LIVELIHOODS AND ECONOMIC BENEFITS OF WETLAND UTILIZATION IN THE LITTLE RUAHA SUB-CATCHMENT, MUFINDI, IRINGA

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

This study was conducted in the wetlands of the Little Ruaha sub-catchment to assess livelihoods and economic benefits of wetland utilization. The Specific objective were to; (a) identify socio-economic activities undertaken by local communities dependence in wetlands of the Little Ruaha sub-catchment (b) identify crops grown in wetlands of the Little Ruaha sub-catchment during both wet and dry seasons, (c) assess the economic value of wetlands outputs to household income and food security, (d) determine factors that influence utilization of wetlands resources in the Little Ruaha sub-catchment. Purposeful and simple random samplings techniques were employed to select respondents whereby 120 respondents were selected. The data were collected through structured questionnaires and Focus Group Discussion (FGD). Descriptive statistical analysis was used to analyse the qualitative and quantitative data. Gross margin analysis was used to estimate total economic benefits of wetlands utilization; food available for consumption method was used to assess food security; contingent valuation method was used to assess the contribution of wetlands services to household welfare and linear regression analysis explored the factors influencing utilization of wetlands resources. Valley bottom activities include agricultural production practiced by over 98% of the population followed by livestock keeping and other wetlands outputs. Activities not directly related to valley bottom included petty and major businesses and government employment. Valley bottom wetlands contribute 15% to household food security and 95% to household income that is equivalent to Tshs 128 209 (US$103) and 3 234 721 (US$ 2588) per household per year. Age, farming experience, access to markets, number of dependants and household size significantly influenced wetlands utilization. Valley bottom wetland cultivation contributes significantly to household economy and food security. The study recommends planning for wetland friendly agricultural activities to ensure wetlands conservation and sustainable contribution to household economy and food security.

DECLARATION

I, Nice Wilfred Ntupwa, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and that it has neither been submitted nor been concurrently submitted for degree award in any other institution.

_____ _____

Nice Wilfred Ntupwa Date

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This above declaration is confirmed

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Prof. Munishi, P.K.T. Date

(Supervisor)

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Dr. Kadigi, R.M.J. Date

(Supervisor)

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DEDICATION

To almighty God and my parent Ms. Flora Z. Kawa who made a good foundation for my education. Thank you for your love. Your love has been of valuable contribution to my success in education.

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LIST OF ABBREVIATIONS AND SYMBOLS

CVM	Contingent Valuation Method
ESP	Environmental Support Programme
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GoT	Government of Tanzania
HIV-AIDS	Human Immune Virus-Acquired Immune Deficiency Syndrome
IUCN	International Union for Conservation of Nature
MAFC	Ministry of Agriculture, Food security and Cooperatives
MKUKUTA	Mkakati wa Kukuza Uchumi na Kupunguza Umasikini Tanzania
MNRT	Ministry of Natural Resource and Tourism
MSc	Master of Science
NBS	National Bureau of Statistics
NGO	Non Governmental Organizations
NSGRP	National Strategy for Growth and Reduction of Poverty
OLS	Ordinary Least Square
PhD	Doctor of Philosophy
PRA	Participatory Rural Appraisal
REMP	Research Master Plan
REPOA	Research on Poverty Alleviation
SNAL	Sokoine National Agricultural Library

SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TAZARA	Tanzania Zambia Railway
UNO	United Nation Organization
URT	United Republic of Tanzania
WHO	World Health Organization
WWF	World Wide Fund for nature

CHAPTER ONE

INTRODUCTION

1.1 Background

Wetlands are defined as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, brackish or salty, including areas of marine water the depth of which, at low tide, does not exceed six meters" (Ramsar Convention, 1971). Wetlands are among the world's most biologically productive ecosystems and rich in a diversity of species. Of the 20 000 species of fish in the world, more than 40% live in fresh water. Wetlands are very important storehouses of plant genetic material some of which are valuable resources for human wellbeing. For example, rice, which is a common wetlands plant, is the staple diet of more than half of the world's human population (Ramsar Convention, 1971). From time immemorial, wetlands have been regarded as wastelands, but they are among the last truly wild and untouched places of the world.

In Tanzania there are major wetlands systems forming the valley bottom wetlands, and these include the Great Ruaha, Wami, Kilombero, Pangani, Malagarasi, Ruvu and Katavi river systems. The largest in this category are the Great Ruaha river systems with wetlands covering 6950 ha (MNRT, 2003). All the wetlands are considered useful for agriculture and as a source of other natural resources, which are important to human wellbeing. Agricultural production, which has a significant contribution to economic wellbeing of a society, is one of the major livelihood activities of wetlands utilization.

There are several factors that influence a sustainable utilization of these wetlands resources in Tanzania. These factors range from socio-economic, socio-cultural, socio-political and biophysical. Socio-economic factors include, lack of capital to invest in different socio-economic undertakings and poor farming practices leading to land degradation, lack of extension services due to manpower shortages and lack of agricultural inputs (MNRT, 2003). Socio-cultural factors include crosscutting issues that comprise gender and youth considerations, wetlands related health hazards (malaria, bilharzias and HIV-AIDS). Socio-political factors include resource use conflicts and conflict management, and the biophysical factors include drought which is caused by unreliable rainfall, poor soil moisture storage characteristics, crop diseases and pests, all of which affect agricultural crops and livestock.

1.2 Problem Statement and Justification

Tanzania is endowed with exceptional wetlands resources ranging from lake systems, river floodplains, to deltaic mangrove formations that cover about 10% of the land surface (MNRT, 2003). All the wetlands are potentially suitable for agriculture because of having plenty of water and high soil fertility; thus wetlands can be among the resources for poverty reduction in Tanzania (Munishi *et al*., 2003). It is reported that wetlands make a substantial contribution to rural livelihoods in terms of direct cash income and food security. Many households utilize wetlands as a coping strategy during the time of food scarcity (Mkavidanda and Kaswamila, 2001). Previous studies on wetlands utilization in Tanzania mainly focused on major wetlands that are mostly associated with activities of greater economic importance such as large-scale farming, transportation, and fisheries; save for the study by Mkavidanda and Kaswamila (2001), which looked at the role of *vinyungu* in poverty reduction and concluded that *vinyungu* are a key factor in sustaining livelihoods and in reducing

poverty. *Kinyungu* (singular) or *Vinyungu* (plural) is Hehe/Bena ward which refers to valley bottom land use for dry season family practices to harness moisture, water from river and or spring to produce both food and cash crops using traditional irrigation techniques (Mkavidanda and Kaswamila, 2001).

Furthermore, contribution of agricultural production in wetlands of the Little Ruaha sub-catchment to rural livelihoods of the local people in terms of direct cash income and food security is not well quantified. The information on the extent, productivity, socio-economic role and the impact of wetlands in the Little Ruaha sub-catchment is scanty thus constraining a wise use and sustainable utilization of the wetlands. Also, there are frequent concerns that agricultural practices in wetlands of the Little Ruaha sub-catchment may amount to extensive wetlands degradation, which may have a negative impact on water resources and wetlands productivity.

As long as they are managed wisely, wetlands will continue to support the country's efforts in poverty alleviation and maintenance of human wellbeing. The wise use and sustainable utilization of wetlands in Tanzania are constrained by inadequate, fragmented and uncoordinated information on the status and values of these wetlands (ESP, 2003). Studies in valley bottom farming and associated technologies have not received much attention to justify management decisions on wise use. This is because valley bottom farming is largely considered as a nonessential agricultural activity. The complexity of multiple uses of wetlands in the Little Ruaha sub-catchment calls for inventory and critical study of the socio-economic aspects of the wetlands, development on plans for a wise, efficient, and beneficial utilization of the wetlands resources using participatory approaches. This will argument the efforts of alleviating poverty as envisaged in the National Strategy for Growth and Reduction of Poverty (NSGRP).

The wetlands in the Little Ruaha sub-catchment form a wide range of inland drainage and floodplain wetlands in Tanzania. The wide range of these wetlands supports a variety of livelihood activities, which are economically beneficial among the adjacent communities as well as other people outside the wetlands (MNRT, 2003). Understanding the drainage of the cultivated wetlands may encourage farmers in adhering to more sustainable practices in sustaining their livelihoods. This knowledge would also be useful in understanding the relationships between human activities and observed environmental changes.

1.3 Objectives

1.3.1 Overall objective

The main objective of this study was to assess livelihoods and economic benefits of wetlands utilization in the Little Ruaha sub-catchment to household income and food security in Mufindi district.

1.3.2 Specific objectives

The specific objectives of this study were to:

i. Identify the wetland dependent socio - economic activities undertaken by local communities in wetlands of the Little Ruaha sub-catchment,
ii. Identify the crops grown in wetlands of the Little Ruaha sub-catchment during both wet and dry seasons,
iii. Assess the economic value of wetlands outputs to household income and food security and
iv. Determine the factors that influence utilization of wetland resources in the Little Ruaha sub-catchment.

1.3.3 Research questions

i. What are the socio - economic activities undertaken by the local community in the wetlands of the Little Ruaha sub-catchment?

ii. What are the crops grown in both wet and dry seasons in the wetlands of the Little Ruaha sub-catchment?

iii. What are the productivity and seasonality of the crops grown in the wetlands of the Little Ruaha sub-catchment?

iv. What are the economic values of wetlands outputs of the Little Ruaha sub-catchment?

v. What is the contribution of wetlands outputs to household income and food security?

vi. What are the factors that influence utilization of wetlands resources in the Little Ruaha sub-catchment?

CHAPTER TWO

LITERATURE REVIEW

2.1 The Wetlands of Tanzania

In the Tanzanian context, wetlands can be defined as a continuum or system of areas which are flooded or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of organisms typically adapted for life in saturated soil conditions. And this may include areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty, including areas of marine water, the depth of which does not exceed six meters at low tide (MNRT, 2004). In addition, wetlands may incorporate areas of lakes the depth of which does not exceed six meters in the riparian and coastal zones adjacent to wetlands and islands or bodies of marine water deeper than six meters (MNRT, 2004).

In Tanzania the definition of wetlands recognizes wetlands as a continuum or a system in which the upstream-downstream connection is seen as an important consideration in wetlands management. Further, it recognizes that wetlands are not static but dynamic systems that have both temporal and spatial extent and this includes the parts of lakes (MNRT, 2004).

Tanzania is rich in wetlands resources that include the great lake system, inland drainage systems, major river networks and deltaic mangroves. These wetlands resources are among the most productive ecosystems, which have significant economic, social, cultural and biological values. They are vital for the production of

electricity, and groundwater recharge. Wetland resources are also vital in controlling floods, retaining water and preventing eutrophication of river and lakes. They are also vital for the support of specific biota and for other traditional uses. Wetlands are considered useful for agricultural intensification through irrigation (Munishi *et al*., 2003).

Furthermore, wetlands contribute significantly to the country's GDP through tourism. Wetlands are also particularly important in semi-arid areas where they play a significant role in providing water and water related resources for various purposes especially during the dry season. The productive nature of the wetlands ecosystems in Tanzania has been undervalued and threatened by various development activities. Most of the wetlands have been intensively utilized for agricultural activities and livestock grazing (Maltby, 1986). Various wetlands types that include, Great Ruaha, Wami, Kilombero, Pangani, Malagarasi, Ruvu and Katavi river systems cover about 10% of the Tanzania's geographical area. The largest in this category are the Great Ruaha river systems that have wetlands covering 695 000 ha (MNRT, 2003).

The Ramsar Convention requires each of the contracting parties to develop its own wetlands classification system relevant to the country's environment. Classification is an important component and a tool in developing bio-criteria for wetlands management as wetlands have biological communities that reflect climate, hydro period, habitat and geomorphology among others. Wetlands classification may be based on regions that are ecologically similar. Wetlands in the mountains for instance would be grouped or classified separately from wetlands in the valleys.

Wetlands in Tanzania are classified broadly into six categories basing on eco-regions and hydro geomorphology. The categories include, highland headwater wetlands, freshwater estuarine wetlands, internal drainage wetlands, rivers and inland floodplains wetlands, man-made wetlands, and marine and coastal wetlands (Kamukala and Crafter, 2003). Rivers and inland flood plain wetlands are usually formed in the low altitudes where the rivers flood during the rain seasons. These are the areas where deposition takes place, and the layers of soil profiles are formed in various seasons and years developing into very fertile soils with adequate soil moisture for reliable agriculture (Kamukala and Crafter, 2003).

2.2 Importance of Wetlands and Wetland Systems

Among their many valuable functions, wetlands filter pollutants that might otherwise flow into rivers, streams or lakes. Wetlands are often referred to as the "kidneys of the landscape." Riparian wetlands, whose sponge like quality enables them to store heavy rains that could otherwise cause floods, also help to prevent erosion of streambeds (MNRT, 2003). Wetlands are the breeding, feeding and nesting grounds for many endangered species including plants, non-endangered wildlife and natural communities. Wetlands are also used for recreational activities such as bird watching, canoeing, fishing and hiking. The economic, environmental, and recreational values of wetlands are immeasurable. The only continent with no wetlands is the Antarctica (Wambura, 2004).

