WETLAND RESOURCE UTILIZATION AND ITS IMPACT ON BIODIVERSITY OF THE KILOMBERO VALLEY FLOODPLAINS RAMSAR SITE, TANZANIA

BY

JOSEPH JOACHIM CHUWA

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ABSTRACT

Kilombero Valley Floodplain displays a diversity of quality habitats with unique levels of biodiversity of international importance. Despite the increasing utilization pressure of this ecosystem no effective protection has yet been implemented and the future of the valley is uncertain. The rich and distinct biodiversity of the wetlands is under multiple threats which are yet to be adequately quantified. The objectives of this study were to identify socio-economic factors influencing utilization pressure, to identify and assess threats affecting the biodiversity of the wetlands and assess conservation efforts and management effectiveness in addressing the threats in the area. Information on the utilization threats was obtained through Threat Reduction Assessment while management effectiveness was assesed by use of the World Commission Management Effectiveness Tracking Tool on Protected Areas and information on socio-economic factors was obtained through structured questionnaires. Logistic regression model was used to analyze the socio-economic factors. Based on local people assessment, Threat Reduction Assessment Index (TRA-Index) ranged from 6 to 13%. On the other hand, the TRA-Index at management level (Ulanga and Kilombero Districts) ranged from 14.2 to 19.5%. The Kilombero wetlands are therefore highly threatened from the perspectives of both local people and managers. The management effectiveness for the wetland ranged from 15 to 32% thus, the percentage score ranking given is poor. An increase in the number of ethnic groups, married couples, farm size and market forces for socio-economic characteristics significantly ($p<0.05$) increase the odds of utilization pressure and wetland degradation. In order to achieve sustainable management of the ecosystem, active collaboration between different stakeholders with interests vested in the ecosystem, appropriate policy, legal and institutional framework is imperative.

DECLARATION

I, JOSEPH JOACHIM CHUWA do hereby declare to neither the Senate of Sokoine University of Agriculture that, this dissertation is my own original work and that it has not been nor concurrently, being submitted for a higher degree award in any other University

_____ _____

Joseph Joachim Chuwa. Date

(MSc. Candidate)

The above declaration is confirmed

_____ _____

Prof. P.K.T. Munishi Date

(Supervisor)

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LISTOF ABBREVIATIONS AND SYMBOLS

CBFM	-	Community Based Forest Management
DFO	-	District Forest Officer
DGO	-	District Game Officer
DNRO	-	District Natural Resource Officer
FBD	-	Forestry and Beekeeping Division
FGD	-	Focused Group Discussion
IBA	-	Important Bird Area
IIED	-	International Institute for Environment and Development (UK)
IRA	-	Institute of Resource Assessment (University of Dar es Salaam)
IUCN	-	World Conservation Union
JFM	-	Joint Forest Management
LSD	-	Least Significant Difference
MEA	-	Management Effectiveness Assessment
MAP	-	Mean Annual Precipitation
MNRT	-	Ministry of Natural Resources and Tourism
NGOs	-	Non – Governmental Organizations
PFM	-	Participatory Forest Management
PLUM	-	Participatory Land Use Management
RAMSAR	-	Is a name of the City where the agreement signed
SUA	-	Sokoine University of Agriculture
TRA	-	Threat Reduction Assessment
VEC	-	Village Environnemental Commit tee
VEO	-	Village Executive Officer
WCPA	-	World Commission on Protected Areas

WMA	-	Wildlife Management Areas
WRI	-	World Resources Institute
WWF	-	Worldwide Fund for Nature
KVTC	-	Kilombero Valley Teak Company.
KVFP	-	Kilombero Valley Floodplain

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The Ramsar Convention on Wetlands is an international treaty for the conservation and sustainable utilization of wetlands, which aims to stem the progressive encroachment on and loss of wetlands, recognizing their fundamental ecological, economic, cultural, scientific, and recreational value. According to Ramsar Convention (1971), wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Furthermore, wetlands may incorporate riparian and coastal zones adjacent to the wetlands and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands" (Ramsar Convention, 1971). There are 47 African countries out of 158 countries globally that are recognized as Contracting Parties to the Ramsar Convention. As at 8 February 2008, there are 1718 designated "Ramsar wetland sites" covering more than 159 517 260 hectares globally (Ogunseitan, 2007).

Wetlands are one of the world's most valuable ecosystems, performing a variety of important ecological functions yet fragile ecosystems which require sensitive and sustainable management if they are to continue providing their range of functions and benefits. Socio-economically wetlands are acknowledged to support family livelihoods through crop production, grazing pastures, fishing, hunting, medicinal plants, water and others (Ngana *et al.,* 2003).

1.1.1 Wetlands in Tanzania

Almost 10% of the Tanzania's surface area is covered by wetlands (Hongo and Masikini, 2002; IUCN, 2005); research and surveys have provided empirical evidence to show that wetlands are the most productive ecosystems of Tanzania (Hongo; Masikini, 2002). Tanzania presently has four sites designated as wetland of International importance with surface namely Malagarasi-Muyovozi (3 250 000ha), Lake Natron Basin (224 781ha), Kilombero Valley Floodplain (KVFP) (796 735ha) and Rufiji-Mafia Kilwa (596 906) (Ramsar Convention of wetland, 2008).

The KVFP among Ramsar site in Tanzania is an area rich in agricultural potential and natural resources. The wetland serves as a source of water for farming, livestock, domestic uses and fishing. However, over the last two decades the use of wetlands for agriculture has increased because of increasing population of both pastoral and agro-pastoral communities, and hence resulting onto increasing on the wetland resources utilization. For example high cattle densities, expanding human settlements and the conversion of miombo woodland into farms and teak plantations are among of major human pressures threatening the KVFP wetland (Kangalawe and Liwenga, 2005).

The contribution of wetlands to the livelihoods of rural households living around them in terms of direct cash income and contributions to food security is enormous and very important. For example, in Tanzania, annual incomes from wetlands can be as high as US $1000 per household (or 90% of the total household income), with high variation across sites and households (Morardet, and Koukou-Tchamba, 2004). Moreover Morardet & Koukou-Tchamba (2004) and IUCN (2005) observed that, many households utilize wetlands in coping strategies during time of food scarcity. However, wetlands in Tanzania

suffer from over-extraction of fresh water, overuse of their resources, drainage, pollution and deforestation (Doody and Mesaki, 2003; MNRT, 2004).

1.2 Problem Statement and Justification

Kilombero Valley Floodplain is a National Game Controlled Area. However, this restricts only the hunting of large animals and does not protect the habitat. There are no specific conservation measures in place at present for the biodiversity conservation, but further research and monitoring of various Flora and Fauna has been recommended, to assess the effects of potential threats on this vulnerable species Starkey *et al.* (2002). Despite the alarming status of the valley especially unsustainable land use practices and use of wetland resources no effective protection has yet been implemented and the future of the valley is uncertain (IUCN, 1997).

The rich and distinct biodiversity of the wetlands is under multiple threats including loss of habitat to human settlement, agriculture and overgrazing, illegal fishing, poaching and tree cutting, introduction and spread of exotic (Teaks plantations), pollution, altered fire regimes and land clearing. Population growth of both human and livestock including the influx of pastoralists has increased the demand for resources such as land. However, there is little empirical data on the level of effective management and status of the factors that are perceived to be threatening the ecosystem. This study therefore was conceived to investigate current socio-economic activities and utilization pressures, management effectiveness in the conservation and management of the valley. The study will provide a better understanding of the current link between human population trend and valley resource utilization pressure in time with respect to sustainable wetland management approaches to improve human livelihood. Therefore, this study was intended to assess the socio-economic impact of activities on utilization of wetland resources, level of the threats

affecting biodiversity and management effectiveness in conservation and management of the valley. The findings revealed by the study are expected to generate information that will contribute to the policy formulation, development planners, stakeholders on the wetland conservation and management of KVFP Ramsar Site.

1.3 Objectives

1.3.1 General objective

Assessment of utilization pressure on wetland resources and threats to biodiversity of Kilombero Valley Flood Plains.

1.3.2 Specific objectives

1. To identify socio-economic factors influencing resource utilization in Kilombero Valley Floodplain.
2. To identify and assess threats affecting biodiversity in the wetland.
3. To assess conservation effort and management effectiveness in addressing the threats in the wetland resources

1.4 Conceptual Framework

Society is the major key player driving changes and utilization of wetland resources. Increased human population coupled with unsustainable utilization of wetland such as overgrazing, over fishing, agriculture and settlement expansion creates utilization pressure threatening Kilombero Valley Floodplains wetland with an overall result in loss of biodiversity. In order to accommodate both the needs of local people and conservation of wetland resources such as wildlife there is a need to integrate conservation measures with community development. Local community and other stakeholder’s involvement will enhance effective management planning and ultimately sustainable utilization of wetland

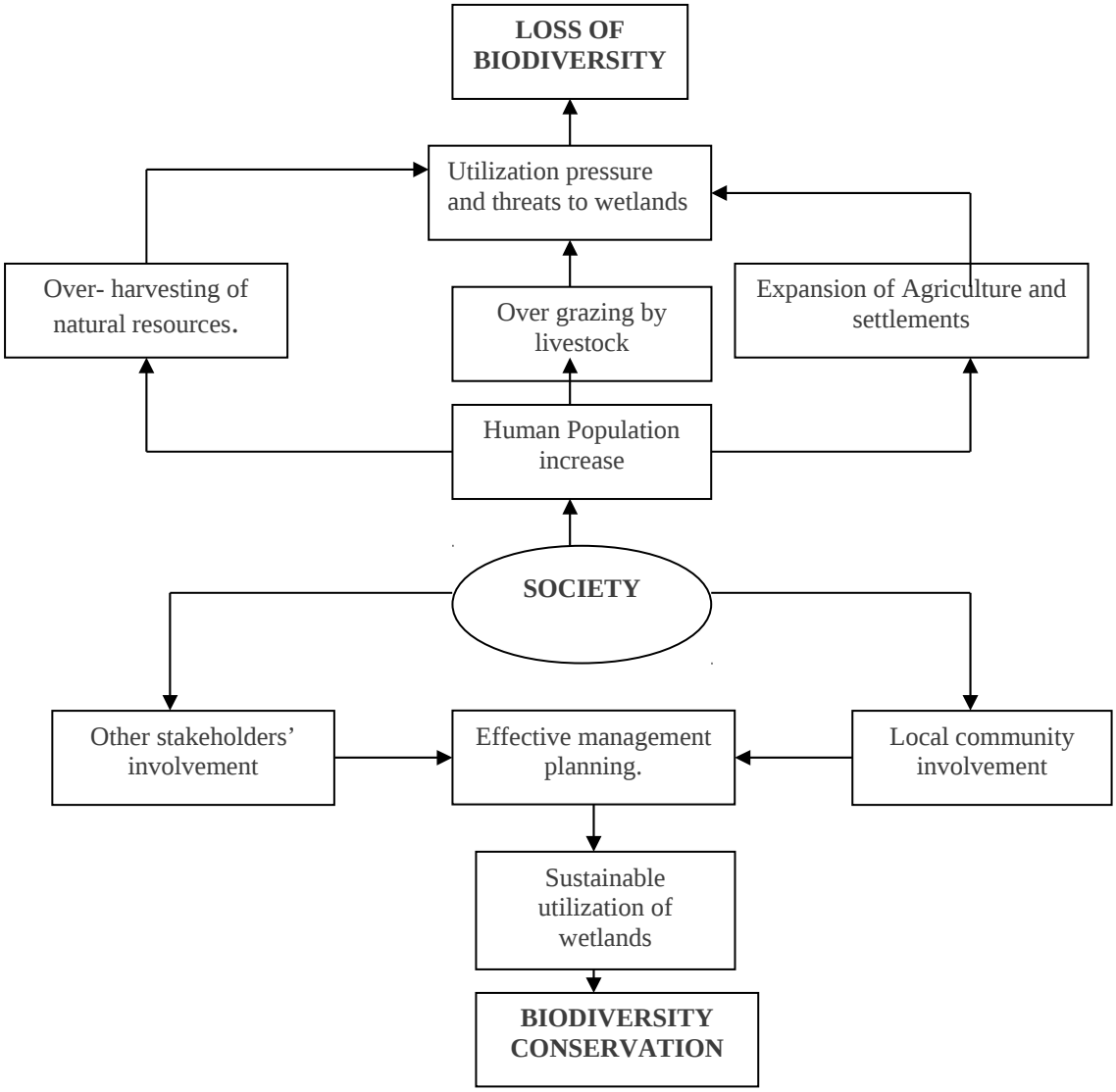

Figure 1: Conceptual Framework

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Roles of Wetland

The role of wetlands include ground water recharge, ground water discharge, storage of flood water, shoreline stabilization and reduction of erosion, sediment trapping, nutrient retention/removal, support for food chains, habitat for wildlife, recreation, natural heritage values, biomass production, water transport, bio-diversity presentation and micro-climate stabilization (IWRB, 1992; Dugan 1990).

Millions of poor people depend on wetlands for fishing, agriculture, livestock keeping and collection of a multitude of minor wetland products. The wetlands further provide essential services in the form of purifying water, flood control and ensuring year round flow of water for human consumption, irrigation and hydropower generation. Wetlands finally provide important eco-tourism destinations and contain significant biodiversity values (MNRT, 2003). Wetlands are regarded as having natural functions and economic uses both of which have economic values (Pearce; Turner 1990). According to (Dugan, 1990; Mitsch and Gosselink, 2000), wetlands have both hydrological and ecological values to the surrounding local communities including, flood storage or prevention, stabilization of ecological communities, energy and carbon dioxide storage, water quality improvement resulting from nutrients retention and fuel wood from mangroves that are in most cases dominant in wetlands.

2.3 Wetland Coverage

Estimates of total global wetlands vary considerably because of lack of data and the transient nature of these seasonal areas. Most analysts concur that from 5 to 9 million square kilometers of wetlands are distributed fairly evenly over the continents, except Antarctica, with slightly higher concentrations in Europe and Asia (Darras *et al.*, 1999). According (Zedler and Kercher 2005), estimates of global wetland area range from 5.3 to 12.8 million km^2.

2.4 Major Threats to Wetlands resources and Biodiversity

According to MNRT (2003), several wetlands are under increasing pressure and in the process of losing many of their important functions, with serious consequences in the form of changed water regimes, significant conflicts over resource use, and loss of livelihood opportunities. Many wetland areas experience a rapidly growing population with poor people moving into the areas in search of livelihood opportunities leading to a strong economic pressure for conversion of wetlands to other functions and only limited considerations are given to the sustainability of the changes. The pressure of population growth and economic activities are among the key threatening factors on the sustainable growth of wetland ecosystem. Extensive areas of tropical wetlands are being lost due to direct conversion to intensive agriculture, aquaculture, construction projects, settlement development and other livelihood activities (Turner *et al.*, 1998).

A major factor contributing to these activities is that decision-makers often have insufficient understanding of the economic values of wetlands, in which case the protection of wetlands may not appear to be a serious enough alternative (Kirsten and Brandert, 2004). Management of wetland is still very sectoral and does not recognize the multiple functions of wetlands and existing experiences on sustainable wetland management in

Tanzania are not generally available or used by key stakeholders. Planning for land and resource use in wetlands is limited and furthermore plans are seldom put into practice. Coordination of the activities taking place on the ground in the wetlands is exceedingly difficult and the skills for undertaking wetland management are insufficient. The knowledge base about wetland resources, status and key management problems is limited and no proper policy guidance is in place.

