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Executive summary

Background of Study[1]:

Ihefu Wetlands is an important ecosystem to the local community, the national economy – 65% of national hydropower is generated from waters originating from this area – as well as global biodiversity. The Economic Valuation of Ihefu Wetlands was carried out under the UNDP/UNEP Poverty and Environment Initiative Tanzania Programme (2007 – 2010) which focuses on "Integrating Environment into National Strategy for Growth and the Reduction of Poverty (NSGRP/MKUKUTA) Implementation". This Joint Programme is executed by the Government of Tanzania led by the Vice-President's Office (VPO) / Department of Environment (DoE) in collaboration with the Ministry of Finance / PED, National Environmental Management Council, National Bureau of Statistics, Ministry of Natural Resources and Tourism, and Prime Minister's Office/Regional Administration and Local Government. The programme focuses on the realization of environmental targets contained in the MKUKUTA and the implementation of the Environment Management Act through:

- Capacity strengthening to integrate environment in sector and district plans and implement strategic poverty-environment interventions at local level;
- Improved access and utilization of poverty-environment data in the MKUKUTA process and local level planning ;
- Sustainable financing of environment targets in the MKUKUTA and in local level planning processes; and
- Promotion of efficient utilization of rangelands and empowering pastoralists through improved livestock productivity and market access

Methodology

The study assessed the economic value of wetlands linked to community welfare and livelihoods. The study applied partial valuation techniques, socio economic surveys and literature reviews to identify livelihood activities supported by natural resources in Ihefu and levels of dependence on these resources. Structured interview, participatory observation approach, and focus group discussion were the main methods of field data collection.

[1] UNDP/UNEP Poverty and Environment Initiative and Environment for Development Initiative, University of Dar es Salaam, Department of Economics

This study contributes to tackling under-investment in environmental assets through better economic analysis and business models for environmental investments, including mobilization of government and donor resources for environment. In particular, the study provides lesson learned for sustainably managing environmental resources to benefit the Ihefu community which uses the wetlands as their main source of livelihood and as well as improving the management of other protected areas in the country, reducing conflict and ensuring maximum poverty reduction benefits from sustainable use of natural resources.

Main Findings:

The study assessed the economic value of wetlands linked to community welfare and livelihoods. The study applied partial valuation techniques, socio economic surveys and literature reviews to identify livelihood activities supported by natural resources in Ihefu and levels of dependence through a participatory approach to come up with the following key findings:

- Ihefu's significant contribution to hydropower production also relies on systems outside Ihefu: The direct value of the study area with regard to power production is through contributing to the generation of 14.8 of HEP to the national grid along with flows from Kisigo and little Ruaha Rivers.
- A more comprehensive approach is required to manage the entire catchment area: Current efforts to manage the land use at Usangu and Ihefu plains constitute only 0.38% of the whole catchment. Displaced populations from Ihefu settling in upper catchment areas have potentially negative impacts on downstream water flows.
- Significantly reduced access to natural resources has affected community livelihoods: Before the expansion of the Ruaha National Park, the community in Mbarali district could access up to 15,560 km2 covered by forest and savanna woodland, flood plains used for paddy production and wetlands used for grazing. Following the expansion of the Ruaha National Park, the accessible area has reduced to 5,000 km2 including some areas not considered wetlands. This has resulted in reduced grazing land, farming land and limited wetlands products such as fruits, grasses and vegetables and potential incomes from bee keeping. Likewise, the restriction on fishing grounds has reduced the supply of fish which is an important source of protein in the area.
- Less poverty prevalence in the area could be linked to livelihood opportunities from natural resources: In 2001, the area included in the study – Mbarali – had less poverty prevalence (13%) than neighboring districts as well as less severe poverty (lower poverty gap). This may be partly due to livelihood opportunities available from use of natural resources. More recent data is required to assess how this situation could have changed with the existing limits to economic and livelihood opportunities from utilization of natural resources from the wetlands.
- The traditional modes of crop and livestock production employed are environmentally wasteful, inefficient and unsustainable. Up to 85% of the water diverted or pumped for irrigation (the dominant use of water resources) does not reach the crops and crop productivity is low despite

application of high levels of inorganic fertilizers. Despite high stocking rates in the area, the use of organic fertilizers in agricultural production is negligible.