For centuries, Tanzania’s wetlands have supported life of human populations that have developed specialized strategies to utilize the agricultural, fishing, hunting, and grazing potentials and other resources that the wetlands can provide. Furthermore,

wetlands are endowed with a host of functions that provide beneficial goods and services to mankind (Ellis, 2000). The importance of wetlands to human populations is arguably most clearly demonstrated within the Tanzania's context. With this regard, wetlands play a vital role in sustaining a significant proportion of the country's population. With much of Tanzania lying within arid and semi arid climates, biological productivity is dependent upon the availability of water and nutrients. It is in Tanzania's wetlands that these requirements for life are abundant (Ngailo *et al*., 2002).

2.3 Factors Influencing Utilization of Wetlands Resources in Tanzania

The factors that influence the utilization of wetlands resources in Tanzania are many ranging from socio-cultural, socio-political, socio-economic and biophysical (MNRT, 2004; Wambura, 2004). Likewise, in many parts of Tanzania major problems influencing sustainable utilization of wetlands include drought, which is caused by unreliable rainfall; poor soil moisture storage characteristics; crop diseases and pests all of which affect agricultural crops and livestock. Other problems include lack of capital to invest on different socio-economic undertakings, poor farming practices leading to land degradation, lack of extension services due to manpower shortage, and lack of agricultural inputs among others (Makala *et al.*, 2003).

2.4 Challenges to Wetlands Management in Tanzania

Tanzania is extremely rich in wetlands resources. These resources play an important role in poverty alleviation and in the protection of the environment (ESP, 2003). Although most of these wetlands are still in fairly natural conditions, some of these for example Pangani and Usangu in Ruaha-Rufiji river systems and their flood plains have major ecological alteration (Turpie, 2000).

A wise use and sustainable management of the wetlands resources are therefore a prerequisite if they are to continue saving economic development goals of Tanzania. The Government of Tanzania (henceforth GoT) has shown its commitment towards a wise use of wetlands resources by ratifying the Ramsar Convention. The convention provides the contracting countries with an overall framework for wetlands management. It is an international forum for the exchange of experiences, information, as well as specific guidelines on important wetlands issues such as policies, wetlands resources inventories and wetlands management. The GoT therefore has guidance within an overall international framework to steer the implementation process of wetlands management. Together with such efforts, the country is implementing the wise use principle in wetlands management as per the Ramsar's convention guidelines.

However, there are still some limits and challenges in attaining the objective of the wise use principle in the wetlands management as per the Ramsar's convention guidelines. Some of the limits and challenges Tanzania faces include the compromise between the long-term and short-term benefits. The short-term solutions might provide a burst in income over a short period of time but such solutions are seldom sustainable. On the other hand, the long-term sustainable planning and utilization are often more difficult albeit, they have proven to provide the largest and continuous benefits over a long period of time. Thus, according to Ramsar Convention, it is a wise use, but to the rural poor and whose focus is on a day-to-day survival, it is a great challenge, requiring assistance from the government and international community.

Further, lack of capacity in terms of human and financial resources is a big constraint on wetlands management. The most notorious of all the constraints in sustainable wetlands management in Tanzania is the level of information and the knowledge base on specific wetlands resources and their values. Such information and knowledge are extremely limited. The inventory assessment, monitoring and research in wetlands resources should be at the top of the country's priorities, if Tanzania is to manage the wetlands resources in a more sustainable manner in supporting the efforts of improved livelihood and poverty reduction (ESP, 2003).

2.5 Socio - Economic Activities in Wetlands Ecosystems

Local communities are characterized as highly dependant on the wetlands for their livelihoods. Among the major stakeholders in wetlands utilization are individual wetlands users, smallholder associations, livestock keepers, peasant farmers, fishermen and women, large-scale farmers/investors, beekeepers, traders, miners, handcrafters and carpenters, water users, local government ministries and allied agencies. Small-scale (peasant) farmers still constitute the largest proportion of inhabitants and users of wetlands areas (Hella *et al*., 2001).

2.5.1 Agricultural utilization of the wetlands

A variety of food crops, which include paddy, fruits (citrus, mangoes and pawpaw), maize, beans, cassava, sweet potatoes, sugarcane, onions and vegetables, are grown in the wetlands. Paddy, which is normally grown during the wet season under rain fed farming, is a major wetlands crop in Usangu sub-catchment of the Great Ruaha river basin (Kadigi *et al*., 2004). The maximum land under paddy in Usangu during a normal to wet year, when the average weather conditions are favourable, amounts to

about 4200 ha. During the drier years however, the land size is comparably smaller amounting to about 24 500 ha. During these bad years, both rice and non-rice crops such as millet and sorghum (*guinea corn*) are grown through irrigation mostly using river flows. The non-rice mixed cropping covering about 2500 ha, which include maize, groundnuts, beans, vegetables and fruits extend throughout the year. Dry season plots are very small amounting to about 0.1 - 0.2 ha, and the main crops grown in these plots include maize, beans, tomatoes, sugarcane, onions and vegetables (Kadigi *et al*., 2004).

2.6 Household Income, Food Security and Livelihood

An income is the amount of money a household receives over a period of time either as payment for work, goods or services, or as profits on capital (Keenja, 2001). Wetlands products are a source of income for many adjacent households. For example, in Kilombero, fishing is the second income generating activity after agriculture, contributing about 3.6 billion annually (Ochieng, 2002). In Mafia, fishing and mangrove harvesting are among the ten major income generating and self-sufficient activities (Anderson and Ngazi, 1995; Doody and Mesaki, 2003).

Over 90% of the inhabitants of over 15 villages around Nyumba ya Mungu Dam depend on fishing for income and household food (Munishi and Kilungu, 2004). Similarly, in the Kilombero, fishing accounts for about 75% of all the fishing in Ulanga district in which the fish is consumed locally or sold to neighbouring regions/districts, the trend that has an implication on the people’s livelihoods (Ochieng, 2002).

At the household level, food security refers to the ability of the household to acquire adequate, safe and quality food, through production/or purchase, transfer or exchange, to fulfil the nutritional needs of all members of the household (FAO, 1995; FAO, 1998). For example, in Mara river swamp about 14 types of fish species are known to exist at various levels of quantity. Therefore, on average, over 80% of the population in the adjacent communities are fishermen and women who earn their living out of fishing. In some villages, it is reported that almost every member of the community would do fishing at some point in time during the year for the household food supply. The major species harvested for household food and for sale include *Clarias* spp, African lungfish and *Oreoclomis nilotica* (WWF, 2002). Furthermore, a total of 81 terrestrial bird species belonging to 28 families were identified around the Mara river swamp. Therefore, most wetlands are repositories and refugia for waterfowls and other bird species especially during the times of food scarcity.

The Mara river swamp contributes significantly to the production of agricultural crops especially during the dry season and agricultural production was ranked the second major socio - economic activity carried out in the swamp (Doody and Mesaki 2003; Munishi and Kilungu, 2004). The land outside the core wetlands is wet throughout the year and several crops can be produced for domestic consumption and for sale. Such crops include maize, sorghum, finger millet, beans, cassava, paddy, groundnuts, simsim and a variety of vegetable crops such as tomato, amaranthus, watermelon, onions, and sweet pepper (Doody and Mesaki 2003; Munishi and Kilungu, 2004).

It has been observed that about 28% of the available arable land in the Mara river basin is under agricultural production either in smallholding mixed farming or in large scale commercial farming (WWF, 2002). The main food crops under smallholder mixed farming are maize, wheat, beans and vegetables. The major food crops in this category include maize, cassava, sorghum, sweet potatoes, finger millet, paddy, and beans. Although most of the crops can also grow in the uplands, vegetable crops depend, to a great extent, on the swamp and thus the production of such crops would not have been possible during the dry season without the swamp (Doody and Mesaki 2003; Munishi and Kilungu, 2004).

Household livelihoods comprise the assets (natural, physical, human, financial and social capital); the activities and the access to these (mediated by institutions and social relations) determine the livelihood of the individual or household (Ellis, 2000). The source of livelihood to many inhabitants of wetlands ecosystems in Tanzania is therefore opportunistic and has been and still is based on direct exploitation of the wetlands natural resources including forests, fisheries, wildlife and agriculture. Furthermore, majority of the population in Kilombero, Rufiji delta, and Lake Jipe earn their livelihoods through fishing and farming in the wetlands. The success of these ventures, in most cases, is directly dependent on the availability of suitable land and water.

2.7 Past Studies and Valuation Methods

A study by Mutakubwa (2007) tried to establish a relative economic profitability of cassava grown by farmers at different levels of market chain in the coast region of Tanzania. The gross margin analysis by Mutakubwa was used in this study because it

was found relevant as it assesses the benefit of the product being investigated. In this study the author used linear regression model to assess the extent at which the margin is affected by buying prices and selling prices in the same study area.

Another study by Ngwasy (2007) used descriptive statistics to summarize general characteristics of market participants and financial sources using frequencies and percentages. Cross tabulation was also used in the analysis of relationship between pairs of variables in horticultural traders in Mbeya and Dar es Salaam (Ngwasy, 2007). Ngwasy also used linear regression model to assess the factors that influence size of loan applied by traders in horticultural marketing in Mbeya and Dar es Salaam. The author used gross margin analysis to assess the performance of horticultural traders in the same study area.

In the current study descriptive statistics including frequency and percentages were used to assess the socio - economic characteristics of the respondents, agricultural utilization of wetlands of the Little Ruaha sub-catchment (socio - economic activities and crops grown in the dry and wet seasons). Cross tabulations were also used to analyze the relationship between pairs of variables in objectives 1 and 2.

The gross margin analysis was used in this study to assess the economic benefits of wetland utilization, specifically the direct use values obtained from farming activities in the valley bottom and upland/main fields were obtained by the difference between revenues per person per year and the cost of production per person per year in addressing objective 3. The values of US dollars in brackets were obtained by dividing the benefits; that is the average values of benefits from valley bottom and upland/main fields were divided by the average value of 1250 Tshs for one US dollars which means 1US$ representing 1250 Tshs.

The main advantage of the analysis is that it is easily understood and it does not involve tedious calculation. The gross margin, however, is not a profit figure. Fixed costs have to be covered before arriving at a profit. The gross margin can vary widely from one year to the next. This is due to the difference in market prices, weather conditions, and efficiency. According to Mashimba (2007), the use of this technique is not widespread because it is more demanding compared with other approaches. Also, the gross margin analysis was used to assess the values of socio-economic activities and other wetlands outputs obtained by the difference between revenues per person per month and the cost incurred per person per month in addressing objective 3. Food available for consumption as an indicator of food security was used to assess the level of household food security from food crops produced in valley bottom and upland/main fields in the study area in addressing objective 3.

The linear regression analysis was used to determine the factors that influence utilization of wetlands resources in the Little Ruaha sub-catchment in addressing objective 4. The utilization of wetlands resources was determined by a number of factors such as access to market, extension services, access to credits, number of dependants, household size, land size, age of the respondents, farming experience, off farm activities, gender of the respondents and marital status. In estimating linear and non-linear regression models, Ordinary Least Squares (OLS) are commonly used. This equation is appropriate for single equation models. Ordinary Least Square estimation method uses the least square criterion that the regression line can be drawn through the scatter of the sample observation such that the positive and negative deviations of observation cancel out.

On the other hand, the second criterion requires the sum of squares of the deviations of the sample observations minimized. According to Gujarati (1995) the OLS estimation technique is simple to use, eloquent, and gives the best estimator. Also, it does not require the knowledge of the probability distribution of the underlying population being studied. It also leads to the best linear unbiased estimator and this is why it is popular in applied econometrics. The model was estimated using the Ordinary Least Squares (OLS) method with an assumption that a random error term has constant variance, zero mean, and normally distributed.

Regression models are usually associated with some heteroskedasticity and multicollinearity problems. Heteroskedasticity is the disturbance variance that differs across each observation. Multicollinearity occurs when the variables are so highly correlated with each other that it is difficult to come up with reliable estimates of their individual regression coefficients. When two variables are highly correlated, they are basically measuring the same phenomenon or construct. In other words, essentially they both convey the same information. Verification of absence of serious heteroskedasticity and multicollinearity was done by drawing a scatter plot for the former and the use of block entry regression for the latter.

The value of the coefficient of determination (Adjusted R-square) measuring the goodness of fit of the model is equal to 0.840 such that 84% of the variation in the response variable was explained by the independent variables. The unknown or an error term explained the remaining 16%. This means that the model was fit for this data since the adjusted R-square is above 50%.

