THE EXTENSION NEEDS OF HOUSEHOLDS UTILIZING RIVERINE WETLANDS AND THEIR CONTRIBUTION TO FOOD SECURITY IN NYAMIRA DIVISION, KENYA

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A Thesis Submitted to the Graduate School in Partial Fulfillment for the Requirements of the award of the Degree of Master of Science in Agricultural Extension of Egerton University

EGERTON UNIVERSITY

April, 2012

DECLARATION AND RECOMMENDATION

DECLARATION

I hereby declare that this thesis is my original work and that it has not been previously presented in part or as a whole for any academic award in this or in any other University

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RECOMMENDATION

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DEDICATION

To my father, the late Daniel Mecha Ongechi who sacrificed all to see me through Undergraduate.

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ABSTRACT

The Ramsar Convention on Wetlands of International Importance of 1971 brought out the importance of wetlands in the world and the threats they face. In Kenya various types of wetlands face varying challenges, the major one being conversion for agricultural use. The riverine wetlands in Nyamira Division of Nyamira District, Nyamira County face the same challenges because they have been converted for agricultural use, brick making and growing of woodlots due to declining land on the uplands. The main drive of utilizing the riverine wetlands is household food security. The extension programmes had not adequately addressed the extension needs of households utilizing riverine wetlands. This was because the policies developed on wetlands in Kenya advocate for wetland conservation and preservation and this left the farmers utilizing these riverine wetlands without adequate agricultural extension support. The main objective of the study was to establish the agricultural extension needs of households utilizing riverine wetlands and their contribution to household food security in Nyamira Division. The study used cross-sectional survey design. The target population was made up of 2200 household heads who were utilizing the three riverine wetlands namely Sironga, Charachani and Nyabomite. The study used stratified random sampling to select 120 household heads from the three riverine wetlands. A structured interview schedule was used to collect data from the sample. To authenticate collected data, focus group discussions were held using a discussion guide. Both descriptive and inferential statistics were used in the study. Inferential statistics used in the study at $\alpha = 0.05$ were Chi-square to test for the level of influence of extension services on riverine wetland use; ANOVA to test for differences in extension needs and Pearson's product moment correlation to test for the correlation between riverine wetland and food security. Data analysis was done using Statistical Package for Social Sciences (SPSS) programme. The study revealed the need for agricultural extension services on wise use of riverine wetlands because there was extensive utilization of the riverine wetlands in producing food crops, cash crops, bricks and woodlots. The study indicated that there were no significant differences in agricultural extension needs of households with different wetland uses. The study also showed that utilization of riverine wetlands was contributing to household food security. It is recommended that government policy incorporates the extension needs of households utilizing riverine wetlands in the National Extension programme and recognize their contribution to household food security. This will promote wise use of the wetlands.

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ABBREVIATIONS AND ACRONYMS

DSO	District Statistical Office
EWRP	Ethiopian Wetland Research Programme
FAO	Food Agriculture Organization
FGD	Focus Group Discussions
GECAFS	Global Environmental Change and Food Systems
IDB	Irrigation and Drainage Branch of Ministry of Agriculture
IUCN	International Union for the Conservation of Nature
IWMI	International Wetland Management Institute
KVDP	Kisii Valley Development Programme
LBDA	Lake Basin Development Authority
MOA	Ministry of Agriculture
MOAIDB	Ministry of Agriculture- Irrigation and Drainage Branch
MOENARE	Ministry of Environment and Natural Resources
MOL&FD	Ministry of Livestock and Fisheries Development
MPA	Marine Protected Areas
NEMA	National Environment and Management Authority
NRI	Natural Resource Institute
SOE	State of the Environment
UNEP	United Nations Environmental Programme
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

CHAPTER ONE

INTRODUCTION

1.1 Background Information

According to the Convention on Wetlands of International Importance (RASMAR, 1971) Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides does not exceed six meters. Wetlands occupy six percent (6%) of the Earth's land surface whereas in Kenya they occupy 3-4% of the land surface which increases to 6% during the rainy season. Kenya has designated Lakes Nakuru, Bogoria, Naivasha and Baringo as Ramsar sites described as Wetlands of International Importance (NEMA, 2003). Such wetlands are meant to be protected from degradation because of their contribution to International Biodiversity. Other wetlands not graded as Ramsar sites face varying challenges because of the need to expand agriculture to feed a growing population (Rijsberman & Silva, 2004). Kenya as one of the developing countries faces serious challenges as far as sustainable wetland utilization is concerned due to sectoral laws and policies that favour conservation and protection (Gichuki, 2000). This leaves wetlands open to overexploitation and degradation because they are sensitive ecosystems.

In Nyamira District, all the wetlands are riverine and are found within open conduits that have been naturally created at the bottom of valleys with continuously moving water. These wetlands had been converted into farmlands and grazing fields without taking into consideration their fragility. Those utilizing these riverine wetlands lacked adequate agricultural extension information on the best ways of using them without degradation. Diminishing upland farms was the main reason households were moving to riverine wetlands so as to remain food secure. Many of the riverine wetlands in the Division are Trust Land under the Nyamira County Council (MoA, 1995). In the 1960s these riverine wetlands were untouched because the uplands were sufficient to cater for the needs of households and the wetlands were considered as government land and hence out of bounds. Population pressure on the uplands (ridges) forced the farmers to start exploiting the riverine wetlands in the late 1970s. By the 1980s there was extensive conversion of the riverine wetland habitats into farmlands (MoA, 1995). The overriding

objective for this conversion was increase available land for food production. Attempts by the Kisii Valley Bottom Development Project (KVDP) to intervene and assist in reclamation and wise use of the wetlands failed when the donor funding the project pulled out in 1991 before its impact could be felt (MoA, 1995). The same fate befell the Lake Basin Development Authority (LBDA) in 1994 after funding by Food and Agriculture Organization (FAO) was withdrawn.

Nyamira Division has a population density of 936 persons, average household size of four and average land sizes of 0.40 hectares (Nyamira District Development Office, 2009). This situation is made worse with poverty levels of 71% and food poverty levels of 50% (Ministry of Agriculture and Rural Development, 2004), leaving no riverine wetland in Nyamira Division unutilized. Failure of the government to carry out land adjudication made it even more difficult for the farmers to carry out wise use of wetlands because they lacked security of tenure (MoA, 1995). MoA (1995) identified inadequate extension as the main reason that led to progressive decline in crop yields in the wetlands. This decline forced many households to convert the wetlands into grazing areas, growing woodlots and brick making although some still grew crops.

1.2 The Statement of the Problem

Public and private Agricultural Extension providers have targeted uplands for provision of extension services and hardly provide these services to those using wetlands except in fish farming. Many wetlands in the world are being converted for agricultural and non agricultural uses. This is more severe in Kenya and specifically in Nyamira Division where households are exploiting riverine wetlands to remain food secure and enhance their economic stability. The Agricultural Extension needs of Households utilizing riverine wetlands are unknown or undocumented. It is also not known whether utilizing riverine wetlands contributes to household food security. Therefore there was need for an empirical study to document the extension needs that enhance sustainable riverine wetland utilization and address household food security.

1.3 Purpose of the Study

The purpose of this study was to establish the agricultural extension needs of households utilizing riverine wetlands and their contribution to household food security in Nyamira Division.

1.4 Objectives

The study was guided by the following objectives:

i. To establish and document the agricultural extension needs of households with different riverine wetland utilization types in Nyamira Division.
ii. To determine the influence of agricultural extension service on the utilization of riverine wetlands in Nyamira Division.
iii. To determine the contribution of riverine wetlands to household food security in Nyamira Division.

1.5 Hypothesis

The following hypotheses guided the study and were tested at $\alpha = 0.05$

Ho_1: There were no statistically significant differences in the agricultural extension needs of households with different wetland utilization types in Nyamira Division.

Ho_2: There is no statistically significant influence of agricultural extension services on utilization of riverine wetlands in Nyamira Division.

Ho_3: There is no statistically significant contribution of riverine wetlands to household food security in Nyamira Division.

1.6 Significance of the Study

The results from this study reveal the extension needs of households utilizing Riverine Wetlands and whether the Riverine Wetlands contribute to household food security in Nyamira Division. This information is useful to extension providers who may use it to develop appropriate and adequate extension packages based on the extension needs of households utilizing riverine wetlands. The findings may also be used to improve the level of contact between households exploiting wetlands and extension providers.

Policy makers may use this information to put in place policies that will enhance sustainable use of riverine wetlands. Policies that take into consideration the needs of riverine wetland users like their extension needs.

Households using riverine wetlands may use this information to exploit the riverine wetlands in a sustainable manner hence promoting the wise use concept of wetlands because of their fragility. The findings of the study may also be useful to researchers in agriculture and environment who may use the findings to develop a technological package that will enhance sustainable use of riverine wetlands.

1.7 Scope of the study

The study was conducted in Nyamira Division of Nyamira District. It involved selected households that were utilizing riverine wetlands. It was concerned with the extension needs of households utilizing riverine wetlands and the contribution of the wetlands to household food security. Socioeconomic factors studied were household heads' age, gender, marital status, household head type, household income, educational level and wetland size. In household food security the indicator was level of household food security for the previous twelve months which was measured at three levels namely: food secure, moderately food secure and food insecure households. Extension information critical in wise use of riverine wetlands was developed under extension needs of households. The influence of agricultural extension services on the utilization of riverine wetlands was also investigated. The independent variables were factored into the study because types of riverine wetland use and extent of use were different. Moderator variables that would have influenced type and extent of wetland use were also investigated and these were sources of income and level of education.

1.8 Assumptions

This study made the following assumptions:

i. That the current policies on wetlands do not support sustainable wetland use.
ii. That all household heads had limited land on the uplands.

iii. The responses from household heads were honest and true.

1.9 Limitations

The study had the following limitations:

i. Household heads who did not keep records might not have given the exact figures in their responses.

ii. Focus group discussion members gave approximate figures in their responses and not exact figures due to lack of records during the discussions.

1.9 Definition of terms

For the purposes of this study the following operational terms applied:-

Extension needs: This is agricultural information that farmers require to improve productivity in their farming activities. In this study it refers to the information that households require to sustainably utilize riverine wetlands.

Agricultural extension - Agricultural extension is the process of educating farmers as recipients of agricultural knowledge and technology. In this research it is the process of educating households utilizing riverine wetlands as recipients of agricultural knowledge and sustainable technology.

Riverine Wetland- A Riverine Wetland is a wetland contained in the banks of a channel that may contain moving water or that forms a connecting link between two bodies of standing water (Kabu, 2002). In this study it refers to wetlands that are found within open conduits that have been naturally created at the bottom of valleys with continuously moving water in Nyamira Division.

Extent of wetland use: This is the proportion of wetland being used. In this study it refers to the the proportion of riverine wetland being utilized by households for various activities.

Food security: This is a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996). In this study food security is when at all times, households utilizing riverine wetland have access to enough, safe and nutritious food that meets dietary needs for an active and healthy life.

Household composition: Is the number of individuals related and unrelated in a household. In this study it refers to the number of individuals with or without blood relations living together and utilizing riverine wetlands, their ages and gender.

Household food security: This is when all household members have access at all times to enough food for an active, healthy life (USDA, 2005). In this study, it is the access of a household under study to the amount and variety of food from riverine wetland production, donation or purchase of safe foods using proceeds accruing from wetland use that its members need to lead active and healthy lives.

Wise use of wetlands: This is the use of wetlands without compromising its natural properties so that future generations can also use them. In this study it refers to the sustainable utilization of riverine wetlands for the benefit of households in a way compatible with the maintenance of the natural properties of the ecosystem.

Degraded Wetland: A wetland with one or more functions reduced, impaired, or damaged due to human activity. In this study it is a riverine wetland with more of its functions impaired.

CHAPTER TWO
REVIEW OF LITERATURE

2.0 Importance of Wetlands

The United States Environmental Protection Agency (EPA) (2010) explains that wetlands provide important benefits such as flood control, water cleaners and suppliers, vital habitats, recreation and economy and inspiration. Wetlands act as filters of nutrient and silt loaded water, most of which are retained through absorption by wetland plants. In this way wetlands play a critical role in preventing eutrophication in the receiving water bodies (Ochola, Kerkides & Ayieko, 2004).

Vegetation and flat topography in wetlands slow water flow, causing sediments to be deposited in the wetland, and reducing siltation of rivers, lakes, and streams. Wetlands function as a barrier to shoreline erosion from wave action because their interlocking root systems stabilize soil at the water's edge, enhance soil accumulation through sediment trapping, curb wave action, and slow water currents. Wetlands act as huge sponges temporarily storing flood waters and releasing them slowly, thus reducing flood peaks and protecting downstream property owners from damage (EPA, 2010).

Wetlands have an inherent capacity for carbon sequestration (Odada, Olago, Kulindwa, Ntiba & Wandiga, 2004). In addition wetlands have cultural and educational values. Many wetlands are important sites for scientific research and education. They are often used to study long term or global environmental trends. At the same time, many communities use distinct sites such as wetlands for religious and cultural activities (e.g., circumcision) or value such sites for some religious or spiritual occurrence that they believe took place there (NEMA, 2002). Socio-economically, wetlands support family livelihoods as bases for crop production, grazing animals, fishing, and harvesting medicinal plants among others (Mwakubo, Obare, Birungi, Rono, & Karamagi, 2004).

Despite these critical functions of wetlands, people have encroached onto them in search of food. Mwakubo et al. (2004) explains that there has been large-scale conversion of wetlands to

agricultural land. While not easy to perceive, the conversion has also implied that nature's capacity of reduction and retention of nutrients has diminished. As McCartney (2003) points out, wetlands contribute in diverse ways to the livelihoods of many millions of people in Africa. In numerous areas they are inextricably linked to cropping and livestock management systems. Increasing population, in conjunction with efforts to increase food security is escalating socioeconomic pressure to expand the agricultural utilization of African wetlands. Agarwal (2008) acknowledges that as human populations grow pressure on the wetlands increases as people look for more land for agriculture, construction and industry. Riverine wetlands in Nyamira Division are being encroached on because the uplands have reduced in size and hence food production has dwindled. Households are utilizing these wetlands in various ways to improve their livelihoods.

2.1 Riverine Wetlands and Agricultural Extension needs

Wetlands are an essential feature for ecological sustainability of nature and mankind. They are one of the most productive eco-system in the biosphere. They are indispensable part of human civilization fulfilling crucial needs for economical, spiritual and cultural well-being; drinking water; energy; fodder; bio-diversity; flood storage; recreational activities as boating, fishing and bird watching; research; transport; economy and as climate stabilizers. (Agarwal, 2008). This requires the right combination of information, policies, public awareness, and appropriate farming methods to sustainably use the wetlands (International Water Management Institute, 2006). Such information should answer questions like how much drainage should be done without negatively impacting the healthy functioning of riverine wetlands. What methods can small-scale farmers use to make riverine wetland-based farming more productive without damaging the environment? What institutions and policies are needed to ensure that other vital wetland functions are protected? (IWMI, 2006). This information on sustainable riverine wetland utilization is lacking and the little that is available is 'partisan' because the management of wetlands is currently under various institutions, whose mandates and activities are not only sectoral but also uncoordinated, and sometimes overlapping and ineffective (East African Wildlife Society, 2007). Each of the institutions interacts with the wetlands in accordance with its interpretation of its mandate (Kiai & Mailu, 1997).

Research information that is available is general to all wetlands and is geared towards wholesale conservation. Immediate survival needs of the population conflict with the long-term conservation and management of wetlands. As a consequence, poverty and issues of maintenance of individual wetlands are intertwined and need to be addressed simultaneously (NEMA, 2002). Each wetland, in this case riverine wetland requires unique and site specific information package on its utilization and conservation. Wetland management requires coordination amongst different users in order to obtain the best returns from these areas in a sustainable manner. Wetlands are inter-linked systems and actions in one area can lead to changes elsewhere in the wetland which can impact upon other users.