- Substitutes for animal traction should complement existing destocking exercises: 47% of households rely on animal traction which has implications for the successful implementation of the current destocking campaign. There is increasing use of power tillers to complement the use of the animal transaction.
- Ihefu's vast tourism potential is underexploited: There is limited exploitation of the areas vast tourism potential based on its rich biodiversity.
- Increased potential of human-wildlife conflict. There is an increased potential for human-wildlife conflict as up to 56% of crops in Mawinda and Madibira are lost to wild animals.
- The limited access to electricity in the area and a heavy reliance on fuel wood as the main source of energy for cooking and brick burning. As such, limiting access to sustainable harvesting of wood products has a negative impact on community welfare.
- About 46% of the respondents believe there welfare status is much worse than it was five years ago. The perception the current household welfare is worse now than before the expansion of Ruaha National Park and eviction is strongly influenced by age of the head of the household. Livestock farmers also have a higher probability of perceiving welfare deterioration as a result of the policy decision compared to crop farmers.

Concluding Remarks and Recommendations:

This study contributes to tackling under-investment in environmental assets through better economic analysis and business models for environmental investments, including mobilization of government and donor resources for environment. In particular, the study provides lesson learned for sustainably managing environmental resources to benefit the Ihefu community which uses the wetlands as their main source of livelihood and as well as improving the management of other protected areas in the country, reducing conflict and ensuring maximum poverty reduction benefits from sustainable use of natural resources. Based on the findings, key policy recommendations are as follows:

- Key policy decisions on management of forest should take into account livelihoods of neighboring communities including energy requirements due to a high dependence on biomass nationwide.
- Local populations in Mbarali district and along the Usangu flood plain have a high dependence on environment for their livelihoods including provision of food, fuel-wood, pasture, building material and medicine. As such, local communities perceptions and socio-economic needs require special consideration when formulating, implementing and enforcing national environment policy.

- Enhanced awareness of sustainable use of environmental resources and participation by local communities in decision making is a prerequisite for improving enforcement of environmental policies and regulations.
- Environment management mechanisms should promote sustainable utilization of the environment and natural resources by communities for improving their livelihoods e.g. sustainable wood harvesting, fishing, and access to electricity.

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LIST OF ABBRIVIATIONS

BWO	Basin Water Office
CBFM	Community Based Forest management
CBD	Convention on Biological Diversity
CVM	Contingent Valuation Methods
DALDO	District Agricultural and Livestock Officer
DOE	Department of Economics
DUV	Direct Use Value
EMA	Environmental management Act
EIA	Environmental Impact Assessment
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GIS	Geographic Information Systems
HEP	Hydro Electric Power

IMF	International Momentary Fund
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
IPCC	Inter Governmental Panel of Climate Change
ITCZ	Inter-Tropical Convergence Zone
JFM	Joint Forest Management
MDGs	Millennium Development Goals
MNRT	Ministry of Natural Resources and Touism
NBS	National Bureau of Statistics
NIMP	National Irrigation Mater Plan
NSGPR	National strategy for growth and poverty reduction
NTFP	Non Timber Forest Products
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
PCCB	Prevention and Combating Corruption Bureau
TANAPA	Tanzania National Parks Authority
TEV	Total Economic value
Tsh	Tanzanian Shilling
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United nations Framework Convention on Climate Change
URT	United Republic of Tanzania
UDSM	University of Dar es Salaam
WCED	World Commission for Environment and Development
WTP	Willingness to Pay
WMA	Wildlife Management Area
WUA	Water Users Association
VPO	Vice President Office

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CHAPTER 1
Introduction

1.1 Introduction

In many parts of the world environmental resources such as water resources are becoming a scarce good (Postel *et al.* 1996; Seckler *et al.* 1998; Gleick 1998), due to the increasing scarcity of the resources, competition and conflicts among uses and users is high. It is therefore necessary to make decisions about conservation and use allocation of the scarce resources that are compatible with social objectives such as economic efficiency, sustainability and equity. A decision of this nature was undertaken by Tanzanian government on Ihefu wetlands in 1997. It was expected that the lessons learned from the sustainably managed environmental resources will be useful in improving the management of other protected areas in the country, reduce conflicts and ensure maximum poverty reduction benefits to communities living adjacent to the protected areas.

Ihefu wetland is an important ecosystem for the welfare of local people, the national economy and the global biodiversity. At the national level, more than 65% of hydropower comes from water in which, the Ihefu wetlands serves as collection point and distribution to river channels[2] for power generation. For the local community Ihefu wetlands have been the main sources of the livelihoods such as livestock keeping, crop cultivation, extraction of non-timber forest products (NTFP), as well as fishing. The wetlands are important for the provision of food, fuel-wood, pasture, building material, medicines etc. This means therefore that protective measures imposed on the wetland resources should be made with greater care in order to avoid the increased poverty due to lack of access to resources as a result of protection. Thus to achieve a sustainable resources management there is a need to take into consideration the livelihoods of the local population and the general public that depend on them.