The Contingent Valuation Method (CVM) is a non-market based technique that elicits information concerning environmental preferences from individuals through the use of surveys, questionnaires, and interviews. For example, Kiagho (2003) assessed policy instruments in integrated water resources management and sustainable livelihoods in the Great Ruaha basin by using contingent valuation method. When deploying the contingent valuation method, the examiner constructs a scenario or hypothetical market involving an improvement or a decline of the environmental quality through utilization of environmental resources. The scenario is then posed to a random sample of the population to estimate their willingness to pay for the decline in environmental quality or remedy the decline. The questionnaire may take the form of a simple open-ended question or it may involve a bidding process (e.g. how much would you pay). Based on the responses, the examiner estimates the willingness to pay for a decline in the environmental quality. However, the individual demonstrates preferences, which, in turn place values on environmental resources.

The CVM is extremely flexible and can be used to value almost any environmental asset. However, the primary disadvantage of CVM is that it may not yield accurate results due to biasness that may be introduced in the survey or through the respondent's behaviour. This biasness include strategic bias, where the respondent believe that his answers may be used to influence government policy; and this may influence the respondent to overstate his willingness to pay to achieve the desired policy results. The payment vehicle cited in the questionnaire may also result into biasness due to aversion of certain taxes or fees. The availability of information or misperceptions concerning environmental quality can also result into biasness. To minimize biasness, the analyst must be extremely careful in designing the surveys and conducting the interviews.

In general, economic valuation of wetlands has two benefits. First, the valuation is important in highlighting the relative importance of different economic activities that depend on wetlands functions. In this way, it can make important contributions to management plans of wetlands. Secondly, economic valuation may be useful on wetlands conservation. Putting a monetary value on activities can highlight the significance of the wetlands to the people and thus provide strong arguments for the conservation of wetlands and water as opposed to reclamation or diversion. In both cases, monetary valuation is an important complementary assessment to other qualitative assessments on wetlands functions that cannot be monetarized.

CHAPTER THREE

CONCEPTUAL FRAMEWORK AND METHODOLOGY

3.1 The Conceptual Framework for the Study

The conceptual framework for this study is given in Fig. 1. The study assumed that valley bottom and upland farming play a key role in increasing household income and food security to local communities. The objectives of the gross margin analysis were first to determine whether there is any statistical significance for the mentioned valley bottom wetlands in contributing to the economic benefits of the people. The study also intended to assess the magnitude of the effect of such activities. Also, the gross margin analysis was used to assess the marginal values of these valley bottom wetlands, and assess their contribution to the economic benefits of the people. The assumptions for this study were as follows; first, the agricultural products produced in the valley bottom wetlands have a significant contribution to economic benefits of the people to household income and food security. Secondly, socio - economic activities resulting from the presence of valley bottom wetlands have a positive impact on the economic benefits of the people to household income and food security. Third, other wetland outputs and wetlands services resulting from the presence of valley bottom wetlands have significant contribution to economic benefits with regards to people's household income and food security; and lastly it was assumed that the factors that influence utilization of wetlands resources have a significant contribution to the economic benefits of the people. This framework relates to the study objectives as evidenced by the depicted variable interrelationships.

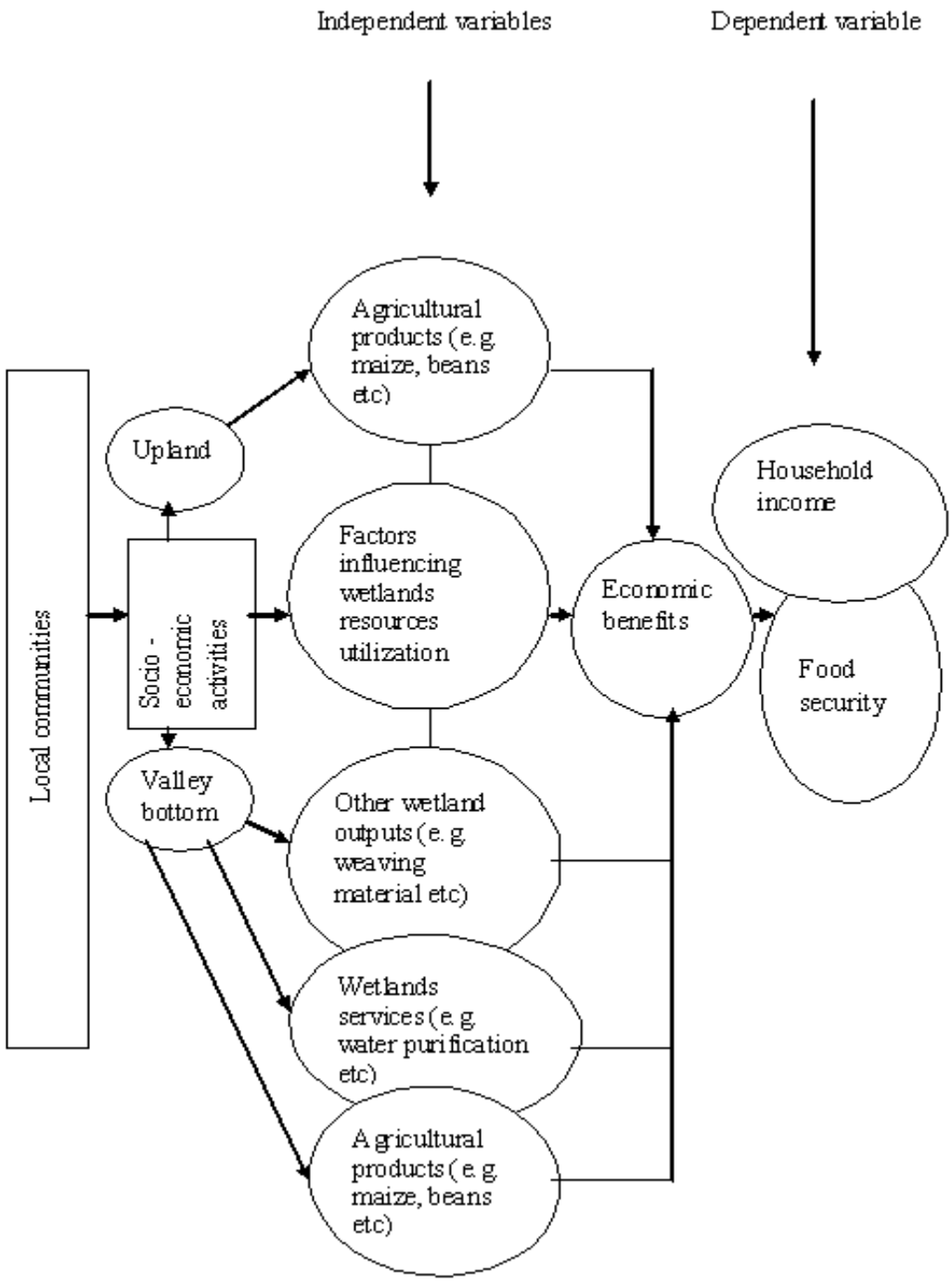

Figure 1: Conceptual framework

3.2 Description of the Study Area

This study was conducted in the wetlands of the Little Ruaha sub-catchment in Iringa region in southern Tanzania. Iringa region consists of seven districts namely Mufindi, Iringa Rural, Kilolo, Iringa Urban, Njombe, Ludewa and Makete. Mufindi district, has an area of 7 123 km^2 (URT, 2000). The district is situated approximately 140km south of Iringa town along the Mbeya-Iringa highway. The district is in the altitude of around 1800 - 2000m above the sea level and lies around latitude $08^0$00 - $09^0$15S and longitude $34^0$35 - $35^0$55E. The district is bordered by Kilolo and Iringa Urban districts to the north, Njombe district to the south, Morogoro region to the east and Singida region to the west (Fig. 2).

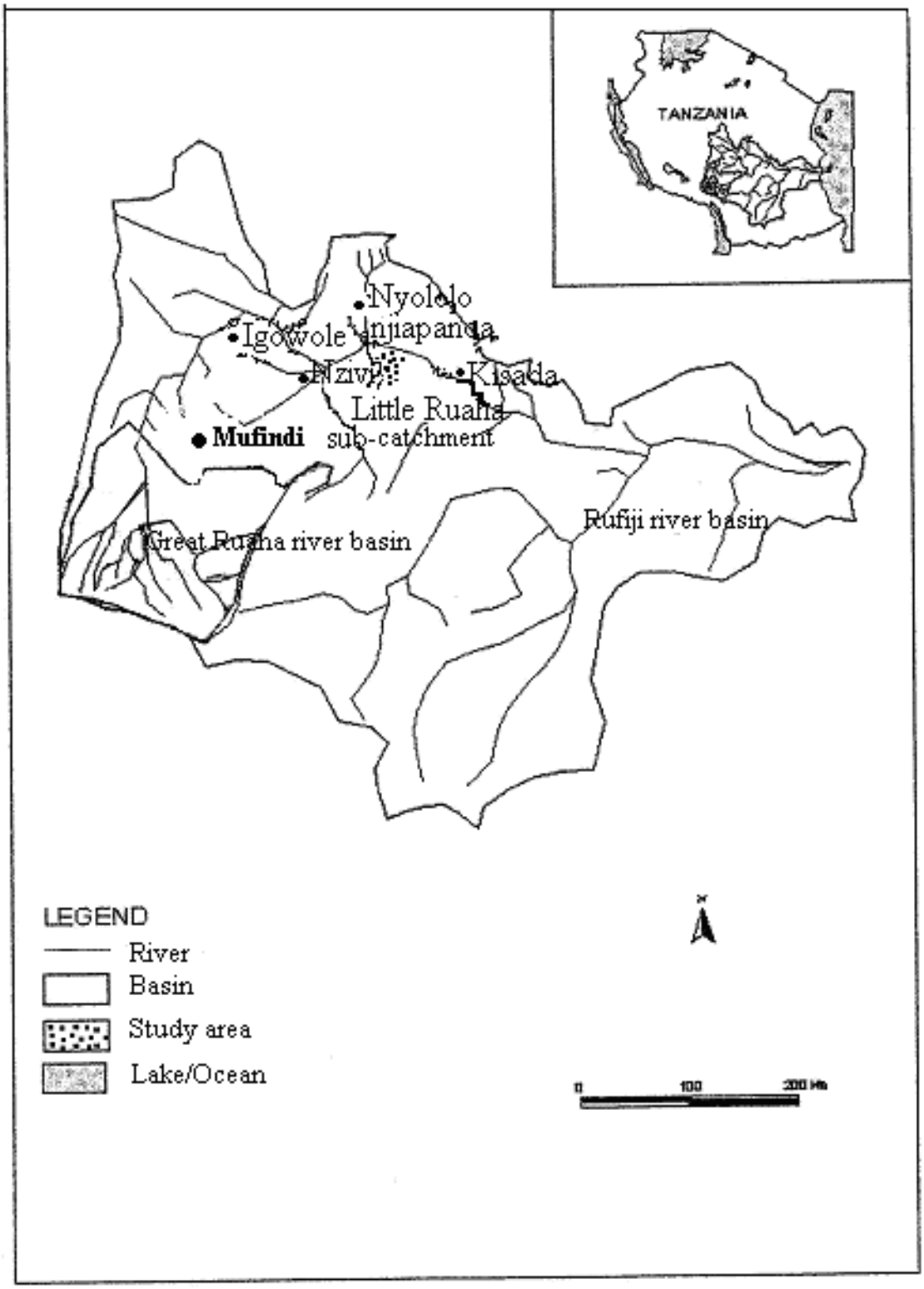

Figure 2: The study area

Administratively, the district comprises 5 divisions namely Malangali, Mdabulo, Nyololo, Mafinga and Sadani with 28 wards namely Bumilayinga, Idunda, Ifwagi, Igombavanu, Igowole, Ihalimba, Ihanu, Ihowanza, Ikweha, Isalavanu, Tandula, Kasanga, Kibengu and Kiyowela. Other divisions include, Luhunga, Mafinga, Makungu, Malangali, Mapanda, Mbalamaziwa, Mdabulo, Mninga, Mpanga TAZARA, Mtambula, Mtwango, Nyololo, Rungemba and Sadani all of which have a total of 133 villages (URT, 2000).

The Little Ruaha sub-catchment is one of the sub-catchments of the Great Ruaha river basin. The human population of Mufindi district is 283 032 with 133 828 males and 149 204 females and an average household size of 4.3. In Igowole ward, the population stood at 5232 males and 5964 females with the household size of 4.1. At Nyololo ward, the population stood at 4890 males and 5495 females with the household size of 4.4, while the population size of Bumilayinga ward stood at 2591 males and 2985 females with the household size of 4.6 (NBS, 2002).

3.3 Research Design and Sampling Techniques

A cross sectional research design was used in this study. This design was considered suitable in this study, because according to Sauli (2007), it allows the process of collecting data at a single point in time without repetition from the target population for the determination of relationships of variables. The design was preferred also because of time limitations for data collection. Qualitative and quantitative data were collected through field observations, Focus Group Discussions (FGD's) and questionnaires (household surveys). The study covered three wards Bumilayinga, Igowole and Nyololo out of which four villages were studied. The villages include

Nyololo Njiapanda in Nyololo ward, Kisada in Bumilayinga ward, and Igowole and Nzivi in Igowole ward.