The extension services which had been in place before NALEP were more or less top-down in approach and were supply-driven, with inadequate participation of the beneficiaries and were for all practical purposes, a public monopoly. It did not give enough consideration to socio-economic circumstances of the farmer, including his/her knowledge and experience of his/her environment and took little account of the on-farm and off-farm activities. It also lacked wider involvement of the stakeholders and adequate interaction between the farmers and the other relevant actors (Ministry Of Agriculture Rural Development, 2001). Both NALEP and KAPP (Kenya Agricultural Productivity Program) supports a pluralistic approach to the provision of extension services, involvement of all key stakeholders, and a gradual transition from predominant public to private sector extension (MOARD, 2001). Both have an environmental component that advocates proper technology development and dissemination in order to enhance the rate of technology adoption but lack specific information on wise use of riverine wetlands. The other problem with these programs is that they are donor funded and hence donor driven, they cover selected areas only and once funding is withdrawn, the program ends. This leaves ecosystems like riverine wetlands exposed to continued degradation.

The Kenyan government through the National Environment Management Authority (NEMA) advocates for conservation of wetlands with minimal use. The Ministry of Agriculture and Rural development has no clear extension package for wetland users because of their fragility. Lack of sufficient extension packages for farmers utilizing wetlands threatens the very existence of

these wetlands and hence the livelihoods of those utilizing them. As Walters (2004) opines, those supporting wetland use do not advocate for mass wetland cultivation but where they support food security, agricultural extension officers to recognize their value and help them exploit sustainably. This is because if communities over-utilize wetlands, they jeopardize their own food and water security and other wetland functions including flood and drought regulation, water purification, and biodiversity support.

In Nyamira Division there are eight riverine wetlands covering a total area of 2095 hectares, all of which are at different stages of reclamation. They fall into three systems of land tenure namely, freehold, Government and trust land. Small segments of the riverine wetlands are freehold where the absolute ownership of that land is vested in the owner. Majority of wetlands fall under trust land where land is held by the local authorities in trust of the local residents. Small portions of the wetlands are government land. The biggest of all is located at Sironga. It was first identified in 1919 by MOA and investigated between 1930 and 1982. It was developed by the Kisii Valley Development Programme from 1983, but abandoned in 1991 after funding was withdrawn by the donor (MOA, 1995). It was taken over by farmers, Lake Basin Development Authority and other interested parties. It is one of the biggest brick producers in the division. It is also well covered by eucalyptus woodlots. The Lake Basin Development Authority (LBDA) commissioned its projects at Sironga in the early 1990s with nurseries for fruits such as avocadoes and oranges, tea, coffee, eucalyptus and kay apples. It also initiated fingerling rearing, zero grazing units and growing of Napier grass (MOA, 1995). The fish farming project was funded by FAO and was wound up in 1994. Table 2 indicates breakdown of activities carried out by the LBDA between 1999 and 2005.

Table 1: Activities of LBDA at Sironga

Activity	**1999-2000**	**2001-2002**	**2003-2004**	**July2005**	**Total revenue (ksh)**
Brick making	49486	-	113000	78000	706,703
Eucalyptus	5000	-	-	-	25,000
Kay apples	2000	-	-	-	8,000
Tea seedlings	20000	-			100,000
Coffea robusta	2000	-	-	-	10,000

Source: Lake Basin Development Authority Annual Report 2007.

Nyabomite, charachani, kianungu, enunda, kebuko, mobamba were developed by the KVDP from 1983 to 1991 when the programme was abandoned after the donor pulled out (MOA, 1995). They were also taken up by farmers who have reclaimed them and are utilizing them for grazing, brick making, crop production and growing of woodlots. Lack of appropriate extension package for the farmers utilizing these riverine wetlands threatens their survival because the current use is unsustainable.

2.2 Riverine Wetlands and Household Food Security

Household food security refers to the ability of the household to secure, either from its own production or through purchases, adequate food for meeting the dietary needs of all members of the household (FAO, 2003). Riverine wetlands are all wetland and deepwater habitats contained within an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water (Walton, 1998).

The use of wetlands for subsistence cropping is far more widespread than publicly acknowledged: wetlands are cultivated in much of Sub Saharan Africa. Governments haven't yet acknowledged the enormous contribution of wetlands to the livelihoods of the rural poor (Walters, 2004). This can be attributed to the fact that most African countries consider wetlands as wastelands and the few that acknowledge their importance advocate for full conservation. As

McCartney and Van Koppen (2004) emphasize, wetlands make an appreciable contribution to rural livelihoods in terms of both direct cash income and contributions to food security. Wetlands provide income in both dry and wet years for fairly large number of people engaged in agriculture because of their available water and high soil fertility (Kashaigili and Mahoo, 2005). In research done in Western Ethiopia, Wood (2004) concludes that wetlands contribute directly to food security through the production of green and mature maize and vegetables. The main harvest from these areas, in the early rainy season, is ready just when the supply of food from the upland fields is running out for many families and the "hungry season" is starting. Indeed wetland cultivation at this time of year can be seen as a critical survival mechanism and as a source of food security, especially for those people whose upland harvest was poor. Wetlands also contribute indirectly to food security by providing products which people can collect and sell to provide them with cash for purchasing food.

Food insecurity implies a limited access to or availability of food, or a limited or uncertain ability to acquire food in socially acceptable ways (Holben, 2004). It has broadly been broken down to food secure, marginally food insecure and food insecure households. Food secure households are those that experience minimal or no incidence of food insecurity, marginally food insecure are households whose food intake for adults has been reduced to an extent that implies that adults have repeatedly experienced the physical sensation of hunger and food insecure households are those whose food intake for children is reduced to and extent that they repeatedly experience hunger (Bickel et. al., 2000). This has been echoed by the Global Environmental Change Adaptations for Food Security (GECAFS) initiative (GECAFS, 2006) as illustrated in Figure 1.

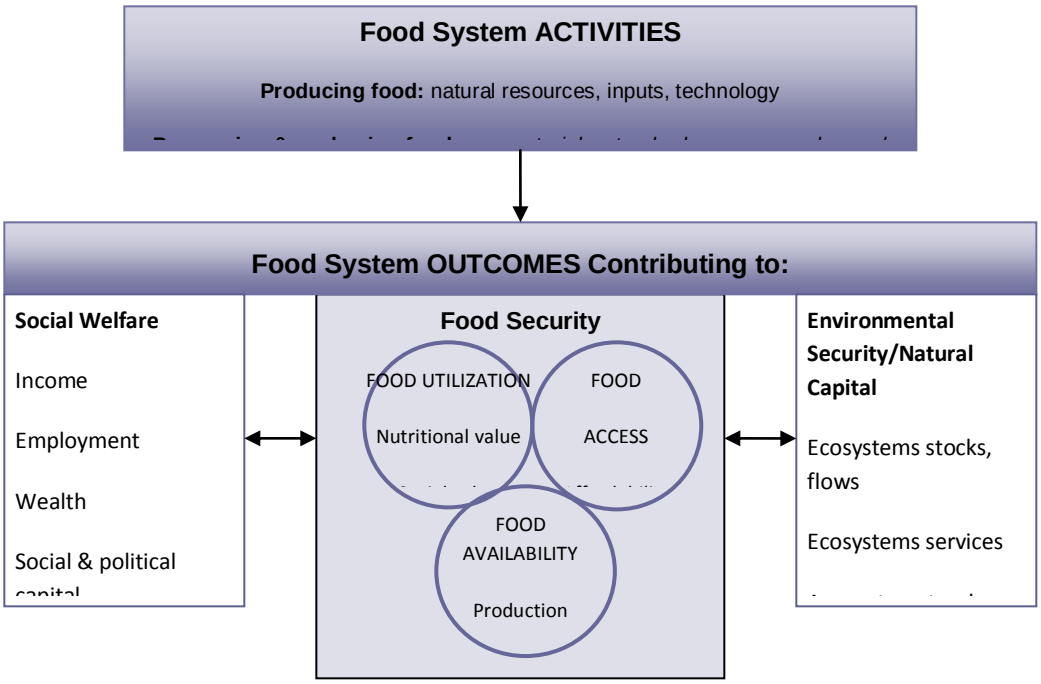

Figure 1: The main features of food systems

Source: Adapted from GECAFS, 2005

The causes of poverty and food insecurity in Kenya include low agricultural productivity, inadequate access to productive assets (land and capital), inadequate infrastructure, limited well functioning markets, high population pressure on land, inadequate access to appropriate technologies by farmers, effects of global trade and slow reform process (Kinyua, 2004). Other factors that contribute to food insecurity include; pressure on agricultural land, low soil fertility, poor diversity of food crop production, poor post-harvest practices, poor access to fertile farmland and fishing areas. In addition limited extension services, lack of marketing framework, lack of sufficient credit and income, labour and time constraints, single adult or child headed families, and diseases such as HIV and AIDS. These problems affect the households' ability to increase food production and to care adequately for the nutritionally vulnerable **(**Callens, & Phiri, 2003).

If communities over-utilize riverine wetlands, they jeopardize their own food and water security and other wetland functions (Mwendera, 2003). This is because as Masiyadima et al. (2004) observes land degradation in upland areas is a major contributing factor to and result of increased

conversion of riverine wetlands to croplands. As the uplands in most countries become increasingly degraded and lose productivity, riverine wetlands are being used to compensate for the losses in productivity. However, if the wetlands also become irreversibly degraded, there will be no other alternatives for food production and livelihoods sustenance (Dixon et al., 2001). This situation must be stopped or avoided at all costs through promotion of sustainable utilization of wetland resources. This can probably be achieved through community training, with emphasis on rational, wise and no-destructive utilization (Mironga, 2005).

In Kenya, there is little evidence about the contribution of wetlands to household food security. As we appreciate the contribution of riverine wetlands to household food security in other parts of Africa, this study intends to determine the contribution of riverine wetlands to household food security. Once this relationship is determined then appropriate extension packages can be developed to assist in optimal or sustainable use which will ensure positive benefits for both households and conservation of wetland environment. This is because wetlands can be used sustainably, contributing to both local and wider needs for food production and other activities which contribute to rural livelihoods, as well as showing how environmental functioning can be retained (Wood, 2004).

2.3 Sustainable Wetland Utilization and Conservation

Sustainable wetland management should ensure people's continued access to resources in ways which maintain their livelihoods and the resources on which they depend. In other words conversion to agriculture must be controlled so that other benefits are not destroyed or seriously reduced, in this way limited wetland conversion can be undertaken so that it enhances the benefits that local populations derive from the natural ecosystems but maintains those ecosystems (Abbot & Hailu, 2000).

Conservation can be regarded as the medium- to long term maintenance and protection of natural environments and the quality of their biological diversity. In wetlands, conservation initiatives are commonly linked to biodiversity conservation, as biodiversity is associated with environmental stability in the wetland ecosystem (Abbot & Hailu 2000). According to NEMA (2002) wetlands are important habitats for a variety of biological resources, some of which

depend entirely on wetlands for their survival. Of particular importance in understanding the need to conserve wetlands is the concept of ecological goods and services. Wetland ecosystems obviously provide marketable commodities, e.g. food from fisheries. They also provide a wealth of products from which marketable goods are made in addition to providing services for which there are obvious economic returns.

Whilst environmental and biodiversity concerns are important in sustaining rural livelihoods, protecting riverine wetlands in their pristine state is not always feasible or desirable, especially as population pressures increase. Combining wetland conservation with some conversion or development may enhance the natural productivity or value of the riverine wetland. In such cases, environmentally sensitive management can increase the value of one or more functions of the wetland system without significant or irreversible damage to the others (Abbot & Hailu, 2000). It is necessary that conservation principles are built into the management practices of riverine wetland areas as they are used. In this way it will be possible to ensure the sustained ecological functioning of these areas as wetlands. This will guarantee the continued production of the ecological and socioeconomic benefits which can be obtained from natural wetlands and the production of some additional benefits, such as "hungry season" food supply, without degrading the wetland (Walters, 2004). This is largely because conversion of wetlands to uses other than conservation is determined by household pursuit of welfare improvement, which in turn, is influenced by households' asset position and vulnerability shocks (Mwakubo et al., (2004).

Sustainable riverine wetland management also requires the active participation of the relevant stakeholders in the planning and implementing process. Riverine wetlands need an integrated approach to their planning and sustainable use (Walubengo, 2002). Policy and technical tools are needed to counteract lack of appropriate information and intervention failure which cause riverine wetlands to be used in an unsustainable way. The concept of sustainable use of riverine wetlands is particularly relevant and popular in Africa and the developing world due to it's recognition of riverine wetland values to local communities for meeting several of their needs (Rebelo, McCartney & Finlayson, 2009). Development of appropriate extension information

package based on the needs of riverine wetland users will help in the sustainable utilization of riverine wetlands and their management.

2.4 Government Policy on Wetlands and their Use

Wetlands are increasingly being recognized as vital resources for achieving food, water and livelihood security in many parts of sub-Saharan Africa (MEA, 2005). Traditionally, they have been used for a wide range of livelihood activities including fishing, agriculture and the collection of water, food and forage (Kangalawe & Liwenga, 2005) However, as profound social, political and environmental transformations across Africa have placed pressure on local livelihoods, in many cases poor households have sought to safeguard their livelihoods through the intensification of wetland use, especially in small wetlands which can be easily managed at the community level (Schuyt, 2005). As Gichuki (1994) explains, in Kenya, wetlands support the rural economy and up to seven million people depend on them for their livelihood. In addition, there is considerable inter-institutional competition for wetland resources, particularly water. Kenya developed a national policy on wetlands known as National Wetland Conservation and Management through a policy paper in 2002 on which the government recognizes the need to balance between wetland conservation and sustainable utilization. According to the policy (NEMA, 2002), given the spatial location of the majority of wetlands, often with inherently fertile soils, multiple use pressure is inevitable. All these factors combine to make such sites attractive for a diverse range of competing economic activities. In this sense, the natural resource conflicts that arise can be considered inevitable. Within the same statute a contradiction arises where total conservation and protection is advocated.

Other sectoral statutes include Water Act, Fisheries Act, Wildlife Act and Forests Act. Each of the institutions interacts with the wetlands in accordance with its interpretation of its mandate (NEMA, 2002). This leads to overlapping and duplication of mandates further confounding the problem. The conflicting policies on wetland use pose great danger to the use of these vital resources. At the time of this study there was a government drive to eliminate all eucalyptus trees from water catchment areas and this had proved a big set back for the households. There was serious resistance from those utilizing the wetlands as they insisted that the government provides

alternative trees that were as good as the eucalyptus. As the National Environment Management authority was advocating for the elimination of the trees, the Kenya Forest Service was raising the red flag over the cutting of the trees (Wesangula, 2009). This confusion in government policy leads to conflict among various organs and departments and this results in environmental degradation.

The government needs to harmonize the various policies taking into consideration the needs of communities to avoid conflict. Inconsistencies and contradictions among policies at different levels (from global to local) fail at integrating the multiple objectives of their multiple users. These policy failures can largely be explained by lack of knowledge and information about the essential functions of wetlands and the benefits and costs supported by their different users (Turner et al., 2000). The situation is even more critical in developing countries, where environmental policies are relatively recent and suffer from the poor means allocated to research. Government policies that have failed to recognize the significance of local wetland management practices, and indeed the wider value of wetlands, have also stimulated the intensification of wetland agriculture, in an attempt to create more economically productive land. Consequently, a key concern in the long term is that the carrying capacity of wetlands, in terms of the exploitation of products and functions, will be exceeded, resulting in degradation and loss of livelihood benefits for all (Wood, 2005).

A balanced and coordinated approach is required in which many wetlands will be utilized for domestic and commercial output under the wise use principles by amalgamating the statutes. This will cater for conservation and use of wetlands rather than conservation and protection only. Wetlands in Kenya are used to grow crops such as rice, horticultural crops and other cereals such as maize and tuber crops. In some places crops like sugarcane are propagated. They are also used in livestock keeping where wetlands act as grazing fields or fields for growing fodder. Brick making is another major economic activity in the wetlands due to suitable soils. The rest of the wetlands are used to grow woodlots and straws for weaving. Small portions of some wetlands grow thatch for grass thatched houses. These uses need to be integrated into the overall wetland management policy because they contribute significantly to the livelihoods of households. The

extension needs of those who utilize these riverine wetlands need to be included in the national extension policy to avoid conflict between utilization and conservation of the wetlands.