According to Frontier Tanzania (2001a) for example, pressures on Kilombero Valley Floodplain wetland resources include teak plantations that have replaced the miombo woodland, timber logging of *Milicia excelsa*, increased livestock keeping in the floodplains, wildlife hunting and over fishing. Jenkins *et al.* (2002) also reported that high cattle densities, expanding human settlements and conversion of miombo woodland into farms and teak plantations are threatening wildlife populations in Kilombero valley. The large numbers of people living within and adjacent to the Kilombero valley highly depend on wetland resources of the valley for their livelihood. There is a high rate of influx of pastoral communities into the wetland in search of grazing land due to the land use competition elsewhere. Apart from the perceived threats to the flora and fauna of the Kilombero Valley itself, there was concern that there could be knock-on effects for the neighboring Selous Game Reserve, a World Heritage site (Bonnington *et al.,* 2007). According to IUCN (2008), most species are threatened due to habitat loss however the major factors threatening the survival of various species in Kilombero valley include habitat destruction, fragmentation, degradation, encroachment, livestock grazing, infrastructure development, exploitation and pollution.

2.5 Policy and Legal Framework Relating to Wetland Resource Utilization

The Ramsar Convention recognizes the right of the contracting parties to formulate their national wetland policies in a manner that is appropriate to their respective national circumstances. Currently there is no specific legal and policy framework regarding wetlands in Tanzania, but wetland-related issues are touched upon in a variety of laws, policies and strategies, due to the inherent cross-sectoral character of wetlands issues MNRT (2003). The policy and legal framework surrounding wetlands can be roughly divided into the policies and laws of a sectoral nature (Wildlife, Fisheries, Agriculture and Livestock, Forest and Minerals). Wetlands are partly covered by existing laws but the coverage is somewhat fragmented. There are large gaps and many provisions are not comprehensive; coverage is fragmented and not well coordinated. Key legislation such as that covering agriculture, for example, does not specifically mention wetlands and there is direct contradictory regulations regarding wetlands, for example, in land and water legislation. The tools for protection and sustainable management in current legislation (primarily the Wildlife Act) are not flexible enough to cater for the diverse needs of protection and management of wetlands according to the wise use principle (MNRT, 2003).

Another important problem in the current legislation is that the environmental regulations remain widely unimplemented and the resources to enforce regulations are not available. That means the lack of an overall legal and policy framework for wetlands leaves government bodies at all levels with highly inadequate tools to effectively manage wetlands in a sustainable manner. The sectoral policies are generally most concerned with their core areas, but do recognize the need for cross-sectoral regulation, albeit without specifying sufficiently where and how to do this. Some of the relevant policies are not specific enough and do not, for example, make particular reference to wetlands where this

might be appropriate and those of a more general and cross-sectoral nature (Water, Environment and Land). Although policies and laws are currently inadequate, the coverage of wetland policies and strategies has been enhanced in recent years. Many of the newly revised policies have good intentions, but even their conversion into legislation, let alone their implementation, is limited MNRT (2004).

2.6 Wetland Management

Coordination of the activities taking place on the ground in the wetlands is exceedingly difficult and the skills for undertaking wetland management are insufficient. The knowledge base about wetland resources, status and key management problems is limited and no proper policy guidance is in place (MNRT, 2003). Although presently inadequate, the inclusion of wetland issues in different policies and strategies has been enhanced in recent years. As an important prerequisite for sustainable management, the decentralization process and the community-based resource management approach is recognized in all the more recent policies related to wetland management. Many of the newly revised policies have good intentions, but their conversion into legislation will take more time, let alone the implementation. Wetlands are partly covered in existing laws, but the coverage is somewhat fragmented. There are big gaps and many provisions are not comprehensive, coverage is fragmented and not well coordinated (MNRT, 2003).

2.7 Wetland Loss and Degradation Worldwide

About half the global wetland area has been lost as a result of growing economic pressures and increased transnational investment opportunities (Zedler; Kercher, 2005). The loss of wetlands worldwide has been estimated at 50% of those that existed since 1900 and since the 1950s, tropical and sub-tropical wetlands have been increasingly degraded or lost through conversion to agricultural use (Dugan, 1993; OECD, 1996). Agriculture is the

principal cause for wetland loss worldwide. By 1985 it was estimated that 56.65% of available wetland had been drained for intensive agriculture in Europe and North America, 27% in Asia, 6% in South America and 2% in Africa, a total of 26% loss to agriculture worldwide (OECD, 1996). It has being noted that in recent years the expansion of human settlements, livestock grazing, agriculture and commercial forestry has increase pressure on Tanzania's natural habitats (Newmark, 2000; East, 1998; Caro, 1999).

2.8 Effects of Increase in Human Population

Population growth and the resultant human activities generate pressures to the natural and man-made environments. This statement is demonstrated by the rapid decline in tropical forests, global warming, and world pollution, to mention only a few (UN, 1993). While the population has reached the 6 billion mark in 1999, the world natural resource base has continued to be at a diminishing state. Similar consequences are evident at regional and national levels, including Tanzania (Madulu, 2004). For example, the major single greatest threat to the Kilombero valley is the rapidly increasing human population that coupled with immigration of pastoralists that impose utilization pressure to the wetland resources. It is estimated that 200 000 people lived in the Kilombero Valley about ten years ago and the number of cattle appear to have increased significantly over the last ten years (URT, 1998). Changing of land uses as a result of human population growth and increased demand for different land uses have resulted to the decline of Africa's biodiversity (MNRT, 2002). The increasing rate of exploitation of the natural resources is probably a function of an increase in the number of people as it raises the demand for food, water and arable land. Rapid growing of human population and settlements may interfere with migratory routes or increase isolation of the protected areas (Haule, 1997; Caro, 1999).

CHAPTER THREE

3.0 MATERIAL AND METHODOLOGY

3.1 Description of the Study Area

The study was conducted in four villages surrounding KVFP. The choice of the study area was based on the expected impacts towards utilization pressure caused by activities of local communities' vicinity to the wetland.

3.1.1 Geographical Location

The KVFP is part of Rufiji Basin and is located at Latitude 08°40'S and Longitude 036°10'E in Kilombero and Ulanga districts of Morogoro Region. Administratively, the valley is divided between two districts whereby Kilombero district is on northern part while Ulanga is the southern part. The valley is dissected by Kilombero River almost in the middle and the same river forms the boundary between the two districts. The valley lies at the foot of the Great Escarpment of East Africa in the southern half of Tanzania, about 300 km from the coast and located to the west of Selous Game Reserve in south-central Tanzania (Jatzold; Baum, 1968). The valley runs south-west to north-east, joining Selous Game Reserve in the east. It is about 40 km wide at an altitude about 300 m. The valley bottom is very flat, with a difference of only about 20m in height between the sides and the centre (Fig. 2).

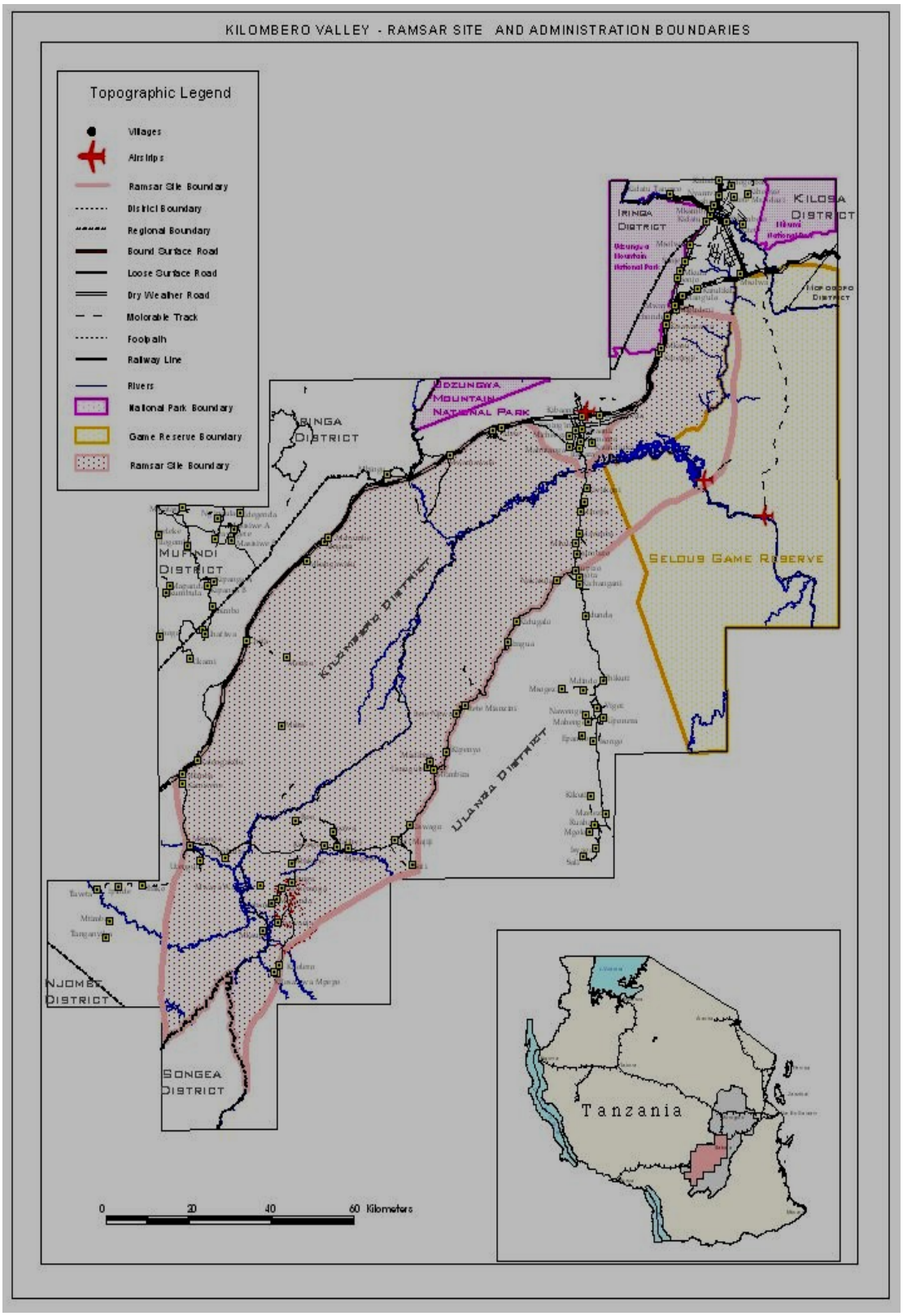
KILOMBERO VALLEY - RAMSAR SITE AND ADMINISTRATION BOUNDARIES
Topographic Legend
Villages
Airstrips
Ramsar Site Boundary
District Boundary
Regional Boundary
Bound Surface Road
Loose Surface Road
Dry Weather Road
Motorable Track
Footpath
Railway Line
Rivers
National Park Boundary
Game Reserve Boundary
Ramsar Site Boundary
IRINGA DISTRICT
KILOSA DISTRICT
UDZUNGWA MOUNTAIN NATIONAL PARK
MUFINDI DISTRICT
KILOMBERO DISTRICT
ULANGA DISTRICT
SELOUS GAME RESERVE
NJOMBE DISTRICT
SONGEA DISTRICT
Tanzania
0 20 40 60 Kilometers

Figure 2: Map of Kilombero Valley Floodplain.
Source: Kilombero Valley Project report, 1997

3.1.2 Biodiversity value

3.1.2.1 Flora

There is limited information on rare and endemic plants in Kilombero valley wetland. However, Starkey *et al.* (2002), report the valley to contain a diverse of unusual flora. They noted 350 plant species most of them being new records for the area surveyed which is not the entire valley. This suggests that a more extensive survey is necessary to be able to establish the existence of rare and endemic species. Some of the species found include a previously unknown of *Vigna spp* from the family Leguminosae that are found in the Kibasila swamp, *Aframomum alpinum spp* which is rare and possibly endangered, a composite *Grauanthus parviflorus* that has been collected only once before and is thought to be rare and possibly endangered and the rare legume species *Crotalaria polygaloides sub sp. orientalis*. The plant communities existing in the valley represent a hydrological gradient, or a catena, from the centre to the margins of the valley. The existence of several species collected rarely before and the presence of rare and possibly endangered species in the valley highlights both its botanical interest and the lack of botanical knowledge of the area as a whole (Frontier Tanzania, 1997). Seven vegetation habitats in the Kilombero Valley Ramsar Site have been categorized from literature and site visit. The vegetation habitats form a gradient from high altitude to the Kilombero River these being evergreen forest, woodland grasslands floodplain, riverine forest, wetland and cultivation.

Indigenous and exotic species or plants association is that of the teak plantations which allow for coexistence of with some natural vegetation unlike sugar and paddy and teak in

Kilombero valley. Exotic species pose both economic and ecological problems the worst being extinction of indigenous species. An example of the impact of exotic species in the Kilombero valley wetland a teak company (KVTC) own 14 000 ha for *Tectona grandis* (teak) plantations whereby the studies show that bulk feeders and termite specialists mammals were absent where evergreen forest occurred. Bonnington *et al.* (2007) found significant difference in habitat use by mammal species suggesting that large mammal activity in plantation decrease as the teak ages. They concluded that teak plantations were unfavorable for mammals and represent a diminishing conservation potential. On the other hand, clearance of natural vegetation for new teak plantations create a new habitat with extensive green flush that can be used by all mammal species but this is only temporary till the dense canopy with the teak growth limiting access to larger mammals and reducing sunlight to the forest floor causing the forage to die back.

3.1.2.2 Fauna

Kilombero valley is unique complex ecosystem with one of the highest wild animal densities in Tanzania and has long been noted for the exceptionally high density of large mammals that it contains (WWF, 1992). In the Kilombero valley there at least 64 mammal species, 251 bird species, 50 reptiles, 25 amphibians, and 81 butterfly species (WWF, 1992). It appears few surveys have been conducted to identify invertebrates' species in valley with only limited studies on the butterflies in the selected area. High concentrations of large mammals, especially Puku antelope *Kobus vardoni* (with nearly 75% of the world population), buffalo, elephant, hippotamus, lion, and three endemic birds are found in floodplain (Ramsar, 2005). Although puku remain in the valley throughout the year, moving to slightly higher ground during the peak flooding, a large proportion of the other animals, especially elephant and buffalo, are migratory and move seasonally to and from the Selous Game Reserve that adjoins the valley at both ends (UDNRO, 1997).

The value of the valley as a bird habitat is undoubted (Starkey *et al.,* 2002), and the valley is an important Bird Area (IBA) Baker and Baker (2002). There are at least 59 families and over 251 bird species represented in Kilombero valley (Stevenson and Fanshawe, 2002). The Kilombero weaver (*Ploceus burnieri*) strictly endemic to the valley Baker and Baker (1990) and is a globally threatened species (IUCN, 2008). Other species of interest include the near-threated Madagascar squacco heron (*Ardeola idea*) and Sterling's woodpecker (*Dendropicos stielingi*) IUCN (2008), and Southern-banded snake eagle (*Circaetus fasciolatus*). Two other bird species endemic to the valley are Kilombero Cisticola (*Cisticola* sp.nov.) and Melodious Cisticola (*Cisticola* sp nov.), the former only discovered in 1986 and restricted to the Kilombero swamp near Ifakara. Two bird species also found in the valley are Olive-headed weaver (*Ploceus olivaceiceps*) also near-threatened and Pale-billed hornbill (*Tockus palliddirostris*) is near endemic to Tanzania.