With this therefore local communities' involvement and socio-economic needs require special consideration when formulating national environmental policies and legislation without which implementation will be difficult. Even where local people are not directly involved in policy formulation, they need to be adequately informed and involved in the government development policies and goals and their role in implementing them. However the decision to conserve the Ihefu wetlands was made with little effort to involve the local communities. The conservation programme involved eviction of livestock keepers from the wetlands areas. To strengthen the management of the Ihefu wetland the areas was declared as national park. Following this decision there have been concerns of significant welfare loss among the community living adjacent to the wetlands. These concerns and criticism of the decision taken by the government call for rethinking about the best modality of conserving the wetland which strike the balance between the conservation needs and the immediate welfare needs of the local community. Economic valuation therefore is expected to give us an indication of the extent of the dependence of the natural environment of the Ihefu wetland.

1.2 Objectives of the study

[2] Includes the great Ruaha and little Ruaha rivers for power generation at Kidatu and Mtera hydropower stations

The general objective of the study is to assess the economic value of the Ihefu wetlands and show how the community livelihood depended on the wetlands resources and the resources provided. Specifically, the study identifies and assesses the communities' livelihoods that are supported by the Ihefu wetlands. Secondly, the study assess the contribution of the Ihefu wetland resources to the welfare of community living adjacent the Ihefu wetlands. Finally the study analyzes the link between the wetlands resources and the welfare of the local community.

1.3 Organization of the report

The report is organized as follows: chapter two present the brief literature review on valuation and the methodology employed in this study. Chapter three is about the overview of the study. A brief overview of the Mbarari district and the Ihefu wetlands is presented. Chapter four presents the policies and legal framework pertaining the natural resource management and welfare development in the country. Chapter five presents the results and the discussion of the main finding of the study. .

CHAPTER 2

An overview of the Mbarali district and the study area

2.1 Geographical location

Ihefu wetlands are found in Mbarali district/council one of the seven districts of Mbeya region. The district was established on July 2000 by the Local government Act No. 8 of 1982 and amended by Act No. 6 of 1999 and received certificate of registration on fifth June 2003. The District lies between latitude 70° and 90° South of equator and between longitude 33° and 35° East. The District is at an altitude ranging from 1000 to 1800 meters above sea level. The District is bordered by Iringa Rural District on the North-East, on the west is bordered by Mbeya District while on the East the District is bordered by Njombe and Mufindi Districts. To the North Mbozi District borders Ruaha National Park while to the South it borders Makete District and Mpanga Kipengere Game Reserve.

2.2 Climate

The climate of the study area is controlled by the Inter-Tropical Convergence Zone (ITCZ), and rainfall is highly seasonal, with a single rainy season from November to April, and characterized by high intensity rainfall events (thunderstorms). This rainfall pattern is reflected in the hydrology, with rivers showing extremely peaked flow patterns and a clearly distinguishable wet and dry season. Rainfall is strongly correlated with altitude in which areas with high altitudes receives up to 1, 600 mm of rain per year (WWF, 2010). The mean annual temperature varies from about 18^0C at high altitudes to about 28^0C in the low. The mean annual potential evapotranspiration is 1,900 mm (SMUWC, 2001).

2.3 Population

The district is among the highly populated district in the region. According to the 2002 National census, Mbarali District had a total 234,100 people and the population growth rate of 2.8% per annum. The current estimated population is about 282,900 whereby 140,400 are males and 142,500 are females. Administratively, the District is divided into two divisions namely Ilongo and Rujewa, with a total of 10 Wards, 93 registered Villages while the number of hamlets is 731 and 55,374 households. The per capita income of Mbarali in the year 2008/2009 was Tshs 350,000.00.Mbarali district had relatively low incidence of poverty (13%) compared to other districts in Mbeya region as well as the national average in 2001 (Table 4). That is only 13 percent of the population in Mbarali lived below the poverty line compared to national average of about 34 percent While the poverty gap for 2000/01 was 4, which is among lowest in the region, only Mbeya Urban district has a lower poverty gap of 3. Thus the district seems less poor than the others and one of the reasons could be livelihood opportunities from the access to Ihefu resources (e.g. fish, livestock keeping, farming etc) as this period is before the eviction. It is noted however that Mbarali district has the lowest primary education enrollment compared to other districts in the Mbeya region. The net enrolment ratio (NER) for 2004 in Mbarali district was 86 compared to 100 recorded in Mbeya Rural, Kyela, Rugwe, Ileje and Mbozi districts. Furthermore, infant mortality rate and under 5 mortality rate for 2002 are indicating to be 115 and 192 respectively, which are the highest in the region compared to other districts. Table 4 summarizes the detail of the socio-demographic factors of Mbarali district when compared with other districts in Mbeya region.

