |  |
| Mining of clay controlled |  |  |  |  |
| Prohibiting dumping of human waste and other forms of pollution activity |  |  |  |  |

**20.0 Why do you think community members have poor knowledge of Riparian rules and regulations?**

|  | Yes | No |
|---|---|---|
| Insufficient Information from the government agencies |  |  |
| Lack of interest in matters related to the environment. |  |  |
| Waste of Time |  |  |
| conserve this Riparian as it was destroyed beyond repair |  |  |
| issue of exclusion of stakeholders in the deliberations during meetings |  |  |
| rarely are outcomes of such meetings implemented |  |  |
| gender and disability exclusion |  |  |

21.0 How do you get information about Riparian management?

| | Yes | No |
|---|---|---|
| Community interactions. | | |
| government agencies, | | |
| workshops and meetings | | |
| Government agencies, political leaders, and traditional leaders. | | |
| Informal barazas and village forum | | |
| interaction with riparian users during field surveys | | |

**APPENDIX II: INTERVIEW SCHEDULE GUIDE FOR NATIONAL AND COUNTY GOVERNMENT ENVIRONMENT MANAGEMENT OFFICERS IN KERICHO COUNTY**

1. What is the relevance of Kipranye riparian? Please name them

2. Explain some of the human activities carried out on Kipranye riparian ecosystem?

3. How do these human activities influence Riparian ecosystems with specific reference to Kipranye River in Kericho County?

4. What conservation measures are put in place to protect the riparian ecosystem in Kericho County?

5. Explain why the local communities resort to planting only food crops

6. Why do the farmers use chemical fertilizers and pesticides instead of compost manure? What are the effects of these on Kipranye river ecosystems?

7. Explain whether local farmers are properly trained

8. How is the disposal of waste produce managed in the area?

9. Do the local, County and national environmental officials efficiently dispense their work? Explain.

10. Explain how cultural indigenous knowledge can contribute to the conservation of Kipranye riparian.

# APPENDIX III: SAMPLING TABLE

## Required Sample Size[†]

| Population Size | Confidence = 95% | | | | Confidence = 99% | | | |
|---|---|---|---|---|---|---|---|---|
| | Margin of Error | | | | Margin of Error | | | |
| | 5.0% | 3.5% | 2.5% | 1.0% | 5.0% | 3.5% | 2.5% | 1.0% |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 | 19 | 20 | 20 | 20 | 19 | 20 | 20 | 20 |
| 30 | 28 | 29 | 29 | 30 | 29 | 29 | 30 | 30 |
| 50 | 44 | 47 | 48 | 50 | 47 | 48 | 49 | 50 |
| 75 | 63 | 69 | 72 | 74 | 67 | 71 | 73 | 75 |
| 100 | 80 | 89 | 94 | 99 | 87 | 93 | 96 | 99 |
| 150 | 108 | 126 | 137 | 148 | 122 | 135 | 142 | 149 |
| 200 | 132 | 160 | 177 | 196 | 154 | 174 | 186 | 198 |
| 250 | 152 | 190 | 215 | 244 | 182 | 211 | 229 | 246 |
| 300 | 169 | 217 | 251 | 291 | 207 | 246 | 270 | 295 |
| 400 | 196 | 265 | 318 | 384 | 250 | 309 | 348 | 391 |
| 500 | 217 | 306 | 377 | 475 | 285 | 365 | 421 | 485 |
| 600 | 234 | 340 | 432 | 565 | 315 | 416 | 490 | 579 |
| 700 | 248 | 370 | 481 | 653 | 341 | 462 | 554 | 672 |
| 800 | 260 | 396 | 526 | 739 | 363 | 503 | 615 | 763 |
| 1,000 | 278 | 440 | 606 | 906 | 399 | 575 | 727 | 943 |
| 1,200 | 291 | 474 | 674 | 1067 | 427 | 636 | 827 | 1119 |
| 1,500 | 306 | 515 | 759 | 1297 | 460 | 712 | 959 | 1376 |
| 2,000 | 322 | 563 | 869 | 1655 | 498 | 808 | 1141 | 1785 |
| 2,500 | 333 | 597 | 952 | 1984 | 524 | 879 | 1288 | 2173 |
| 3,500 | 346 | 641 | 1068 | 2565 | 558 | 977 | 1510 | 2890 |
| 5,000 | 357 | 678 | 1176 | 3288 | 586 | 1066 | 1734 | 3842 |
| 7,500 | 365 | 710 | 1275 | 4211 | 610 | 1147 | 1960 | 5165 |
| 10,000 | 370 | 727 | 1332 | 4899 | 622 | 1193 | 2098 | 6239 |
| 25,000 | 378 | 760 | 1448 | 6939 | 646 | 1285 | 2399 | 9972 |
| 50,000 | 381 | 772 | 1491 | 8056 | 655 | 1318 | 2520 | 12455 |
| 75,000 | 382 | 776 | 1506 | 8514 | 658 | 1330 | 2563 | 13583 |
| 100,000 | 383 | 778 | 1513 | 8762 | 659 | 1336 | 2585 | 14227 |
| 250,000 | 384 | 782 | 1527 | 9248 | 662 | 1347 | 2626 | 15555 |
| 500,000 | 384 | 783 | 1532 | 9423 | 663 | 1350 | 2640 | 16055 |
| 1,000,000 | 384 | 783 | 1534 | 9512 | 663 | 1352 | 2647 | 16317 |
| 2,500,000 | 384 | 784 | 1536 | 9567 | 663 | 1353 | 2651 | 16478 |
| 10,000,000 | 384 | 784 | 1536 | 9594 | 663 | 1354 | 2653 | 16560 |
| 100,000,000 | 384 | 784 | 1537 | 9603 | 663 | 1354 | 2654 | 16584 |
| 300,000,000 | 384 | 784 | 1537 | 9603 | 663 | 1354 | 2654 | 16586 |