There is an endemic toad to the Kilombero valley wetlands namely *Bufo reesi* (now called (*Amietopphryne reesi*) that is known only from the influence of the Kihansi and the Kilombero. Another species or subspecies is *Hyperolius reesi***,** a small reed frog. Currently this is often included in the *Hyperolius viridiflavus* species complex, but earlier author regarded it as a full species. Both of these were named after Alan Rees, a game ranger for Ulanga District, who published some of the first checklists for the area (K.M. Howell pers Comm. 2009).

3.1.2.3 Soils

Soils of the wetland complex are mainly heavy black cotton (mbuga) or montimoronolite soils that retain water over relatively long periods with isolated patches of lighter sandy soils (RAMSAR, 2006). On the higher fringes the combination of the crystalline nature of

the metamorphosed rocks, moist climate and warm temperatures has produced highly weathered soils that are commonly more than 3m deep. Descriptive accounts of broad ecological zones in the valley were made by Jätzold and Baum (1968) and more recently the soils of the valley were classified in relation to these vegetation zones (Chase, 1994). The floodplain was described to have deep well-draining fertile clays that crack open in the dry season and are inundated in the wet season. This area supports flood grasslands and papyrus swamps. On slightly higher ground towards the edge of the plain, soil is sandier and flood savannas exist. On lower slopes deep moderately-draining red soils support miombo woodland.

3.1.2.4 Climate

Mean annual rainfall (MAP) in the Kilombero sub-basin varies from 1100 mm to 2100 mm. Higher MAP (1500-2100) are received in the eastern Mahenge, Central Udzungwa drained by Rivers Mpanga and Kihansi and low altitude southern plains. The Kilombero Floodplain receives about 12oo-1400 mm of rainfall annually. The largest part (84-93%) of annual rainfall is received during the rainy season between December and April while June –September is relatively dry with typical monthly amounts below 10 mm except in the Udzungwa.

The climate in the sub-basin is highly variable between the highlands and lowlands. Whilst the lowland are warmer with annual mean daily temperature of 24^0C at Ifakara, the highlands are cooler with annual mean daily temperature 17^0C.The seasonal temperature variations indicate December and January are the warmest months with day temperature exceeding 27^0C (lowlands) and 19^0C (highlands) while July is the coolest month with temperature around 21^0C and 14^0Cin the lowlands and highlands respectively. Other

climatic variables between 75% (range: 58-85%) in the lowlands and 80% (range: 70-87%) in the Udzungwa.

3.2 Data Collection

3.2.1 Sampling Design for Socio-economic Study

Multi-stage sampling was used to select sampling units whereby 4 out of 108 villages with a population of 394 482 surrounding Kilombero Valley Floodplain were sampled. This procedure was preferred because it facilitates sampling from a large population whose members are not known. Also, it made it easier to select respondents from large geographical area. A simple random sampling technique was used to select sampling units in order to avoid bias. This technique allows selection of sample from the entire population in such a way that every member of the population has an equal chance of being selected. The sampling frame was the village registers containing a list of households and the sampling units were households because it is where all decisions are made. They usually share a dwelling house and may cultivate same land. They recognize the authority of one person, the household head who is the ultimate decision-maker for the household (Poate and Daplyn, 1988 as cited by Kajembe, 1994). The sample village was selected purposely based on accessibility and proximity to the wetland. The sample size per village was 5% of the total number of households as recommended by Boyd *et al*. (1981). Sampling was random and the list of households was established in collaboration with village leaders.

3.2.2 Data collection tools

Questionnaires were developed to pursue major issues identified during reconnaissance survey. Four villages; Mofu, Ikwambi, Itete Njiwa and Itete Minazini were involved in the assessment of threats in the Kilombero Valley Floodplain Ramsar Site. From each village, representatives of the Village Environmental Committee (VEC), the Village Game Scouts

(VGS), and elders experienced with the wetland and the Village Government formed a team which was involved in the TRA survey process. District officials involved were the wetland facilitation team and Departmental heads of both Kilombero and Ulanga. Different methodologies were used to assess threat levels including random walks in the wetland and along existing agro-pastoralist grazing activities within the wetland to give better information on areas of highest human activity/impact. Five major direct threats to the biodiversity of the wetland present and observed during the survey were identified by the survey team and discussions with local people/ward/district government officials. Information collected included socio-economic activities pertaining to the use of the wetland, income status, environmental and cultural aspect of the communities. A checklist was used to collect information from key informants that included District Commissioners, Project Manager and staffs of Kilombero Ramsar Site, District Executive Directors, District Natural resource officers, District Game Officers, District Agricultural officers, District Livestock Officers, Ward Executive Officers, Tourist Hunting Companies and Village leaders both from Kilombero and Ulanga Districts.

3.2.3 Primary data collection

The study was conducted in three phases. The reconnaissance survey were conducted in phase one to provide a general picture of the study area through a rapid assessment. During this survey the study villages were established, the questionnaires were pre-tested in order to establish their suitability and training to the field team. The necessary adjustment was done according to the real situation observed in pre-testing period. During the socio-economic survey, household interviews and PRA techniques including key informant interviews, focus group discussion and participatory field observations were applied as data capture tools. Other methods used include physical observations and review of the relevant documents.

3.2.4 Secondary data collection

Secondary data were collected from published and unpublished information. This information was obtained from such sources as Official Census Reports, Sokoine National Agricultural Library, Websites, Government projects, Ward and Village offices where available.

3.3 Data analysis and presentation

3.3.1 Quantitative data analysis

All quantitative analysis were performed by using Statistical Package for Social Science for Windows (SPSS 11.5). Descriptive statistical analyses such as frequencies, percentages, cross tabulations and logistic regressions were used to summarize data on socio-economic factors influencing wetland utilization. Logistic Regression Model was used to assess the relationship between socio-economic factors and utilization pressure on wetlands.

Logistic regression is useful for situations in which one wants to predict the presence or absence of a characteristic or outcome based on values of set of predictor variables. It is similar to a linear regression model but it is suited to models where the dependent variable is dichotomous, while the independent variables can be interval level or categorical. The logistical regression coefficients can be used to estimate odd ratios for each of the independent variable in the model. In this study the logistic regression analysis established a relationship between dependent variable i.e. existence of utilization pressure and resource degradation and independent variables i.e. socio-economic and demographic factors (such as age, gender, education level, ethnicity (tribe), duration of stay in the village, farm size,

income level, and demand of wetland products and services) as follows (Whitehead, 1998; Pampel, 2000).

The following logistic regression model from Pampel (2000) was used.

Y_i = $\beta o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots \beta_i x_i + e$ (the linear combination).....(1)

Yi = the i^{th} probability of event to occur for the dependent variable (existence of human utilization pressure and wetland degradation a binary/dichotomous variable with value of 1 if there is utilization and wetland degradation on the reserve and 0 if other wise),

Zi = the i^{th} observed value of the independent variables,

βo = constant term of the model without the independent variables,

βo to β1 = independent variables coefficients estimates from the data,

e = is a natural logarithm base approximately 2.718,

i = 1, 2, …, n; where n is the total number of variables,

x_1 to x_n = independent variables (social economic and demographic factors (age, education, market forces (buyers), and duration of residence, occupation, ethnicity, gender, household income, farm size and household size).

The probability of an event not to occur was estimated as:

Pro (no event) = 1- Pro (event).

The hypotheses tested were;

Ho: b = 0 (implying that the regression coefficients are equal to zero and thus there is no Correlation between wetland utilization and degradation (dependent variable) and socio-economic (independent variables);

Against,

H_1: $b \neq 0$ (implying that the regression coefficients are not equal to zero and thus there is either a positive or a negative correlation between utilization pressure and wetland degradation and the socio-economic factors).

Ho: will be rejected only where $p<0.05$.

3.3.2 Interpretation of logistic regression results

The t-value (Wald statistic), the sign of β coefficient, exp (β) and the magnitude of the similarity between measured variables were used to make an interpretation of the results (Norusis, 1990; Pampel, 2000; Power and Xie, 2000).

- The t-value (Wald statistic) tests whether the effect of particular independent variable is statistically significant,
- The sign of the effect (β), shows to what extent the increase in independent variable increases or decreases the probability of utilization and degradation of wetlands,
- The relative magnitudes of similarity of measured variables determine which of the independent variable seem to have greater influence on utilization of the wetlands
- The exp (β), show how much 1-unit increase in the independent variable (Xi) changes the odds of wetland utilization.

To assess the goodness of fit of the regression model to the data, both Chi-square as suggested by Pampel (2000) and -2loglikelihood (-2LL) was used and tested at 5% probability level. Both measures how well the independent variables affect the outcome of dependent variable.

3.3.3 Qualitative data

The qualitative data and information was analyzed using the content and structural functional analysis techniques. This is used to analyze in detail the components of verbal discussions held with key informants and open-ended questions whereby recorded dialogue with respondents were broken down into smallest meaningful units of information and tendencies. This helps the researcher in ascertaining values and attitudes of the respondents (Thomslison, 1965 as cited by Kajembe and Luoga, 1996).

3.3.3.1 Assessment of threats affecting biodiversity in the wetland resources

The TRA approach used was based on that described by Salafsky and Margoluis (1999 as cited by Persha (2004), Madoffe and Munishi, 2005). Each threat identified was ranked based on a set of pre-determined criteria: area referring to the percentage of the habitats in the site that the threat affected; intensity referring to the impact of the threat within a micro-site – will the threat completely destroyed the habitat in a small locality, or will it only cause minor changes and urgency referring to the immediacy of the threat – will the threat occur in the near future or in so many years in the future. The degree of progress made towards reducing each threat (by first defining what "100% threat met" means for each threat), were assessed as percentage threat met. The information was used to compute the final Threat Reduction Assessment (TRA). Through "Threat Reduction Assessment Index" (TRAI) i.e. TRA= [(Raw Score/Total Ranking)x 100] and TRAI is obtained by Raw Score = Total Ranking x % Threat Met.

3.3.3.2 Assessment of Conservation efforts

MEA approach followed the World Commission on Protected Areas (WCPA) 'framework' for assessment of the effectiveness of management practices in protected areas and protected area systems (Hockings *et al.*, 2000; Persha, 2004; Madoffe and Munishi, 2005). This tool composes of a set of questions that address the different steps and stages or elements of management necessary to achieve the objectives of management of the area for which it was established. The steps reflect the context of existing values and threats, the planning, allocation of resources (inputs), management actions (processes), products and services (outputs) and impacts or outcomes. The assessment was done in the office by the Kilombero Valley Ramsar Site facilitating team that comprised of Project Manager, District Game Officer, District Forest Officer, and District Fisheries Officer. These were considered to have adequate knowledge in regard to management of the Kilombero Ramsar

site. The management tracking tool has two sections; the data sheet section containing detailed key information on the site, its characteristics and management objectives. Section two is the assessment form which is sub-divided into three; the main part of the assessment form with a series of 30 questions that were answered by assigning a simple score ranging between 0 (poor) to 3 (excellent). A series of four alternative answers were provided against each question for assessors to make judgments as to the level of score given. There were also six supplementary questions which elaborate on key themes in the previous questions and provide additional information and points. The comments box next to each question allowed qualitative judgments by explaining why they were made and ranged from personal opinion to reference documents. Then for each question, long-term management needs were identified to further relevant adaptive management of the wetland reserve.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic Factors Influencing Utilization of Kilombero Valley Floodplains Ramsar Site Resources.

The socio-economic factors observed to have a profound influence on the utilization of the wetland resources and likely cause degradation in the study area include; education level, marital status, age, gender, ethnicity, household size, duration of stay in the village, farm size, income level, occupation and market forces (buyers of wetland products including rice, fish, reeds and timber) (See Table 1).

Table 1: Logistic Regression Results on Factors Influencing Wetland Utilization in KVFPRS

Variable	B	S.E	Wald	Df	Sig	Exp(B)
Ethnicity	1.951	0.762	6.562	1	0.010*	7.039
Age	0.401	1.199	0.112	1	0.738ns	1.493
Gender	0.399	0.933	0.183	1	0.669ns	1.491
Marital status	1.474	0.713	4.266	1	0.039*	4.365
Duration of stay	-1.555	0.947	2.696	1	0.101ns	0.211
Household size	-0.433	0.717	0.365	1	0.546ns	0.649
Education	0.819	1.221	0.449	1	0.503ns	2.268
Occupation	-20.886	9356.146	0.000	1	0.998ns	0.000
Market forces (buyers)	4.173	1.542	7.323	1	0.007**	64.889
Household income	0.411	0.692	0.353	1	0.553ns	1.508
Farm size	1.730	0.836	4.277	1	0.039*	5.638
Constant	15.309		0.000	1	0.999ns	4450578.366

-2 Log likelihood = 73.843
Cox & Snell R Square = 0.149
Nagelkerke R Square = 0.327
Model Chi-square = 26.687 (P>.005), (df=11)
Overall Percentage = 92.1
* = Statistically significant at 0.05 level of significance

**	=	Statistically significant at 0.001 level of significance
ns	=	Statistically non significant at 0.05 level of significance
Sig	=	Significance level
Df	=	Degree of freedom

Goodness of fit and significant variables for the model

In terms of goodness of fit, the logistic regression model (LRM) fitted well to the data by 95% as shown by the significant value of 0.005 for a constant (Table 1). The overall model is also highly significant (p = 0.005) with a Chi-square statistics of 26.687 (df = 11) implying that the independent variables affected very well the outcome or dependent variable. The –2 log likelihood (-2LL) value of 73.843 indicated that the model fitted the data reasonably well. Furthermore, the model predicts 92.1% of the responses correctly (i.e., the bigger the percentage correct predictions, the better the model). Also independent variable coefficients with high (significant) Wald statistics indicate superior specification of the variable Whitehead (1998). In this case age, ethnicity and demand of forest products and services were significant in influencing forest disturbance.

Of the eleven factors studied, four factors; ethnicity, marital status, farm size and market forces were statistically significant in influencing utilization and threats to the wetlands.