2.5 Theoretical Framework

The extension needs of households utilizing riverine wetlands and their contribution to food security could be based on a theoretical framework proposed by Scoones (1998) which outlines a framework for analyzing sustainable livelihoods (Figure 2). This theory is appropriate to the study because it shows how determination of extension needs of riverine wetland users and the provision of extension services by various bodies will influence wetland utilization and their provision to household food security. The framework can be used to analyze how the utilization of riverine wetlands can be used to achieve sustainable livelihood outcomes like improved household food security and sustainable wetland use.

The framework starts by looking at a person's livelihood assets, how they change over time, and the specific vulnerabilities they face. It understands that people adopt many strategies to secure their livelihoods and draw on a range of "assets" to do so. These are influenced by an array of external factors, including government policies and institutions, the private sector, and local organizations. The framework seeks to understand the dynamic nature of livelihoods and what influences them and builds on people's perceived strengths and opportunities. It also looks at the influence of policies and institutions on livelihood options and highlights the need for policies to be informed by insights from the local level and by the priorities of the poor and counts on partnerships drawing on both the public and private sectors. The framework finally aims for sustainability because sustainability is important if poverty reduction is to be lasting (Trickleup, 2012).

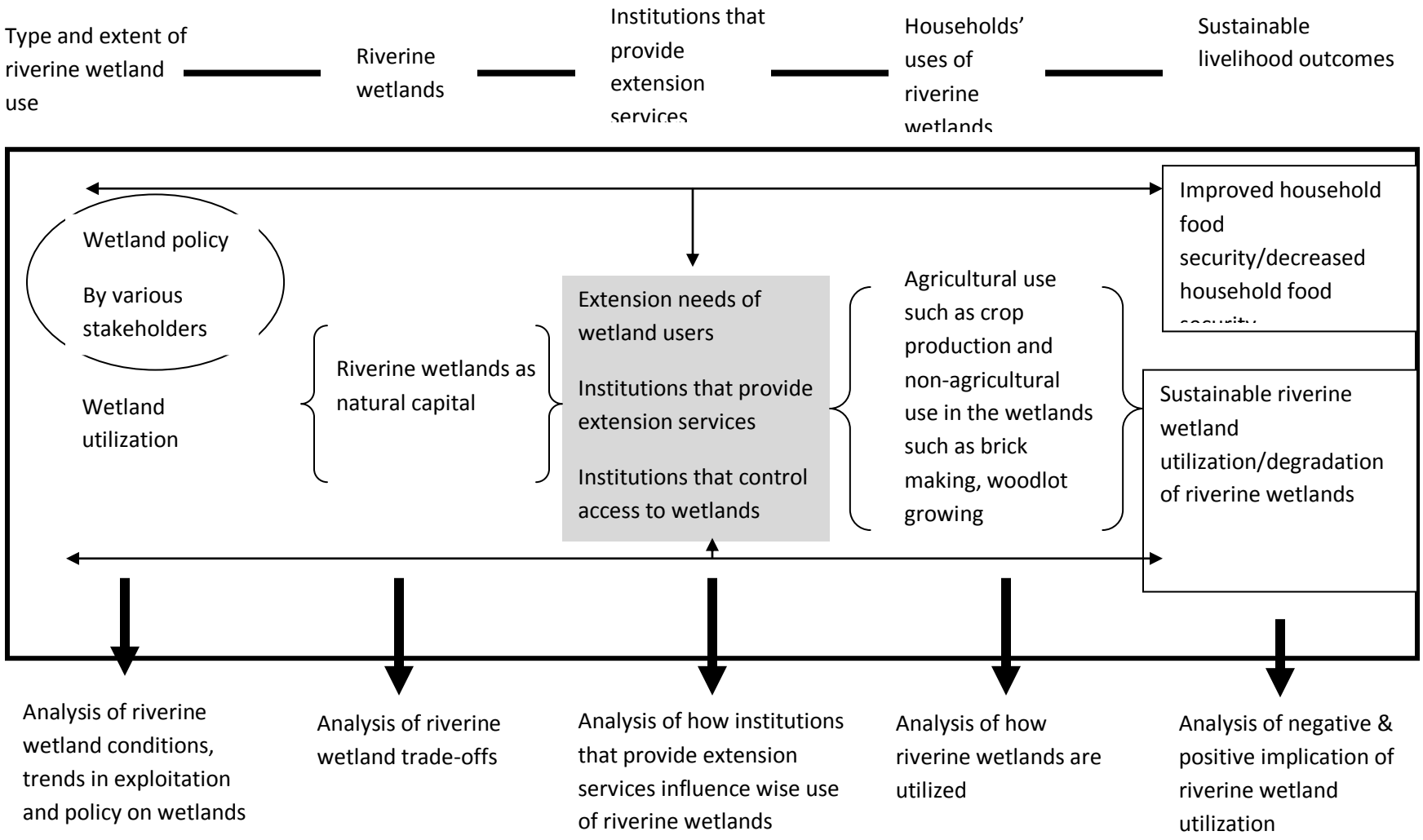

Figure 2: Theoretical framework on riverine wetland utilization

Source: Modified from Scoones, (1998)

2.6 Conceptual Framework

The conceptual framework (Figure 3) was based on Scoones' proposition on sustainable riverine wetland use and improved household food security as shown in the theoretical framework (Figure 2). Scoones' theory shows how provision of extension needs of households may influence utilization of riverine wetlands hence household food security.

Type of wetland utilization studied included crop farming, grazing, brick making, growing woodlots and leasing. The dependent variables were agricultural extension needs which were measured at the level of knowledge, frequency of use and opportunities to use. Level of household food security was measured by looking at the perception and state of food security for the previous 12 months using the United States Household Standard Food Security Survey Module (Appendix B part 4). The levels of food security used were; food secure, moderately food secure and food insecure households. The intervening variables formulated for the research are access to education and occupation and these variables were controlled by statistically isolating and studying them. The study determined the effect of other sources of income on household food security and extent of wetland utilization. It determined how access to education influenced wetland use and identification of agricultural extension needs for individual households.

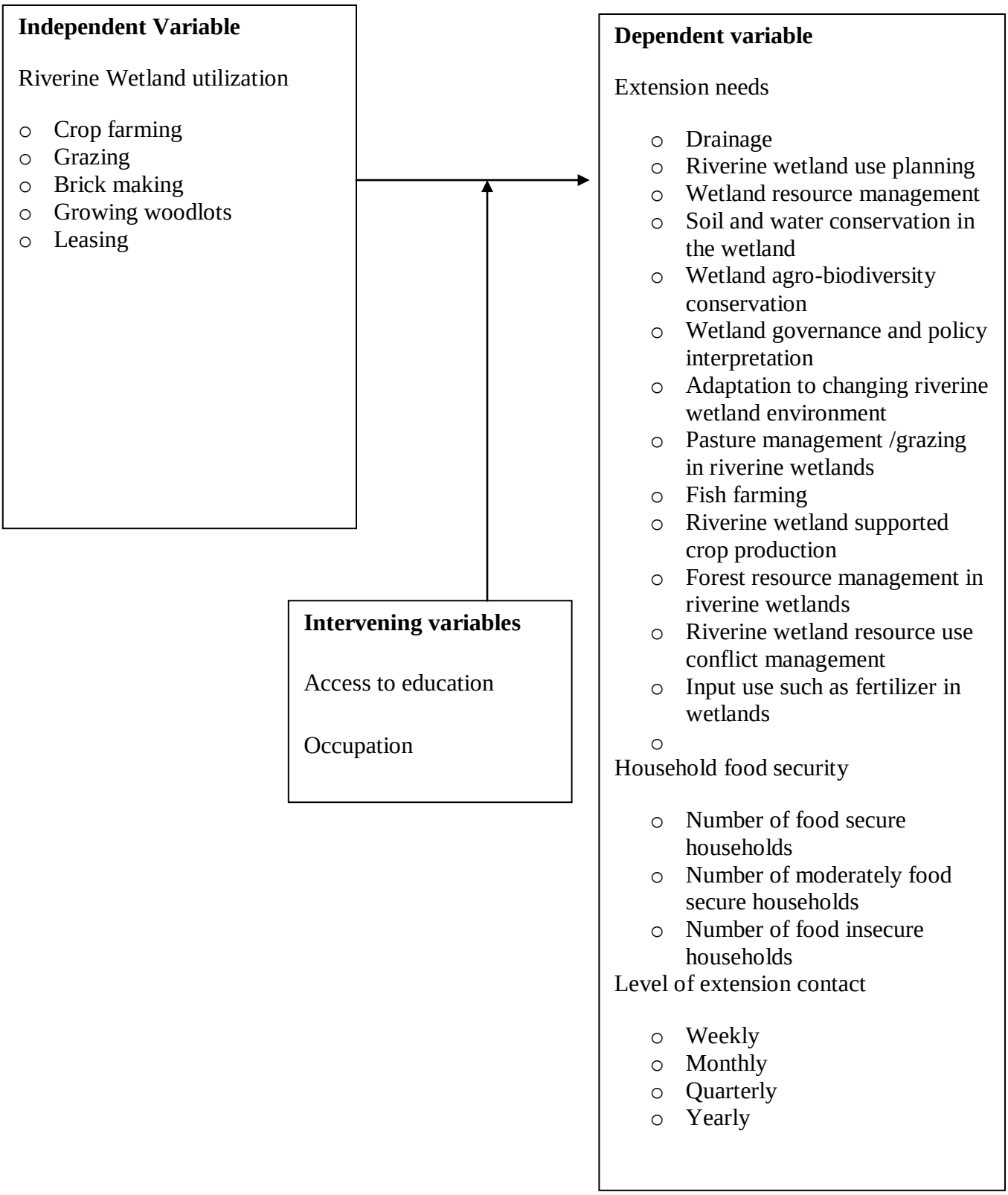

Figure 3: A conceptual framework showing the contribution of riverine wetlands utilization to household food security

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter provides a description of how the research was conducted. The chapter covers the research design, location of study and population of the study, sampling procedures, instrumentation, data collection procedures and processes of analysis.

3.1 Research Design

A cross-sectional survey design was adopted because the researcher intended to collect data at one point in time unlike longitudinal survey that collects data over a period of time. Data was collected from a sample of Household Heads that represented households that were utilizing Riverine Wetlands. The design was chosen because it is economical, data collection is rapid and it uses a part of a population to understand the rest of the population (Oso & Onen, 2005). The downside of this design is that respondents tend to give socially desirable responses that make them look good to the researcher, inability to make inferences at the level of cause-effect as in experimental and quasi-experimental designs (Hagan, 2000) and responses are opinions that are bound to change due to circumstances and events (McCarthy, 1999). These limitations were overcome by randomly selecting a sample size of 120 instead of 100 as recommended by Kathuri and Pals (1993).

3.2 Location of Study

The study was carried out in Nyamira Division of Nyamira District. Nyamira Division is divided into five administrative units namely Bosamaro Chache, Bosamaro Masaba, Bogichora, Bonyamatuta Chache and Bonyamatuta Masaba. It borders Nyamaiya to the North, Nyamira North District to the East, Manga District to the West and Masaba to the South. The division covers an area of 113 Square Kilometres (Nyamira District Development Plan, 2009). The Division has a topography which is characterised by a series of long and elongated ridges with rounded crests with an altitude range of 1800 - 2200 m above sea level. The Division receives an

average annual rainfall of 2000mm, evenly distributed in two seasons with long rains (March-June) and short rains (September-November). Average normal temperature of 20^{o}C favourable for both agricultural and livestock production. The ridges have slope range of 2-50% on average. In between these ridges are narrow and elongated valley bottoms with width varying between 300-1000 m (MoA, 2005) which were the research points. The Division was purposively chosen because it has the highest number of riverine wetlands in the district. Secondly, the Riverine Wetlands have all been converted for both agricultural and non agricultural uses hence ideal for this study. The study was carried out at three of the eight swamps in the Division namely Nyabomite, Sironga and Charachani I.

3.3 Study Population

The target population was 4069 Households Heads in the three Sub-locations namely Ikobe, Bundo and Ibucha. The accessible population consisted of 2200 Household Heads who were utilizing the Riverine Wetlands under study namely Nyabomite, Sironga and Charachani I. These Household Heads were purposively selected by the Ministry of Agriculture and Rural Development because they were actively involved in the utilization of the riverine wetlands. The study population sample was made of 120 household heads from the accessible population.

3.4 Sample size and Sampling Procedure

The sample size for this study was 120 Household Heads. According to Kathuri and Pals (1993) the minimum sample for survey type of research should be 100 for major sub-groups and 20-50 for each minor sub-group. The researcher selected 120 Household Heads whose households were actively utilizing the Riverine Wetlands from a list provided by the Ministry of Agriculture and Rural Development Nyamira Division Agricultural Extension Office. The sample size was manageable in terms of money and time and the extra 20 Household Heads were necessary to mitigate for non-respondents. The sample was selected using proportionate stratified random sampling procedure. This ensured equitable and proportionate representation of the population in the sample and avoided over-representing or under-representing some strata. The proportionate random sampling ensured that no sub-group was omitted from the sample and avoided

overloading in certain sub-population (Borg & Gall, 1996). The selected household heads were distributed as shown in Table 2.

Table 2: Strata sizes and sample sizes from each wetland

Strata	Sample size	Strata size	proportion	percentage
Sironga	60	1100	.50	50
Charachani	40	733	.33	33
Nyabomite	20	367	.17	17
Total	120	2200	1.00	100

In choosing participants for focus group discussions, the researcher used purposive sampling to select equal number of male household heads and female household heads from the strata size of the three wetlands. Three focus group discussions were held at each of the three Riverine Wetlands under study. The researcher selected 14 members for each of the discussions, but Table 3 indicates those who participated and their gender.

Table 3: Focus Group Respondents

Focus group	Number of respondents	Male	female
1	10	6	4
2	12	5	7
3	8	3	5

Data from focus group discussions was then used to support and complement data from the interview schedule. Responses from the focus group discussions were transcribed and summarized in appendix D.

3.5 Instrumentation

A Structured Interview Schedule (Appendix B) was used to collect data on socio-economic characteristics of wetland users, their source of income, household food security, the size of their land and what portion constitutes Riverine Wetland, type of wetland use and the extension needs

of households utilizing Riverine Wetlands. The interview schedule covered characteristics of households heads (sex, type of household headship, age, marital status, household size, educational level); household characteristics (income, expenditure income from wetlands); household food security, sources of food, food reserve months and hunger months, land size/riverine wetland size and its use. It also covered extension needs of households utilizing riverine wetlands, level of contact between extension providers and households utilizing riverine wetlands and areas where the households had received extension services. The interview schedule was administered to household heads by the researcher. This tool was ideal for this study because it was efficient, economical and practical when large samples are used (Fraenkel & Wallen, 2000). Administration and scoring of Structured Interview Schedule was also straightforward and the results lend themselves readily to analysis (Mugenda & Mugenda, 1999). Disadvantages with Structured Interview Schedule is that they have unclear or ambiguous questions that cannot be clarified and the respondent has no chance to expand on, or react verbally to, a question of particular interest or importance (Fraenkel & Wallen, 2000). The researcher overcame this limitation by using standard instructions given to all respondents and using information from focus group discussions to support the data from interview schedule.

3.5.1 Validity

The content validity and face validity of the instrument was established by experts on statistics in the Department of Agricultural Education and Extension of Egerton University, colleagues and supervisors. They looked at the content of the instrument to determine whether it had adequate representation of what is was supposed to represent. Face validity involved subjective assessment of the items of the interview schedule to determine whether they cover the content the tool would measure. Comments from the experts, my supervisors and colleagues were used to improve the tool so that it would yield valid data that could be used to make inferences.

3.5.2 Reliability

Nyabioto riverine wetland (Manga Distrtict) was used for the pilo-testing of the instrument because it had similarities with the riverine wetlands under study and was far enough (15 kms) to avoid contamination of the respondents studied. Using a guide by Kathuri & Pals (1993) a small

group of 30 household heads who had similar characteristics to those in the study location was used. Piloting of the instrument was important because it helped the researcher refine it and make it more ideal. Reliability of the instrument was estimated by obtaining the Cronbach's reliability coefficient from the pilot test data. The reliability co-efficient of 0.81 was obtained. The researcher preferred Cronbach's reliability coefficient because it is a measure for internal consistency. A reliability coefficient of 0.7 and above would be acceptable as indicated by Kathuri and Pals (1993). The high coefficient implies that there is consistency among the items in measuring the concept of interest (Mugenda & Mugenda, 1999). Reliability of less than 0.7 would have called for revision of the instrument but the instrument had a reliability coefficient of 0.81 which was within the acceptability range.