**Appendix IV: Map: Kipranye River and Riparian La**
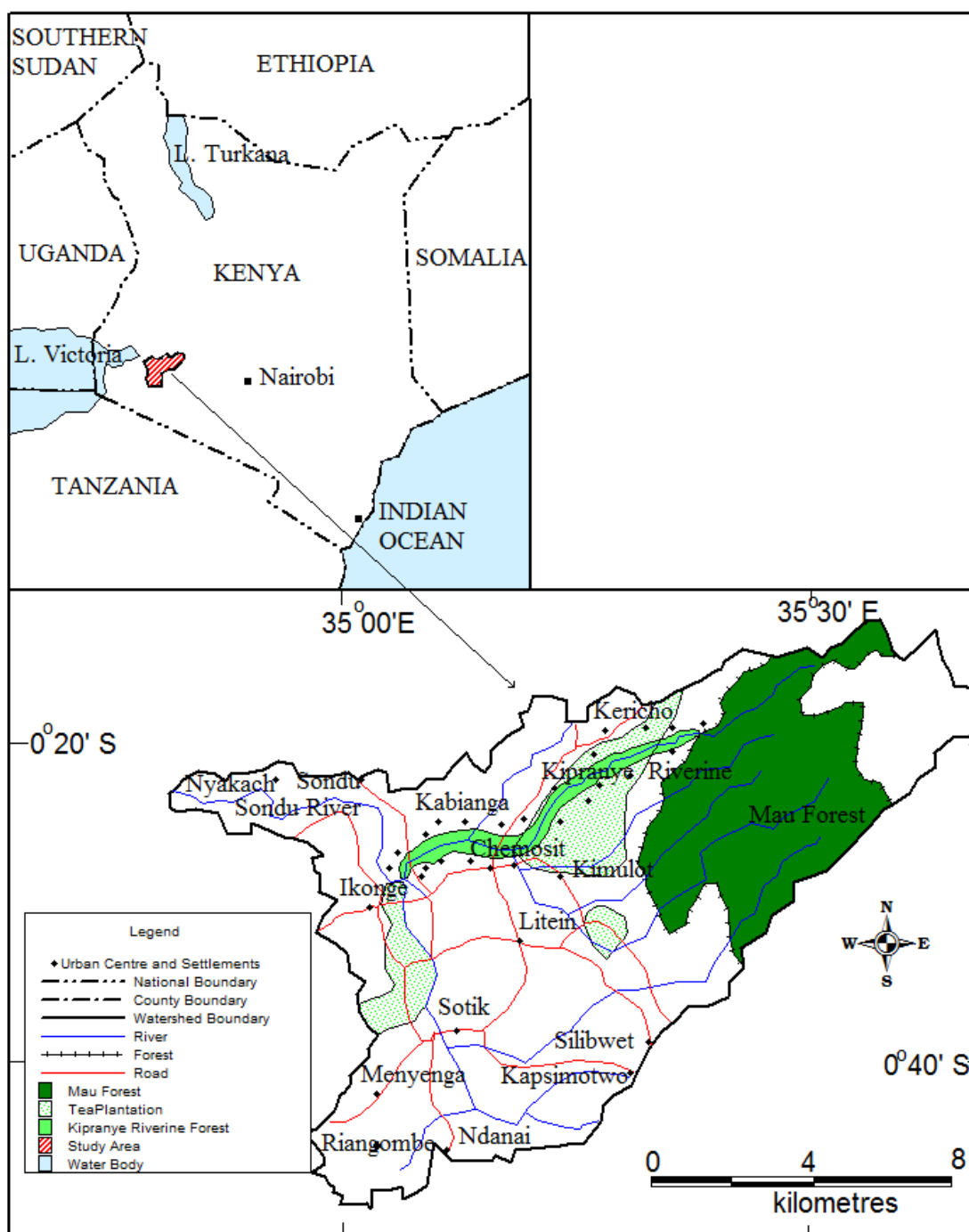


*Map of river Kipranye riparian*

*Source: Moi University Geography Department GIS Lab*

# APPENDIX V: LETTER OF INTRODUCTION

| | | |
|---|---|---|
| Telephone (053) 43001-8/43620 | **MOI UNIVERSITY** | P.O. BOX 3900 |
| Fax No. (0321) 43047 | | Eldoret |
| Telex No. MOIVARSITY 35047 | | KENYA |

## SCHOOL OF ARTS & SOCIAL SCIENCES

## DEPARTMENT OF GEOGRAPHY

22st JULY 2019

To
The Director
National Commission for Science, Technology and Innovation

### RE: RESEARCH PERMIT FOR KIPNGENO JAPHET: SASS/DPHIL/GEO/O3/18

This is certify that MrKipngeno Japhet is a PhD students in the department of Geography, Moi University. He successfully presented his research proposal entitled *"An Investigation into Human Activities and Their Impacts on Sondu River Basin Wetlands, Kericho County, Kenya"* at a departmental seminar held on 2nd May 2019. The department has therefore cleared him to proceed to the field for data collection. Kindly assist him process research permit to enable him undertake data collection.
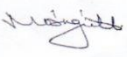
Thanking you in advance.

Yours faithfully,

HEAD DEPARTMENT OF GEOGRAPHY
MOI UNIVERSITY
P. O. BOX 3900
ELDORET

*William Kiplagat*
**HEAD, DEPARTMENT OF GEOGRAPHY**

## APPENDIX VI: RESEARCH AUTHORIZATION (NACOSTI)

**REPUBLIC OF KENYA**

**NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION**

Ref No: **765559**

Date of Issue: **14/August/2019**

### RESEARCH LICENSE

This is to Certify that Mr.. JAPHET KIPNGENO of Moi University, has been licensed to conduct research in Kericho on the topic: **AN INVESTIGATION INTO HUMAN ACTIVITIES AND THEIR IMPACTS ON KIPRANYE SONDU RIVER BASIN WETLANDS, KERICHO COUNTY, KENYA** for the period ending : 14/August/2020.

License No: **NACOSTI/P/19/551**

**765559**

**Applicant Identification Number**

Director General
**NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION**

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Scan the QR Code using QR scanner application.

# APPENDIX VII: AUTHORIZATION LETTER FROM MINISTRY OF INTERIOR

## OFFICE OF THE PRESIDENT
### MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

Telegrams: ...........................
Telephone: Kericho 20132
When replying please quote
kerichocc@yahoo.com

THE COUNTY COMMISSIONER
KERICHO COUNTY
P.O. BOX 19
KERICHO

REF: MISC.19 VOL.IV/26

27th September, 2019

Japhet Kipngeno
**Moi University**

**RE: RESEARCH AUTHORISATION**

I am pleased to inform you that you are authorized to undertake research as per the letter Ref. No. 765559 dated 14th August, 2019 on *"An investigation into Human Activities and their impacts on Kipranye Sondu River Basin Wetlands in Kericho County , Kenya"* for a period ending 14th August, 2020.

Any assistance accorded to him is highly appreciated.

COUNTY COMMISSIONER
KERICHO COUNTY

Ezekiel Amonde
FOR: COUNTY COMMISSIONER
**KERICHO**

CC:   County Director of Education
**KERICHO**

# APPENDIX VIII: AUTHORIZATION LETTER FROM MINISTRY OF EDUCATION



## MINISTRY OF EDUCATION
### STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

Email:cdekerichocounty@gmail.com
When Replying Please Quote:

County Education Office
P.O BOX 149
**KERICHO**

**REF:** KER/C/ED/GC/2/VOL.II/44

27TH SEPTEMBER, 2019.

### TO WHOM IT MAY CONCERN.

### RE: RESEARCH AUTHORIZATION.
### MR. JAPHET KIPNGENO.

The above student has been authorized by the National Commission for Science, Technology and innovation to undertake research on "*An Investigation into human activities and their impacts on Kipranye Sondu River basic wetlands in Kericho County, Kenya*", for the period ending **14th August, 2020.**

Kindly accord him the necessary assistance.

ff ZACHARY MUTURIE
COUNTY DIRECTOR OF EDUCATION
**KERICHO COUNTY**.