Table 2: Significant Socio-economic Characteristics of Villages Adjacent to Kilombrero Valley Floodplain Morogoro , Tanzania

Socio-economic characteristics	% Respondents				All (N=116)
	Ikwambi (N=42)	Mofu (N=20)	Njiwa (N=28)	Minazini (N=26)	
(a) Marital status					
Others	40	25	11	27	28
Married	60	75	89	73	72

(b) Farm size					
>5 acres	5	20	11	4	9
<5 acres	95	80	89	96	91
(c) Market forces (Buyers)					
Inside the village	2	15	0	15	7
Outside the village	98	85	100	85	93
(d) Ethnicity					
Native	98	100	75	81	89
Non-Natives	2	0	25	19	11

4.1.1 Ethnicity

The positive logit coefficient (1.951) of "ethnicity" of the respondent indicates that an increase in one non-native household increases the odds ratio by a factor of 7.039 of wetland utilization pressure and resource degradation (Table 1). The assumption here was that non- natives may have no sense of ownership and may have different culture that may cause more utilization pressure and resources degradation in the wetland while the natives have a sense of ownership and feel responsible for the proper resource utilization and management of the wetland. Jenkins *et al.* (2002) reported that, high cattle densities, expanding human settlements resulting from immigrants have resulted into conversion of miombo woodlands into farms and teak plantations threatening wildlife populations and resources in the Kilombero valley floodplains. Threat Reduction Assessment and group discussion revealed that, the degradation has been accelerated by agro-pastoralist immigrants who are non-natives and occupy large areas of land for agriculture and grazing (Plates 1, 2, 3, 6, 7&8). For example Sukuma is one of immigrant ethnic in KVFP have the tendency of keeping large stock and extensive clearing of woodland resources for opening farms and grazing areas

4.1.2 Marital status

The marital status of respondents show a positive logit coefficient (1.474) which implies that an increase in the number of married couples increases the odd ratio of wetland

utilization by a factor of 4.365 and was statistically significant in influencing wetland utilization ($P<0.05$), (Table1). The study further revealed that the number of married respondents was high (72%), (Table 2). Household with married couples have more responsibilities to accomplish with more family demands over use of natural resources. In this case, they are in most cases tempted to encroach on the wetland reserve in order to increase the chances of meeting household needs. Also more land for farming and settlements will be required as the number of married couples increase with consequent increase in pressure on wetlands. Wirth (1988) observed that, marriage may diversify the socio-economic activities at household level due to complimentarily of men and women labor roles within the household.

4.1.3 Market forces (buyers)

Market forces have a positive logit coefficient of 4.173, implying that an increase of one buyer of wetland products increases utilization pressure on wetlands by a factor of 64.889. Increasing the number of buyers of wetland products increases the demand and hence may be a forceful factor in increasing utilization pressure on the wetlands to satisfy the increasing demand. Majority (93%) of respondents revealed that, most buyers of agricultural crops especially paddy come from outside the villages. The effect of market forces on wetlands products on utilization was highly significant in influencing wetlands utilization ($p<0.01$). This would mean that, there is a high demand of wetland products especially rice by business men in the study area resulting into high utilization pressure with resultant wetland degradation through agriculture expansion for rice cultivation.

4.1.4 Size of land holdings

The size of land holdings of the respondents shows a positive logit coefficient (1.730) which implies that, an increase in household land sizes increases the odds ratio of wetland

utilization pressure and resource degradation by a factor of 5.638 (Table1). The study revealed that 91% of the household respondents own less than 5 acre of land for farming (Table 2). It implies that majority of natives have no enough land for cultivation whereby, encroachment to the wetland reserve has been seen as an alternative to the prevailing situation especially for Njiwa and Minazini villages. Most of the agriculture expansion is into the wetland because of the favourable condition for crop production especially rice which is the major food and cash crop. Field observations and discussion with Wild Footprints Hunting Company Ltd who is an investor in the southern part of Kilombero wetland, revealed a serious conflict with natives over encroachment into hunting block for agriculture. Mayeta, (2004) reported that a decrease in farm size increases the chances of resource use conflicts and vice versa and this end into more encroachment into pristine areas of the wetlands hence wetland resource degradation. The effect of size of the farm on wetland utilization and degradation was statistically significant ($p<0.05$).

Though not statistically significant seven (7) variables; education level, age, gender, household size, duration of stay in the village, income level, and occupation were found to play a role in contributing to wetland utilization and degradation in the Ramsar site.

4.1.5 Education

Education levels of respondent show a positive logit coefficient (0.819) implying that an increase in one literate person increases the odd ratio for wetland utilization by a factor of 2.268 (Table 1). The results show that majority (97%) of respondents in the area surveyed have formal education. Education has direct influence on people's knowledge and participation in natural resources management and promotes utilization of natural resources. The significance of education in explaining the awareness of people on the importance of natural resources conservation is well documented (Kajembe and Luoga,

1996; Mbwambo, 2000). Katani (1999) argued further that an increase in education level increases the level of awareness and thereby creating positive attitudes, values and thereby motivating people to manage natural resources in sustainable manner. Maro (1995) contended that, education play major role in the socio-economic development of any society and it fosters human creativity and makes people confident on their efforts to improve their lives and readiness to integrate new innovations in wetland management into traditional systems of land use management. Kajembe and Luoga (1996) reported that there is no development without education. The increase in the level of education also increases options of respondents to meet their livelihoods. However, the influence of level of education on wetland utilization and resource degradation was statistically not significant ($p>0.05$).

Table 3: Non Significant Socio-economic Characteristics of Villages Adjacent to Kilombrero Valley Floodplain Morogoro , Tanzania

Socio-economic characteristics of respondents	% Respondents				All (N=116)
	Ikwambi (N=42)	Mofu (N=20)	Njiwa (N=28)	Minazini (N=26)	
(a) Education level					
Formal education	100	95	96	96	97
Informal education	0	5	4	4	3
(b) Age					
>31	71	95	86	92	84
15 -30 years	29	5	14	8	16
(c) Gender					
Male	69	90	75	88	78
Female	31	10	25	12	22
(d) Household size					
< 5	43	80	89	54	63

> 5	57	20	11	46	37
(e) Duration of stay					
> 10 years	78	100	96	84	88
1-10 years	22	0	4	16	12
(f) Income level					
>100,000/=	7	15	32	15	16.4
<100,000/=	93	85	68	85	83.6
(g) Occupation					
Others	14	0	11	8	10
A farmer	86	100	89	92	90

4.1.6 Age of respondent

The results from regression shows that, the age of the respondent has positive logit coefficient (0.401) that an increase in one mature aged person increase the odds ratio of utilization pressure and degradation in the wetland by a factor of 1.493 (Table 1). The age of interviewees varied from 15 to over 60 years, with most (84%) of the respondents having an age above 31 while 16% between 15-30 years. This implies that most respondents interviewed were matured people who perform majority of the household activities such as agriculture, fishing, petty business, hunting and collection of wetland products. According to Overholt *et al.* (1991), age is an important parameter in social analysis since different age groups perform different roles. Basnayake and Gunaratne (2002) observed that the age of a person usually is a factor that explains the level of production and efficiency. As a matter of fact, an increase in the age of the household head increases the chances of increasing wetland utilization and degradation than young members can do. It was assumed that mature people are active and energetic in providing labor force which can be invested in the exploitation of the wetland resources among other activities. However, the influence of age on wetland utilization pressure and degradation was statistically not significant ($p>0.05$).

4.1.7 Gender of respondent

Table 1 show that gender has a positive regression coefficient (B). This implies that, both men and female don't participate equally in the wetland utilization pressure and resources degradation. Also it means that an increase in one man headed household increases the odds ratio for wetland utilization and degradation by a factor of 1.491. Further it was revealed that, majority (78%) of the interviewee are males while 22% are females (Table 3). Similar results were observed by IRA (2001) in Malagarasi-Muyovozi wetlands. However, man headed household significantly increases the utilization and degradation to wetland because in most cases it is men who are involved in illegal exploitation and business on the wetland products. However, the effect of gender on the odds of wetland utilization pressure and degradation of the reserve was not statistically significant ($p>0.05$).

4.1.8 Household size

Household size has a positive regression coefficient of 0.411 (Table 1). This implies that an increase in the number of household members increases positive utilization and wetland degradation by factor 1.007. This is because, as the size of household increases, the household demand for land and different products from wetland resources base also increases.

Further it is observed that, many of respondents (63%) have household size less than 5 individuals while 47% had more than 5 individuals. This means that an increase in demand due to increased in number of members in the household lead to increases of people's desire for diversified economic production because of increased labor supply that may create more pressure over the use of wetland. The findings concur with the report by Shrestha, (1996) who documented that, household size is an important variable in

determining possible supply of family labors of different activities at the household level. This corresponds with the results reported by Abdallah *et al*. (2007) who found that, there is positive relation between household size and wood fuel consumption. However, the influence of household size on utilization pressure and wetland degradation was statistically not significant ($p>0.05$).

4.1.9 Income level of respondent

Results further reveal that, the "household income" has a positive logit coefficient (0.411). This implies that, an increase in a single unit of income for household increases the odds ratio by a factor of 1.508 (Table 1). This means that the level of income of the people around the Kilombero Valley Floodplains determines their level of dependence on the wetland resources. Sustainable use and conservation of the wetland resources to a large extend depends on the economic status of the community in question, which would ultimately determine the level of utilization and management. Widespread poverty, land pressure and unemployment, limited and insecure local production bases, often means absence of alternatives, hence community members have little choice but to over-exploit wetland resources to generate sufficient subsistence, income and employment to meet their ends. Thus both low income and high income earners are responsible for the present wetland condition meanwhile, high income individual may increase his/her financial power to exploit resources extensively while low income may compel individual to increase dependence on the natural resources for survival.

Majority of respondents (84%) have an average income less than 100 000/= per month which is earned through selling of wetland products such as crops e.g. paddy and fish. Taking an average income less than 100 000/= and 5 number of individuals as an average household size, the household per capita income per month was found to be TShs. 20

000/= (Table 5), which is below an International poverty line of US $ 1.00 a day (World bank, 1999). This implies that the level of poverty in the communities adjacent to the Kilombero wetland can be a driving force toward wetland utilization and degradation. FAO (2003) established that, as income increases the living standard improves and hence people become less dependent on forest products such as fuelwood for cooking activities. Kihiyo and Monela (1999) argued that as people's income improves they shift from fuelwood to other forms of fuel such as kerosene and hence allows the growth of forests. Furthermore, the effect of the level of household income on the wetland degradation and utilization pressure is statistically non significant ($p>0.05$).

4.1.10 Duration of stay of respondents

The logistic regression (Table 1) indicated that, the duration of stay of respondents has a negative regression coefficient of -1.555 and ($p=0.101$). This implies that an increase in years of residence of respondents reduces the odds ratios of utilization pressure and resource degradation by factor of 0.221. The results (Table 5) show that, majority of respondents (88%) have stayed in the village more than 10 years while 12% have less than 10years. According to Mayetta (2004), the longer a person stays in a particular place the more he/she becomes involved in natural resources conservation and hence the more such a person becomes aware of the broader role of natural resources conservation to an individual, national and international economy. Similarly, the more time a person stays in a particular area, the more indigenous resource conservation knowledge and positive attitudes towards conservation. However, the effect of duration of residence in the area of study on utilization pressure and wetland degradation was statistically not significant ($p>0.05$). This implies that the less time the person stay is assumed to be an immigrant who is less knowledgeable on wetland conservation and with no sense of resource ownership hence can contribute highly to utilization pressure and resource degradation.

4.1.11 Occupation of respondent

The occupation of respondent has negative logistic regression coefficient of -20.886 and (p=0.998) (Table 1). This implies that, the occupation of respondents has no effect to utilization pressure and wetland degradation since increase the diversification of occupation among the coming members reduces the odds ratios by factor of zero (0.00). According to the results (Table 5), many of respondents (90%) were farmers while (10%) do others like employment and business. However, statistically it was found that the occupation was not significant i.e. the correlation between dependent and independent variables had no effect to the odds.

4.1.12 Perceptions on the current state and condition of the Kilombero Valley Floodplain Ramsar Site

Majority of the respondents (96%) perceived that the current condition of the wetland is poor and not well managed (Table 4). Respondents claimed that, the situation is attributed to poor law-enforcement (34%) and inadequate management (66%) by the government. The government has pioneered several interventions to counter wetland degradation including the declaration of the KVFP as a wetland of International significance (Ramsar site) through the support from Belgium Government in collaboration with The United Republic of Tanzania. These range from knowledge base building, legal and institutional establishments and community based approaches.

Table 4: Local People Perceptions on the Current State of the Kilombero Valley Floodplain Ramsar, Morogoro, Tanzania

Issue/ Information	% Respondents in each village				All (N=116)
	Ikwambi	Mofu	Njiwa	Minazini	
(i) Current status of wetland					

Good	5	5	7	0	4
poor	95	95	93	100	96
(ii)Major problems					
Encroachment for Agriculture	38	21	30	12	28
Encroachment for settlement	15	16	15	12	14
Illegal fishing	5	16	15	24	13
Wildfire	5	0	0	0	2
Poaching	0	11	7	0	4
Deforestation	5	5	4	20	8
Overgrazing by livestock	32	31	29	32	31
(iii) Reasons for poor wetland status					
Poor law enforcement	22	37	33	52	34
Inadequate management	78	63	67	48	66

Majority of respondents admitted that encroachment both for agriculture (28%) and settlements (14%), illegal fishing and destruction of breeding sites (13%), wildfire (3%), poaching (4%), deforestation (8%) and overgrazing by livestock (31%) were the major wetland degrading activities. Competition for quality grazing land by domestic stocks is one of the main factors impacting wild species during the encroachment. According to Bonnington *et al.* (2007), Kilombero Game Controlled Area (KGCA) which is currently a core area of Kilombero Valley Floodplain Ramsar Site has extensive livestock husbandry which is negatively associated with wildlife populations, especially outside the hunting season. According to (Zedler and Kerche, 2005) biodiversity support, water quality improvement, flood abatement, and carbon sequestration are key functions that are impaired when wetlands are lost or degraded.

4.1.13 Suggested management and conservation measures in the Kilombero Valley Floodplain Ramsar Site, Morogoro, Tanzania

Majority of respondents suggested that the development of clear policy and regulations (31), involvement of local people (23), patrols (17), frequent environmental education (10) and change of current status of protected area into wetland reserve to be among the major management and conservation measures (Table5). Furthermore, local people suggested that, prompt protection action including law enforcement (48) and management of livestock populations (52) is an urgent measure for conservation. Sustainable management of wetlands requires strengthening community involvement in planning and implementation of required actions. Such community participation can be achieved through formation of Community Based Wetlands Management Plans (CBWMP) or an integrated management plan that take into account local people values and livelihood improvement. Sensitization and educational programs to empower local communities with knowledge and awareness particularly on the ecological roles of wetlands need to be scaled up to influence a positive shift of attitude and practices towards these ecosystems. According to MNRT, (2003), the knowledge base about wetland resources, status and key management problems is limited and no proper policy guidance is in place. Wetlands are partly covered in existing laws though the coverage is somewhat fragmented. This conform with (Newmark, 2000) who suggested that, in order to accommodate both needs of people and wildlife conservation measures should be integrated with community development. Improved protection and sustainable utilizations of the Kilombero valley is urgent if biodiversity and ecological services of the wetlands are to be maintained and passed on to future generations.

Table 5: Suggested Management and Conservation Measures for Kilombero Valley Floodplain Ramsar Site, Morogoro –Tanzania

	% Respondents	All

Local peoples perceptions	Ikwambi (n=42)	Mofu (n=19)	Njiwa (n=27)	Minazini (n=25)	(N=116)
(a) Suggestions on management					
1. Clear policy and regulations	39	31	33	24	31
2. Intensify field patrols	9	21	26	20	17
3. Local people involvement	24	21	18	32	23
4. Education through seminars	14	10	7	8	10
5. Change the status to wetland reserve	16	16	15	16	15
(b) Protection actions					
1. Law enforcement	61	47	30	52	48
2. Management of livestock population	29	53	70	48	52

Results (Table 5) show that respondents had an opinion that law enforcement (48%) and management of livestock population (52%) to be among the immediate protection action in order to rescue the wetland from more degradation. Luoga 2000 observed in woodland forest of Tanzania that less than half of the respondents suggesting the government to place more emphasis on law enforcement and that local people should be involved in the utilization and safeguarding the resources. The existing Kilombero Game Controlled Area system was perceived as ineffective in achieving conservation of the area since it does not restrict land-use (agriculture, cattle-keeping, settlement) within the valley, and the level of enforcement of restrictions on hunting is thought to be very low, mostly due to lack of man-power (MNRT, 2003).