3.6 Data Collection Procedures

After getting approval from Graduate School of Egerton University for carrying out the study, the researcher obtained a permit from the National Council for Science and Technology to collect data. He then proceeded to the field where he informed the local Provincial Administration, the Ministry of Education of his intention to collect data for research purpose. The Ministry of Agriculture and Rural development was also informed and provided a list of households that were utilizing riverine wetlands in Nyamira division. Using interview schedules the researcher asked the respondents questions and filled in the answers. The researcher held three focus group discussions to gather data to support information from the interview schedules. He used the focus group discussion guide (appendix C) to gather information from the household heads who turned up for the discussions.

3.7 Data Analysis

Data from the interview schedule was checked for any possible errors, summarized and coded. It was then entered into the Statistical Package for Social Sciences (SPSS) computer software for quantitative data analysis. Data analysis was based on the objectives and hypotheses of the study and used both descriptive and inferential statistics. Means, percentages and frequencies were used to analyze all the variables to meet objectives of the study Descriptive statistics was used to summarize the data pertaining to the personal characteristics of the household heads. Inferential

statistics was used to test the hypotheses. Hypothesis one was tested using Analysis of Variance (ANOVA), hypothesis two was tested using Pearson's Product moment correlation and hypothesis three Chi-square was used. Data interpretation was based on correlation coefficient value of 'F' for Ho_1 and 'P' value for Ho_2 and 'P' value for Ho_3. Throughout the study, a 0.05 probability level was used as the basis for rejecting the null hypotheses because the sample size was adopted from figures calculated on the basis of $\alpha = 0.05$ level of significance. Data from the focus group discussions was transcribed and summarized in table form as indicated in appendix D.

Table 4: Summary of Analytical procedures for the study

Objective	**Hypothesis**	**Independent variable**	**Dependent variable**	**Statistic**
To establish the extension needs of households with different wetland utilization types in Nyamira Division	There is no statistically significant difference on the agricultural extension needs of households with different wetland utilization types in Nyamira division.	Riverine wetland utilization type	Extension needs	ANOVA test
To determine the influence of agricultural extension services on utilization of riverine wetlands in Nyamira Division	There is no statistically significant influence of agricultural extension services on utilization of riverine wetlands in Nyamira Division.	Riverine wetland use	Agricultural extension services	Mean Frequency Percentage Chi-square
To determine the contribution of riverine wetlands to household food security	There is no statistically significant contribution of riverine wetlands to household food security in Nyamira Division.	Riverine wetland use	Household food security	Pearson's product moment correlation.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This section discusses the results of the study based on the objectives and hypotheses. The study aimed at establishing the extension needs of households utilizing wetlands and the contribution of the riverine wetlands towards household food security in Nyamira Division. The study used both descriptive and inferential statistics. In descriptive statistics, means, percentages and frequencies were used while inferential statistics were used to test the hypotheses. ANOVA was used to test for significant differences in the extension needs of households with different riverine wetland utilization types, Chi-square was used to test for significant influence of agricultural extension services on utilization of Riverine Wetlands and Pearson's correlation coefficient was used to test for significant contribution of riverine wetlands towards household food security. This chapter has been arranged to present results based on sub-headings describing household characteristics, sources of income and their uses, household expenditure, household food security, hypotheses testing to establish the extension needs of households with different riverine wetland utilization types and determine the contribution of riverine wetlands to household food security.

The following objectives were used to guide the study:

i. To establish the agricultural extension needs of households with different riverine wetland utilization types in Nyamira Division.
ii. To determine the influence of agricultural extension service on the utilization of riverine wetlands in Nyamira Division.
iii. To determine the contribution of riverine wetlands to household food security in Nyamira Division.

4.1 Profiles of the Respondents

This study targeted 120 respondents from three sub-locations who were utilizing the Riverine Wetlands as illustrated in Table 5. During the actual research, 100 respondents were successfully interviewed making a response rate of 83 percent with 20 non respondents.

Table 5: Household head respondents per sub-location

Sub-location	Frequency	Percent
Bundo	36	36.0
Ibucha	30	30.0
Ikobe	34	34.0
Total	100	100.0

Table 5 gives a summary of the number and percentage of household heads who were interviewed based on the sub-location they hailed from.

4.2 Household heads per riverine wetland

There are three riverine wetlands within the three sub-locations, the largest being Sironga followed by Charachani while Nyabomite is the smallest. These wetlands were used in sampling to get the respondents for the study.

Table 6: Household heads per riverine wetland

Wetlands	Frequency	Percent
Charachani	37	37.0
Nyabomite	14	14.0
Sironga	49	49.0
Total	100	100.0

Sironga contributed 49 household heads, Charachani contributed 37 household heads and Nyabomite contributed 14 household heads as shown in Table 6. Households from Bundo and Ikobe sub-locations utilize Charachani riverine wetland while Nyabomite is utilized exclusively

by households from Bundo sub-location. Sironga wetland is utilized by households from the three sub-locations with small portions being taken by Lake Basin Development Authority, Kenya Prisons Service, churches and schools.

4.3 Household Characteristics

Household characteristics were important for this study because studies have shown that they influence resource utilization and in this case type and extent of wetland use (Eicher, & Staatz, 1998). Morardet et al (2008) suggests that the design and implementation of relevant policies that are targeted to groups that are dependent on resources and manage these resources should take into account the socio-economic characteristics of households within the community. The socio-economic characteristics of households shape the livelihood strategies that the households engage in. The household characteristics investigated were gender, marital status, household headship age, household size, level of education and occupation.

4.3.1 Gender of the respondents

Table 7: Gender of household heads

Sex	Frequency	Percentage
Male	66	66.0
Female	34	34.0
Total	100	100.0

Results show in Table 7 that 66 percent of the household head respondents were males and 34 percent were females. The high number of male respondents can be attributed to the culture of the community where men are considered heads of families and hence given priority when filling out questionnaires. Men and women engage in different activities at household level as defined by the African historical cultural domain. Household head gender was conjectured to influence type of activities likely to be engaged by female or male headed families in as far as wetland cultivation was concerned. Earlier studies showed that wetland cultivation was apparently a gendered activity in some areas. Chinsinga (2007) noted that wherever wetland cultivation competes for time and attention with seemingly lucrative alternatives, it becomes predominantly a feminine activity.

Households headed by females were therefore expected to participate in wetland cultivation more than male headed households, for males would rather focus on field crops.

4.3.2 Marital Status

Table 8: Marital status

Marital Status	Frequency	Percentage
Married	76	76
Single	11	11
Divorced	1	1
Separated	1	1
Widower	4	4
Widowed	7	7
Total	100	100.0

Table 8 outlines the marital status of the respondents with 76 percent of them being married, 11 percent were single, 1 percent each for divorced and separated, 4 percent were widowers and 7 percent of them being widowed. As LeVine (1979) explains, divorce and separation are very rare in the community under study due to cultural expectations. This explains the low number of respondents within this group. Marital status is a factor in who determines the use of land in the household. Because the community is patriarchal, this decision lies with the husband in most cases. Women in this region get married away from their clans and hence those who are single and utilizing riverine wetlands are mostly men. In the area under study, men make decisions on use of resources but it is the women who utilize these resources except in a few cases like brick making where men dominate.

4.3.3 Household Headship

Household headship was important for this study because responses for the interview schedules were given by household heads. Household heads were also important in decision making within the household which affects utilization of fragile ecosystems like wetlands. The decision-making

process in the farm household is influenced by the culture of the community to which the household belongs. In patriarchal societies like the one under study, decisions are taken by the household head, a man.

Table 9: Household Headship

Household headship	Frequency	Percentage
Married living together	71	71
Married partner working out	8	8
Widow /widower	13	13
Single	7	7
Orphan	1	1
Total	100	100.0

Those married and living together accounted for 71 percent of the household heads, 8 percent of the household heads were married but one partner was working elsewhere, 13 percent were widows or widowers, 7 percent were single and 1 percent was headed by an orphan. The low number of households headed by orphans is due to the fact that under age orphans are taken up by the extended family members until they are of age to fend for themselves. This is shown in Table 9. The decision to utilize riverine wetlands and how to utilize it depends on the husband for those married and living together. In most cases those left behind to look after the farm are women as men move out to towns in search of work and most day to day decisions on land use including riverine wetland use depends on the woman. Adoption of technologies that promote sustainable use of riverine wetlands depends on who makes decisions. In a study done in Malawi Kapanda *et al.* (2005) evaluated factors affecting adoption of fish farming in wetlands in Malawi and noted that, household head gender had a negative influence, on adoption rate by respondents. This disagrees with this study in the sense that it is men who make decisions about the use of riverine wetlands, therefore household head gender will have a positive influence on adoption of technologies that promote wise use of the riverine wetlands.

4.3.4 Age

Age connotes experience and perhaps an accumulation of wealth (Nyang, 1999) and thus older people do things in moderation. In the application of indigenous knowledge in conservation of fragile ecosystems, age was critical because it was the old people who controlled the exploitation of such areas.

Table 10: Age

Age	Frequency
Mean age	47
Modal age	45
Median	46
Total	100

As Table 10 shows the mean age of the household heads was 47 years, the median age was 46 years and the most frequent year was 45 years. This indicated that majority of household head respondents were middle aged. The household heads were in charge of allocating their children who were of age various portions of the wetland to utilize. Age as measured by the actual number of years of the household head plays a vital role in terms of land ownership cum wetland utilization in rural areas, where older household heads are expected to have better access to land than younger heads because younger men either have to wait for a land distribution or have to share land with their families (Kapanda et al., 2005).

4.3.5 Household Size

The mean household size was 6 members. Household size was measured by the number of family and non family members in the household. Household size would be expected to determine the labour force available to cultivate in the uplands and wetlands. Zidana *et al.* (2007) revealed that a positive relation between wetland cultivation and household size was possibly caused by lack of access to land leading households with large family sizes to invade wetlands in search of land for cultivation.

4.3.6 Educational Level

Education is a crucial variable as one becomes aware of the importance and even benefits of wetlands. Education, which is a proxy for information flow, may overcome many characteristics of farmers and papyrus harvesters that act as obstacles to sustainable utilization of wetlands such as unreceptiveness to new ideas, fear of change and lack of incentives (Mwakubo, 2004). Other studies have also found a positive association between education and adoption of conservation technology (Ervin and Ervin, 1982). Siribuit et al. (2008), based on a study of socio-economic conditions affecting small farmers` management of wetlands in Thailand noted that, education of household head, amount of livestock and income from wetland products had a positive influence to households` participation in wetland resource management activities.

Table 11: Educational level

Educational Level	Frequency	Percentage
Never went to school	6	6
Primary level	24	24
Secondary level	61	61
College level	5	5
Diploma	4	4
Total	100	100.0

Results in Table 11 indicate that 85 percent of the household heads had basic education and 9 percent had college education with 6 percent having never gone to school. This indicated high level of literacy of about 94 percent. Education in that respect helps people to appreciate more values of wetlands. In essence, as noted by Muchapondwa (2003), education would make it easier for households to comprehend negative externalities and passive user values of natural resources. Ideally, decisions pertaining to wetland utilization are expected to be influenced by education level of households. The legal conflict behind wetland cultivation presents another scenario where the risk averseness common to educated people would influence educated households heads to distances themselves from wetland cultivation. Similar effects were also earlier on observed by Zidana et al. (2007) reporting a negative relationship between river bank

cultivation and education as mainly caused by less access to non farm incomes by uneducated households, hence resorting to river bank cultivation. In this study, the level of of education was expected to promote wise use concept as users of riverine wetlands become more aware of the dangers of over-exploitation.

4.3.7 Occupation of Household Head

Occupation of the household head was important in this study because studies show that it can influence the kind of activity carried out on the wetlands (Dixon, 2002). The study was carried out in a rural setting explaining the high percentage of peasant farmers (74 percent) and the low percentage of civil servants/teachers (5 percent) in the area. Occupation can influence the type of wetland utilization because those with other sources of income will reduce the intensiveness of wetland use. In a study done in Zimbabwe, Zidana et al. (2007) concluded that main occupation was an important parameter in influencing farmers to engage in river bank cultivation.

Table 12: Occupation

Occupation	Frequency	Percentage
Peasant farmer	74	74
Civil servant/teacher	5	5
Small scale business	8	8
Domestic work	13	13
Total	100	100.0

4.4 Extension Services and Wetland Utilization

Provision of extension services to households utilizing riverine wetlands was examined in this study to know the level of contact between extension providers and households utilizing the riverine wetlands. Studies have shown that where extension services are lacking, degradation of natural resources is common (Kachali, 2007).

Table 13: Access to Extension services

	Frequency	Percent
Yes	22	22.0
No	78	78.0
Total	100	100.0

Results in Table 13 indicate a substantial number of households (78 percent) had not received any extension services on wetland utilization while 22 percent had received extension service. Results from the focus group discussions (Table 14) indicate that majority of the respondents had received minimal extension services on wetland use from the government or any other provider. In studies done in Zimbabwe on sustainable utilization of wetlands, majority of farmers who had access to agricultural extension services were aware of the natural value of natural resources and were supportive of their wise use (Svotwa, Manyanhaire and Makombe, 2007). In this study few had access to extension services and hence the need to identify the extension needs of those utilizing riverine wetlands so that they can be aware of the natural value of the riverine wetlands.

Table 14: Access to Extension Services – FGD responses

	Focus group 1	Focus group 2	Focus group 3
Yes	1	0	1
No	9	12	7

4.4.1 Activity Specific Extension Services on Riverine Wetlands

To determine whether some activities were receiving better access to extension than others, household heads were asked to indicate in which activity they had access to extension.

Table 15: Activity Specific Extension Services on Wetlands

	Crop production	Livestock production	Drainage	Fish farming	Soil and water management	Wetland management
Yes	12	6	0	3	1	4
No	88	94	100	97	99	96
Total	100	100	100	100	100	100

Results in Table 15 revealed that a very high percentage of household heads had not received any extension services on various activities on the wetland. In crop production only 12 percent had received extension services, 6 percent of the households had received agricultural extension services in livestock production. This can be attributed to provision of extension services on uplands and this was extending to riverine wetlands. In wetland specific activities like drainage, none of the household head had received any extension service. In fish farming it was only 3 percent of the household heads who had received extension services. A paltry 1 percent had received extension services in soil and water management and 4 percent had received extension services on wetland management. Results from the focus group discussions (Appendix D) there were only two respondents who had received extension services on fish farming amongst the thirty focus group respondents. This confirms that the policy of government is to protect and conserve wetlands without utilizing them and yet there is extensive utilization of the riverine wetlands. In a research done in Uganda on the level of contact between extension workers and fish farmers of Arua wetlands, the findings revealed that there was little technical support and monitoring from extension workers. The extension agents rarely visited the farmers, so information dissemination was poor, and the farmers had little or no opportunity to be trained by government workers (Rutaisire et al 2010).

In Zimbabwe, the government has as top priority stimulation of the adoption of appropriate agriculture conservation and management practices among farmers. The small-scale communal farmers have been particular target. Such government attention on farmers cultivates in them confidence, will and zeal in sustainable production which boosts their yields and financial returns. In the process, the farmers develop the capacity to recognize factors, which determine the nature and quality of the human environment. (Svotwa, Manyanhaire and Makombe, 2007).

Policies that not only conflict but promote preservation of wetlands where they are already being converted and utilized exposes the same wetlands to degradation and over utilization. In Zimbabwe Farmers were satisfied with the support they received from the Agricultural Research and Extension (AREX) and Natural Resources Departments (the Environmental Management Agency) on the utilization of wetlands (Svotwa, Manyanhaire and Makombe, 2007). The NALEP Programme in Kenya in its own impact assessment report indicates that most of its staff were not trained in Environmental Impact Assessment and were relying on their own training to advice farmers (Mars Group Kenya, 2006). If stakeholders in wetland management can train their personnel on the extension needs of wetland users, they can work together in assisting households utilize fragile ecosystems like riverine wetlands sustainably.