Table 1: Soci-demographic factors for Mbeya region

	Mbarali	Chunya	Mbeya-R	Mbeya-U	Kyela	Rungwe	Ileje	Mbozi
Total population, 2002	**234,908**	206,615	254,897	266,422	174,470	307,270	110,194	515,270
Population per health facility, 2002	**4,877**	6,056	6,197	6,640	6,438	5,375	4,776	11,944
% of households below poverty line (2000/01)	**13**	25	12	31	24	32	31	21
Poverty Gap, 2000/01	**4**	7	8	3	7	9	9	6
Gini Coefficient, 2000/01	**31**	35	30	36	33	34	30	32
Primary education, NER, 2004	**86**	81	100	94	100	100	100	100
Infant Mortality Rate, 2002	**115**	101	-	68	105	91	91	101
Under 5 Mortality Rate, 2002	**192**	165	-	106	172	146	146	165

2.4 Land use pattern

Before expansion of the Ruaha National Park, land accessible to the generally public in Mbarali District was 15,560 km^2. Table 1 indicates land use patterns before the expansion of Ruaha National Park. Half of it was covered by forest and savannah woodlands (Miombo). The rest of the District was made up of flood plain, which were used for paddy production, and wetlands, which was for grazing.

Table 2: Land use in Mbarali District Before Expansion of the Ruaha National Park

	Before the expansion	
Classification	Area in Km^2	Square area in %
Arable Land	1,960	12.2
Game Reserve	5,200	32.5
Forest Reserve	172	1.1
Settlement	6,078	38.0
Hills etc	2,590	16.2
Total	16,000	100

Source: Mbarali District Council 2002

2.5 The Usangu catchment and I hefu wetlands

2.5.1 The Usangu catchment

The Usangu catchment area consists 15,000 km^2 as highlands made up by the three mountains; Uporoto, Chunya and Kipengere. Within the Usangu catchment, there is Usangu plain with an area of 5 800 km^2 and is located between latitude 7° 25' and 9° 25' South, and longitude 33° 40' and 35° 40' East surrounded by three mountains namely Chunya, Uporoto and Kipengere. The Usangu plain is a reservoir that collects water mainly through different river channels (Table 2). This plain is

composed of two wetlands – western and the eastern wetland. Water flows from the western wetland to the eastern wetland is via the channel at Nyaluhanga. The water flowing first fills in the western wetland and spills over flows to fill the eastern wetland. Within the eastern wetland the water again spreads out over the plain, flowing into the permanent swamp which is known as Ihefu. From the Ihefu, water flow out the area via Great Ruaha river to the Mtera – Kidatu reservoir system.

Table 3: Ihefu wetlands, Rivers and their respective maintains sources

Name of River	Mountain (Upstream)	Direction
Kimbi	Chunya	Western
Mjanja	Chunya	Western
Gwiri	Kipengere	Southern
Mlowa	Kipengere	Southern
Ipatagwa	Kipengere	Southern
Chimara	Kipengere	Southern
Great Ruaha	Kipengere	Southern
Kimani	Uporoto	Eastern
Mbarali	Uporoto	Eastern
Kioga	Uporoto	Eastern
Ndembera	Uporoto	Eastern

Source: IWMI (2007) and Field observation 2010

Table 4: The size of the Usangu catchment and the Ihefu wetlands

Categories	area(km square)	% of catchment
Usangu catchment	20,800	100.00
Usangu plain	5,800	27.88
Floodplain	2,000	9.62
Ihefu	80	0.38

Current effort has been to manage the land use at the Ihefu which constitute only 0.38% of the whole catchment (Table 4). This area form small fraction of the catchment thus the effectiveness of the management of the Ihefu wetlands may not be realized if the entire catchment system is not protected and properly managed. Evicting people from the Ihefu area and letting majority of them to settle in the upper part of the catchment would have again negative effects on the water resource to the downstream.