4.2 Threats to the Biodiversity of the Wetlands

The study intended to verify the hypothesis that; “there are little efforts taken to reduce threats in the Kilombero Valley Floodplains wetlands (KVFP). A detailed account of verification for this hypothesis is outlined below through the calculation of a Threats Reduction Assessment Index (TRAI) and its interpretation.

According to the perception of the local communities on status of the Kilombero valley in the study area, the analysis of the threats facing the wetland show that the TRA Index for the protected area ranges from 6-13% which is an indication that the wetland is highly threatened (Table 6). These results conform to perceptions by local communities majority of whom (96%) have mentioned that, the current status of wetland is poor (Table 4). On the other hand, the TRA Index as assessed by the Kilombero and Ulanga District authorities was 19.5% and 14.2% respectively (Table 6).

The average TRA for the local communities and districts authorities is 13% which indicate general perception of poor condition of the wetlands. According to Persha (2004); Madoffe & Munishi (2005), the lower the TRA percentage the higher the threats and vice versa. Given this low TRA Index it seems that the protected area is highly threatened by unsustainable land use practices (Madoffe and Munishi, 2005). This signifies that little efforts have been taken by the management to reduce threats on the Kilombero wetlands. This conform with findings from socio- economic survey done in the study area whereby 66% and 34% of the respondents said that the poor condition of the reserve is attributed to inadequate management by the government and poor law enforcement respectively (Table 4).

Table 6: Results from Threat Reduction Assessment for the Local People and Management Authorities of Kilombero and Ulanga Districts, Morogoro-Tanzania

S/N	Direct threats	Area ranking	Intensity ranking	Urgency ranking	Total ranking	% Treat MET	Raw score	% TRA Index
Kilombero District								
1	Livestock	5	4	2	11	10	1.1	
2	Overgrazing	5	5	4	14	10	1.4	

3	Deforestation	3	3	2	8	15	1.2	
4	Illegal fishing	5	4	4	13	25	3.25	
5	Wildfire	4	3	3	10	40	4	
Total					**56**		**10.95**	**19.55**
Ulanga District								
1	Livestock	5	5	3	13	18	2.34	
2	Agric and settlement encroachment	3	3	3	9	5	0.45	
3	Illegal fishing	5	4	5	14	5	0.70	
4	Poaching	5	5	3	13	30	3.90	
5	Wildfire	5	3	3	11	10	1.10	
Total					**60**		**8.49**	**14.15**
Mofu Village								
1	Overgrazing	5	5	5	15	10	1.50	
2	Agriculture encroachment	5	5	4	14	5	0.70	
3	Deforestation	5	5	5	15	5	0.75	
4	Illegal fishing	5	5	5	15	5	0.75	
5	Settlement encroachment	5	5	5	15	5	0.75	
Total					**74**		**4.45**	**6.01**
Ikwambi Village								
1	Overgrazing	5	5	5	15	5	0.75	
2	Agriculture encroachment	5	5	4	14	5	0.70	
3	Deforestation	5	5	5	15	20	3.00	
4	Illegal fishing	5	5	3	13	30	3.90	
5	Settlement encroachment	4	5	5	14	10	1.40	
Total					**71**		**9.75**	**13.73**
Njiwa Village								
1	Overgrazing	5	5	5	15	10	1.50	
2	Agriculture encroachment	5	4	5	14	7	0.98	
3	Deforestation	5	5	4	14	15	2.10	
4	Illegal fishing	5	5	5	15	10	1.50	
5	Settlement encroachment	4	4	3	11	10	1.10	
Total					**69**		**7.18**	**10.41**
Minazini Village								
1	Overgrazing	5	4	5	14	10	1.4	
2	Deforestation	5	4	5	14	10	1.4	
3	Settlement encroachment	4	3	5	12	30	3.6	
4	Illegal fishing	5	5	5	15	5	0.75	
5	Agriculture encroachment	3	5	5	13	6	0.78	
Total					**68**		**7.93**	**11.66**
Average % TRA Index								**12.585**

A similar study by Madoffe and Munishi (2005) in the EAMs revealed that most of the forests had TRA ranging between 30 – 39% indicating that most of the forests are highly threatened. The five (5) main threats according to their significance were overgrazing, encroachment for agriculture, Illegal fishing and destruction of breeding areas, deforestation and encroachment for settlement. Potential threats to the wetland resources

especially wildlife population are therefore likely due to habitat degradation through over-grazing by domestic herbivores, agricultural encroachment and the expansion of human settlements.

4.2.1 Overgrazing

There are significant conflicts (real and conceptual) between the management of livestock and wetlands (Plate1). Personal observation done during the reconnaissance survey revealed it to be a big problem now both on the south and in the north of the wetland especially on the natural ponds, rivers, swamps and streams. Seen in the floodplains of Kibasila, Ngapemba, Mende, Kilombero River, Kikumba and Ndolo swamps. The survey revealed that these areas are heavily used for livestock grazing during the dry season, where large herds of cattle were seen.

Most respondents mentioned some of seasonal and permanent water bodies dried up while in others the flow of water has been reduced and the situation has reached alarming levels where about entire wetlands have been destroyed. Frontier Tanzania (2001a) noted that increased livestock grazing in the floodplains and wetlands was one of the pressures on natural resources in the KVFP ecosystem. Similarly Frontier Tanzania (2002); Madoffe and Munishi (2005) noted significant grazing pressure on some EAMs forests.

Table 7: Results from Pair-Wise ranking of the Threats facing KVFP of Local People

Threats to the wetlands	1	2	3	4	5	6	7
Ikwambi Village							
1. Agriculture encroachment	X						
2. Illegal fishing	1	X					
3. Poaching	1	2	X				
4. Wildfire	1	2	4	X			
5. Settlement encroachment	1	5	5	5	X		
6. Deforestation	1	2	6	6	5	X	

7. Overgrazing	7	7	7	7	7	7	X
Frequencies	**5**	**3**	**0**	**1**	**4**	**2**	**6**
Mofu Village							
1. Wildfire	X						
2. Poaching	2	X					
3. Overgrazing	3	3	X				
4. Deforestation	4	4	3	X			
5. Agriculture encroachment	5	5	3	5	X		
6. Settlement encroachment	6	6	3	4	5	X	
7. Illegal fishing	7	7	3	4	5	6	X
Frequencies	**0**	**1**	**6**	**4**	**5**	**3**	**2**
1. Agriculture encroachment	X						
2. Overgrazing	2	X					
3. Deforestation	3	2	X				
4. Wildfire	1	2	3	X			
5. Poaching	1	2	3	5	X		
6. Settlement encroachment	1	2	3	6	6	X	
7. Illegal fishing	1	2	7	7	7	6	X
Frequencies	**4**	**6**	**4**	**0**	**1**	**2**	**3**
Minazini Village							
1. Overgrazing	X						
2. Deforestation	1	X					
3. Wildfire	1	2	X				
4. Poaching	1	2	4	X			
5. Agriculture encroachment	1	2	5	5	X		
6. Illegal fishing	1	2	6	6	6	X	
7. Settlement encroachment	1	2	7	7	7	7	X
Frequencies	**6**	**5**	**0**	**1**	**2**	**3**	**4**
Kilombero district							
1. Livestock	X						
2. Agriculture encroachment	1	X					
3. Illegal fishing	1	2	X				
4. Poaching	1	4	4	X			
5. Wildfire	1	2	3	4	X		
6. Settlement encroachment	1	2	6	6	6	X	
7. Pollution	1	2	3	4	5	6	X
Frequencies	**6**	**4**	**2**	**4**	**1**	**4**	**0**
Ulanga District							
1. Poaching	X						
2. Agriculture encroachment	2	X					
3. Pollution	1	2	X				
4. Livestock	4	4	4	X			
5. Wildfire	1	2	3	4	X		
6. Settlement encroachment	6	2	6	4	6	X	
7. Illegal fishing	7	2	7	4	7	6	X
Frequencies	**2**	**5**	**1**	**6**	**0**	**4**	**3**

Hongo and Masikini (2002) experienced a high influx of immigrant pastoral herds from drought prone districts to Magu district causing soil erosion, loss of vegetation cover and deforestation and ultimately leading to pollution of Lake Victoria along the Speke gulf in particular. Overgrazing leads to habitat degradation and loss of preferred species. During this survey huge herds of livestock were seen in different areas of the valley especially in

river bank and natural ponds causing serious erosion (Plates 2,6,7). The results from pair-wise ranking for the local people and districts management authorities of both Ulanga and Kilombero revealed that, overgrazing by livestock is the foremost and big problem facing the wetlands (Table 8).

Table 8: Summary for Average ranking for all Villages and Districts for each threat

THREATS	Number of frequencies						Total FQ	Average Ranking
	IK	MO	IN	MI	KI	UL		
Agriculture encroachment	5	5	4	2	4	5	25	2
Illegal fishing	3	2	3	3	2	3	16	4
Poaching	0	1	1	1	4	2	9	6
Wildfire	1	0	0	0	1	0	2	7
Settlement encroachment	4	3	2	4	4	4	21	3
Deforestation	2	4	4	5	0	0	15	5
Overgrazing	6	6	6	6	6	6	36	1

IK= Ikwambi village, MO= Mofu village, IN= Itete Njiwa village, MI= Minazini village, KI= Kilombero District, UL= Ulanga District and FQ= Frequncies

Plate 1: Overgrazed area near Kibasila swamp.

Plate 2: Livestock in water streams in KVFP.

4.2.2 Encroachment

Encroachment for settlement and agriculture is another threat to the Kilombero Valley Floodplains (Plates 3, 4). The encroachment takes the form of opening new farms, settlements and major economic activities including tree cutting for fuel, fishing, timber harvesting for sale, rope production, and building materials. These human activities result into deforestation, loss of wildlife habitats and ultimately to catchments degradation. The survey showed that the principal cause of the problem is population growth. This population is highly contributed by excessive influx of pastoralists and their cattle from other places and their resultant activities that create land scarcity to the native communities hence more pressure to the wetland seeking for grazing, settlements and agricultural land. SENAPA (2004) reported encroachment for cultivation by local communities in Serengeti National Park as a big threat to the park. Furthermore, it was estimated by 1985 that 56.65% of available wetland had been drained for intensive agriculture in Europe and

North America, 27% in Asia, 6% in South America and 2% in Africa, with a total of 26% loss to agriculture worldwide (OECD, 1996).

According to Frontier Tanzania (2001a), high cattle densities and expanding human settlements are among the major human pressures threatening KVFP. It was reported by both the District Game officers of Kilombero and Ulanga that some of the areas previously tourist hunting blocks for-example at Igumbiro village is no longer there due to absence of animals to hunt as a result of encroachment. Discussion and field observations with Mofu village Government also revealed that some of the wildlife inhabiting Kibasila area including hartebeest, lion, warthogs, and reedbuck hyenas has disappeared locally. The results from Pair-wise ranking exercise ranked encroachment for agriculture and settlement to be the second and third threats facing the wetlands respectively (Table 8).

Plate 3: Agricultural and settlement encroachment near Kibasila within KVFP.

Plate 4: Agriculture and settlements encroachment At Namitwanga area near Wild foot prints Tourist camp at KVFP.

4.2.3 Illegal fishing and destruction of fish breeding areas

Increase in fishing effort and the use of illegal fishing gears are the major contributing factors to the declining fishery in the KVFP. Fishers visited at camp said that the increase in fishers and fishing gears operating in the floodplain is attributed by the open access policy of the activity. Entry into fishing is open to all Tanzanians provided they have the required permits. On the other hand, most fishers do fishing illegally.

Plate 5: Fishers at Namitwanga camp along Kilombero River.

The illegal fishing gears used include the use of small meshed nets, damming of river tributaries, poisonous chemicals both industrial and local, drift nets and intercepting fish at spawning migration. Discussion held with key informants revealed that very small mesh sized fishing nets such as beach seines and mosquito nets catch fish before attaining their first sexual maturity hence affect their population.

It was further explained that, damming of the river locally known as “Lulimbo” involves total harvesting of the fish back waters using mosquito nets after complete damming of the tributary. Such back water constitutes spawning and nursery grounds for many resident species that greatly affect the structure of fish populations in the river. Declines in fish in Kilombero River, may also have led the fishers to switch into using non-conservational ways of fishing such as ichthyotoxic plant extracts and poisonous industrial chemicals.

Poisonous fishing is destructive to the environment as it kills both target and untargeted aquatic fauna species. It was learnt from discussion that, the use of drift nets is now common in Kilombero which is believed to have evolved after decline in catch rates by bottom set gill nets. According to Frontier Tanzania (2001a) over fishing is one of the pressures on natural resources in the KVFP.

Plate 6: Livestock trampling in fish breeding areas in Mofu near Kibasila swamp within KVF.

Plate 7: Livestock trampling in water bodies.

4.2.4 Deforestation

Illegal tree/pole collections as building materials for construction of cattle enclosures were common all over the KVFP. Big cattle enclosures established by poles especially those of hard woods such as Mpingo *(Dalbegia melanoxylon*) were seen during the survey in the southern and northern parts of the KVFP. About 14.8% of the respondents mentioned that, deforestation is one of the major problems facing Kilombero valley (Table 4). Threat Reduction Assessment (TRA) revealed deforestation to be among the five major direct threats outlined by respondents. Hall and Rodgers (1986) noted that more than 50% of the poles in the easily accessible areas in the Kimboza, Pande and Pugu forest reserves have been cut for different uses. Similarly Frontier Tanzania (2001b, 2002); Madoffe and Munishi (2005) noted that, tree and pole cutting was intensive along some of the EAMs forests boundaries within the proximity of villages. Clearance for establishment of farms, settlement and grazing by livestock are reported to drive wildlife away from traditional habitats Kato (2007). According to IUCN (2008), most species are threatened due to habitat loss.

Plate 8: Deforestation due to the establishment of the cattle enclosure by using some hard woods such as mpingo (*Dalbergia melanoxylon*).

Plate 9: Deforestation due to establishment of cattle enclosure using Shrubs and hard wood.

4.3 Management Effectiveness and Conservation Initiatives in the KVFP

4.3.1 Management Effectiveness of the wetland

The management effectiveness of the KVFP at districts level ranged between 15 – 32% (Appendix 2). The higher the percentage the more effective (strong) is the management and vice versa. According to Hockings *et al.* (2000); Madoffe & Munishi (2005), percentage score ranking given in this wetland reserve is poor. There is little success by the government in protecting the wetland to date. This indicates that the KVFP is poorly managed and therefore it stands a chance of loosing its status as biodiversity conservation area if the situation is not reversed. Furthermore, the results from socio-economic survey show that 96% of the respondents perceived that the current state of the KVFP is very poor and not well managed (Table 4). Further discussion with key informants revealed that, the poor condition of the reserve is attributed to inadequate management by the government and poor law enforcement. Similar study by Chizyuka (2006) in Malawi's forests indicated that, the vulnerability of important forests in Malawi stem from inadequate law enforcement, consumption demands on forest products, staffing problems, high levels of poverty as among the general populace that was exacerbated by a poor management regime on the part of the forest authorities.