4.4.2 Level of contact of household heads with extension officers

The level of contact of households utilizing riverine wetlands with extension officers was important in this study because low levels of contact result in unsustainable use of natural resources like wetlands (Munyasi, et al 2010). Household heads who were respondents in the study were asked to state their level of contact with extension officers.

Table 16: Level of contact with extension officers

Level of contact	Frequency	Percent
never	57	57.0
weekly	6	6.0
fortnightly	3	3.0
monthly	8	8.0
after several months	15	15.0
yearly	11	11.0
Total	100	100.0

Results in Table 16 show that on average 57 percent of the households had never come into contact with extension officers. This left a big gap in terms of reaching the households with the

necessary extension messages. Households that had contact with extension officers on a weekly basis were 6 percent, those who had contact on a fortnightly basis were 3 percent, those who had contact after several months were 15 percent and 11 percent had contact on a yearly basis. These findings are in agreement with a study by the World Bank that indicates that the data on farmer-extension contact suggest little improvement in staff productivity or systemic efficiency. Despite the low level of contact, farmers who receive extension messages rate them as useful and applicable (World Bank, 1999). Owen, et al. (1995) observed that agricultural research and extension services, credit, and marketing institutions have not been designed to support wetland farming. This would explain the low levels of contact between riverine wetland users and extension providers.

Results from focus group discussions (Appendix D), brought out the reasons for lack of extension services for wetland users and low levels of contact between wetland users and extension providers. All the participants in the focus group discussions were in agreement that no household had received extension services on many wetland uses. A few of them had received extension services on other enterprises like animal production, crop production on the uplands but none had received any information regarding use of wetlands save for two respondents who had received extension services on fish farming. According to the focus group discussions, household heads whose contact with extension providers was weekly and fortnightly were within the focal area that was being covered by the NALEP programme at the time this study was being done.

4.4.3 Extension Needs

Bauer and Cohen (1996) observe that since wetlands are a relatively new issue, few Extension staff and even fewer landowners and land managers are knowledgeable about wetlands and wetland management. This is the reason extension information on sustainable riverine wetland utilization is lacking or shallow. This study wanted to identify the extension needs of households utilizing riverine wetlands and develop an extension needs scale. The scale will indicate possible priority areas in the provision of agricultural extension services to riverine wetland users. The study first identified a list of possible areas that riverine wetland users will need Agricultural

Extension support (Table 17) then sought responses from the household heads on their level of knowledge, frequency of use and opportunities to use extension services in the identified areas. Many household heads had limited level of knowledge, frequency of use and opportunities to use extension services on various wetland management practices. Using the responses from household heads on level of knowledge, frequency of use and opportunities to use extension services in various wetland topics, the research calculated the most occurring (mode) of LOK, FOU and OTU to consolidate the three columns of each level into single columns as shown in Table 17. Using the equation developed by Barrick, Ladwig, and Hedges, (1983) the researcher was able to calculate the score used to rank the extension needs in order of priority to form a scale.

([F - K) X F] + [(F - O) X F])/2
I = Importance Score
K = Knowledge Score
O = Opportunity Score

Three sets of weighted scores were calculated for each topic based upon respondents' ratings on each of the three criteria. The first weighted score was calculated as suggested by Barrick, Ladwig, and Hedges, (1983) by subtracting the knowledge score from the importance score and then multiplying by the importance score. A second weighted score was calculated similarly by subtracting the opportunity score from the importance score and multiplying by the importance score then dividing the total by two. For pasture management/ grazing in riverine wetlands, the index is calculated as follows:

([16-22)×16] + [(16-16) ×16]) /2
=(-6×16) +(0×16)/2
= -96/2
= - 48

Table 17: Extension needs scale

	Extension need	Level of knowledge	Frequency of use	Opportunities to use	Extension needs scale index
1	Pasture management /grazing in Riverine Wetlands	22	16	16	-48
2	Riverine Wetland supported crop production	18	14	16	-42
3	Wetland governance and policy interpretation	12	9	12	-27
4	Wetland resource management	23	21	21	-21
5	Fish farming	8	7	7	-3.5
6	Adaptation to changing Riverine Wetland environment	22	19	16	0
7	Forest resource management in Riverine Wetlands	16	18	20	0
8	Riverine Wetland resource use conflict management	10	11	7	22
9	Drainage	29	27	26	40.5
10	Wetland agro-biodiversity conservation	11	12	6	42
11	Soil and water conservation in the wetland	29	26	19	52

Table 17 indicates that the level of extension services required in pasture management in the riverine wetlands is high compared to soil and water conservation whose extension scale index is highest. This can be attributed to the fact that household heads have never received extension support in ways of improving pastures on the Riverine Wetlands so as to increase milk production. Crop production on the Riverine Wetlands has also been on the decline over the

years due to decreased fertility levels and because of this households have been abandoning crop production for other beneficial activities on the wetlands.

4.5 Household Income

Income of households was an important economic factor because they impacted on type and extent of wetland use and could influence household food security. Improved levels of income meant more access to the right amount and type of food for the household. Sources of income for the household are shown in Table 18.

Table 18: Source of income for the household

Activity	Frequency	Percent
Farming	68	68.0
Formal employment	5	5.0
Brick making	22	22.0
Business	4	4.0
Other	1	1.0
Total	100	100.0

Because the study was done in a rural set up results show that the main source of income for households was farming which accounted for 68 percent, brick making which was being done on the riverine wetlands accounted for 22 percent of the income, 5 percent got their income from formal employment. 4 percent from business and 1 percent got their income from other sources. Results from the focus group discussions (appendix D) agreed with these results because all the focus group members identified farming as the main source of income for the households. They identified mixed farming as the main type of farming carried out by many households.

4.5.1 Income from Riverine Wetlands

Income from wetlands was necessary in this study because the study focused on the contribution of riverine wetlands to household food security and income from riverine wetlands may have been one of those contributions. This contribution would be in form of money generated from

activities on the wetlands and how that income was utilized in the household. Income in the community was considered private. No household head was willing to divulge the exact amount of money they generated from the wetlands hence the distribution as shown in Table 19.

Table 19: Income from wetlands per month

Amount of income	Frequency	Percent
500-5000	7	7.0
5000-20,000	33	33.0
20,000-50,000	38	49.0
Over 50,000	11	11.0
Nil	11	11.0
Total	100	100.0

Results show that 7 percent of the households got between 500 and 5,000 shillings income from wetlands, 33 percent got between 5000 and 20,000 shillings from wetlands, and 38 percent got between 20,000 and 50,000 shillings income from wetlands while 11 percent got over 50,000 shillings income from the wetlands. Those who did not get any income from wetlands were 11 percent. In total, 89 percent of the households derived some income from the wetlands which indicated that many households were dependant on the wetlands for some income. This indicates that households were becoming more and more dependent on riverine wetlands to support the household economy.

Table 20: Money generated by wetlands per month- Focus group Responses

	Focus group 1	Focus group 2	Focus group 3
0-15,000	7	4	5
15,001-30,000	1	3	0
30,001- 50,000	1	4	2
50,000	1	0	1

Results from the focus group discussions as shown in Table 20 did put average figures on the money generated from wetlands per month. The figures ranged from two thousand shillings to

one hundred and fifty thousand shillings with the majority respondents giving figures between ten thousand shillings and fifty thousand shillings per month. Those above fifty thousand shillings were only two. As the focus groups argued, these figures were averages because there are certain months of the year when little is generated from the riverine wetlands. These results agree with Research done in Ethiopia by Wood and Hailu (2002) where they conclude that Wetlands also contribute indirectly to food security by providing products which people can collect and sell to provide them with cash for purchasing food.

4.6 Household Expenditure

Expenditure was necessary in this study because it would indicate how income from wetlands was spent and if households were spending more money to purchase the main food items it was an indication that households were not producing enough to meet their food needs.

Table 21: Household Expenditure

Expenditure	Frequency	Percent
Food	54	54.0
Education	39	39.0
Health	3	3.0
Clothing	1	1.0
Shelter	2	2.0
Other	1	1.0
Total	100	100.0

Household expenditure is shown in Table 21. Results show that food was the main household expenditure and accounted for 54 percent. This could mean that households were not producing enough food from their uplands and wetlands. Households spend a substantial amount of their income in educating their children and that is why education accounts for 39 percent of household expenditure.

4.7 Type and Extent of Riverine Wetland Use

4.7.1 Land size

Land size is an important factor in this study because it explains the reasons households were moving into the riverine wetlands to utilize them. The main reason that pushed households to the riverine wetland was reducing upland sizes coupled with increasing population. Svotwa et al (2006) identifies the pressure factors leading to exploitation of the wetland resources and these include: need to increase income levels, decreasing soil fertility in the upland soils, recurrent drought episodes and increasing land scarcity among the rural communities. For this study land fragmentation and subdivision had drastically reduced land size holdings for households. As Table 22 shows 65 percent of households had less than one acre of land with 33 percent having land that is less than five acres but more than 1 acre.

Table 22: Size of land

Size of land	Frequency	Percent
Less than one acre	65	65.0
More than one acre but less than five acres	33	33.0
More than five acres	2	2.0
Total	100	100.0

The small land portion sizes are indicative of the high rate of land fragmentation that is associated with the general increase in the size of the population and the number of families that need to survive on the wetland. The increase in population density within the perimeter of the wetland can also be attributed to the land degradation expressed as pronounced soil erosion and decrease in soil productivity (Svotwa, 2006). In Sub-Saharan Africa, claims Waugh (2000), due to rapid population expansion, small plots are further divided. This provides a threat to sustainable utilization of the wetland and is at risk of degenerating into 'the tragedy of the commons' as postulated by Hardin in 1968. The land size becomes too small for mechanization and output is limited.

4.7.2 Wetland size

Wetland size was important for this study because it reveals the contribution of the wetland to household food security. If a household has a wetland that is large, then it has the ability to carry out many activities which will generate enough money to keep the household food secure. Those with small wetlands will be forced to carry out limited activities or single activities which would not generate much money hence food insecure.

Table23: Size of the wetland

Wetland size	Frequency	Percent
0-1 acre	53	53.0
1-5 acres	31	31.0
More than 5 acres	16	16.0
Total	100	100.0

Wetland sub division is limited and that explains why 16 percent of the household heads have more than 5 acres of wetland. Those who had between 1 and 5 acres were 31 percent and those who had less than 1 acre were 53 percent (Table 23). The other reason that explains the size of the riverine wetlands is that it varies in width. In some areas the valley bottom is very wide making the riverine wetland big and in other places the valley bottom is less than 20 meters wide.

4.8 Economic activity on the wetland

Economic activities on the wetlands were important in this study because they generated income that was used to purchase food to keep the household food secure. The activities also show the type and extent of wetland utilization. Initially when households started utilizing the wetlands, they were exclusively used for crop production. Over time productivity declined due to over-drainage and over exploitation which reduced fertility. Households started finding alternative uses for the wetlands. Most households carry out more than one economic activity on the riverine wetlands and Table 24 shows some of the most commonly occurring combinations of these economic activities.

Table 24: Economic activities on the wetland

Economic activity	Frequency	Percent
Farming, grazing, woodlots, brick making	22	22.0
Grazing and brick making	21	21.0
Brick making and woodlots	31	31.0
Fish farming, brick making and woodlots	6	6.0
Woodlot growing	15	15.0
Leasing	3	3.0
Others	2	2.0
Total	100	100.0

The results show that 22 percent of the households use the wetlands for crop production, grazing, woodlot growing and brick making. Grazing and brick making took 21 percent while 31 percent of the households use it for brick making and woodlot growing. The combination of fish farming, brick making and growing of woodlots were being done by 6 percent of households and 15% grow woodlots composed mainly of eucalyptus species. Other minor economic activities on the riverine wetlands include leasing at 3 percent and 2 percent for straw growing. These results agree with findings of Masese (1997) carried out at Sironga and Kianginda Wetlands where her study established that although wetlands provided ecological services and functions including habitat for different biota, 69 percent of the local people at Sironga and 79 percent at Kianginda perceived them mainly as frontiers for economic gains. The study further established that an average of 74 percent of the respondents perceived wetlands as an economic resource and as a source of income generation particularly through brick making industry.

This is in agreement with research done in Ethiopia that concludes that a number of developments have increased the demand for wetland cultivation. These include crop land shortage due to crop expansion, land tenure changes and food security policies which require local self-sufficiency (Dixon and Wood 2001). In another study done in Tanzania, Wetland based socio-economic activities included agricultural production (farming) practiced by over 98% of the population followed by livestock grazing and fishing. Wetland based socio-economic activities carried out in valley bottoms commonly known by local people as *vinyungu* contribute

about 15% of household food and 55 - 95% of household income annually, equivalent to Tshs 3,234,721 (US$ 2,588). In this respect valleybottom wetlands contribute significantly to household economy and food security (Munishi et al. 2010)

Focus group discussions identified brick making, grazing, growing of woodlots and growing of crops as the main activities households were engaged in on the riverine wetlands. The discussions also indicated that majority of respondents were putting the wetlands into more than one use. This, according to the focus discussions was to spread the risks and ensure there was availability of money throughout the year.

The wetlands were suitable for brick making because of the suitable soil that produced good and stable bricks. Those who were unable to make bricks had leased sections of their wetlands to other people who had the ability to produce bricks. Those employed had also leased land from those willing to lease their wetlands and employed some youths to make bricks for them for sale to supplement their income. The brick making exercise was gaining prominence on the wetlands and many more people were joining because demand for bricks was increasing. Food crop production within the wetlands had drastically declined over the years due to what the focus group discussions attributed to lack of sufficient agricultural extension information, declining fertility, bad soil, over drainage and the *Eucalyptus saligna* tree. Many households according to the discussions were moving away from food crop production on the riverine wetlands to other uses like brick making, grazing and growing of trees. The focus group discussions (Appendix D) identified tea as the cash crop that was being grown on the wetlands. It started as a trial for a few farmers who wanted to extend their tea plantations beyond the uplands because majority of households had tea farms bordering the riverine wetlands When the tea established and started doing well, others joined in and the trend continued. Tea production on the wetlands has many lingering queries which can be answered by extension services. Some of these questions include quality, suitability of the soil and its impact on the riverine wetland.

Due to the declining fertility, many of the households had created grazing fields on the wetlands where the animals were left free to graze for those with well fenced paddocks or tethered for those without fences. The focus group respondents agreed that the pastures found on the

wetlands were not very good for milk production. Many households had converted their upland grazing fields into farms for crop production due to declining land sizes hence the only available land for grazing was the wetland. The focus group discussions identified the Blue Gum (*Eucalyptus salgina*) as the most grown tree on the riverine wetland. They attributed this to its fast maturing characteristic and ready market. Some farmers had converted all their wetland areas into woodlots of the blue gum tree so as to rip the benefits of the tree. Nyamira Division has two tea processing factories and two that lie just outside the division which provide ready market for the Eucalyptus tree which they use as firewood in their kilns for tea processing. The trees are also used in kilning the bricks hence the interdependence between brick making and Eucalyptus growing. Apart from the uses identified above the tree was also important in building houses and was the main source of fuel for all households. The impact of most of these uses that households were subjecting their wetlands to on the same wetlands is unknown. Provision of extension services to wetland users can reveal economic activities that are sustainable and those that are unsustainable. This will eliminate activities that degrade the riverine wetlands and encourage uses that benefit locals without degrading the wetlands.

4.9 Wetland Utilization and Household Food Security

4.9.1 Household Food Security

Household food security was included in this study to establish whether riverine wetland utilization was contributing to household food security. If households utilizing riverine wetlands were food secure through wetland utilization, then it would be important to consider their extension needs to avoid wetland degradation. Using the United States Household Standard Food Security Survey Module (Bickel et al., 2000) which has eighteen questions, the status of household food security was summarized by looking at the perception and state of household food security for the previous 12 months.

A household was classified into one of the food security status-level categories on the basis of its score on the food security scale (Table 25), while the household's scale score was determined by its overall pattern of response to the set of indicator questions (Table 26). Households with very low scale scores were those that reported no, or very limited, food-insecurity or hunger

experiences. These households were classified as food secure. At the other extreme, households with very high scale scores were those that had reported a large number of the conditions and are classified as food insecure. Both the scale value and the status-level classification of each survey household depend on (1) the number of affirmative answers the respondent has given and (2) whether the household has children i.e., members less than 18 years old. For example, if a household with children gives six out of eighteen affirmative answers, that household is assigned a scale value of 3.9 and classified as food insecure (Bickel et al., 2000). For this study all households had children and hence were subjected to the eighteen question module.