The nature of the distribution of wetlands in the Little Ruaha sub-catchment called for purposeful sampling. Hence, the locations/villages and farmers were selected in order to enable a better capturing of valley bottoms and uplands, where the focus was on the households that own farms in either valley bottoms or uplands. Therefore, the four selected villages were those engaged in valley bottom and upland farming. Also, the purposive sampling gave the selection of sample units that conformed to some pre-determined criteria of this study. The sampling of individual respondents from each sub-population of the village farmers was done randomly so as to reduce bias and ensure equal chance of each sampling unit to be selected. The sampling unit for the study included households and local community representatives (village leaders).

3.4 Data Sources and Collection Methods

Both primary and secondary data were used in this study. Primary data (qualitative and quantitative) were collected through field observations, Focus Group Discussions (FGD's) and questionnaires (household surveys). Local communities were asked to identify socio - economic activities undertaken by local communities' and which depended on the wetlands of the Little Ruaha sub-catchment, these were used to determine economic value.

Primary data were collected from farmers practicing farming in the valley bottom and those dealing with agricultural activities in the upland farms. The information collected based on socio - economic characteristics of the respondents, agricultural

utilization of wetlands in the Little Ruaha sub-catchment (socio - economic activities and crops grown in dry and wet seasons), and economic importance of wetlands in the Little Ruaha sub-catchment to the household income and food security and the factors that influence utilization of wetlands resources in the Little Ruaha sub-catchment. The questionnaire was administered on individual household basis. Farmer interviews took place in the farmers own homesteads to facilitate observation by the researcher and build rapport with the farmers. The head of the household either the husband or the wife participated in responding to the questions asked.

Secondary data were obtained from various sources of information including the Mufindi District Council, Non - Governmental Organizations (NGO) in the area, the Ministry of Agriculture, Food security and Cooperatives (MAFC), the Ministry of Natural Resource and Tourism (MNRT), Sokoine National Agriculture Library (SNAL), electronic sources such as the Internet and other documented sources of information. The study collected information from issues pertaining to economic benefits of wetland utilization.

3.5 Tools for Data Analysis

The data collected were analyzed using the Statistical Package for Social Sciences (SPSS) and Excel for windows software. The collected data were analyzed using both qualitative and quantitative techniques. The techniques were intended to avail information on socio-economic characteristics of the respondents, agricultural utilization of wetlands in the Little Ruaha sub-catchment (socio-economic activities and crops grown in the dry and wet seasons), as well as the economic importance of wetlands to household income and food security and the factors that influence

utilization of wetlands resources. Descriptive statistical analysis techniques including frequency and percentages were used to assess the socio - economic characteristics of wetlands, agricultural utilization of wetlands in the Little Ruaha sub-catchment (socio-economic activities and crops grown in the dry and wet seasons); and cross tabulations were used to analyze the relationship between pairs of variables. The economic benefits were assessed by using gross margin analysis; food available for consumption as an indicator of food security was used to assess food security at the household level; contingent valuation technique was applied to assess the value of wetlands services; and linear regression analysis was used to determine the factors that influence utilization of wetlands resources.

3.5.1 Gross margin analysis

The gross margin analysis was computed as;

Formula: GM = TR - TC

Where;

GM = Average gross margin (Tshs/kg) or (Tshs/month)

TR = Average total revenue (Tshs/kg) or (Tshs/month)

TC = Average variable total cost (Tshs/kg) or (Tshs/month)

3.5.2 Food available for consumption

The food available for consumption at household level was determined to be 3 bags or 300 kg of cereal/ person/ year, as the amount used to offset post harvest losses (storage loss and handling loss) (FAO, 1985; Ishengoma, 1998). Food available for consumption was obtained by subtracting the amount of food crop that was sold, that is, the total food produced/person/year minus the amount of food sold/person/year.

The assumption was that the amount of food sold was used to attend other family needs. For consistency, some units were standardized to have equivalent units. That is 3 bags or 300 kg of cereal/ person/ year, indicate that the household has had adequate food (food security), greater than 3 bags or 300 kg of cereal/ person/ year, indicate that the household has had food surplus and less than 3 bags or 300 kg of cereal/ person/ year indicate that the household has had food shortage (food insecurity) (Ishengoma, 1998). The standardization of food available for consumption was done using adult equivalent scale considering age category (Table 1).

Table 1: Adult equivalent scale

Age	Unit equivalent
Infant 0-10	0.36
Children 11-15	0.75
Adult over 15	1

Source: Ishengoma (1998)

Further, since most of the population in the study area consume maize, it was taken as a reference cereal for which the amount of other food crops that were available for consumption at a given household were converted into maize by using farm gate price, and the amount of revenue obtained was assumed to have been used to purchase maize.

3.5.3 Contingent valuation method

In this method, individuals were asked to state directly their maximum willingness to pay per month to obtain an environmental benefit. The study also calculated the average willingness to pay made by individual users of the valley bottom wetland.

The techniques used to reduce bias using contingent valuation method in this study were probability sampling (sample type and size). Face to face interview and pre-testing questionnaire were used to control a range of individual characteristics and better plan of the survey. The analysis involved deleting protest bids or outliers.

3.5.4 Linear regression model

The extent of utilization of wetland resources by a household was taken as a measure of dependence on wetlands. The estimated empirical linear regression model which was used is specified in the equation below.

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \beta_n X_{n+} \mu$

Where;

Y = dependent variable (utilization of wetlands resources)

α = constant; β_1 - β_{11} = parameters estimated; X_1 - X_{11} = independent variables

X_1 = access to market, X_2 = extension services, X_3 = access to credits, X_4 = number of dependants, X_5= household size, X_6= land size, X_7= age of the respondents, X_8= farming experience, X_9 = off farm activities, X_{10} = gender of the respondents and X_{11} = marital status and μ = error term

(a) Dependent variable

Utilization of wetland resources was measured in terms of types and number of socio-economic activities performed in the valley bottom wetlands resources which were affected by;

(b) Independent variables

Variables such as access to market, access to credits, extension services, off farm activities and gender do affect wetland utilization, so they were categorised as dummy variables such that 1- if there is access and 0 - if there is no access to market and credits. If farmers get access to farming education as extension services and if farmers perform other activities apart from farming (an off-farm activities), they were given 1 for having access and 0 for not having access. The number of dependants and household size affect wetland utilization because an increase the number of dependants and household size would increase wetland utilization. The age of the respondents and farming experience affect wetland utilization because the age determines the maturity and energy of a farmer, the same is true for farming experience which was measured by the number of years one was engaged in farming activities. The land size affects wetland utilization because the larger the land holdings the farmer has, the bigger the area for utilization of wetland. Gender of the respondents affects utilization of wetland such that an increase of males would increase utilization of the wetland. Marital status affects utilization of wetland such that an increase of married couples would increase the utilization of wetland.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio - Economic Characteristics of the Respondents in the Wetlands of the Little Ruaha Sub-Catchment

4.1.1 Gender

The farmers who were involved in valley bottom and upland farming activities were both males (54%) and females (46%). According to Kyando (2007), in the 1980s, farmers who were more involved in *vinyungu* were women. Kyando reported that men have been involved in *vinyungu* in the current decades due to the fact that crops harvested from *vinyungu* fields contribute to higher earnings. Apart from cash earnings, the involvement of men in *vinyungu* was also due to the decline of soil fertility in the upland fields. That is, in the 1980s men possessed upland fields where they were engaged in maize production for earning money while women were engaged in valley bottom wetland cultivation for vegetable production for household consumption. As time went by, soil fertility in the uplands declined and the available area for upland cultivation declined too, forcing men to shift to valley bottom in search for plots for cultivating crops to earn money. According to URT (1997), women produced about 70% of the food crops and also shouldered substantial family responsibilities in many aspects such as exporting of crops and livestock production (Table 2).

Table 2: Socio - economic characteristics of the respondents in the wetlands of the Little Ruaha sub-catchment

Socio - economic characteristics	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Gender					
Male	23	60	53	80	54
Female	77	40	47	20	46
Age					
18 – 34	70	43	13	53	45
35 – 59	30	43	70	40	46
60 – 80	0	13	17	7	9
Marital status					
Married	94	80	77	80	83
Widow	3	10	20	7	10
Single	3	10	3	13	8
Household size					
0 – 4	33	70	60	43	52
5 – 10	60	30	40	40	43
> 10	7	0	0	17	6

4.1.2 Age

Majority of the respondents were aged between 18 and 59 years. These are considered the most active age group in a community. This indicates that the valley bottom and the upland farming activities were performed mostly by strong and active aged group of 18-59 years (Table 2).

4.1.3 Marital status

Most (83%) of the respondents interviewed were married followed by singles (8%) and lastly widows and widowers (10%) all of who shouldered substantial responsibilities. This means that these respondents had their own settlements and were self-dependent in obtaining daily family requirements. Also, these results imply

that married people venture into the valley bottom production activities as a means of meeting financial obligations in their families (Table 2).

4.1.4 Household size

About (52%) of the respondents in the household had (0-4) peoples a small sized families (Table 2). The proportion of families, with small family sizes is high which may imply that majority of the households would not exert too much pressure on the land to produce food for their families.

4.2 Utilization of Valley Bottom Wetlands in the Little Ruaha Sub-Catchment

4.2.1 Main socio - economic activities

The major socio-economic activities related to wetland utilization in the catchment included agricultural production which was the most dominant socio-economic activity undertaken by 44% of the population, livestock keeping undertaken by 31% and fishing undertaken by 1%. Agricultural production was undertaken in both valley bottom (45%) and uplands (42%). Other socio-economic activities that do not directly relate to wetland utilization included government employment, petty and major businesses (Table 3; Fig. 1).

Table 3: Main socio - economic activities in the wetlands of the Little Ruaha sub-catchment

Socio-economic activities	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Farming valley bottom	52	36	50	42	45
Farming upland	44	37	47	41	42
Livestock keeping	23	23	13	63	31
Fishing	0	0	0	3	1
Others					
Petty businesses	47	13	23	33	29
Major businesses	3	27	40	0	18
Government employment	17	0	13	0	8

4.2.2 Crops grown during dry and wet seasons

The information obtained shows that various crops are grown in the valley bottom wetlands during the dry and wet seasons, implying that the wetlands are being cultivated throughout the year. Crops commonly grown during the dry season include maize (63%), beans (75%) and vegetables (93%). The three crops were leading because they are used for household food and business purposes (Table 4; Fig. 1). Also, there were other crops, which were cultivated in small proportions such as Irish potatoes (23%), sweet potatoes (10%) and wheat (6%).

Table 4: Crops grown during dry season in the wetlands of the Little Ruaha sub-catchment

Dry season	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Vegetables	97	83	93	100	93
Beans	87	70	63	80	75
Maize	70	40	70	70	63
Irish potatoes	53	20	20	0	23
Sweet potatoes	7	0	30	3	10
Wheat	0	0	23	0	6

Crops commonly grown during the wet season were maize (91%), beans (93%) and vegetables (53%). The three crops were leading for the same reasons stated above, that is, they are used for household food and business purposes (Table 5; Fig. 1). Also, there were other crops, which were cultivated in small proportions such as sweet potatoes (38%), Irish potatoes (13%), sunflower (24%) and wheat (25%).

Table 5: Crops grown during wet season in the wetlands of the Little Ruaha sub-catchment

Wet season	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Beans	93	97	100	80	93
Maize	93	100	70	100	91
Vegetables	37	40	87	50	53
Sweet potatoes	43	17	27	63	38
Wheat	43	0	43	13	25
Sunflower	17	37	27	17	24
Irish potatoes	23	3	20	7	13

4.3 Economic Importance of Wetlands of the Little Ruaha Sub-Catchment

The total benefits of wetlands in the Little Ruaha sub-catchment can be determined by considering the values accruing from agricultural crops cultivated in the valley

bottom and other wetlands outputs. The other wetlands outputs that can be considered as beneficial to the adjacent communities include carpentry, lumbering, charcoal, grazing, and fishing, firewood, masonry and weaving material.

Given the total population of about 11 813 people in the five villages around the wetlands of the Little Ruaha sub-catchment (average 2363 people per village), the total values of all the socio-economic activities in the five villages of the valley bottom wetland in the wetland of the Little Ruaha sub-catchment were estimated at Tshs 38 211 759 173 (US$ 30 569 407) per year, which is equivalent to Tshs 254 745 061 (US$ 203 796) per household per year. These results are in agreement with the findings by (Yanda and Majule, 2004) that the value of the wetlands in Mara river (Masurura) swamp biodiversity and services is estimated at Tshs 27 637 000 000.0 (US$ 22 109 600.0) per year. This value of benefits is given from the perspectives of the communities adjacent to the swamp. The value of domestic water supplies in the wetlands of Pangani basin for instance has been estimated to be in the order of Tshs 37 - 46 billion (Turpie *et al*., 2005).