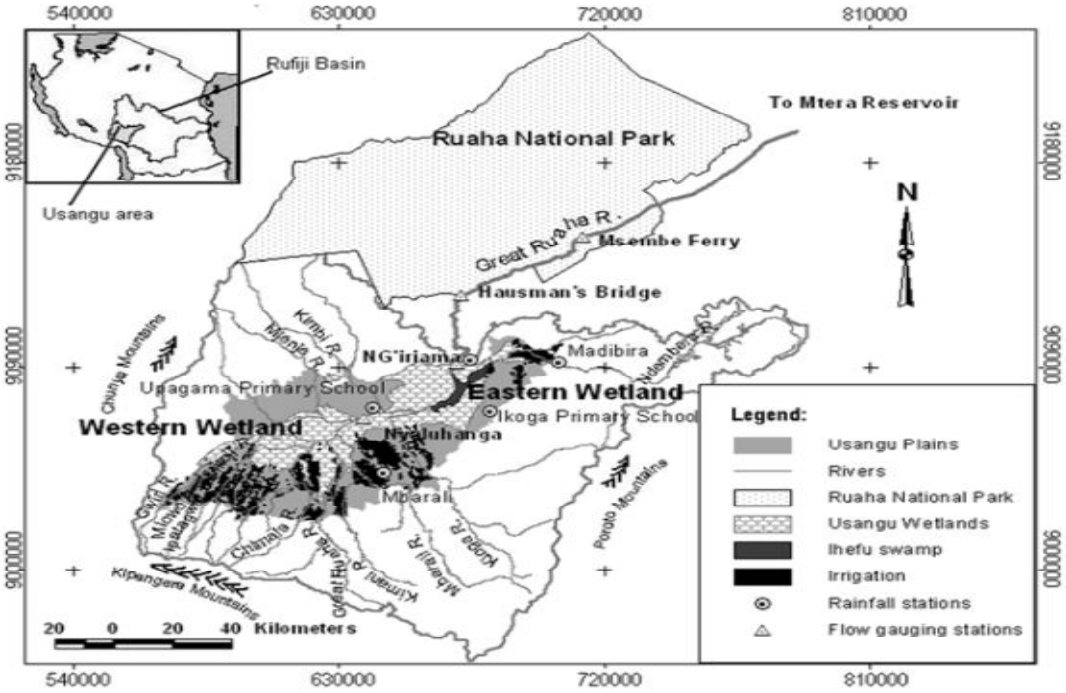


Figure 2: Map showing the Ihefu Wetlands (source: IWMI 2007)

2.5.2 The land use in the study

The land use categories in Mbarali district is dominated largely by the forest cover and woodland. Area under agriculture accounts for only 24% of the total land area. Forest cover and woodland covering about 52% of the total land area. Table 9 summarizes the main distribution of land use and cover. Note that agricultural land is only a quarter of the entire land use in the Usangu catchments, but provide 93 percent livelihood support. This implies that raising agriculture sustainably would have significant impact on livelihoods.

Table 5: Land use and cover in Usangu Catchments

Land use category	area(ha)	% of catchment
Agriculture	504,895	24.29
rain fed	430,583	20.72
irrigated	74,312	3.58
Forest & woodland	1,084,770	52.19
Bush land	206,425	9.93
Grassland	274,039	13.19
Perennial swamp	8,263	0.40
Total	2,078,392	100.00

Source: WWF, 2010

Before expansion of Ruaha National Park to include the Ihefu wetlands, Mbarali District was rich in forests that were accessible to the general public. About half of the district's area was a forested land. The remaining area was wetlands and flatland used for agriculture and livestock keeping. However, as a result of conversion of the Ihefu wetlands as part of the national park the district has remained with small forested areas accessible by the general public; among them are community based forest reserves, which count for more than 20,000 ha. The District has wildlife corridor where animals cross from the Park to the Reserve and vice versa and also Waga buffer zone which is managed by community as Wildlife Management Areas (WMA). Within this area there is different types of tree species, some have edible fruits like ***Sclerocaryabirrea*** (*Amarula* tree), ***Uapacakirkiana*** (*Makusu*), ***Adansoniadigitata*** (*Mibuyu*), etc. In the District, there are few Natural Forest that are under the Central Government such as Chimala Scarp (17,000 ha), Ikoga - Mapogoro (15,000 ha), Mwambalizi and North Usafwa forest Reserves. All these forests have tree species that have edible fruits