Table 25: Food security scale values and status levels corresponding to number of affirmative responses

Number of Affirmative responses (Out of 18 questions) Households with Children	Food security scale values	Food security status level	
		Code	Category
0 1 2	0.0 1.0 1.2 1.8 2.2	0	Food secure
3 4 5 6 7	2.4 3.0 3.0 3.4 3.7 3.9 4.3 4.4	1	Moderately food secure
8 9 10 11 12 13 14 15 16 17 18	4.7 5.0 5.1 5.5 5.7 5.9 6.3 6.4 6.6 7.0 7.2 7.4 7.9 8.0 8.7 9.3	2	Food insecure

Table 26: Summary of Household food security

Perception and state of food security	Almost every month	Some months but not every month	Never or 1 or 2 months
Anxiety or perception that HH food budget or food supply was inadequate	48%	35%	16%
Perceptions that the food eaten by adults or children was inadequate in quality	53%	38%	9%
Reported instances of reduced food intake for adults	25%	50%	24%
Reported instances of reduced food intake in children	27%	48%	25%
Average %	38%	42%	19%
Status	**Food insecure**	**Moderately food secure**	**Food secure**

Results indicate in Table 26 that 19 percent of households were food secure. These households never experienced anxiety about food inadequacy, doubts about quality, reduced food intake in both children and adults. If they experienced any of these, then it was only for one or two months. Those who were moderately food secure (42%) had a perception that food was inadequate in quantity and quality and there were reduced food intake in both adults and children in some months of the year. The households in this category experienced food insecurity during hunger months. These are months when crops harvested have been exhausted and those in the field are not ready for consumption. The foods insecure (38%) were anxious about food inadequacy in quality and quantity and had reported reduced food intake in adults and children in almost every month. The food insecurity in this group may be attributed to unviable land sizes, large household sizes and limited sources of income. Although the uplands were under pressure due to increased population, they were productive enough to guarantee household food security for some households that had few members. Income from wetlands and cash crops like tea was used to purchase food ensuring food sufficiency. This may explain the food secure households.

All the respondents from the focus group discussions indicated that riverine wetlands contributed to household food security. They identified money generated from the wetlands by selling bricks and timber as being used to purchase food during difficult months to keep households food secure. As Morardet and Tchamba (2004) observe, wetlands also take an essential part in food security, especially during the dry season or in drought years, when dry land farming, which is limited to the rainfall season, cannot adequately cater for the needs of these households.

4.9.2 Coping strategies

The focus group respondents identified coping strategies employed by household heads to address difficulties in obtaining food as identified in Table 27.

Table 27: Coping strategies- FGD responses

	Focus group 1	Focus group 2	Focus group 3
Reducing quantity of food	8	12	0
Reducing number of meals	0	9	8
Switching to indigenous foods	0	0	5
Borrowing	4	0	0

The immediate strategy employed by households was reducing the amount of food consumed by reducing the quantity and number of meals in a day. Borrowing food from neighbours and relatives was another common strategy used by households to cope with food insecurity. The first people to be approached are close relatives who had surplus food before distant relatives were approached. Neighbours were the last to be approached if there was no immediate relationship.

Another coping strategy employed by households was switching to easily available foods that grow naturally in the environment. These foods were not usually consumed in the household when food was available but came in handy when food reserves dwindled. These included traditional vegetables and tubers.

4.9.3 Addressing Food Security Challenges

The food security challenges that were to be tackled were food availability, accessibility, affordability and utilization. Food Availability was defined for the focus group discussions as enough quantities of appropriate, necessary types of food from domestic production and purchases that are always available to the individuals or are within their reach.

According to the focus group discussions (Appendix D), to increase availability of basic foods, households needed to use modern ways of food production. Some of the modern ways that the households wanted taught to them is dry land farming. Many a times households experienced severe food insecurity during the dry period. This was despite the fact that water was easily available from wells and springs at the bottom of the valleys. Although water was easily available, no household had tried practicing irrigation during the dry period. This denied the households easy ways of producing food without purchasing. Cost of inputs was identified as another limitation to availability of basic foods. The costs of fertilizers, seeds and agro-chemicals was termed prohibitive and beyond the reach of all those in the focus group discussions. This seriously reduced yields leaving the households with little food hence food insecure. In all the focus groups, half of the participants felt that the government should subsidize the cost of inputs mostly seeds and fertilizer.

All the focus group discussions did identify the over reliance on maize as a hindrance to the production of other crops. Much of the land of most households was covered by maize and tea. Small portions of the farm were left for other crops like vegetables, potatoes, finger millet and fruits. There was unanimity that most households had abandoned traditional foods that were easy to produce in favour of foreign foods that were susceptible to pests and diseases. Their suggestion was to re-embrace production of traditional foods and preserve the seeds for future use so as to increase availability of basic foods. Household size was identified as a big determinant of food availability. Many of those in the focus group discussions had household sizes averaging five children which according to them was a big number. This strained the households in terms of availability of appropriate foods.

In terms of food accessibility, the focus group discussions (Appendix D) suggested commercial farming in favour of subsistence farming as a way of improving households' income. Although majority of the participants were meaningfully engaged in farming, they did not consider it a reliable source of income because much of their farming was for subsistence purposes. Poor post harvest practices like poor storage and lack of preservation of excess food were also identified as a hindrance to food accessibility.

During the rainy season, there was plenty of food which many a times was thrown away or fed to animals and during the dry period, there was complete lack of the same food. In the three focus group discussions (Appendix D), the issue of food preservation was raised as a way of mitigating the effects of food insecurity during the dry period. Drying of excess perishables like vegetables during plenty was the most suggested solution in the discussions. Embracing irrigation was another method that was suggested by most participants in the discussions because water was always available. All the members of the focus group discussions agreed that an efficient marketing system will ensure the excess vegetables find market elsewhere to earn them money which they can save and use to purchase food during times of scarcity. To improve food utilization the focus group discussions identified proper cooking, improved hygiene in food handling and consuming traditional foods instead of maize meal as the basic food as some of the ways of improving utilization. All these challenges could easily be tackled by Extension service providers by determing the extension needs of riverine wetland users and improving the level of contact between extension and those utilizing the riverine wetlands.

4.10 Food reserves

Food reserves were relevant to this study because they indicate food availability and distribution throughout the year. Food security can easily be explained when one looks at food reserves. January to June those with food reserves stand at 23 percent. These months were difficult for the households in terms of food because food harvested between July and November was running low, high demand for money in January by students going to school forced many families to sell their produce to get the necessary funds. Those with food reserves between July and December

were more at 77 percent because the first harvest starts in July and second harvest starts in November. Food reserves distribution throughout the year is shown in Table 28.

Table 28: Food reserves

Months	Frequency	Percent
January to June	23	23.0
July to December	77	77.0
Total	100	100.0

4.11 Hunger Periods

Low food reserves between January and June explained the high percentage of households (84%) that experienced hunger during the same period.

Table 29: Hunger periods

Month	Frequency	Percent
January to June	84	84.0
July to December	16	16.0
Total	100	100.0

Results in Table 29 show that between July and December most of the households had harvested their crops and hence those who experienced hunger were low at 16 percent. This may be attributed to the fact that some households did not obtain food from the farm or land sizes were too small to support meaningful food production. This result agree with a study done in Subukia, Kenya where results showed that the level of food production in households cannot meet food needs of even an area with adequate rainfall patterns. The amount of land holdings seems to play a role in household food adequacy (Ayieko and Midikila, 2010).

Much of the Sub-Saharan African population, particularly in rural areas, experiences some degree of hunger over the rainy, or "hungry" season, when food stocks dwindle and roads become muddy and impassable (Bonnard, 1999). A study by Fortes (cited in Messer 1989)

among the Tallensi reveals grain was short during the planting season and the problem was largely attributed to poor allocation of resources and poor rationing. In somewhat similar way, Sharman's (1970) observation in Uganda indicates that it is not household supply but the care and skill with which mothers rationed or distributed food that determined which household's food security.

4.12 Source of Food for the Household

Sources of food for the household were important for this study because it needed to establish the contribution of the farm and the market to household food security. Shrinking land sizes and high population density made it difficult for households to depend fully on land for food production. This meant that for households to remain food secure, other alternative sources of food had to be identified. The sources identified were the farm, the market, relatives and the community.

Table 30: Source of food for the household

Source of food	Frequency	Percent
Wholly grown/produced from the farm	14	14.0
Partly produced/partly purchased	51	51.0
Wholly purchased	11	11.0
Partly purchased/partly produced	15	15.0
Relatives/Purchased	8	8.0
Relatives/Community	1	1.0
Total	100	100.0

Results in Table 30 show that 14 percent obtained all their food from the farm, 51 percent of the households partly produced their food from the farm and partly purchased. The households that purchased part of their food from the market and partly produced it were 15 percent while 11 percent purchased all their food from the market. Extended family setups play a pivotal role in sharing of food and that is why 8 percent of the households received their food from relatives

and purchased the rest. It was only 1 percent of the households that received their food from relatives and members of the community. This indicates that food for most the households came from various sources. This result agrees with a research done in Nigeria where three sources of food supply to the household were identified and these were purchases from the market, production from uplands as well as wetlands (Umoh, 2008). Deliberations from the focus group discussions as indicated in Table 31 identified three main sources of food for the household and these were the farm produce, the market and borrowing.

Table 31: Sources of food- FGD responses

	Focus group 1	Focus group 2	Focus group 3
Farm produce	10	12	8
Purchase	10	12	8
Borrow	0	0	0

Despite the fact that land sizes were diminishing as time passed, households still produced much of their food from the farms. During the 'hunger' months households resorted to purchasing food. Maize was identified as the food that was commonly purchased but the rest of the food came from the farm. A few households got their food from relatives during the 'hunger months'. The focus group discussions did agree on three main limitations that hindered them from producing food or purchasing food. The first limitation identified was the size of land. Land sizes in the area under study averaged one acre due to inheritance where fathers sub divide the land amongst the sons. This according to the focus group members had severely limited food production from the small land sizes.

Another limitation identified was subsistence farming where production was mainly for consumption. This allocated the bigger junk of land to maize production leaving little for other crops. Majority of those in the focus group discussions did agree that the few farmers who had embraced commercial farming were getting better returns from their land and they were food secure. Over reliance on maize was another limitation identified in the focus group discussions. Many households had abandoned production of indigenous foods in favour of maize. This exposed the households to food insecurity incase of crop failure which was common. Continuous

production of maize in the same area over a long time had resulted in declining yields forcing farmers to invest more in fertilizers. Few households were practicing crop rotation to improve production because either they were unaware of the benefits or were unwilling to embrace it.

When the issue of purchasing food from the market came up for discussion, each member of the focus groups agreed that prices was a big setback. Prices of inputs and food were beyond the reach of many households. During planting many households had to borrow money to purchase fertilizer and seeds because their prices were too high. Those unable to borrow were forced to plant without fertilizers which resulted in low food production.

4.13 Hypothesis Testing

Based on the objectives of the study, the formulated hypotheses were tested in order to establish any significant difference on the agricultural extension needs of households with different wetland utilization types, any significant influence of agricultural extension services on utilization of riverine, and any significant contribution of riverine wetlands to household food security:

4.13.1 Agricultural Extension needs and wetland utilization types

To compare the agricultural extension needs of households with different riverine wetland utilization types, the following hypothesis was formulated:

Ho_1: There is no statistically significant difference on the Agricultural extension needs of households with different wetland utilization types in Nyamira Division.

To test the null hypothesis, the mean scores relating to extension needs were subjected to the ANOVA test in order to find out whether there were significant differences in the extension needs of households with different riverine wetlands utilization types. The results are shown in Table 32. The null hypothesis of significant differences was accepted as all the values are more that the critical alpha value of 0.05 except for extension needs for adaptation to changing riverine wetland environment and input use such as fertilizer in riverine wetlands. Morardet and Tchamba (2004) observe that despite the abundant literature on sustainable use of wetlands, there

are few decision-support tools designed to assist stakeholders in their choices. Different approaches exist to assess the value of natural resources such as wetlands, according to types of use (e.g. consumptive/non consumptive, productive/non productive). The types of uses and the share of wetlands in rural people's welfare vary extensively according to natural settings of wetland sites, socio-economic characteristics of the communities and households. This makes the extension needs of households utilizing riverine wetlands as diverse as the uses of the wetlands.

Inconsistencies and contradictions among policies at different levels (from global to local) fail at integrating the multiple objectives of their multiple users. These policy failures can largely be explained by lack of knowledge and information about the essential functions of wetlands and the benefits and costs supported by their different users (Turner et al., 2000). The situation is even more critical in developing countries, where environmental policies are relatively recent and suffer from the poor means allocated to research. Moreover, the under-representation in the decision-making process of poor people whose livelihoods directly depend upon natural resources such as wetlands, result in a lack of consideration of their interests in the formulation of environmental regulations (Grimble and Wellard, 1997).

Table 32: ANOVA Table Agricultural extension needs of households with different wetland utilization types

Extension need		Sum of Squares	df	Mean Square	F	Sig.
Drainage	Between Groups	3.887	6	.648	.986	.439
	Within Groups	61.113	93	.657		
	Total	65.000	99			
Riverine wetland use planning	Between Groups	2.661	6	.444	.749	.612
	Within Groups	55.099	93	.592		
	Total	57.760	99			
Wetland resource management	Between Groups	2.940	6	.490	.759	.604
	Within Groups	60.060	93	.646		
	Total	63.000	99			
Soil and water conservation	Between Groups	.911	6	.152	.211	.972
	Within Groups	66.879	93	.719		
	Total	67.790	99			
Wetland agro-biodiversity conservation	Between Groups	1.546	6	.258	.529	.785
	Within Groups	45.294	93	.487		
	Total	46.840	99			
Wetland governance and policy interpretaion	Between Groups	3.549	6	.591	1.243	.292
	Within Groups	44.241	93	.476		
	Total	47.790	99			
Adaptation to changing riverine wetland environment	Between Groups	10.954	6	1.826	3.043	.009
	Within Groups	55.796	93	.600		
	Total	66.750	99			
Pasture management /grazing in riverine wetlands	Between Groups	3.603	6	.601	.893	.503
	Within Groups	62.507	93	.672		
	Total	66.110	99			
Fish farming	Between Groups	1.642	6	.274	.746	.614
	Within Groups	34.118	93	.367		
	Total	35.760	99			
Riverine wetland supported crop production	Between Groups	1.402	6	.234	.369	.897
	Within Groups	58.958	93	.634		
	Total	60.360	99			
Forest resource management in riverine wetlands	Between Groups	2.881	6	.480	.758	.604
	Within Groups	58.879	93	.633		
	Total	61.760	99			
Riverine wetland resource use conflict management	Between Groups	2.963	6	.494	1.063	.391
	Within Groups	43.227	93	.465		
	Total	46.190	99			
Input use such as fertilizer in wetlands	Between Groups	8.699	6	1.450	2.576	.024
	Within Groups	52.341	93	.563		

These findings are consistent with study carried out by Adebayo, Anyanwu and Osiyale (2003) that found out that extension services carry great potentials for improving the use of natural resources and promoting the right attitudes among natural resource managers.

4.13.2 Agricultural Extension services and riverine wetland utilization

The following hypothesis was formulated to test for significant influence of agricultural extension services on utilization of riverine wetlands in Nyamira Division:

Ho_2: There is no statistically significant influence of agricultural extension services on utilization of riverine wetlands in Nyamira Division.

The household heads were asked to state their level of contact with extension providers and in which areas of wetland use had they received extension services. The mean scores were subjected to Chi-square test to determine the influence of extension services on utilization of riverine wetlands.