The values of agricultural products from the valley bottom and other wetlands outputs amounted to Tshs 3 234 721 (US$ 2588) per household per year. The contribution of valley bottom wetland activities from the valley bottom and other wetlands outputs in the wetland of the Little Ruaha sub-catchment to the household income with in the five villages is (1%). The average values of benefits per person per year are shown in (Table 6, 7 and 8).

4.3.1 Direct use values of agricultural production in the wetlands of the Little Ruaha sub-catchment

The communities around the wetlands in the Little Ruaha sub-catchment depend

much on, maize, beans and wheat produced in the valley bottoms for both income and food. Maize contributes (55%) of the total annual food production per household in the valley bottoms (Table 6; Fig. 3). These results are in agreement with the findings by Kyando (2007) that the *vinyungu* farming plays a significant role in generating income as well as providing a buffer food stock to the local communities during drought periods and which are frequent these days. The direct use values of the upland farming are such that maize contributes (52%) of the total annual food production per household in the upland/main fields. Therefore, maize was the most dominant crop in contributing to household income in both dry and wet seasons (Table 6; Fig. 4).

Table 6: Direct use values of agricultural production in the wetlands of the Little Ruaha sub-catchment

Valley bottom	**Tshs/ household / year**				
	Igowole (n=30)	**Kisada (n=30)**	**N/Njiapanda (n=30)**	**Nzivi (n=30)**	**Average (N=120)**
Wheat	10 839	3 780	2 100	933	4 413
Maize	203 964	23 655	27 351	19 967	68 734
Beans	81 724	14 976	12 672	84 514	48 472
Irish potatoes	2 120	4 004	3 688	2 066	2 970
Sweet potatoes	2 359	1 413	3 206	5 376	3 089
Vegetables	920	540	180	489	532
Sub Total					**128 209**
Upland					
Wheat	26 667	0	0	2 333	7 250
Maize	26 570	144 717	30 484	67 592	67 341
Beans	6 076	100 640	10 880	45 886	40 871
Irish potatoes	2 260	14 493	4 853	11 337	8 236
Sweet potatoes	1 010	13 070	4 024	4 024	5 532
Sunflower	190	8 200	951	89	2 358
Vegetables	480	1 500	20	244	561
Sub Total					**132 148**
Total					**260 357**
Month Average					**21 696**

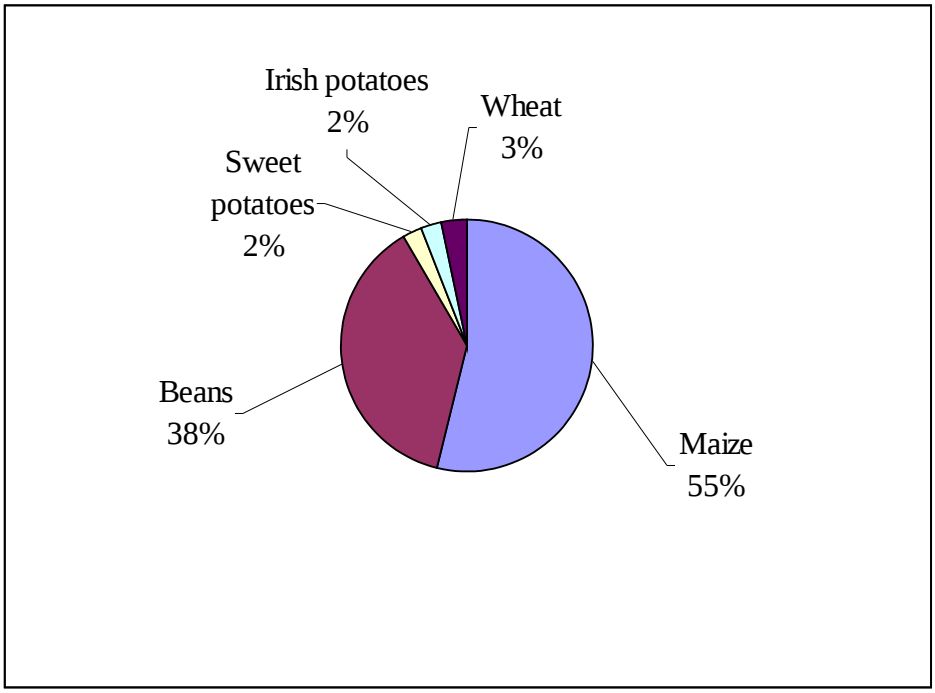

Figure 3: Contribution of valley bottom agriculture to household income in the wetlands of the Little Ruaha sub-catchment

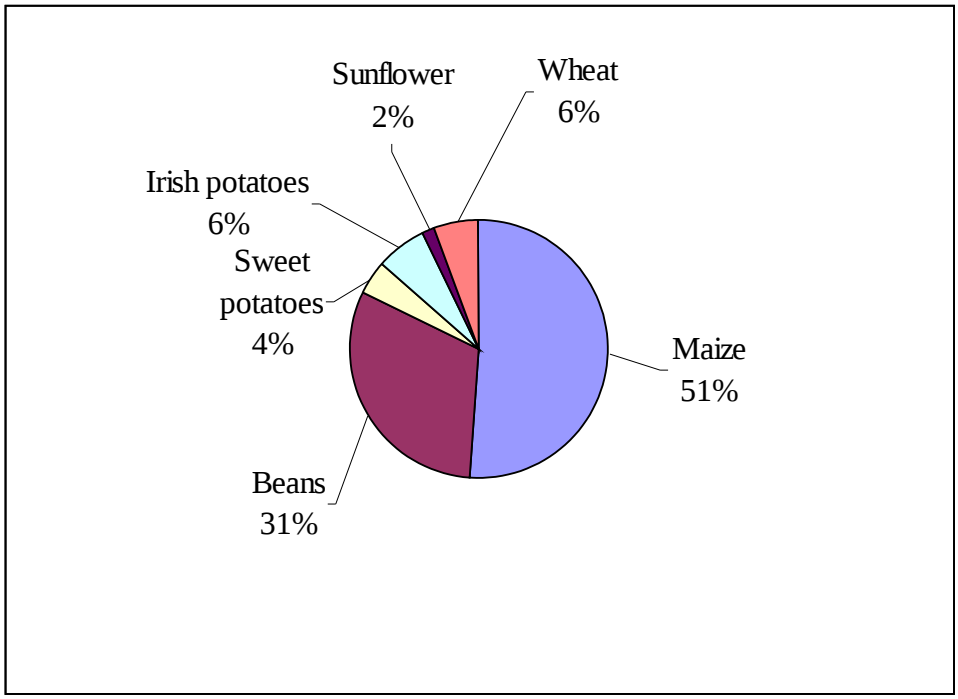

Figure 4: Contribution of upland/main field's agriculture to household income in the wetlands of the Little Ruaha sub-catchment

4.3.2 Direct use values of other wetlands outputs in the wetlands of the Little Ruaha sub-catchment

The average use values of other wetlands outputs in the wetland of the Little Ruaha sub-catchment is shown in Table 7. Carpentry was the most dominant activity among the other activities in contributing to household income (61%) per household per month and this has an implication on the utilization of forest products from the wetlands (Fig. 5).

Table 7: Direct use values of other wetlands outputs in the wetlands of the Little Ruaha sub-catchment

Activities	**Tshs/ household / month**				
	Igowole (n=30)	**Kisada (n=30)**	**N/Njiapanda (n=30)**	**Nzivi (n=30)**	**Average (N=120)**
Other wetlands outputs					
Carpentry	150 000	0	490 000	0	160 000
Lumbering	50 000	50 000	0	0	25 000
Charcoal	30 000	0	30 000	0	15 000
Grazing	2 419	7 864	12 315	47 907	17 626
Fishing	0	0	0	40 000	10 000
Firewood	0	0	10 000	50 000	15 000
Masonry	22 500	0	22 500	0	11 250
Weaving material	0	10 000	0	10 000	5 000
Sub Total					**258 876**

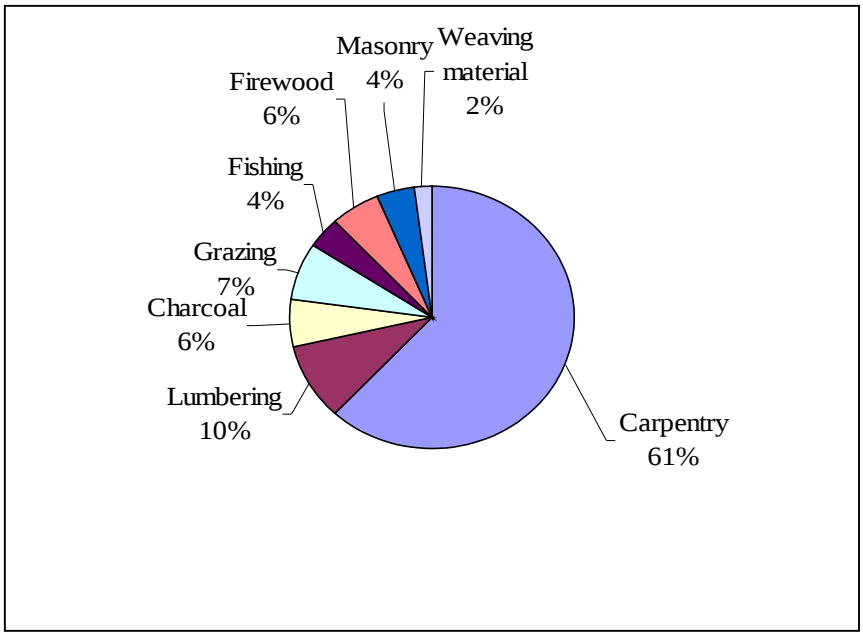

Figure 5: Contribution of other wetlands outputs to household income in the wetlands of the Little Ruaha sub-catchment

4.3.3 Indirect use values for wetlands services in the wetlands of the Little Ruaha sub-catchment

Since the environment is losing its quality and the farmer derives the benefits through using the wetlands, he/she must therefore pay for the loss of environmental quality in order to continue using the wetlands. The indirect use values in the wetlands of the Little Ruaha sub-catchment utilization in each village studied were determined in terms of farmers' willingness to pay for such wetlands services as water purification and biodiversity conservation. Majority of the respondents (91%) were willing to pay for wetlands services. As to the value of the wetlands from local perspectives the majority were willing to pay less than Tshs 2000 per person per month for the services provided by the wetlands (Table 8; Fig. 1). This implies that majority of the respondents were willing to pay in order to continue using the wetlands services, and this has an implication of the importance of the wetlands in contributing to household welfare.

Table 8: Willingness to pay for wetlands services in the wetlands of the Little Ruaha sub-catchment

(a) Willingness to pay	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Yes	97	93	93	80	91
No	3	7	7	20	9

(b) Amount willing to pay (Tshs/month)	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
400	30	6	12	33	20
500	18	15	18	33	21
1000	3	21	36	12	18
1500	6	21	15	3	11
2000	27	27	9	9	18
3000	6	0	0	0	2

4.3.4 Household food security

The contribution of food crops from valley bottom and upland/main fields in the wetlands of the Little Ruaha sub-catchment to household food security indicates that 69% of the respondents were food insecure, that is, consume less than 300 kg of maize/ person/ year. Wetland cultivation contributes 31% of the total annual food production per household in valley bottom and upland/main fields. Valley bottom wetlands contribute 15% to household food security, which is equivalent to Tshs 128 209 (US$103) per household per year. This production is dominant during the dry season and in the absence of valley bottom wetlands the food insecurity would be even worse (Table 9).

Table 9: Household food security in the wetlands of the Little Ruaha sub-catchment

(a) Food security	% Population

	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
<300kg/person/year – deficit	60	67	80	70	69
>300kg/person/year – surplus	40	33	20	30	31

(b) Valley bottom wetlands	Tshs/ household / year				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Valley bottom	301 926	48 368	49 197	113 345	128 209
Upland	63 253	282	51 212	131 505	132 148
		620			
Total					**260 357**

4.4 Contribution of Socio - Economic Activities to Household Income

The average use values of socio-economic activities in the wetlands of the Little Ruaha sub-catchment are shown in Table 10. Farming in the valley bottom and other wetlands outputs in the wetland of the Little Ruaha sub-catchment contribute 95% to the household income which is equivalent to Tshs 3 234 721 (US$ 2588) per household per year, and this is a substantial contribution to the economic welfare and rural livelihood to adjacent communities especially during the dry season or drought years (Fig. 6).