Successful management effectiveness should include ingredients such as clear reserve boundaries, management plan, secured funding, good law enforcement, appropriate and well-trained staff, and local community involvement. Education and community outreach programmes, resource inventory, equipments, and a good system of monitoring and evaluation in place are also crucial to implementing management activities and thus maintaining the biological wealth of the wetland ecosystem. This study identified 16 (sixteen) key issues to the management of the KVFP Ramsar site out of the 90 (ninety) main issues used to evaluate the management effectiveness by the WCPA tracking tool (Table 9).

Table 9: Selected Critical Management Issues for the Kvfp, Morogoro Tanzania

Issue	Score
1. Management plan	0
2. Protected area policy	0
3. Protected area boundary demarcation	0
4. Protected area legislation	0
5. Law enforcement	1
6. Current budget	0
7. Regular work plan	1
8. Education and awareness programme	1
9. Involvement of local communities	1
10. Monitoring and Evaluation	1
11. Resource inventory	0
12. Resource management	1
13. Condition of the values	0
14. Economic benefit assessment	2
15. Staff numbers and training	1
16. Equipment	1

Scores: 0 = poor, 1 = fair, 2 = good, and 3 = excellent

4.3.2 Protected area boundary demarcation

The boundary of the reserve is not known by the management authority and local residents and there is no boundary appropriately demarcated. Ownership to any important resource entails identity of the resource, which includes boundary demarcation. The discussions and availed data further revealed that, encroachment for agriculture and settlement in KVFPRS has been exacerbated under the cover of poor and unknown boundary demarcation. The problem is further compounded by lack of statutory regulations defining the identification or demarcation of wetland boundaries. Similar findings by (Goodman, 2002) from KwaZulu-Natal indicated that, some of the protected areas had no clear boundary demarcation while others have boundaries but not appropriately maintained that has resulted into encroachment both agriculture and settlement into the wetland reserve.

4.3.3 Management plan

Management plan is an important tool for both short and long term wetland activities. Unfortunately, the wetland reserve has no management plan, a situation that makes most

activities happen on an irregular or ad hoc basis. A management plan is very helpful in identifying clearly the expected outcomes and impacts from the management of the area and one can make future projections of resource needs. Management plan can be used to combat wetland and biodiversity loss, while ensuring that benefits accrue to adjacent communities. A study by Madoffe and Munishi (2005) in some EAMs forests reported similar findings. This is in line with Goodman (2002) argument that despite the long tradition of protected area management planning in the organization, the majority of protected areas (54%) in KwaZulu-Natal did not have current management plans. Similarly, according to WWF (2004) only 12 percent of the 200 forest protected areas in 34 countries worldwide surveyed have an approved management plan. Clearly this is a critical weakness with respect to management effectiveness and requires urgent attention.

4.3.4 Staff numbers and training

Staff numbers are inadequate for critical management activities (1) of the wetland. Successful execution of management activities such as planning, law enforcement, supervision, monitoring, needs sufficient and well trained staff. On the other hand staff training and skills was low relative to the needs of the protected area (1). Madoffe and Munishi (2005) observed in some forests that, all forests have either inadequate number of staff or below optimum level. Also training of staff was either low or was adequate but could be further improved to fully achieve the objectives of the management. Similar studies elsewhere (UWA, 2002; KNP, 2003; SENAPA, 2004) reported that currently, staff manpower (especially the rangers/ant-poaching unit) was still not sufficient, given the sizes of the parks, some with inadequate training and skills thus affecting law enforcement efforts. In such a situation the reserve is poorly managed with a lot of encroachment both agricultural and settlements, illegal harvesting, poaching and other illegal human activities, resulting into degradation of the KVFP Ramsar site resources and loss of its biodiversity.

Similar findings by (Frontier Tanzania, 2001a) revealed that, the existing Kilombero Game Controlled Area which is a core area within KVFPRS was perceived as ineffective in achieving conservation of the area since it does not restrict land-use (agriculture, cattle-keeping, settlement) within the valley, and the level of enforcement of restrictions on hunting is thought to be very low, mostly due to lack of man-power. Although hunting is regulated there is no control over settlements or agriculture within the Game Controlled Area, and there are farms in many areas of the valley, including dry season farms in suitable areas of the interior of the floodplain. The amount of cultivation in the valley has been increasing, and there is therefore a perceived threat to wildlife habitats. TRA Index based on discussion between Kilombero and Ulanga District authorities were 19.5% and 14.2%respectively while the perception of local people in four villages surveyed indicated TRA Index of 6.01, 13.73, 10.41 and 11.66% all indicating that the biodiversity is highly threatened due to improper management.

4.3.5 Law-enforcement

Both Districts of Kilombero and Ulanga have major deficiencies in staff capacity/resources to enforce wetland reserve legislation and regulations (e.g. lack of skills, no patrol budget) (1). Adequate law enforcement by the staff is vital to the protection of the reserve and conservation of its biodiversity. Inadequacy in capacity has resulted into rampant illegal activities in the reserve with detrimental effects to the wetland. Gibson *et al.* (2004) as cited by Banana *et al*. (2004) argues that the regularity of law enforcement is the most important factor in determining forest conditions. Furthermore, WWF (2004) warns that, poor governance and law enforcement which results in sanctions upon violation of laws not being applied reduces the motivation of rangers and encourages illegal acts by criminal groups such as those involved in illegal trade of rare species. In Kilombero valley, similar results from the districts and regional official documents and personal observations show

that there are rampart poaching of elephants, buffalos, puku as well as poisoning lions, leopards, hyenas, vultures and other species resident in the area. The Kilombero valley was once an area of high wildlife density and rich ecosystem which gave it its international importance and designation as a RAMSAR site. Due to the lawlessness and resulting environmental damage in the Kilombero valley, the wetland qualifies to be a catastrophe and national disaster.

4.3.6 Current budget

The reserve does not have a budget for its activities (0); however, there is collaboration between Government of Republic of Tanzania and Government of Belgium for four years project on management of KVFP Ramsar Site that commenced 2007. The project concentrates much on capacity building and it covers 31 out of 108 villages which are meant for demonstration. No specific fund is set aside by the Government authorities for conservation and management of the wetland. Lack of capacity to implement wetland management in terms of human and financial resources poses a great challenge. While, at national level, the budget allocations for wetland management have been gradually increased, the allocations for lower administrative levels remain insufficient. Funding is inadequate and much of it comes from donors. This poses uncertainty in the absence of donors. The availability of funds and financial management is a prerequisite for effective and efficient execution of planned activities. Inadequacy of funds coupled with its irregular flows explains why the wetland reserve is poorly managed. Madoffe and Munishi (2005) observed in some forests that most of the forests had either no budget or was inadequate for basic management needs. Elsewhere UWA (2002) and KNP (2003) reported that funds were inadequate and untimely released making law enforcement and other operations in the parks ineffective. Banana *et al.* (2004), WWF (2004), and Chizyuka (2006) further stresses that inadequate funding results in understaffing and lack of capacity to implement

management plans, monitoring and law enforcement which make protected areas vulnerable to problems as they arise thus, paving a way for human activities to undermine its biological wealth. These issues need an urgent attention.

4.3.7 Equipment

There was some equipment and facilities but they are wholly inadequate. There are no specific vehicles for wetland management apart from those purchased by the project in both districts and the management of the wetland was segmented i.e. fisheries, wildlife, forestry and agriculture. Effective and efficient implementation of working plans need adequate and well maintained equipment and facilities among other things. UWA (2002) in Bwindi Impenetrable National Park, Uganda; and KNP (2003) in Kaziranga National Park, India reported that equipments were inadequate, and this also applied to the infrastructure and funds constraints preventing regular maintenance. Goodman (2002) reported that, there is widely expressed opinion, that the maintenance and care of equipment and infrastructure is substandard, thus posing a serious threat to the sustainability of current levels of management inputs by the organization in KwaZulu-Natal.

4.3.7 Education and awareness programme

There is limited and ad hoc education and awareness programme (1) in the study area. Whichever wetland management regime is developed for a given area, whatever community management aspect is agreed, or whether communities are required to become better custodians of wetland, a continued programme of wetland education and awareness rising will be essential. There is insufficient awareness of wetland values and functions at all levels of government and within society as a whole. This is partly because of the limited knowledge base but also because certain sectors of society regard wetlands as unproductive wastelands. Furthermore, wetland education activities in Tanzania are only

available on a limited scale. (FBD, 2001; Madoffe and Munishi, 2005) cited that, conservation education and awareness creation to the local communities adjacent to the forest is considered as an important tool for forest management and conservation. The Belgium Government in collaboration with the Government of the United Republic of Tanzania are undertaking a project that supports and facilitates this awareness and training programmes for VEC and the VGS in 31 selected villages which is approximately 29% of all the villages' proximity of the wetland. Also a specific wetland law and general sensitization of the general public is required to focus attention of the general public to wetland management. Goodman (2002) observed in KwaZulu-Natal that, the level of outreach and education programmes on restoration and prevention were not consistent with the degrees of pressures and threats experienced by protected areas. This has resulted into ecosystem degradation and loss of some important biodiversity.

4.3.8 Involvement of local communities

The local communities have some input into discussion relating to management but no direct role in management (1). During the socio-economic survey, some of the local people (23%) (Table 5) across the sampled villages stated that, the involvement of local people in sustainable management of KVFPRS is very crucial. One of the major constraints to natural resource management in Tanzania is lack or insufficient involvement of local communities at all stages of development and implementation. The involvement of the public has been beneficial in identifying natural resource problems and in developing sustainable and acceptable solutions. The objective is to develop and extend practical methodologies for wetland resource management by local communities. In keeping with current conservation thinking that emphasizes the involvement of local communities in the study area, a proposal was made by WWF in the early 1990's for the initiation of a community-based conservation scheme with a pilot project on the northern

side of the valley. However, this project fell through, officially due to lack of funds, but also because the proposed project was felt to be too large to be workable. More capacity building is required at district and lower levels to enable communities to increasingly take up the responsibilities of wetland management under the decentralized system of governance. This can address the funding constraints and inadequate staffing. Mayeta, (2004) agued that, involvement of local communities in the conservation of natural resources reduces chances of resource abuse because the practice imparts sense of ownership and benefit sharing at local level.

KNP (2003) and SENAPA (2004) reported that poor collaboration and involvement of local communities has resulted into high poaching and encroachment rates in Kaziranga National Park, India and Serengeti National Park, Tanzania. An argument by Goodman (2002) states that, improved communication with local communities is likely to lead to a much better understanding of the value of the protected area, a greater degree of participatory management and acceptance of the protected area and hence improved management effectiveness. Furthermore (FBD, 2001; FORCONSULT, 2003; Madoffe and Munishi, 2005) argued that, involving local communities in decision making motivates conservation because the communities will feel that the forest belongs to them. Meinzen-Dick and Knox (1999) as cited by Banana *et al*. (2004) claim that participation in decision-making is the most critical form of participation in natural resources management. The study by Madoffe and Munishi (2005) in some EAMs forests reported that, most of the forests either don't involve the local communities or the communities have some discussions relating to management but no direct involvement in the resulting decisions. Madoffe *et al*. (2006) further argue that one could not overlook the role of human being in forest degradation and therefore the need for involvement of the local community in natural resources management. As poverty and population growth are the main force

behind these degradation, people's participation could be an important tool in the reduction of the losses. Furthermore, Chizyuka (2006) argue that communities that live in areas adjacent to protected areas also need support to develop a general appreciation for natural resource conservation, as they are looking for solutions to meet their basic food and income requirements.

4.3.9 Resource inventory

Information on critical habitats, species, ecological processes and cultural values of the protected area is not sufficient to support planning and decision making (1). There is no national inventory of wetlands to guide management in addition to general lack of research data and serious lack of knowledge about wetlands. The existing wetland inventory does not provide comprehensive data required for management purposes. The inventory for example does not provide adequate quantitative data on the status of wetlands. Even available research data is not accessible especially to the local communities. One of the management objectives of the wetland is to ensure that biological diversity is adequately conserved. The knowledge base about wetland resource biodiversity, status and key management problems is limited and no proper policy guidance is in place. However, various surveys and research work carried in the wetland were not specific to the management of specific species. IRA (2001) concurs with the need for a detailed and exhaustive inventory of the existing natural resources in the protected areas. For example Malimbwi and Zahabu (2000) argue that, there is a need to know what is in the forest reserve in terms of vegetation and other biodiversity. Goodman (2002) on a similar issue in KwaZulu-Natal reported that although most respondents felt that there were up-to-date natural resource inventories in place almost 40% felt that these were inadequate for their protected areas. In this regard, important (threatened, rare, endemic) species inventories were felt to be incomplete, and in many instances medium scale (1:50 000) soil and

vegetation classifications maps were not available, thus, calling for more efforts to address this need.

4.3.10 Resource management

Very few of the requirements for active management of the critical habitats, species, ecological processes and cultural value are being implemented (1) Management of the wetland resources against fires, poaching, encroachment, lumbering, fishing, grazing, invasive species, is thus neither planned nor coordinated together by the conservators. This calls for an integrated management approach for the wetland resources to reverse the current poor state of the wetland ecosystem and deterioration of the biodiversity values.

4.3.11 Monitoring and evaluation

There is some ad hoc monitoring and evaluation, but no overall strategy and/ or no regular collection of data for monitoring purposes (1). Monitoring requires baseline data which does not exist though there are plans to do this under the project Intergrated Management Plan for the Kilombero Ramsar site. A study by Madoffe and Munishi (2005) in some EAMs forests had a similar observation in all forests. The authors further argued that monitoring and evaluation ensures that management obstacles are discovered and solutions sought promptly. Banana *et al.* (2004) concurs with these findings and reports from Uganda that, due to reduced monitoring and law enforcement caused by lack of manpower in the DFO's office together with perverse incentives for local councilors to protect forest resources, one would anticipate widespread illegal harvesting of forest products and degradation of the resource. Further discussions with management authority revealed that, an establishment of wetland inventory and monitoring activities as well as strategic studies is very important in support of policy development.

4.3.12 Economic benefits assessment

There is a significant or major flow of economic benefits to local communities from activities in and around the Kilombero valley floodplains. The existence of multiple economic benefits accruing from the wetland has kept population increasing around it which was not there before its gazettement as Game Controlled area. The economic activities in the reserve include lumbering, fishing, beekeeping, hunting and rice plantation. With the introduction of a hunting block in the reserve, the local communities earn income through participation in tourism activities as labour force during the hunting season. Also the twenty five per cent (25%) of the retention fund from the hunting fees is allocated back to the villages surrounding the protected area for protected area protection and other village development programmes. A similar study by UWA (2000) in Bwindi Impenetrable National Park, Uganda reported that all rangers are employed from the areas surrounding the park, and park initiated community tourist camp for community income and revenue sharing scheme is in place.

4.3.13 Protected areas policy and legislations

Currently there is no specific legal and policy framework regarding wetlands in Tanzania but wetland-related issues are touched upon in a variety of laws, policies and strategies due to the inherent cross-sectoral character of wetlands issues. It was observed that lack of an overall legal and policy framework for wetlands leaves government bodies at all levels with highly inadequate tools to effectively manage wetlands in a sustainable manner. According to MNRT (2003), wetlands of Tanzania are partly covered in existing laws, but the coverage is somewhat fragmented. There are large gaps and many provisions are neither comprehensive nor well coordinated. Access to these pieces to the general public is therefore constrained. The policy and legal framework surrounding wetlands are roughly divided into the policies and laws of a sectoral nature (Wildlife, Fisheries,

Agriculture and Livestock, Forest and Minerals) and those of a more general and cross-sectoral nature (Water, Environment and Land). The sectoral policies are generally most concerned with their core areas, but do recognize the need for cross-sectoral regulation, albeit without specifying sufficiently where and how to do this. Abila (2002) stated that, the major drawback of wetland conservation in Kenya has been the lack of clear policies guiding utilization. The Ramsar Convention recognizes the right of the contracting parties to formulate their national wetland policies in a manner that is appropriate to their respective national circumstances.