Table 33: Level of contact between extension officers and riverine wetland users

		economic activity on the wetland							
		crop production	grazing	brick making	fish farming	woodlot growing	leasing	others	Total
Level of contact with extension officers	never	9	13	19	2	10	2	2	57
	weekly	1	0	3	0	2	0	0	6
	fortnightly	1	0	2	0	0	0	0	3
	monthly	4	2	1	1	0	0	0	8
	after several months	5	3	4	0	2	1	0	15
	yearly	2	3	2	3	1	0	0	11
Total		22	21	31	6	15	3	2	100

Results show that those who had never had contact with extension officers was high at 57 percent. These results are consistent with studies done by Owen, et al. (1995) who observed that

agricultural research and extension services, credit, and marketing institutions have not been designed to support wetland farming. This would explain the low levels of contact between riverine wetland users and agricultural extension providers. Many households had limited level of knowledge, frequency of use and opportunities to use extension services on various wetland management practices. Bauer and Cohen (1996) observe that since wetlands are a relatively new issue, few Extension staff and even fewer landowners and land managers are knowledgeable about wetlands and wetland management. Morardet *et al* (2008) suggests that the design and implementation of relevant policies that are targeted to groups that are dependent on resources and manage these resources should take into account the socio-economic characteristics of households within the community. The socio-economic characteristics of households shape the livelihood strategies that the households engage in.

Table 34: Chi-Square Test for significant influence of agricultural extension services on riverine wetland utilization

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.375	30	.551
Likelihood Ratio	29.651	30	.484
Linear-by-Linear Association	2.274	1	.132
N of Valid Cases	100		

P = 0.551

These results show that agricultural extension services did not significantly influence riverine wetland utilization: χ^2 (1, N = 100) = 28.36, p □ .05 hence we accept the null hypothesis. This result is in agreement with research done in South Africa by Nel, Walters and Kotze (2004) where they conclude that few extension workers are equipped with the knowledge to advise on wetland management from an agricultural point of view. In another study done in Uganda by ARCOD (2004) concludes that extension services on wetlands in Arua District are as poor. Level of contact of households with extension workers was very low or nonexistent in some cases. Lack of modern production techniques and farm inputs is complicated by the lack of agricultural extension officers who, unlike in the past, are rare in the fields. The officers who were frequent visitors to agricultural farms are hardly seen. The ratio of extension officer to

farmers in the Kisii area stands at 1-3,000 farmers (Kisii.com, 2008). This might explain the current utilization of riverine wetlands which is mostly unsustainable.

4.13.3 Riverine Wetlands and Household Food Security

The following hypothesis was formulated to test for significant contribution of riverine wetlands to household food security:

> Ho_3 : There is no statistically significant contribution of riverine wetlands to household food security in Nyamira Division.

Respondents were asked to indicate their level of access to sufficient food for the previous 12 months to determine their food security status (appendix B, items 16-32). Specific information was provided on income from wetlands, wetland size, economic activities on the riverine wetlands and income from wetlands to purchase food. In order to investigate significant contribution of riverine wetlands on household food security, Pearson's product moment Correlation was used to test the null hypothesis.

Results in Table 35 indicate that the null hypothesis was rejected in favour of the alternative (research) hypothesis because food eaten by the household in the past 12 months correlated significantly with income from wetlands $p= 0.01< \alpha=0.05$.

Table 35: Correlation between food eaten by household and income from wetlands.

Variable	Statistic	Food eaten by household in the last 12 months	Income from wetlands
Food eaten by household in the last 12 months	Pearson Correlation	1	.255(*)
	Sig. (2-tailed)	.	.010
	N	100	100
Income from wetlands	Pearson Correlation	.255(*)	1
	Sig. (2-tailed)	.010	.
	N	100	100

- Correlation is significant at the 0.05 level (2-tail).

Although there was significant correlation between income from wetlands and food eaten by households in the past 12 months, there was no significant correlation between economic activity on the riverine wetland and food eaten by household in the last 12 months as shown in Table 36. These results indicate that the economic activities on the riverine wetlands had no direct contribution to household food security but money generated from the activities carried out on the wetlands had direct effect on household food security. This may be attributed to limited crop production activities on the wetlands due to low fertility levels. The income generated from the riverine wetlands was used to buy food to supplement what was being produced from the uplands. The focus group discussions (Appendix D) agreed that food production from the wetlands was not enough to guarantee household food security. They pointed out that other uses of the riverine wetlands did contribute money that was used to purchase food. They identified the other uses of wetlands as brick making, woodlot growing, grazing and leasing as the main sources of money for many households. They also agreed that indirectly wetlands did reduce pressure on the uplands creating more room for food production and hence contributing to household food security.

Table 36: Correlation between food eaten by household and economic activity on the wetland

		food eaten by household in the last 12 months	economic activity on the wetland
food eaten by household in the last 12 months	Pearson Correlation	1	.157
	Sig. (2-tailed)	.	.120
	N	100	100
economic activity on the wetland	Pearson Correlation	.157	1
	Sig. (2-tailed)	.120	.
	N	100	100

These findings agree with a study by McCartney and Van Koppen (2004) in Tanzania which found out that wetlands make an appreciable contribution to rural livelihoods in terms of both direct cash income and contributions to food security. They are also in agreement with a study done in Tanzania and Zambia by McCartney and Masiyandima (2004) that confirmed that wetlands make an appreciable contribution to rural livelihoods in terms of both direct cash income and contributions to food security. Rebelo et al. (2009) add that wetlands contribute in diverse ways to the livelihoods of millions of people in Sub-Saharan Africa. In many places they are inextricably linked to cropping and livestock management systems. At the same time, increasing population in conjunction with efforts to increase food security is escalating pressure to expand agriculture within wetlands. Dixon and Wood (2005) concluded that wetlands make important contributions to the rural communities in the highlands of south-west Ethiopia through their ecological functioning and the variety of economic products which they provide. Another research done on the Limpopo basin by Morardet et al. (2008) found that the value derived from wetlands forms a significant part of households' income and livelihood, and the wetland-dependent proportion of livelihoods is greatest in the poorest households. For example in Kilombero wetlands in south Tanzania, the wetlands contributes to the food intake of 98 percent of all the households in the villages nearby and more than 40 percent of the households

acknowledge using wetlands as coping strategy during period of food shortages (McCartney and van Koppen, 2004).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter outlines summary of the study, provides conclusions about the study and gives recommendations based on the study findings. It also gives suggestions for further research

5.1 Summary

In Nyamira division, dwindling land sizes and declining production on the uplands forced households to use riverine wetlands to improve their food security status. Lack of adequate extension information on wise use of riverine wetlands led to haphazard and unsustainable use of riverine wetlands. This caused declining crop yields within the riverine wetlands which drove the households to find alternative uses for the wetlands. It was not known whether the many uses that households subjected the wetlands to contributed to their food security. The extension needs of wetland users were also not known. This research was designed to determine the extension needs of households utilizing riverine wetlands and the contribution these wetlands towards household food in Nyamira Division. The study adopted a cross-sectional survey because data was collected at one point in time. The target population was 2200 household heads who were utilizing the wetlands in one way or another. Proportionate stratified random sampling was used to select 120 household heads who were utilizing the three wetlands that were under study.

Simple random sampling was used to select members who participated in focus group discussions. Structured Interview Schedules were used to collect data from the household heads and three focus group discussions were held to reinforce data from the household heads. SPSS was used for data analysis. Percentages and frequencies were used to describe the data. ANOVA, Pearson's Product Moment Correlation and Chi-square test were used to test the hypotheses. Literature relating to wetland utilization, extension needs of households utilizing wetlands, household food security and government policy on wetland use was reviewed. Theoretical framework was based on Scoones' analysis of sustainable livelihoods. The framework considers practical, methodological and operational implications of sustainable use of resources.

From the study, it emerged that the main agronomic activities on the riverine wetlands included growing of food crops like maize, growing of cash crops like tea and the propagation of other crops like Napier grass for feeding livestock. All the riverine wetlands were covered by woodlots of Eucalyptus salgina (Blue gum) which the community regarded highly due to its fast maturing qualities. Brick making was another economic activity on the wetlands. Riverine wetland conversion was so extensive that it was difficult to find a virgin wetland or rehabilitated wetland. All the wetlands were being utilized in one way or another. The research also established that upland land sizes per household had diminished to such an extent that it was uneconomical. This was the reason households had moved to the wetlands. Although the direct contribution of the wetlands to household food security was not significant, the wetlands had greatly reduced pressure on the uplands and also created new avenues through which households could generate income to supplement what was produced from the uplands.

On household food security, the study found that many households were food insecure during months of hunger between January and June. This was attributed to the fact that these were the months when quantity of maize in the household had dwindled or was over. Most households had planted and harvesting was projected to be in July. This clearly indicated that the amount of food produced by the households was not enough to sustain the household unit until the next harvest. Those who were food secure were few and it was attributed to either small household size or multiple sources of income which was used to purchase food. There were those who had other types of food but considered themselves food insecure because they did not have maize which is the stable food in the area.

Hypothesis formulated to determine the contribution of riverine wetlands towards household food security showed significant contribution of the wetlands towards household food security albeit indirectly. The research further established that farmers had no access to extension services on wetland utilization. The literature available indicated that various policies of government were for wetland conservation and not utilization. It was only in fish farming that extension services were offered and the number of households practicing fish farming was minimal.

When level of knowledge, frequency of use and opportunities to use various practices in utilization of riverine wetlands after contact with extension services was measured, majority of respondents had no knowledge, had never used and had no opportunities to use the information. Hypothesis formulated to show differences in extension needs of households with different wetland utilization types indicated significant differences in extension needs of households with different wetland uses. The study also revealed that level of education and occupation of household heads did not influence the type and extent of wetland utilization. This confirmed that wetland utilization did not depend on one's educational level or occupation.

5.2 Conclusions

The following conclusions can be made from this study:

1. There is no difference in agricultural extension needs of households with different wetland utilization types. This can be attributed to the fact that most households were subjecting the riverine wetlands to the same activities.
2. Level of contact of riverine wetland users with extension workers in Nyamira Division was low. Those who had never had contact with extension workers stood at 57 percent. This is because there is no extension package for wetland users.
3. Agricultural extension services did not influence the utilization of riverine wetlands in Nyamira Division. This can be attributed to the low levels of contact between riverine wetland users and extension providers and lack of extension information on wise use of the wetlands.
4. Utilization of riverine wetlands contributed to household food security through the various economic activities that households were doing on the wetlands. This was through income generated by the activities on riverine wetlands more than it was through food produced from the wetlands.
5. There is extensive utilization of wetlands in Nyamira Division. The households were carrying out several activities on the riverine wetlands that included farming, grazing and brick making. There was little virgin riverine wetland left.

5.3 Recommendations

Using the findings of this study and its conclusions, the following recommendations could help in wise and sustainable utilization of riverine wetlands. The recommendations have implications on policy and provision of extension services and they include:

1. The study findings indicate lack of an extension package for wetland users. It is therefore necessary that the agricultural extension needs of households utilizing riverine wetlands are incorporated in the National Extension Programmes.
2. The study findings indicate low levels of contact between agricultural extension providers and riverine wetland users. It is therefore necessary that agricultural extension service providers improve their level of contact with households utilizing riverine wetlands to assist in sustainable use of the wetlands and prevent their degradation.
3. All stakeholders in wetland use and conservation should acknowledge the contribution of riverine wetlands to household food security which can act as an entry point for sustainable utilization of the riverine wetlands.
4. Government and other stakeholders should discourage wetland uses that degrade and destroy wetlands and encourage uses that retain the potential of the wetlands.

5.4 Suggestions for Further Research

1. A study be carried out on the effects of extracting large amounts of soil for brick making on the fertility of the wetlands and the hazards associated with the gaping holes left after the extraction in the study area. This is because the impact of brick making on the wetlands is unknown or undocumented.
2. A study be carried out to determine whether inadequate extension services on wise use of wetlands contributes to declining fertility and dwindling crop yields on the wetlands in the study area. This study would shed light on whether extension services can contribute to wise and sustainable utilization of the riverine wetlands.

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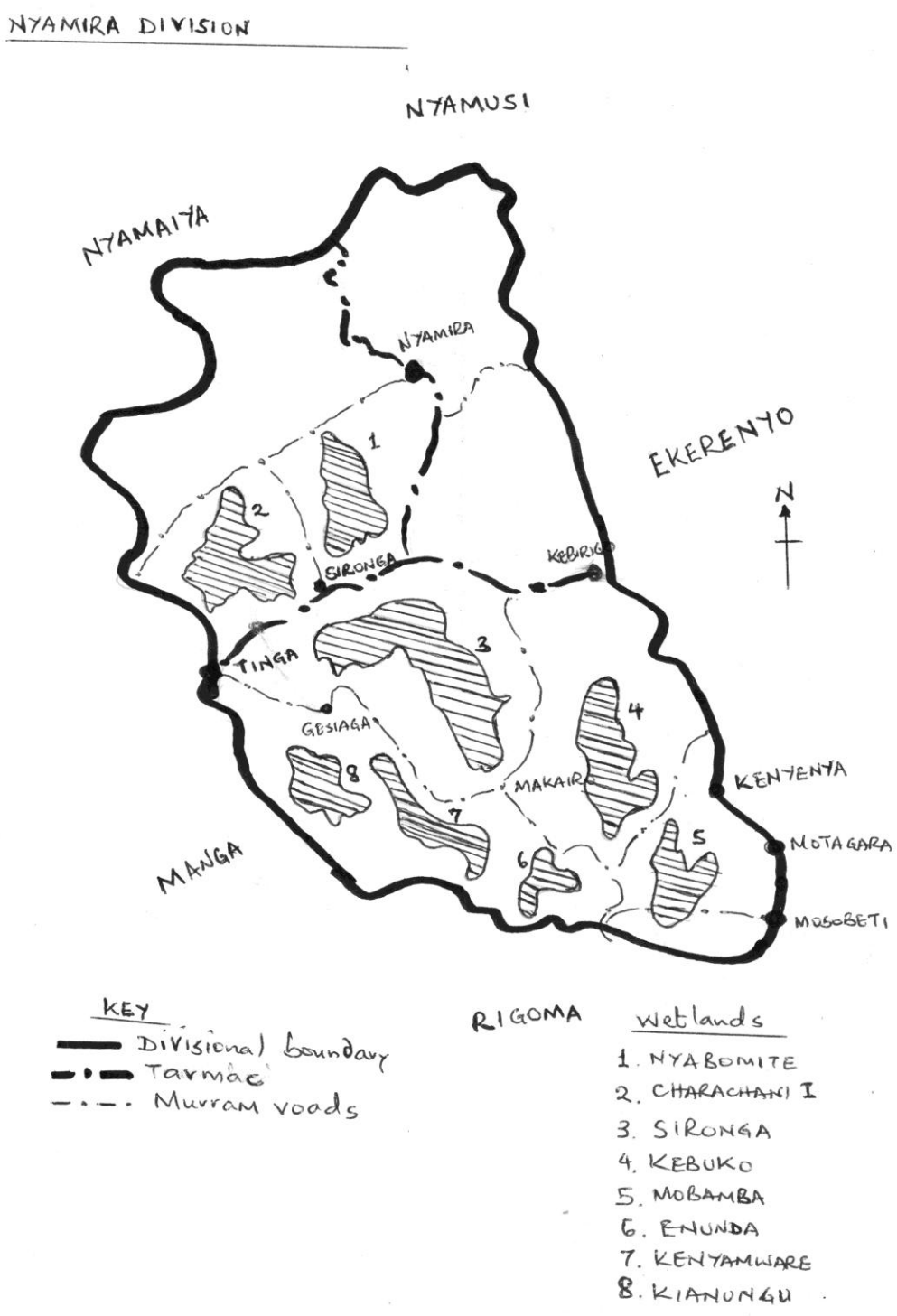
APPENDIX A: MAP OF NYAMIRA WETLANDS



APPENDIX B: HOUSEHOLD HEAD INTERVIEW SCHEDULE

Introduction

I am a student at Egerton University pursuing a Master of Science degree in Agricultural Education and Extension. I am conducting a study on riverine wetlands as part of this degree. The purpose of this interview schedule is to gather information on the extension needs of households utilizing riverine wetlands and the contribution of these riverine wetlands towards household food security within Nyamira Division. Your household has been selected by chance from the households in this area to participate in the study.