Table 10: Contribution of socio - economic activities to household income in the wetlands of the Little Ruaha sub-catchment

Socio - economic activities	Tshs/ household / year				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Valley bottom					
Farming	301 926	48 368	49 197	113 345	128 209
valley bottom					
Other					3 106 512
wetlands					
outputs					
Sub Total					**3 234 721**
Upland					
Livestock	4 269	13 878	21 732	84 542	31 105
keeping					
Petty	10 272	1 560	2 400	16 740	7 743
businesses					
Farming	63 253	282 620	51 212	131 505	132 148
upland					
Government	9 144	0	12 420	0	5 391
employment					
Major	6 270	4 980	6 150	0	4 350
businesses					
Sub Total					**180 737**
Total					**3 415 458**
Month					**284 622**
Average					

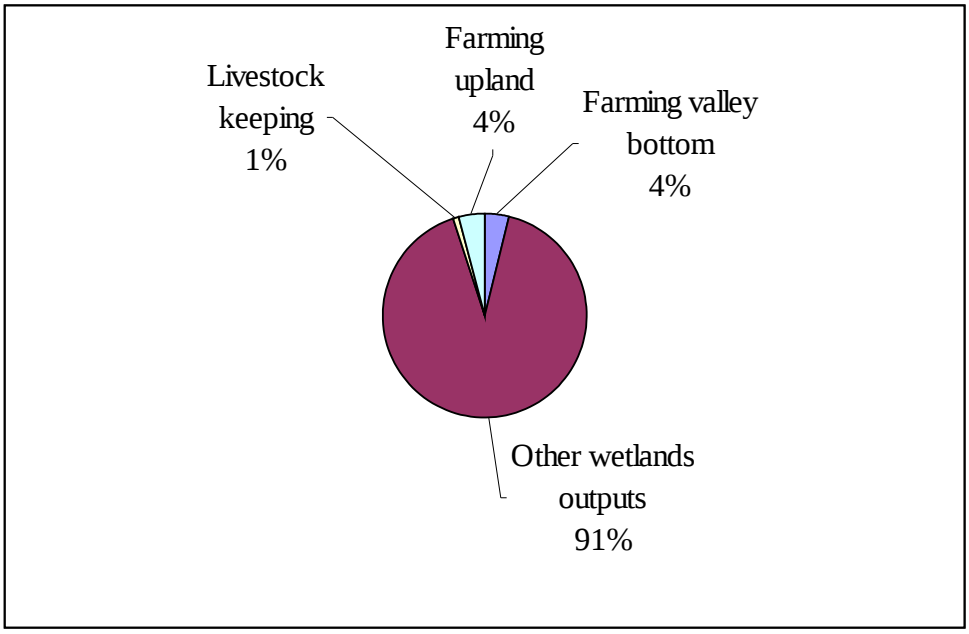

Figure 6: Contribution of different socio - economic activities to household income in the wetlands of the Little Ruaha sub-catchment

4.5 Factors Influencing Utilization of Valley Bottom Wetlands

The factors influencing utilization of valley bottom wetlands resources in the Little Ruaha sub-catchment were access to markets, extension services, access to credits, the number of dependants, household size, land size, the age of the respondents, farming experience, off farm activities, the gender of the respondents and marital status. However, the independent variables such as access to markets, extension services, the number of dependants, household size, and off farm activities were negatively related to the utilization of wetland resources, whilst the other independent variables were positively related to the utilization of wetlands resources. Linear regression analysis results show that the age of the respondents, farming experience; access to markets, the number of dependants and household size significantly influenced the utilization of wetlands resources ($P<0.01$). On the other hand, some factors that would be thought to influence the utilization of valley

bottom wetlands were not significant. Such factors include extension services, access to credits, land size, off farm activities, the gender of the respondents and marital status (Table 11; Fig. 1).

The relationship between access to markets and utilization of wetlands resources was negative and statistically significant ($P<0.01$). This implies that an increase in the access to markets would decrease the utilization pressure of wetlands resources by 35%. The negative correlation of this parameter can be attributed to the fact that majority of farmers perform off farm activities. The relationship between access to extension services and utilization of wetlands resources was negative and not statistically significant ($P<0.05$). This implies that an increase in extension services would decrease the utilization pressure of wetlands resources by 18%. The negative correlation and insignificance of this parameter can be attributed to the fact that majority of the respondents perform off farm activities, and which have no proper access to extension services. The relationship between the number of dependants and utilization of wetlands resources was negative and statistically significant ($P<0.01$) implying that an increase in the number of dependants would decrease the utilization pressure of wetlands resources by 13%. The negative correlation of this parameter can be attributed to the fact that having a large number of family members, and which influence other chances to obtaining income. The relationship between household size and utilization of wetlands resources was negative and statistically significant ($P<0.01$) implying that an increase in household size would decrease the utilization pressure of wetlands resources by 70%. The negative correlation of this parameter can be attributed to the fact that having a large number of educated family members, and which increase other chances to obtaining income. The relationship between off farm activities and utilization of wetlands resources was negative and not statistically significant ($P<0.05$) implying that an increase in off farm activities would

decrease the utilization pressure of wetlands resources by 13%. The negative correlation and insignificance of this parameter can be attributed to the fact that majority of the respondents perform off farm activities, and which they were small scale farmers.

Access to credits was positively correlated with the utilization of wetlands resources though not statistically significant ($P<0.05$) implying that an increase in access to credits would increase the utilization pressure of wetlands resources by 21%. The insignificance of this parameter can be attributed to the fact that majority of the respondents have no proper access to credits. Land size had positive but non-significant correlation with wetland utilization ($P<0.05$) implying that an increase in the land holdings would increase the utilization pressure of wetlands resources by 9%. The insignificance of this parameter can be attributed to the fact that majority of the respondents have less land holdings. The age of the respondents was positively correlated with utilization of wetlands resources ($P<0.01$) implying that an increase of the age of the respondents would increase the likeliness of the utilization pressure of wetlands resources by 44%. The insignificance of this parameter can be attributed to the fact that majority of the respondents were young not aged.

The relationship between farming experience and the utilization of wetlands resources was positive and statistically significant ($P<0.01$) implying that an increase in farming experience would increase the likeliness of the utilization pressure of wetlands resources by 3%. The relationship between gender and utilization of wetlands resources was positive and not statistically significant ($P<0.05$). This implies that an increase of males would increase the utilization pressure of wetlands resources by 2%. The insignificance of this parameter can be attributed to the fact that majority of the respondents were females. The relationship between marital status and utilization of wetlands resources

was positive and not statistically significant (P<0.05) implying that an increase in the number of married couples would increase the utilization pressure of wetlands resources by 14%. The insignificance of this parameter can be attributed to the fact that majority of the interviewed individuals were single, widows and widowers.

Table 11: Linear regression results of the factors that influence utilization of the wetlands resources in the Little Ruaha sub-catchment

Variables	B	Std. error	t-value	P-value	Significance
Constant	3.136	2.947	1.064	0.294	ns
Market (dummy)	-3.471	1.209	-2.871	0.007	s
Extension services (dummy)	-1.750	1.262	-1.387	0.173	ns
Credits (dummy)	0.214	1.341	0.160	0.874	ns
Number of dependants	-1.281	0.158	-8.113	0.01	s
Household size	-0.699	0.166	-4.211	0.01	s
Land size	0.085	0.290	0.293	0.771	ns
Age	4.393	0.124	35.459	0.01	s
Farm experience	0.031	0.003	8.817	0.01	s
Off farm (dummy)	-1.316	2.083	-0.631	0.531	ns
Gender (dummy)	0.021	1.221	0.017	0.987	ns
Marital status	0.135	0.702	0.193	0.848	ns

s = significant at P< 0.01

ns = not-significant at P< 0.05

Adjusted R^2 = 84%

F-value =11020.7

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Major Findings

There has been an intensive use of the valley bottom farming to an extent that cultivation which was originally restricted to vegetables (small ridges of green vegetables) and potatoes has now been extended to the farming of other crops to increase yields especially during the dry season. The socio-economic activities dependent on the wetlands include agricultural production from valley bottoms practised by over 98% of the population followed to a small extent by livestock keeping and other wetland outputs. Though the contribution of valley bottom wetland activities such as farming valley bottom, and other wetlands outputs within the five villages to the household income is relatively low 1%, but the role of these valley bottom wetland activities in enhancing household food security seems to be high 15% and becomes of higher significance especially during the dry season or drought years. In the absence of valley bottom wetlands food insecurity in the wetland of the Little Ruaha sub-catchment would be even worse. Activities that are not directly related to valley bottom wetlands utilization included petty and major businesses and government employment.

The total values of all the socio-economic activities in the five villages of the valley bottom wetland in the wetland of the Little Ruaha sub-catchment were estimated at Tshs 38 211 759 173 (US$ 30 569 407) per year, that is equivalent to Tshs 254 745 061 (US$ 203 796) per household per year. Socio-economic activities in valley bottom wetland contribute more to household income than do the socio-economic activities in the upland. In general, the contribution of valley bottom farming and other wetland outputs in the wetland of the Little Ruaha sub-catchment to household food security is 15% and 95% to household income that is equivalent to Tshs 128 209 (US$103) and Tshs 3 234 721

(US$ 2588) per household per year. The age of the respondents, farming experience, access to markets, the number of dependants and household size significantly influenced the utilization of wetlands resources ($P<0.01$). On the other hand, some factors that would be thought to influence the utilization of valley bottom wetlands were not significant. Such factors include extension services, access to credits, land size, off farm activities, gender of the respondents and marital status.

5.2 Conclusions

The study has shown that different crops that are grown in the valley bottom wetlands contribute variably to household income and food security. Also the study found that socio-economic activities undertaken by local communities contribute variably to the household income and food security. About 98% of the population utilise valley bottom wetlands for agriculture production. Maize was the leading crop to contribute household income and food security especially during the wet season in upland main fields than in the valley bottom. Agriculture production in valley bottom wetlands contributes significantly to the household income and food security especially during the dry season or drought years. Overall valley bottom contribute 15% of household food security. Further valley bottom wetland contributes 95% of the household income during the dry season. Carpentry was the most dominant activity in other wetland activities to contribute household income and food security. Utilization of valley bottom wetlands was influenced by different socio-economic factors. Factors that were significant in influencing wetland utilization include age, farming experience, accesses to market, family size and number of dependants. Generally, valley bottom wetlands utilization by adjacent communities contributes significantly to economic welfare and rural livelihood.

5.3 Recommendation

It is recommended that for sustainability of utilization of the valley bottom wetlands, planning for wetland friendly agricultural activities is paramount in order to ensure wetlands conservation and sustainable contribution to household economy and food security.

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APPENDICES

Appendix 1: Farmer's questionnaire sheet for crop production

Livelihoods and economic benefits of wetlands utilization: A case of the Little Ruaha sub-catchments in Mufindi district, Iringa, Tanzania.

A: Background information

Please, you are kindly asked to provide sincerely information on the following questions. All information provided will strictly be confidential.

Date of interview……Code number of respondents……

Name of interviewer…….Ward……Village……

Hamlet……..Division…….....District…….....

B: Household identification variables (demographic)

Please fill where appropriate

1. Age…….
2. Gender, 1-Male ( ) 2-Female ( )
3. Marital status, 1-Married 2-Single 3-Divorced 4-Widow 5-Others (specify)……..... ( )
4. Education level of farm manager 1-Standard VII 2- Form IV 3- Form VI 4-Higher levels 5- None ( )
5. Household composition

   a. How many children's do you have ……
6. a. Are they all schooling, 1-Yes ( ) 2-No ( )

   b. If "No" explain why? ……

c. If “Yes” what is the level of their education, gender and age?

Children	Age	Gender	Level/ Class
1			
2			
3			
4			
5			

7. How many dependents do you have? …….....
8. What is you are relationship in household 1-Head 2-Wife 3-Husband 4-Child 5-Other relatives 6-Other friends ( )
9. Who is the head of this household? 1-Male ( ) 2-Female ( )
10. How old is she/he?.....
11. What type of ecological zone is this area has 1-Mountainous 2-Hilly 3-Plain 4-Others (specify)..... ( )
12. Altitude.....
13. What is you are main occupation 1-Child 2-Student 3-House girl/Shamba boy 4-Farmer 5-Fisherman 6-Government/Parastatal employee 7-Private sector employee 8-Self employed(non-farm) ( )
14. Number of people in your household

Year	Female	Male
1) Less than 5		
2) 5 -18		
3) Above 18		

C: Household assets

15. Which properties of the following do you own in your household?

Property	How acquired		
	Bought	Inherited	Rent/allocated
Land			
Woodlot (forest)			
House			
Goats			
Cattle			
Sheep			
Donkey			
Chicken			
Pigs			

16. What other assets do you own?

1……..... 2…….....

3 …… 4…….....

17. What is the material used to build your own house?

Floor	1 Yes 2 No	Walls	1 Yes 2 No	Roofs	1 Yes 2 No	Doors	1 Yes 2 No
Earth/ sand		Sun-dried bricks		Grass		Wood	
Finished floor: -Cement -Stone		-Burnt bricks - Concrete blocks - Plastered		Corrugated iron sheets		Corrugated iron sheets	
Rudimentary wood planks		Thatched walls		Other		Grass	
Other		Other				Other	

D: Land availability, ownership and cropping preference

18. What indicates ownership of land by a farmer in your village? a-Village government letter/certificate of ownership b-Local government letter/certificate of ownership c-Title deed d-Nothing ( )

19. a. What is the size of your land?.....Acres

    b. Is it possible to obtain more land? 1-Yes ( ) 2-No ( )

    c. If "No" why? ……....