For all communities surveyed, 31% of the respondents (Table 5) claimed that formulations of clear policy and regulations are only the way forward to sustainable wetland management. Many wetland areas such as KVFP experience rapidly growing population with poor people moving into the areas in search of livelihood opportunities leading to a strong economic pressure for conversion of wetlands to other functions with only limited considerations given to the sustainability of the changes and that necessitate clear policies and legislations to support their management.

4.3.14 Condition and value

Many of important biodiversity, ecological or cultural values are being severely degraded (0). Majority of respondents interviewed (96%) had perceptions that, the condition of wetland status is very poor. Field observations and further discussion with key informants confirmed the current situation of the wetland to be highly degraded (Plates 1 to 9).

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Kilombero Valley Floodplains wetlands have been subjected to unplanned and unsustainable levels of exploitation, which threatens the biodiversity of the wetland and the survival of communities whose livelihood depends on them. However, socio-economic factors observed to have influence on utilization of wetland resources and likely cause degradation in the study area include; education level, marital status, age, gender, ethnicity, household size, duration of stay in the village, farm size, income level, occupation and market forces. Majority of respondents (96%) perceived that the current situation of the KVFP is poor and not well managed. The wetland is under multiple threats and the TRA-index is low which indication that the wetland is highly threatened. The management effectiveness of KVFP obtained through Management Effectiveness Tracking Tool at the districts level ranged from 15-32%. This indicates that there is little success by the government in protecting the wetland and therefore it stands a chance of loosing its status as biodiversity conservation area if the situation is not reserved. In order for the wetland to survive, both needs of communities and wetland must be integrated with community development focusing on conserving the wetlands while maintaining the livelihood benefits to local people.

5.2 Recommendations

Based on the findings and discussions from this study, the following recommendations are proposed as strategies to mitigate the problems facing the KVFP;

(i) For conservation effort and management effectiveness, there is an urgent need to adopt clear and specific wetland policy and legislations, developing an effective management plan and an appropriate land use plans for wetland conservation which will direct efforts at the protection and wise use of the nation's wetland resource heritage.

(ii) The government should consider sensitizing the communities in order for the core areas of KVFP to be zoned and upgraded into higher status of game reserve to deter the escalating human activities and eventually to conserve the natural resources of the area. Only conservation compatible economic activities such as fishing and beekeeping will be allowed in core areas.

(iii) There is a need to conduct repeated assessments on wetland conditions, utilization threats, management effectiveness, and priorities on resource allocation in the floodplain in order to monitor the status, ecological integrity and to evaluate the extent and nature of changes that are taking place.

(iv) To prevent further degradation and support local communities in gaining greater control over their natural resources in and around the wetland, there is a need of initiating participatory resources management programme. Collaboration with the local communities through JFM, CBFM and WMAs programmes are instrumental in reinforcing their commitment to conserving and sustainable use of the natural resources and in safeguarding their livelihoods.

(v) There is a need of increasing awareness and understanding of all stakeholders on the multiple values and functions of the wetlands. Sensitization and educational programs to empower local communities with knowledge and awareness particularly on the ecological roles of wetlands.

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APPENDICES

Appendix 1: Management Effectiveness Assessment Results for KVFP-Kilombero District

	Issue	Maximum Score	Actual Score given
1.	**I: Context** Legal status - Does the protected area have legal status?	3	3
2.	Policy, Laws and regulations -Is there policy, laws and regulations specific for the management and conservation of wetland?	3	0
3.	Protected area regulations - Are inappropriate land uses and activities (e.g. poaching, illegal timber harvesting, fishing, encroachment, livestock grazing) controlled?	3	0
4.	Law enforcement - Can staff enforce protected area rules well enough?	3	0
5.	Protected area boundary demarcation - Is the boundary known and demarcated?	3	1
6.	Resource inventory - Do you have enough information to manage the area?	3	1
7.	**II: Planning** Protected area objectives - Have objectives been agreed?	3	3
8.	Protected area design - Does the protected area need enlarging, corridors etc to meet its objectives?	3	3
9.	Management plan - Is there a management plan and is it being implemented?	3	0
10.	Regular work plan (**Planning/Outputs**) - Is there an annual work plan?	3	0
11.	**III: Inputs** Research - Is there a programme of management-orientated survey and research work?	3	2
12.	Staff numbers - Are there enough people employed to manage the protected area?	3	0
13.	Staff training (**Inputs/Process**) - Is there enough training for staff?	3	0
14.	Current budget - Is the current budget sufficient?	3	1
15.	Security of budget - Is the budget secure?	3	1
16.	**IV: Process** Resource management	3	0

	- Is the protected area adequately managed (e.g. for fire, invasive species, poaching, encroachment, illegal timber harvesting, fishing, livestock grazing)?		
17.	Personnel management - Are the staff managed well enough?	3	2
18.	Management of budget - Is the budget managed to meet critical management needs?	3	1
19.	Equipment - Is equipment adequately maintained?	3	1
20	Education and awareness programme - Is there a planned education programme?	3	1
21	State and commercial neighbours - Is there co-operation with adjacent land users?	3	1
	Indigenous people - Do indigenous and traditional peoples resident or regularly using the PA have input to management decisions?	3	0
	Local communities - Do local communities resident or near the protected area have input to management decisions?	3	0
	Commercial tourism and hunting - Do commercial tour operators and hunting companies contribute to protected area management?	3	0
	Condition assessment - Is the protected area being managed consistent to its objectives?	3	1
TOTAL SCORES		**75**	**22**
Overall Management Effectiveness = (29.33)			

Scores: 0 = poor, 1 = fair, 2 = good, and 3 = excellent

Appendix 2: Management Effectiveness Assessment Results for KVFP-Ulanga District

Issue	Criteria	Scores range from 0-3	Actual Score selected
1.Legal status Does the protected area has legal status (or in the case of private reserve is covered by a covenant or similar)? *Context*	The protected area is not gazette/ covenanted	0	
	There is agreement that the protected area should be gazette/covenanted but the process has not yet begun.	1	
	The protected area is in the process of being gazette/ Covenanted but the process is still incomplete (include sites designated under international convention, such as Ramsar, or local/ tradition law such as community conservation areas, which do not have national legal status or covenant)	2	
	The protected area has been formally gazette/ covenanted	3	3
2.Protected area policy Is there policy in place to guide the use of protected resources? *Planning*	There is no policy for land use and activities in the protected area	0	0
	Policies for controlling land use and activities in the protected area exist but these are major weakness	1	
	Policy for guiding land use and activities exist but there are some weakness or gaps	2	
	Policy for guiding land use and activities in the protected area exist and provide excellent basis for management	3	
3. Protected area regulations Are appropriate regulations in place to control land use and activities (e.g. hunting) *Planning*	There are no regulations for controlling land use and activities in the protected area	0	0
	Some regulations for controlling land use and activities in the protected area exist but these are major weakness	1	
	Regulations for controlling land use and activities exist but there are some weakness or gaps	2	
	Regulation for controlling inappropriate land use and activities in the protected area exist and provide excellent basis for management.	3	
4. Law enforcement Can staff (i.e. those with responsibility for managing site)	The staff has no effective capacity/ resource to enforce protected area regulations.	0	
	There are major deficiencies in staff capacity/ resource to enforce protected regulations(e.g. lack of skills, no patrol	1	1

enforce protected area rules well enough? *Input*	budget, lack of institutional support)		
	The staff have acceptable capacity/ resources to enforce protected area legislations but some deficiencies remain	2	
	The staff have excellent capacity/ resources to enforce protected area legislations and regulation	3	
5. Protected area objectives Is management undertaken according to agreed objectives? *Planning*	No firm objectives have agreed for protected area	0	
	The protected area has agreed objectives but not managed according to these objectives	1	
	The protected area has agreed objectives, but only partially managed according to these objectives	2	2
	The protected area has agreed objectives and is managed to meet these objectives	3	
6. Protected area design Is the protected area the right size and shape to protect species, habitats, ecological processes and water catchments of keys conservation concern? *Planning*	Inadequacies in protected area design mean achieving the major objectives of protected area is very difficult	0	
	Inadequacies in protected area design mean that achievement of major objectives is difficult but some mitigating actions are being taken(e.g. agreement with adjacent land owners of wildlife corridors or introduction of appropriate catchments management	1	
	Protected area design is not significantly constraining achievement of objectives, but could be improved (e.g. with respect to larger scale ecological processes)	2	2
	Protected area design help achievement of objectives; it is appropriate for species and habitat conservation; and maintains ecological processes such as surface and ground water flows at a catchments scale, natural disturbance patterns etc.	3	
7. Protected area boundary demarcation Is boundary known and demarcated? *Processes*	The boundary of protected area is not known by the management authority or local resident / neighboring land users	0	0
	The boundary of protected area is known by the management authority but is known by local resident/ neighboring and land users	1	
	The protected area boundary is known by both the management authority and local resident/ neighboring land users but is not appropriately demarcated	2	
	The boundary of the protected area is not known by the management authority and local resident/ neighboring land users but	3	

	not appropriately demarcated		
8. Management plan Is there a management plan and is it being implemented? *Planning*	There is no management plan	0	0
	A management plan is being prepared or has prepared but is not being implemented	1	
	Management plan exist but it is only being partially implemented because of funding constraints or other problems.	2	
	A management plan exists and is being implemented.	3	
7a. Planning process	The planning process allows adequate opportunity for key stakeholders to influence the management plan	+1	
7b. Planning process	There is an established schedule and process for periodic review and updating of the management plan	+1	
7c. Planning process	The results of monitoring, research and evaluation are routinely incorporated in planning.	+1	
9. Regular work plan Is there a regular work plan and is it being implemented? *Planning/ outputs*	No regular work plan exists	0	
	Regular work plan exists but few activities are implemented	1	1
	A regular work exists and many activities are implemented	2	
	A regular work plan exists and all activities are implemented	3	
10. Resource inventory Do you have enough information to manage the area?	There is little or no information available on the critical habitats, species and cultural values of the protected area.	0	0
	Information on critical habitats, species, ecological processes and cultural values of the protected area is not sufficient to support planning and decision making	1	
	Information on critical habitats, species , ecological processes and cultural values of the protected area is sufficient for most key area of planning and decision making	2	
Input	Information on critical habitats, species, ecological processes and cultural values of the protected area is sufficient to support all areas of planning and decision making.	3	
11. Protection systems Is system in place to control access/ resource use in protected area? *Process/ outcomes*	Protection systems (patrols, permits etc)do not exists or are not effective in controlling access / resource use.	0	
	Protection systems are only partially effective in controlling access/ resource use	1	
	Protection systems are moderately effective in controlling access/ resource use.	2	2
	Protection systems are largely or wholly effective in controlling access/ resource use.	3	

12. Research Is there a programme of management oriented survey and research work? *Process*	There is no survey or research work taking place in protected area	0	
	There is small amount of survey and research work but it is not directed towards the need of protected area management	1	1
	There is a considerable survey and research work but it is not directed towards the need of protected area management	2	
	There is a comprehensive , integrated programme of survey and research work , which is relevant to management need	3	
13. Resource management Is active resource management being undertaken? *Process*	Active resource management is not being undertaken	0	0
	Very few of the requirement for active management of crucial habitat, species, ecological processes and cultural values are being implemented	1	
	Many of the requirements for active management of crucial habitats, species, ecological processes and critical cultural values are being implemented but some key issues are not being addressed	2	
	Requirements for active management of critical habitats, species, ecological processes and cultural values are being sustainably or fully implemented	3	
14. Staff number Are there enough people employed to manage the protected area? *Input*	There are no staff	0	
	Staff are inadequate for critical management activities	1	1
	Staff number are below optimum level for critical management activities	2	
	Staff number is adequate for the management need of the protected area.	3	
15. Staff training Is staff adequately trained to fulfill management objective? *Input/ Process*	Staff lack the skill needed for protected area management	0	
	Staff training and skills are low relative to the need of protected area	1	
	Staff training and skill are adequate but could further be improved to fully achieve the objective of the management	2	2
	Staff training and skill are aligned with the management objective	3	
16. Current budget Is the current budget sufficient?	There is no budget for management of protected area	0	0
	The available budget is inadequate for basic management need and presents a serious constraint to the capacity to manage	1	
	The available budget is acceptable but could	2	

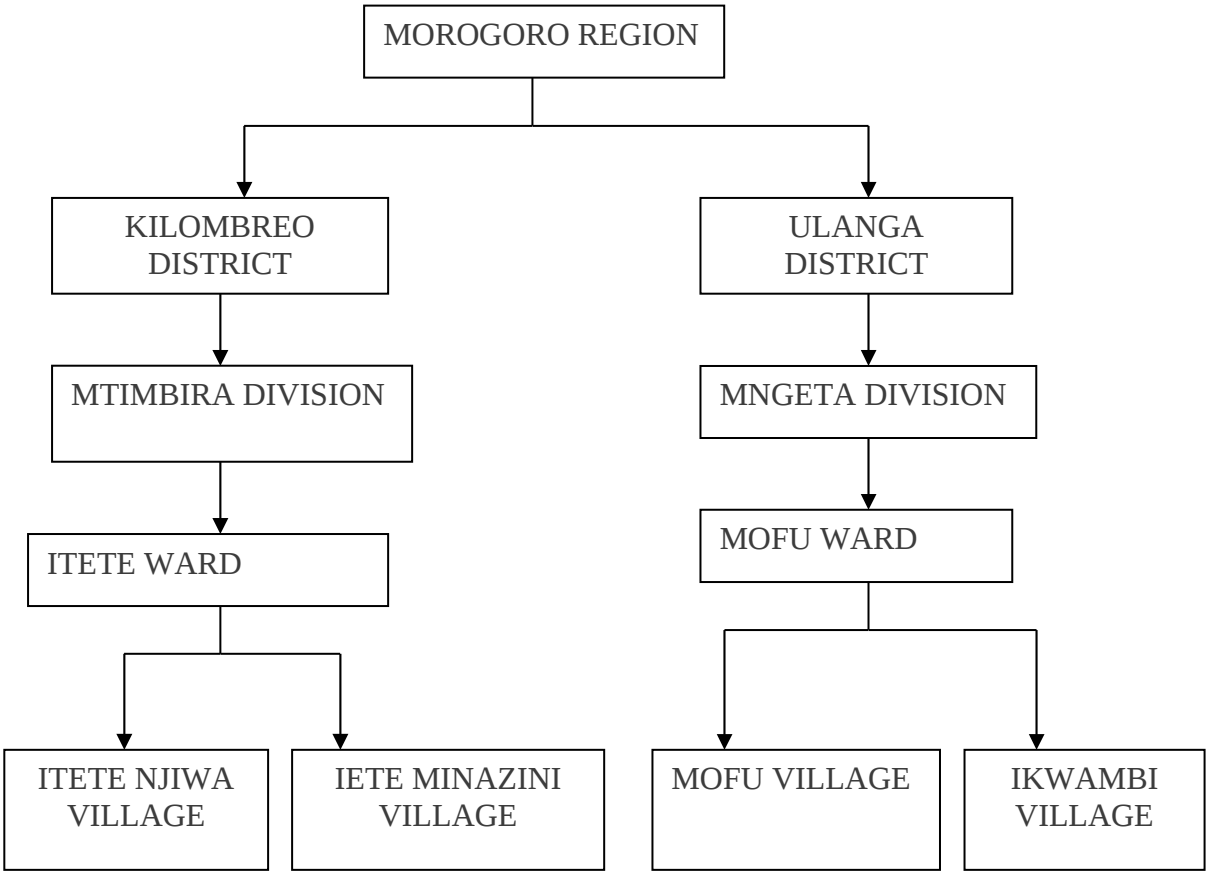
Inputs	further improved to fully achieve effective management		
	The available budget is sufficient and meets the management needs of protected area.	3	
17. Security of the budget Is the budget secure? *Inputs*	There is no secure budget for the protected area and the budget is reliant on outside or highly variable funding	0	0
	There is very little secure budget and protected area could not function adequately without outside funding	1	
	There is reasonably secure core budget for regular operation of the protected area but many innovations and initiatives are reliant on outside funding	2	
	There is a secure budget for protected area and its management needs	3	
18. Equipment Is equipment sufficient for management needs? *Inputs*	There are little or no equipment and facilities for management need	0	
	There are some equipment and facilities but these are adequate for most management needs	1	1
	There are equipment and facilities , but still some gaps that constrain management	2	
	There are adequate equipment and facilities	3	
19. Maintenance of equipment Is equipment adequately maintained *Process*	There is little or no maintenance of equipment and facilities	0	
	There is some *ad hoc* maintenance of equipment and facilities	1	1
	There is basic maintenance of equipment and facilities	2	
	Equipment and facilities are well maintained	3	
20. Education awareness Is there a planned education programme linked to objective and needs? *Process*	There is no education and awareness programme	0	
	There is limited and ad hoc education and awareness programme	1	1
	There is education and awareness programme but it is only partly meet needs and could be improved	2	
	There is an appropriate and fully implemented education and awareness programme	3	
21. Planning for land and water use Does land and water use planning recognize the protected area and aid the achievement	Adjacent land and water use planning does not take into account the needs of the protected area and activities / policies are detrimental to the survival of the area	0	
	Adjacent land and water use planning does not take into account the long term needs of the protected area, but activities are not detrimental to the area	1	1