I request you to respond to the questions in this interview schedule as candidly and truthfully as you can. The information you will provide will be used strictly for purpose of this study and will be treated with utmost confidentiality. Thank you for your cooperation.

Part one: Household members' characteristics

1. Respondent's first name _____ [Optional]
2. Location _____
3. Sub-location _____
4. Sex (tick the appropriate answer)
   - ❒ Male
   - ❒ Female

5. What is the type of household headship?
   - ❒ Single
   - ❒ Married (living together)
   - ❒ Married (partner working outside)
   - ❒ Widow/widower
   - ❒ Orphan
   - ❒ Other (specify)_____

6. Age of the household head _____

7. Marital status (tick the appropriate answer)

- ❒ Married
- ❒ Single
- ❒ Divorced
- ❒ Separated
- ❒ Widower
- ❒ Widowed

8. Household size_____

9. How many people live in your household? _____

10. Indicate the educational level of the household head

- ❒ Never went to school
- ❒ Primary
- ❒ Secondary
- ❒ College
- ❒ Diploma
- ❒ University

Part two: Source of Income

11. What is the single main occupation of the household head?

- ❒ Peasant farmer
- ❒ Civil servant/teacher
- ❒ Medium to large scale business
- ❒ Small scale business
- ❒ Domestic work (own home)
- ❒ Other (specify)_____
- ❒ None

12. What is the single main source of income for the household? (Tick the appropriate)

- ❒ Farming
- ❒ Formal Employment
- ❒ Brick making
- ❒ Business
- ❒ Other (specify) _____

13. What is the household's single main expenditure?

- ❒ Food
- ❒ Education
- ❒ Health
- ❒ Clothing
- ❒ Shelter (housing)
- ❒ Others (specify) _____

14. What proportion of income comes from wetland use? (Tick the appropriate)

- ❒ Full income
- ❒ Half income
- ❒ Quarter income
- ❒ None

15. What proportion of income from wetlands do you use to produce or buy food?

- ❒ Full income
- ❒ Half income
- ❒ Quarter income
- ❒ None

Part four: Household Food Security

16. How often in the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

17. How often in the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

18. How often in the last 12 months, did you ever eat less than you felt you should because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months?
- ❒ Never

19. How often in the last 12 months, were you ever hungry but didn't eat because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

20. How often in the last 12 months, did you lose weight because there wasn't enough food to eat?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

21. How often in the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

22. How often in the last 12 months, did any of the children ever skip a meal because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

23. How often in the last 12 months, did any of the children ever go hungry because there wasn't enough food and you could not afford any?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

24. How true in the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough food?

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

25. How often in the last 12 months did you worry that food would run out before you could produce more."

- ❒ Almost every month,
- ❒ Some months but not every month,
- ❒ Only 1 or 2 months
- ❒ Never

26. In the last 12 months "The food that we produced just didn't last, and we didn't have money to get more." Was that

- ❒ Often true
- ❒ Sometimes true
- ❒ Never true

27. In the last 12 months "We couldn't afford to eat balanced meals because we could not produce or purchase them." Was that

- ❒ Often true
- ❒ Sometimes true
- ❒ Never true

28. In the last 12 months "We couldn't feed the children a balanced meal because we couldn't produce it or afford that." Was that

- ❒ Often true
- ❒ Sometimes true
- ❒ Never true

29. In the last 12 months "The children were not eating enough because we just couldn't produce or buy enough food." Was that

- ❒ Often true
- ❒ Sometimes true
- ❒ Never true

30. Which of these statements best describes the food eaten in your household in the last 12 months?

- ❒ Enough of the kinds of food we want to eat
- ❒ Enough but not always the kinds we want
- ❒ Sometimes not enough to eat
- ❒ Often not enough to eat

31. In which of the following months of the year does the household have food reserves and in which months doe the household experiences hunger (Mark by shading the circle under each letter representing the month)

	J	F	M	A	M	J	J	A	S	O	N	D
Food Reserves	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Hunger	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

32. In the past 12 months how did the household obtain its food stuff (tick - √ - as appropriate)

- ❒ Wholly grown/produced from the farm
- ❒ Wholly purchased from market place
- ❒ Partly produced from the farm
- ❒ Partly purchased from market place
- ❒ Received from relatives
- ❒ Received from members of community
- ❒ Other (specify) _____

Part three: Land size/wetland size and uses

33. What is the total size of your land?

- ❒ Less than one acre
- ❒ More than one acre but less than five acres
- ❒ More than five acres

34. How much of this land is a wetland?

- ❒ 0-1 acre
- ❒ 1-5 acres
- ❒ More than 5 acres

35. What economic activities do you carry out on the wetland?

- ❒ Crop production, grazing, woodlots and brick making
- ❒ Grazing and brick making
- ❒ Brick making and woodlot growing
- ❒ Fish farming, brick making and woodlot growing
- ❒ Woodlot growing
- ❒ Leasing
- ❒ Other(specify)

36. Indicate the portion of your wetland under each of the following

WETLAND USE TYPE	ACRES
Tea	
Food crops	
Pasture/ grazing	
Brick making	
Leasing	
Woodlot growing	
Fallow/ uncultivated	
Other (specify)	

37. Have you ever received agricultural extension services on wetland use from extension officers?

- ❒ Yes
- ❒ No

38. If yes in what areas did you receive extension services in?

- ❒ Crop production
- ❒ Livestock production
- ❒ Drainage
- ❒ Irrigation
- ❒ Fish farming
- ❒ Soil and water management
- ❒ Wetland management
- ❒ Others (specify)

39. Which of the following indicates level of contact your household has with agricultural/ livestock extension officers?

- ❒ Never
- ❒ Weekly
- ❒ Fortnightly
- ❒ Monthly
- ❒ After several months
- ❒ Yearly

40. Indicate by ticking the level of your knowledge, frequency of use and opportunities to use the following practices in the local riverine wetlands after contact with extension services.

	Level of knowledge			**Frequency of use**			**Opportunities to use**		
	High	Low	Nil	Always	Often	Never	Many	Few	None
Drainage									
Riverine wetland use planning									
Wetland resource management									
Soil and water conservation in the wetland									
Wetland agro-biodiversity conservation									
Wetland governance and policy interpretation									
Adaptation to changing riverine wetland environment									
Pasture management /grazing in riverine wetlands									
Fish farming									
Riverine wetland supported crop production									
Forest resource management in riverine wetlands									
Riverine wetland resource use conflict management									
Input use such as fertilizer in wetlands									

********** END OF QUESTIONNAIRE *********

THANK YOU VERY MUCH FOR YOUR PATIENCE, TIME AND COOPERATION.

GOD BLESS.

APPENDIX C: FOCUS GROUP DISCUSSION GUIDE

FOOD SECURITY AND RIVERINE WETLAND UTILIZATION

Food security issues of concern include food availability, accessibility, affordability and utilization. **Food availability** is achieved when sufficient quantities of food are consistently available to all individuals within a community. Such food can be supplied through household production, other domestic output, commercial imports, or food assistance. **Food access** is ensured when households and all individuals within them have adequate resources to obtain appropriate foods for a nutritious diet. Access depends on income available to the household, on the distribution of income within the household, and on the price of food. **Food affordability** is the ease with which household can purchase the food they eat when they want using income from their production, wages, trade or other remittances. **Food utilization** is the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation. Effective food utilization depends in large measure on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper child care, and illness management. This food security issues are used to determine food secure, marginally food insecure and food insecure households. This FGD will establish the community food pathways as relates to wetland utilization and nodes as well as the threats to ensuring food security among households.

Purpose of FGD

1. To identify the most important sources of food and pathways by which households obtain their food through riverine wetland utilization

2. To identify the most significant threats to food accessibility, affordability, availability and utilization strategies as a result of riverine wetland utilization
3. To identify the existing coping strategies the households living around riverine wetland use to address threats to food insecurity
4. To collate views of the community on the possible strategies for addressing food insecurity in the area through sustainable utilization of riverine wetlands
5. To identify the core extension needs of households utilizing riverine wetlands on their use.

Participants

The FGD will involve a gender-representative group of community members cutting across the main households utilizing wetlands. About 8 – 15 carefully recruited participants

Materials

Large sheets of writing paper (flip charts), markers of different colours, seeds stones and leaves

Suggested Approach

- The exercise is simpler and quicker when made participatory and systematically guided by the key questions.
- PRA/PLA techniques will be applied to focus the discussions on food pathways, threats to food security and riverine wetland utilization. This can be through food pathway mapping. This will be done on the ground using locally available materials then transferred to writing materials.

The discussions will focus on the contribution of wetlands to food security.

Time

About 1 hours

Validation

This will be achieved rapidly through two other FGD sessions using another set of participants, triangulating with other data collection instruments such as household baseline survey

Outputs

1. Riverine wetland utilization
2. Type and extent of riverine wetland utilization
3. Extension needs on use of riverine wetlands
4. Food pathway conceptual map
5. Specification of the main sources of food
6. List of and conceptual map of main threats to food security
7. List of most food insecure and vulnerable groups in the community
8. List of the uses of wetlands
9. List of suggested strategies to improve food security
10. Written notes of the exercise

Key Guiding Questions

1. Do households receive extension services on wetland use from the government?
2. Which areas in wetland use have you received extension services in?
3. What uses are the households putting their wetlands to?
4. Are wetlands contributing to the household's food security?
5. How much money does the household make from wetlands?
6. Do households use some of this from wetlands money in buying food?

7. Where do households get their food?
8. What are the factors that limit the ability of households to obtain food from each of these sources?
9. How do households obtain their cash income, and what are the factors that limit the ability of households to obtain income from each of these sources?
10. How do you view the status of food security in the community?
11. Who are the most food insecure or vulnerable population groups in the community?
12. What existing coping strategies are used by households to address difficulties in obtaining food?
13. What should be done to address food security challenges in order
    i. To increase the availability of basic foods;
    ii. To increase access to food;
    iii. To improve affordability of food; and
    iv. To improve the food utilization in the community:
    v. Improve on wetland utilization

APPENDIX D: SUMMARY OF FOCUS GROUP DISCUSSION RESPONSES

No.	Key Guiding Question	FGD 1 (Responses) 10 HH - 6F, 4M	FGD 2 (Responses) 12 HH – 7M, 5F	FGD3 (Responses) 8 HH- 5F, 3M
1	Do households receive extension services on wetland use from the government?	Yes- 1 No -9	Yes- 0 No- 12	Yes- 1 No -7
2	Which areas in wetland use have you received extension services in?	Fish farming- 1 None- 10	None - all	Fish farming- 1 None- 7
3	What uses are the households putting their wetlands to?	Brick making -7 Woodlots – all Grazing – 6 Growing tea – 4 Fish farming- 3 More than one use - 6	Brick making 6 Grazing 5 Fish farming - 3 Woodlots – all Tea growing- 2 Napier grass- 3 More than on use -7	Brick making -4 Grazing -3 Woodlot – all Growing tea- 3 Food crops -2 More than one use 5
4	Are wetlands contributing to the household's food security?	Yes- 10 No -0	Yes -12 No- 0	Yes -8 No - 0
5	How much money does the household make from wetlands per year?	5000- 3 10000-1 15000-3 20,000-50,000-2 150,000-1	4000-1 5000-15000- 3 20,000-35,000-6 50,000-1	2000-10,000-3 15000-2 50,000-2 100,000-1
6	Do households use some of this from wetlands money in buying food?	Yes -10 No- 0	Yes- 10 N0- 0	Yes- 8 No -0

No.	Key Guiding Question	FGD 1 (Responses) 10 HH - 6F, 4M	FGD 2 (Responses) 12 HH – 7M, 5F	FGD3 (Responses) 8 HH- 5F, 3M
7	Where do households get their food?	Farm produce -10 Purchases -10 Borrow- 0	Farm production -12 Purchase -12 Borrow -1	Farm produce- 8 Purchase- 8 Borrow- 0
8	What are the factors that limit the ability of households to obtain food from each of these sources?	Small land size – 10 Mono-cropping – 7 High prices – 10 Price fluctuations - 9	Small land sizes – 12 Overreliance on maize – 10 High prices-3 Price fluctuations-2	Small land sizes- 8 Abandoning of indigenous crops – 4 High food prices – 8 Unstable prices - 7
9(i)	How do households obtain their cash income	Farming-8 Brick making-8 Selling of trees -4	Farming i.e. tea, food crops-12 Brick making-10 Business- 6	Farming-8 Brick selling-8 Business- 4
9(ii)	What are the factors that limit the ability of households to obtain income from each of these sources	Tea hawking-2 Price fluctuations of farm products-4 Lack of market for bricks -8	Price fluctuations-10 Lack of food for animals-7 Difficulties in transporting bricks-6	Fluctuation of prices for bricks-5 Price fluctuations-7 Low prices of tea as a cash crop-8
10	How do you view the status of food security in the community?	Fair- 8 Good -2	Good- 2 Fair- 9 Bad- 1	Good -3 Fair - 8
11	Who are the most food insecure population group in the community?	Widowers - 4 The poor-9 Those with small land sizes-3	The poor- 10 Children- 5	The poor - 8

No.	Key Guiding Question	FGD 1 (Responses) 10 HH - 6F, 4M	FGD 2 (Responses) 12 HH – 7M, 5F	FGD3 (Responses) 8 HH- 5F, 3M
12	What existing coping strategies are used by households to address difficulties in obtaining food?	Reducing quality and quantity of food consumed-8 Borrowing from relatives-4	Reducing quantity of food-12 Reducing number of meals-9	Reduced number of meals-8 Switching to locally available foods.-5
13	What should be done to address food security challenges in order to:			
i	Increase availability of basic foods	Use modern ways of food production- 7 Diversify from maize- 5 Reduce cost of inputs- 6	Reduce cost of inputs -6 Diversify from maize -12 Use irrigation during dry periods- 10	Diversify from maize 8 Use better ways of production -7 Reduce cost of inputs-5
ii	Increase access to food	Improve on sources of income- 8 Move to commercial farming -10	Improve on storage facilities -6 Embrace food preservation- 5 Saving of income during excess production to cater for scarcity period- 6	Using other sources of income to purchase food- 5 Generate money through commercial farming-8
iii	Improve affordability of food	Purchase during periods of plenty and stock- 10 Improve on storage-10	Sell during plenty and use the money to purchase during periods of plenty - 12	Preserve excess food to use during periods of scarcity-8
iv	Improve food utilization in the community	Proper cooking- 5 Use other foods and avoid overreliance on ‘ugali’- 10	Improved hygiene on food handling- 5 Embrace other food such as fruits- 7	Use traditional foods- 8 Diversify from ‘ugali’ as the basic food- 8 Proper cooking- 6

APPENDIX E: RESEARCH PERMIT

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THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss. GINN ABERE MECHA

of (Address) EGERTON UNIVERSITY PO BOX 536 EGERTON,NJORO

has been permitted to conduct research in

Location, NYAMIRA

District, NYANZA

Province,

on the topic The Extension Needs of Household Utilizing Riverine Wetlands and the Contribution of these Wetlands Towards Household Food Security in Nyamira Division Kenya

for a period ending 31ST MARCH **,20**10

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Research Permit No. NCST/5/002/R/1113

Date of issue 7.12.2009

Fee received SHS 1000

Applicant's Signature

Secretary National Council for Science and Technology

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

GPK6055t3mt10/2009

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS— see back page)

APPENDIX F: RESEARCH AUTHORIZATION

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
Telephone: 254-020-241349, 2213102
254-020-310571, 2213123.
Fax: 254-020-2213215, 318245, 318249
When replying please quote

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: NCST/5/002/R/1113/4

Date: 10th December, 2009

Ginn Àbere Mecha
Egerton University
P. O. Box 536
NJORO

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"The extension needs of households utilizing riverine wetlands and the contribution of these wetlands towards household food security in Nyamira Division, Kenya"*** I am pleased to inform you that you have been authorized to undertake your research in ***Nyamira District*** for a period ending ***31st March 2010.***

You are advised to report to **the District Commissioner, Nyamira District, the District Education Officer, Nyamira District and the District Agricultural Officer Nyamira District** before embarking on your research project.

Upon completion of your research project, you are expected to submit two copies of your research report/thesis to our office.

PROF. S. A. ABDULRAZAK Ph.D, MBS
SECRETARY

Copy to:

The District Commissioner