20. a. Do you produce your own food? 1-Yes ( ) 2-No ( )

    b. If "Yes" how much total cultivated area in acres ……..

21. a. What crops are grown? (Rank your crops according to the order of importance)

Food crops; Cash crops;

1……Acres 1…… Acres 2…….....Acres

2……Acres

3…….....Acres 3…… Acres 4……..Acres

4…….Acres

b. Give the criteria used for the ranking……

22. a. Do you cultivate all your area? 1-Yes ( ) 2-No ( )

b. If "No" why do you not cultivate the rest of the land? 1- Low fertility

2- Labour shortage 3- Low technology 4- Others (Specify)…… ( )

23. a. Which other important crops are grown for food availability within household?

a- Maize b-Wheat c-Beans d-Sweet potatoes e-Vegetables (Specify) f-Others (Specify)…… ( )

b. What crops are grown in/around the wetland in the dry season?

a……..b…….c…….

c. What crops are grown in/around the wet season?

a…….b……..c……

24. Do you own *vinyungu* for agricultural activities? 1-Yes ( ) 2-No ( )

25. a. Do you perform any off farm activities? 1-Yes ( ) 2-No ( )

b. If "Yes" what are these activities performed outside the farm……

c. What is the average monthly income from off farm activities …… Tshs

26. What inspired/attracted people to cultivate *vinyungu*? a-Cheap/Easy to get b-More productive compared to uplands c- Cultivated throughout the year d-Dry season alternative(water availability) e-Close to people's working places f-Other(Specify)…… ( )

27. a. Do you practice crop rotation in *vinyungu*? 1-Yes ( ) 2-No ( )

b. If "Yes" how is the rotation from one season to another? 1-Mono cropping 2-Mixed 3-Intercrop/relay ( )

28. a. Are the *vinyungu* plots in your villages irrigated? 1-Yes ( ) 2-No ( )

b. If "Yes" which method of irrigation is used 1-Bucket/can 2-Sprinkler 3-Surface 4-Drip 5-Others (Specify)..... ( )

29. Government and privately owned large scale farms

Do you have government or privately owned large-scale farms in/nearby/adjacent to the village?.....If No, go straight to questions 31	1-Yes 2-No

Name of the farm	Approx.distance from home (km)	Degree of cultivation:	Owners:	Employees:
		0-never cultivated 1-cultivated once for the past 10 years 2-cultivated once for the past five years 3-cultivated after 2 years 4-cultivated every year partially-less than 25% 5-cultivated every year partially-less than 50% 6-cultivated every year partially-less than 75% 7-cultivated every year completely (100%)	1-government 2-private-village resident 3-private-resident in a nearby village 4-private-resident in other district 5-private-resident in other regions 6-private-foreigner 7-other	0-no person employed 1-family members 3-family members and villagers 3-government employees 4-villagers 5-government employees and villagers 6-Others
1				
2				
3				
4				
5				

30. What do you think will be the main method of land acquisition for your children in this village?

1-They will be allocated virgin land or pasture 2-They will be allocated family land now under fallow 3-They will be inherit land already under cultivation

4-They will rent/borrow land from others 5-They will purchase land

6-Do not know, missing ( )

E: Tools, input and output

31. Farm machinery/implements/tools and equipments owned

Machinery/implement/tools	Number	Year purchased	Initial price (Tsh)	Price now (Tsh)
Tractor				
Plough				
Trailer				
Oxen plough				
Oxen cart				
Hand hoe				
Bush knives/panga				
Others (Specify)				

32. Do you apply farmyard manure in *vinyungu* cultivation?

1- Yes 2-No, If "No" go to # 34 ( )

33. How is output (productivity) per *kinyungu* when manure is applied?

1-No change in output 2-Output increases ( )

34. What makes you do not apply manure in *vinyungu*?

...……

35. Do you apply fertilizer in the *vinyungu* cultivation? 1-Yes ( ) 2-No ( )

36. How is the yield per *kinyungu* as compared to manure application?

1-No change in output 2-Output increases 3-Just the same ( )

37. If "No" what might have triggered the use of

fertilizer? .....

38. For what crops is the manure used?

1.....2.....3.....

39. What types of manures are easily available and effective for crop yield?

1-Farmyard manure 2-Compost manure 3-Dung manure 4-Chicken manure

5-Pig ( )

40. How is the manure used in the agricultural activities obtained?

1- Own animal's 2-Buy 3-Others (Specify)..... ( )

41. a. Are there any other traditional methods that you use to improve the soil fertility of your land? 1-Yes ( ) 2-No ( )

b. If "Yes" what are these methods? 1..... 2..... 3.....

42. Where do you buy your inputs? 1- In town 2-Private traders 3- Cooperative society 4- Others (Specify)..... ( )

43. a. Are the inputs available in time when you need? 1-Yes ( ) 2-No ( )

b. If "No" why? …….....

c. If "Yes" what is the major means of transport for your farm inputs?

.....

44. a. Do you get any extension services? 1-Yes ( ) 2-No ( )

b. If "Yes" what type of extension services and how regular?.....

45. a. Do you have access to credit facilities? 1-Yes ( ) 2-No ( )

b. If "Yes" what are the use of the credit borrowed? ……

c. If "No" why? 1- Lack of credit facilities 2- High interest rate

3- Not aware of credit availability 4- High risk 5- Low income obtained from crop ( )

46. a. In your own opinion do you think that credit is helpful? 1-Yes ( ) 2-No ( )

b. If “Yes” why? ……

If “No” why?.....

47. When do you harvest

Crop	Month
Maize	
Sorghum	
Rice	
Cassava	
Sweet potatoes	
Others (specify)	

48. Food crops: Outputs, income and markets

Crop	Unit	Quantity consumed		Quantity sold		Quantity in store		Total produced	Average price (Tsh)	Gross income	Variable costs	Net Total income	Net Cash income
		A Qt	**B** %	**C** Qt	**D** %	**E** Qt	**F** %	**G=A+C+E**	**H**	**I=G×H**	**J**	**K=I-J**	**L=K×D**
Maize													
Paddy													
Mtama													
Cassava													
Sweet potatoes													
Irish potatoes													
Banana													
Uwele													
Wheat													
Beans													
Mikunde													
Mbaazi													
Fiwi													
Coconuts													
Others													
TOTAL													

*****Convert all local units (e.g. gunia, debe, viloba, tenga, ndonya etc.)

into kilogram equivalent and fill in the average price (H) accordingly

WORKING SPACE (VARIABLE INPUT COSTS) for food crops: this table is for working out the variable input costs (**J**) i.e. cash costs for each food crop(use a

separate sheet/table for each crop)					
Crop	Name of input	Quantity used **K**	Price per unit (Tsh) **L**	Cost of input (Tsh) **M=K×L**	Total cost for each crop (Tsh) (sum of **M** values)
Maize	Land preparation(hired labour)				
	Ploughing (hired labour)				
	Planting (hired labour)				
	Weeding (hired labour)				
	Seeds				
	Fertilizers				
	Herbicides				
	Pesticides				
	Scaring/chasing birds/animals (hired)				
	Harvesting costs (hired)				
	Transport costs from farm				
	Storage costs, if any				
	Processing/sorting (hired)				
	Marketing costs				
	Other variable costs				
State if purchased or taken from own harvest and provide quantity and price information for both cases					

Family labour spent for each food crop and farm activity (use a separate sheet/table for each crop)					
Crop	Activity	Mandays	Crop	Activity	Mandays
Maize	Land preparation		Padd y	Land preparation	
	Ploughing			Ploughing	

	Planting			Planting	
	Weeding			Weeding	
	Applying fertilizers			Applying fertilizers	
	Applying herbicides			Applying herbicides	
	Applying pesticides			Applying pesticides	
	Scaring/chasing birds/animals			Scaring/chasing birds/animals	
	Harvesting			Harvesting	
	Transporting from farm			Transporting from farm	
	Storing			Storing	
	Processing/sorting			Processing/sorting	
	Marketing			Marketing	
	Other activities			Other activities	
Total			Total		

Markets for food crops		
Crop	Markets 1-farmgate 2-village market 3-district market 4-regional markets 5- interregional or Dar 6-across the border to neighboring countries or abroad	Distance from home (km)
Maize		

Paddy		
Mtama		
Mihogo		
Sweet potatoes		
Irish potatoes		
Banana		
Uwele		
Ngano		
Beans		
Mikunde		
Mbaazi		
Fiwi		
Nazi		
Others		

49. Traditional and non-traditional cash crops: Outputs, income and markets

Crop	Unit	Quantity consumed		Quantity sold		Quantity in store		Total produced	Average price (Tsh)	Gross income	Variable costs	Net Total income	Net Cash income
		A Qt	**B** %	**C** Qt	**D** %	**E** Qt	**F** %	**G=A+C+E**	**H**	**I=G×H**	**J**	**K=I-J**	**L=K×D**
Cotton													
Ufuta													
Alizeti													
Onions													
Miwa-mezani													
Miwa-sukari													
Nazi													
Karanga													
Mkonge													
Others													
Total													

*****Convert all local units (e.g. gunia, debe, viloba, tenga, ndonya etc.) into kilogram equivalents and fill in the average price (H) accordingly

WORKING SPACE (VARIABLE INPUT COSTS) for cash crops: this table is for working out the variable input costs (**J**) i.e. cash costs for each cash crop(use a separate sheet/table for each crop)					
Crop	Name of input	Quantity used **K**	Price per unit (Tsh) **L**	Cost of input (Tsh) **M=K×L**	Total cost for each crop (Tsh) (sum of **M** values)
Cotton	Land preparation (hired labour)				
	Ploughing (hired labour)				
	Planting (hired labour)				
	Weeding (hired labour)				
	Seeds				
	Fertilizers				
	Herbicides				
	Pesticides				
	Scaring/chasing birds/animals (hired)				
	Harvesting costs (hired)				
	Transport costs from farm				
	Storage costs, if any				
	Processing/sorting (hired)				
	Marketing costs				
	Other variable costs				
State if purchased or taken from own harvest and provide quantity and price information for both cases					

Family labour spent for each cash crop and farm activity (use a separate sheet/table for each crop)					
Crop	Activity	Mandays	Crop	Activity	Mandays

Cotton	Land preparation		Sugar cane	Land preparation	
	Ploughing			Ploughing	
	Planting			Planting	
	Weeding			Weeding	
	Applying fertilizers			Applying fertilizers	
	Applying herbicides			Applying herbicides	
	Applying pesticides			Applying pesticides	
	Scaring/chasing birds/animals			Scaring/chasing birds/animals	
	Harvesting			Harvesting	
	Transporting from farm			Transporting from farm	
	Storing			Storing	
	Processing/sorting			Processing/sorting	
	Marketing			Marketing	
	Other activities			Other activities	
Total			Total		

Markets for traditional and non-traditional cash crops		
Crop	Markets 1-farmgate 2-village market 3-district market 4- regional markets 5- interregional or Dar 6-across the border to neighboring countries or	Distance from home (km)

	abroad	
Cotton		
Ufuta		
Alizeti		
Onions		
Miwa- mezani		
Miwa-sukari		
Nazi		
Karanga		
Mkonge		
Others		

50. Other crops-vegetables, fruits, other horticultural crops, forestry and fodder: Outputs, income and markets

Crop	Unit	Quantity consumed		Quantity sold		Quantity in store		Total produced	Average price (Tsh)	Gross income	Variable costs	Net Total income	Net Cash income
		A Qt	**B** %	**C** Qt	**D** %	**E** Qt	**F** %	**G=A+C+E**	**H**	**I=G×H**	**J**	**K=I-J**	**L=K×D**
Nyanya													
Mchicha													
Pilipili hoho													
Pilipili mbuzi													
Karoti													
Nyanya chungu													
Maembe													
Papai													
Machungwa													
Trees/ Timber													
Fodder													
Others													
Total													

*****Convert all local units (e.g. gunia, debe, viloba, tenga, ndonya etc.) into kilogram equivalents and fill in the average price (H) accordingly

WORKING SPACE (VARIABLE INPUT COSTS) for other crops-vegetables, fruits ,other horticultural crops, forestry and fodder: this table is for working out the variable input costs (**J**) i.e. cash costs for each crop (use a separate sheet/table for each crop)

Crop	Name of input	Quantity used **K**	Price per unit (Tsh) **L**	Cost of input (Tsh) **M=K×L**	Total cost for each crop (Tsh) (sum of **M** values)
Nyanya	Land preparation(hired labour)				
	Ploughing (hired labour)				
	Planting (hired labour)				
	Weeding (hired labour)				
	Seeds				
	Fertilizers				
	Herbicides				
	Pesticides				
	Scaring/chasing birds/animals (hired)				
	Harvesting costs (hired)				
	Transport costs from farm				
	Storage costs, if any				
	Processing/sorting (hired)				
	Marketing costs				
	Other variable costs				
State if purchased or taken from own harvest and provide quantity and price information for both cases					
Family labour spent for each vegetable, fruit, other horticultural crop, forestry and fodder crop and respective farm activities (use a separate sheet/table for each crop)					