of the objective? *Planning*	Adjacent land and water planning partially takes into account the long term needs of protected area.	2	
	Adjacent land and water use planning fully takes into account the long term needs of protected area	3	
21a: Land and water planning for habitat conservation	Planning and management in the catchments or landscape containing a protected area incorporates provision of adequate environmental conditions(e.g. volume, quality and timing of water flow, air pollution level etc) to sustain relevant habitats	+1	
21b:Land and water planning for connectivity	Management of corridors linking the protected area provide wildlife passage to key habitats outside the protected area (e.g. flow of migratory fish to travel between freshwater spawning sites and the sea , or to allow animal migration)	+1	
21c:Land and water planning for ecosystem services and species conservation	"Planning addresses ecosystem –specific needs and/or the needs of particular species of concern at an ecosystem scale (e.g. volume, quality and timing of freshwater flow to sustain particular species, fire management to maintain savannah habitats etc.)"	+1	
22.State and commercial neighbors Is there corporation with adjacent land and water users? *Process*	There is no contact between mangers and neighboring officials or corporate land and water users	0	
	There is contact between managers and neighboring officials or corporate land and water users but little or no corporation	1	1
	There is regular contact between managers and neighboring officials or corporate land and water users but only some corporation	2	
	There is regular contact between managers and neighboring officials or corporate land and water users , and substantial corporation on management	3	
23.Indigenous people Do indigenous and traditional people resident or regularly using the protected have impact *Process*	Indigenous and traditional people have no input into decisions relating to the management of the protected area	0	
	Indigenous and traditional people have no input into discussions relating to the management but no direct role in management	1	
	Indigenous and traditional people directly contribute to some relevant decisions relating to management but their involvement could be improved	2	2

	Indigenous and traditional people directly participate in all relevant decisions relating to management	3	
24. Local communities Do local communities resident or near the protected area have input to management decision? *Process*	Local communities have no input into decisions relating to the management of the protected area	0	0
	Local communities have some input into discussions relating to management but no direct role in management	1	
	Local communities directly contribute to some relevant decisions relating to management but their involvement could be improved	2	
	Local communities directly participate in all relevant decisions relating to the management , e.g. co-management	3	
24a. Impact on communities	There is open communication and trust between local and/or indigenous people, stakeholders and protected area managers.	+1	
24b. Impact on communities	Programmes to enhance community welfare, while conserving protected area resources , are being implemented	+1	+1
24c. Impact on communities	Local and/or indigenous people actively support the protected area	+1	
25.Economic benefit Is protected area providing economic benefits to local communities e.g. income, employment, payment to environmental services? *Outcome*	There protected area does not deliver any economic benefit to local communities	0	
	Potential economic benefits are recognized and plans to release these are being developed	1	
	There is flow of economic benefit to the local communities	2	2
	There is major flow of economic benefits to local communities from activities associated with the protected area	3	
26.Monitoring and evaluation Are management activities monitored against performance? *Planning/Process*	There is no monitoring evaluation in the protected area	0	
	There is some ad hoc monitoring and evaluation, but no overall strategy and/ or no regular collection of results	1	1
	There is an agreed and implemented monitoring and evaluation system but results do not feed back into management	2	
	A good monitoring and evaluation system exists, is well implemented and used in adaptive management	3	
27. Visitors facilities Are visitor facilities	There are no visitor facilities and services despite identified needed	0	
	Visitors facilities and services are	1	1

adequate? *Output*	inappropriate for current level of visitation		
	Visitor facilities and services are adequate for current level of visitation but could be improved	2	
	Visitor facilities and services are excellent for current level of visitation	3	
28. Commercial tourism operators Do commercial tour operators contribute to protected area management? *Process*	There is little or no contact between managers and tourism operators using the protected area.	0	
	There is contact between managers and tourism operators but this is largely confined to administrative or regulatory matters	1	
	There is limited co-operation between managers and tourism operators to enhance visitor experience, and maintain the protected area values	2	2
	There is good co-operation between managers and tourism operators to enhance visitors experience, and maintain protected area values.	3	
29. Fees If fees (i.e. entry fees or fines) are applied, do they help protected area management? *Input/Process*	Although fees are theoretically applied , they are not collected	0	
	Fees are collected, but make no contribution to the protected area or its environment	1	1
	Fees are collected, and make some contribution to the protected area and its environment	2	
	Fees are collected and make substantial contribution to the protected area and its environment	3	
30. Condition of the value What is the condition of important values of the protected area as compared to when it was first designated? *Outcomes*	Many important biodiversity, ecological or cultural values are being severely degraded	0	0
	Some biodiversity, ecological or cultural values are being severely degraded	1	
	Some biodiversity, ecological and cultural value are being partially degraded but the most important value have not been significantly impacted	2	
	Biodiversity, ecological and cultural values are predominantly intact	3	
TOTAL SCORES		90	29

Appendix 3: Sampling scheme for questionnaire's survey



Appendix 4: Questionnaires for socio- economic survey

A. HOUSEHOLD INFORMATION

Date …….

1. District; ……Division;
   Ward; ……Village……
2. Respondent's number; …… ethnic group; ….....
3. Age of the respondent (*Circle the number corresponding to your answer)*:
   1. 15-30 years 2. 31–45 years
   3. 45-60 years 4. Above 60 years
4. Gender of the respondent (*Circle the number corresponding to your answer*
5. 1. Male 2. Female
6. Marital status (*Circle the number corresponding to your answer*):
   1. Single 2. Married.
   3. Divorced 4. Widowed.
7. Duration in years of residence

   Between 0-10 Between 11-20 Between 21-30 31 and Above

8. Household composition (*In the table below enter numbers of males and females under each age category)*

Serial number	Age category (yrs)	Male (1)	Female (0)	Total
1	<18			
2	18-35			
3	35-55			
4	>55			

9. Highest level of education completed by the respondent (*Circle the number corresponding to your answer)*:
   1. Never went to school 2. Primary education
   3. Secondary education 4. Higher education
10. Main occupation (*Please fill in the space provided below*)

Farmer	Fishing	.Business	Livestock keeper	.Others

11. Main source of household income(Tick where applicable)

Selling the crops. Mention them	Selling the fish	Selling the animals and their products.	Others (Mention them)

12. Main source of the market for your farm or animal products.

In the village	In the District	Outside the District

13. What is an average income of your house hold per month?(Tshs.)

<100,000/=	100,000-250,000/=	250,000-350,000/=	350,000<

14. How many livestock do you have? *Tick the box corresponding to your answer*

Number	**Goats**	**sheep**	**cattle**	**pigs**	**others**
Less than 10					
Between 11-50					
More than 50					

15. Farm size in acres Tick *the box corresponding to your answer*

Below 5	Between 6-15	Between 16-25	Above 25

16 (a). Is there any livestock and pastoralists immigration from other places?

(b) Which tribes

1……..
2…….
3……..

(c) What are the main reasons for migration?

Grazing land	Water	Agricultural land	Avoiding disease	Avoiding conflicts	Accessibility to market	Others

(d) Are there problems associated with pastoralists and their livestock in the area?
Yes or No

(e) What are the main problems and their reasons?

Increased conflicts	Reduction in fish productions	Wetland encroachment	Deforestation	Overgrazing	Others

(f) Who and what can be done to rescue the situation?

17. Mention benefits you get from wetland

1 …… 4 ……..
2 …… 5……..
3 ……6……

18. How do you acquire those benefits? (*Please fill in the space provided below*)
……..

19. What are the main problems facing Kilombero floodplain? (*Please fill in the space provided below)*
(1)……
(2)……
(3)…….
(4)……
20. Which problems are very serious compare to other (*mention them in order of seriousness*)
(1) …….
(2) …….
(3) …….
(4)…….
(5) ……..
21. Do you participate in Kilombero floodplain conservation activities (*Circle the number corresponding to your answer)*:
1. Yes 2. No 3. I don't know
22. If yes, mention them……
23. If no, why? ……

Appendix 5: Attitudinal Statement used to capture Utilization Pressure in KVFP

No	Measuring Questions	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1.	Grazing and cattle population is facing the wetland.					
2.	Pastoralists immigration has increased in the wetland					
3.	Teak plantation in and around the wetland has negative effect to the wetlands and crop production.					
4.	Increase in human population and expansion of settlement and agriculture have negative effect to the wetland.					
5.	Cultivation in the wetland is increasing with decreasing and disappearance of wetland resources					
6.	Communities depend highly on wetland for fishing, crop cultivation, grazing and other wetland resources.					
7.	Communities around wetland still need more land for settlement, cultivation, grazing, teak plantations and others.					

Appendix 6: Check list used for Key informants

Name……..

Title…….

Organization……

Respondent. No. ……..

1. What are the human population trends and its effect to Kilombero valley wetland?
2. What are the main economic activities in Kilombero wetland?
3. What are socio-economic factors contributing to the utilization pressure of Kilombero valley flood plain?
4. What are conservation measures and ecosystem management practices?
5. How can the wetland managed sustain ably?
6. What are the impacts of grazing in the wetland?
7. What are the impacts of exotic species (teak plantation) in wetland?
8. What are impacts of agriculture and settlements expansion in wetland?
9. What are the major threats facing Kilombero Valley flood plain?
10. Which are the main resource-use conflicts in the area?
11. What is the main causes underlying the conflicts and who are involved?
12. At which period of the year resource conflicts are likely to occur?
13. What is the local mechanism that can resolve resource conflicts?
14. What are land use practices in Kilombero valley?

Appendix 7: Management Effectiveness Assessment Form used for KVFP

Issue	Maximum Score	Actual Score given
I: Context 1. Legal status - Does the protected area have legal status?	3	
2. Protected area regulations - Are inappropriate land uses and activities (e.g. poaching, illegal timber harvesting, fishing, encroachment, livestock grazing) controlled?	3	
3. Law enforcement - Can staff enforce protected area rules well enough?	3	
4. Protected area boundary demarcation - Is the boundary known and demarcated?	3	
5. Resource inventory - Do you have enough information to manage the area?	3	
II: Planning 6. Protected area objectives - Have objectives been agreed?	3	
7. Protected area design - Does the protected area need enlarging, corridors etc to meet its objectives?	3	
8. Management plan - Is there a management plan and is it being implemented?	3	
• Additional points	3	
9. Regular work plan (**Planning/Outputs**) - Is there an annual work plan?	3	
III: Inputs 10. Research - Is there a programme of management-orientated survey and research work?	3	
11. Staff numbers - Are there enough people employed to manage the protected area?	3	
12. Staff training (**Inputs/Process**) - Is there enough training for staff?	3	
13. Current budget - Is the current budget sufficient?	3	
14. Security of budget - Is the budget secure?	3	
IV: Process 15. Resource management - Is the protected area adequately managed (e.g. for fire, invasive species, poaching, encroachment, illegal timber harvesting, fishing, livestock grazing)?	3	
16. Personnel management - Are the staff managed well enough?	3	

17. Management of budget - Is the budget managed to meet critical management needs?	3	
18. Equipment - Is equipment adequately maintained?	3	
Issue	Maximum Score	Actual Score given
19. Maintenance of equipment - Is equipment adequately maintained?	3	
20. Education and awareness programme - Is there a planned education programme?	3	
21. State and commercial neighbours - Is there co-operation with adjacent land users?	3	
22. Indigenous people - Do indigenous and traditional peoples resident or regularly using the PA have input to management decisions?	3	
23. Local communities - Do local communities resident or near the protected area have input to management decisions?	3	
24. Commercial tourism and hunting - Do commercial tour operators and hunting companies contribute to protected area management?	3	
25 Condition assessment - Is the protected area being managed consistent to its objectives?	3	
26. Economic benefit assessment - Is the protected area providing economic benefits to local communities?	3	
TOTAL SCORES	----	---
Overall Management Effectiveness = ( )		

Scores: 0 = poor, 1 = fair, 2 = good, and 3 = excellent

Appendix 8: Threat Reduction Assessment used for KVFP

S/No	Direct Threats	Area Ranking	Intensity Ranking	Urgency Ranking	Total Ranking	% Threat Met	Raw Score	TRA Index (%)
1								
2								
3								
4								
5								
TOTAL								

Appendix 9: Summary of the way forward showing specific objectives, data to be collected, data collection technique and data analysis technique

S/N	Specific objective	Data to be collected	Data collection technique	Data analysis technique.
1.	To identify socio-economic factors causing utilization pressure in Kilombero Valley Floodplain	-Social economic factors causing utilization pressure.	-Questionnaires -Checklist -PRA	-Multiple regressions model -Content analysis -Likert scaling.
2	To identify and assess threats affecting biodiversity in the wetland resources	List of potential threats according its importance	-Checklist -Group discussion with key informants. -PRA	-Content analysis. -Through Threat Reduction Assessment Index (TRAI)
3	To assess conservation efforts and management effectiveness in addressing the threats in the wetland resources	-List of Key information on the site. -Management objectives	Use of data sheet containing detailed key information on the site, its characteristics and management objectives	-Through the use of Management Effectiveness Tracking Tool (METT) -Content Analysis.