Crop	Activity	Mandays	Crop	Activity	Mandays
Nyanya	Land preparation		Mchicha	Land preparation	
	Ploughing			Ploughing	
	Planting			Planting	
	Weeding			Weeding	
	Applying			Applying	

	fertilizers			fertilizers	
	Applying herbicides			Applying herbicides	
	Applying pesticides			Applying pesticides	
	Scaring/chasing birds/animals			Scaring/chasing birds/animals	
	Harvesting			Harvesting	
	Transporting from farm			Transporting from farm	
	Storing			Storing	
	Processing/sorting			Processing/sorting	
	Marketing			Marketing	
	Other activities			Other activities	
Total			Total		

Markets for vegetable ,fruits ,other horticultural ,forestry and fodder		
Crop	Markets 1-farmgate 2-village market 3-district market 4- regional markets 5- interregional or 6-across the border to neighboring countries or abroad	Distance from home (km)
Nyanya		
Mchicha		
Pilipili hoho		

Pilipili mbuzi		
Karoti		
Nyanya chungu		
Maembe		
Papai		
Machungwa		
Trees/timber		
Fodder		
Others		
Total		

51. Livestock enterprises: Rearing systems, numbers, outputs, income and markets

Livestock keeping systems and numbers											
Type	System 1-Extensive 2-Indoor 3-Ranch	No. Now	No. last year	No. Born	No. Died	No. Bought	No. Sold	No. Gifts in	No. Gifts out	No. Eaten at home	Current price (Tsh)
Indigenous cattle											
Improved Beef cattle											
Improved Dairy Cattle											
Sheep and goats											
Pigs											
Poultry											
Rabbits											
Donkeys											
Others											

*****Price that could be obtained by selling an adult animal or bird now

Livestock outputs/products/by-products and income									
Type of	Unit	Quantity	Quantity	Total	Average	Gross	Variable	Net	Net

product		Consumed		sold		produced	price (Tsh)	income	costs	Total Income	Cash Income
		Qty **A**	% **B**	Qty **C**	% **D**	**E=A+C**	**F**	**G=E×F**	**H**	**I=G-H**	**J=I×D**
Milk											
Yoghurt											
Cheese											
Beef											
Skins											
Hides											
Others											
Total											

WORKING SPACE (VARIABLE INPUTS COSTS) for livestock products and by-products: this table is for working out the variable input costs (**H**) i.e. cash costs for each livestock product/by-product (use a separate sheet/table for each type of livestock)					
Type (e.g. Indigenous cattle)	Name of inputs	Quantity used **K**	Price per unit (Tsh) **L**	Cost of input (Tsh) **M=K×L**	Total cost for each crop (sum of **M** values)
	Herding (hired)				
	Milking (hired)				
	Feeding (hired)				
	Banda/Kraal cleaning /repairing (hired)				
	Vet. Drugs				
	Vet. Service charges				
	Marketing costs				
	Taxes/levies				
	Other costs				

*Use mandays where hired labour is involved

Family labour spent for each livestock enterprises and activity (use a separate sheet/table for each livestock enterprise)					
Type (e.g. Indigeno	Activity	Mandays	Type (e.g. Indigenous cattle)	Activity	Mandays

us cattle)					
	Herding			Herding	
	Milking			Milking	
	Feeding animals			Feeding animals	
	Animal treatment			Animal treatment	
	Banda/Kraal cleaning/repairing (hired)			Banda/Kraal cleaning/repairing (hired)	
	Marketing			Marketing	
	Other activities			Other activities	
Total			Total		

Markets for livestock and livestock products/by-products		
Live animals	Markets 1-farmgate 2-village market 3-district market 4- regional markets 5- interregional or Dar 6-across the border to neighboring countries or	Distance from home (km)

	abroad	
Indigenous cattle		
Improved Beef Cattle		
Improved Dairy Cattle		
Sheep and goats		
Pigs		
Poultry		
Rabbits		
Donkeys		
Others		
Livestock products/by-products		
Milk		
Yoghurt		
Cheese		
Beef		
Skins		
Hides		
Others		

52. Other activities involving the use of natural resources: Output and income

Activity	Quantity Consumed		Quantity Sold		Total produced	Average Price (Tsh)	Gross Income	Variable costs	Net Total Income	Net Cash Income
	Qty **A**	% **B**	Qty **C**	% **D**	**E=A+C**	**F**	**G=E+F**	**H**	**I=G-H**	**J=I×D**
Beekeeping										
Brewing										
Pot making										
Hand craft										
Charcoal										
Firewood										
Hunting										
Fishing										
Wild medicines										
Wild fruits										
Other forestry/wild products										
Total										

WORKING SPACE (VARIABLE INPUTS COSTS) for other activities involving the

use of natural resources: this table is for working out the variable input costs (**H**) i.e. cash costs for each activity (use a separate sheet/table for each activity)					
Activity	Name of input	Quantity used **K**	Price per unit (Tsh) **L**	Cost of input (Tsh) **M=K×L**	Total cost for each crop (sum of **M** values)

Family labour spent for each activity involving the use of natural resources		
Activity	Mandays	Distance from home (km)
Beekeeping		
Brewing		
Pot making		
Handcraft		
Charcoal		
Firewood		
Hunting		
Fishing		
Wild medicines		
Wild fruits		
Other forestry/wild products		
Total		

Markets for other natural resources-based commodities		
Crop	Markets 1-farmgate 2-village market 3-district market 4- regional markets	Distance from home (km)

	5- interregional or Dar 6-across the border to neighboring countries or abroad	
Honey/wax		
Locally brewed beer		
Pots		
Handcraft		
Charcoal		
Firewood		
Game meat		
Fish		
Wild medicines		
Wild fruits		
Other forestry/Wild products		

53. **Other sources of income:** This section relates to wages, salaries, non-natural resources businesses such as trading, shop keeping, bicycle repair etc., pensions, laboring on other farms and other income sources not listed elsewhere. Each household member who has earned outside income during the past year should be interviewed. For example, if there are more than one household members who have earned wages, salaries, self-employment incomes (i.e. own-business income), or have received pension payments during the year, then fill in this section of the questionnaires one for each person.

Code	Type of work	Amount earned last month (Tsh)	Amount earned past year (Tsh)	Place of work write code and name	Explanation of the work (e.g. Garder, Herdsmen, Cleck, Teacher etc.)
				1-Nearby 2-District 3-Rural centre 4-City	
1	Wages-Seasonal				
2	Wages-Regular				
3	Salary-Govt Sector				
4	Salary-Private sector				
5	Business income				
6	Pension Payment				
7	Other Non-Farm				
YEAR TOTAL (Tsh)					

*Enter earnings for past month. For regular pay this should equal daily pay × number of days worked per month

**Enter earnings for year up to date of interview. For regular earnings, this should equal monthly ×12

*** Net person income from business (i.e. gross income-costs). Specify the activity/business (e.g. shop keeping) and the number of people employed in the business (how many people do you employ?)

**** Examples: property rents other than land, insurance payments e.t.c.

Number household members earning from other sources of income	
Total income from other sources-earned by household members (sum of years total for all non-farm earners in the household)	(Tsh)

54. Remittance/Transfers and payment in-kind (including gifts from relatives e.g. food, clothes, food aid from government, food-for-work e.t.c.)

a) REMMITED-IN					
Description and units	How often (times per year)	Amount each time (Tsh)	Total amount (Tsh)	Approx.Value per unit (Tsh)	Approx.Total value (Tsh)
Approx. Total value for all items-REMMITED-IN					
b) REMMITED –OUT					
Description and units	How often (times per year)	Amount each time (Tsh)	Total amount (Tsh)	Approx.Value per unit (Tsh)	Approx.Total value (Tsh)
Approx. Total value for all items-REMMITED-OUT					

55. Savings and credits

Does anyone in this household belong to any credit group or scheme?							1-Yes 2-No
If Yes							
Name	Sex	Name/type of scheme	Last amount borrowed (Tsh)	Purpose of loan	Interest rate	Loan Repayment period	Grace period
	1-Male 2-Female						
1							
2							
3							
4							
5							
6							

Does this scheme also allow for savings?	1-Yes 2-No
If yes, is this regular saving?	1-Yes 2-No
If yes, amount (Tsh)?	
If yes, how often?	
Aside from the scheme, do any members of the household have savings with a credit organization or bank?	1-Yes 2-No
If yes, estimated total amount of savings at time of interview (optional) (Tsh)	

56. Where do you obtain the cash needed to pay for farming expenses?

1.....

2.....

F: Bottomland cultivation preferences

57. Why do you prefer *vinyungu* farming?

1.....

2.....

58. When did you start practicing *vinyungu* farming in your village?

.....

59. What advantages do you find in *vinyungu* farming as compared to upland farming?

1.....

2.....

60. How important to you are the *vinyungu* for crop production as compared to upland fields?

1-Very important 2-Important 3-Fairly important 4-All important ( )

61. How important to you are the *vinyungu* for income generation compared with upland fields?

1-Very important 2-Important 3-Fairly important 4-All have equal important ( )

62. Is there more or less renting of land now than in the past?

1-More 2-Less 3-No change ( )

63. What is the main reason? 1-Land unavailability 2-Land very expensive 3-Others (specify)..... ( )

G: Marketing of farm products

64. a. Is the market of your produces feasible? 1-Yes ( ) 2-No ( )

b. If "No" what are the causes? ……

65. a. Are the prices affordable? 1-Yes ( ) 2-No( )

b. If "No" why? 1- Expensive, 2- Fluctuating of food prices, 3- Others

(Specify)..... ( )

66. What has been the price trend of farm produces for the last three years?1-Increasing 2-Decreasing 3- Fluctuating ( )
67. From above, if it is increasing/decreasing, why? 1-Few/many buyers in the market, 2- Low supply/high production, 3-High/low demand, 4-Others (Specify)… ( )
68. How far is the selling point from your homestead? …… km
69. How long it take to reach to the market where you sell and buy your product…....…hrs

H. Food security information

70. How many times per day do you eat food?

    1-Once 2-Twice 3-Thrice 4-Other (Specify)..... ( )

71. How many times a week does your family eats the following type of food?

Type of food	Frequency; (number of days per week)	Amount consumed	Price per unit (Tsh)	Total value (Tsh)

72. What is your economic occupation?

    1-Farming (specify)…….....2-Livestock keeping (specify)……3-Wage employee (specify)……4-Non farm business (specify) …… ( )

73. a. Do your crop harvests or money you get sustain the household to next harvest?

1-Yes ( ) 2-No ( )

b. If “No” what strategies do you use to enhance food availability in your household…….....

Have you ever experienced food deficit since 2006 to date? 1-Yes ( ) 2-No ( )

74. If “Yes” at what level? 1-Highly, 2-Moderately, 3-Not known ( )
75. At which time in the year do food shortages of any kind commonly occur?.....
76. How do you compare the nutritional level of under five years/ pre-school age children? 1 - Improved, 2-Constant, 3-Declined ( )
77. Indicate livestock number you own and objective of keeping

Type of livestock	Number	Objectives	Estimated price per head (Tsh)
Cows			
Oxen/ Bull			
Goat			
Sheep			
Pigs			
Donkey			
Poultry			
Others			

78. a. Do livestock help you in case of severe food shortage? 1-Yes ( ) 2-No ( )

b. If yes in what ways 1……2…….....3……4.....

79. Comment on the general food security of your household……

I. Miscellaneous

80. Which of the following do you think causes variations in yields on your farm? 1- Climate 2- Price fluctuations of inputs and products 3- Market feasibility, 4-Others (Specify)……..... ( )
81. Who normally controls the earnings from farm activities? 1- Father 2- Mother 3-Both 4- Other (Specify)..... ( )
82. a. Do women own land? ……. 1-Yes ( ) 2-No ( )

    b. If "No" explain why? ……
83. Explain how you spend your money? 1……. 2…….. 3……...4……
84. Under what conditions can women own land in this area?……
85. In your opinions, what are the major constraints do you face in your crop production? (e.g. poor technology) 1…… 2……..3…….4……
86. What should be done to improve food crop production in your village?
87. What are the major constraints/problems encountered in your daily activities?
88. What do you think should be done to solve these problems?
89. Are you willing to pay in order to continue using ""vinyungu"" valley bottom wetland? 1-Yes ( ) 2- ( ) No
90. If yes how much you are willing to pay in order to continue using the valley bottom wetland. 1-500 2-1000 3-1500 4-2000 5-above 2000 6-less 500 ( )

THANKS VERY MUCH FOR YOUR CO-OPERATION