2.5.3 The Ihefu Wetlands and its environmental concern

Ihefu is local name of an area that contains a small perennial swamp. Ihefu wetlands are found in the Usangu catchment. The catchment is bowl shaped with an elevation up to 3000m mean sea level. Administratively, Ihefu wetlands are in Mbarali district. Ihefu wetlands areas were first identified by colonialists as a potential area and therefore the conservation initiatives started over that time.
Initially, conservation was done by making the area sacred (traditional offering place). In 1970s drought hit most parts of the country (northern and central Tanzania- Mwanza and Shinyanga) and this brought about migration of livestock keepers into the Ihefu Wetlands. Number of migrants to the area increased over time mainly because the area was tsetse fly free and also due to the belief that, grasses to feed cattle in Ihefu are so nutritious and causes cattle to become more fertile and reproduce faster than elsewhere in the country. As animal population increased, the environmental degradation in the area began.

The renewed efforts to conserve the Ihefu wetlands started in 1995, with the reallocation of all animals from the wetland areas. Initial agreement was reached by pastoralists and district to remove all cattle grazed in the area. However, the implementation of the programme did not materialize during that time due to lack of commitment to enforce. In addition to this, there has been occurrence of "lawyers' claiming to assist pastoralists to remain in the area legally and therefore, the presence of livestock keepers in the area over long period of time.

Following the continuous deterioration of the wetlands and the danger that the country was facing to go into total blackout due to low water flow to the power generation stations, a statement was issued to relocate all the livestock keepers who invaded the Ihefu Wetland and the Usangu flood plains. On 1st April 2006, Vice President issued official statement that; all pastoralists should leave the Ihefu. Following this statement, Ministry of Natural resources and Tourism carried a special operation to relocate all pastoralists and farmers in the wetland. From this operation, cattle were moved from Ihefu and started to be grazed in the nearby areas[3] (Usangu flood plains). Later on, it was realized that, the Usangu plain was over populated and therefore there was a need to reduce the number of livestock in the area. This necessitated the second operation aimed at reducing livestock

3This is outside the Ihefu wetland boundaries known to be set during colonial era and Mabarali district is in Usangu Basin (Bonde la Usangu)

in the area. In this operation, it was ordered that, all excess livestock beyond the set maximum[4] should be taken to Lindi region and Kisarawe District as there was bush land that could be used for grazing[5].

New map which includes additional areas (from where people were reallocated) was drawn by the Ministry of Natural resources and Tourism. In the process, WDC, DCC and RCC committees made a resolution and passed the new map as area to be under national park. This resolution was taken to the parliament and passed and signed by the President on 15th December 2007.

Coming to its implementation, complaints began as some parts included in the map were actually not a wetland. This problem was aired out even by officials at region and district level who passed the resolution. It was learnt that, they passed the drawn map without knowing exactly the actual area on the ground covered in that map. The '*Baraza la madiwa*' refused to implement the signed government notice (GN 28). It was acknowledged by the district administrative office that, in all these processes, there was no involvement of the village communities- it was Top – Down approach. Following refusal by *Baraza la madiwa*, a special committee was established to visit areas that were included in the new map and suggest exclusion of some areas that was found not to be wetland. In general Ihefu wetlands areas have experienced the conflicting policies regarding the environmental management and the economic development.

Before expansion of Ruaha National Park to include the Ihefu wetlands, Mbarali District was rich in forests that were accessible to the general public. About half of the district's area was a forested land. The remaining area was wetlands and flatland used for agriculture and livestock keeping. However, as a result of conversion of the Ihefu wetlands as part of the national park the district has remained with small forested areas accessible by the general public; among them are community based forest reserves, which count for more than 20,000 ha. The District has wildlife corridor where animals cross from the Park to the Reserve and vice versa and also Waga buffer zone which is managed by community as Wildlife Management Areas (WMA). Within this area there is different types of tree species, some have edible fruits like ***Sclerocaryabirrea*** (*Amarula* tree), ***Uapacakirkiana*** (*Makusu*), ***Adansoniadigitata*** (*Mibuyu*), etc. In the District, there are few Natural Forest that are under the Central Government such as Chimala Scarp (17,000 ha), Ikoga - Mapogoro (15,000 ha), Mwambalizi and North Usafwa forest Reserves. All these forests have tree species that have edible fruits. The current study is using this as case study to provide the link between environment and poverty. The total economic valuation is undertaken for this purpose

4 The district limit was that, household should stay with cattle not more than 100.

5 The challenge faced this operation was the luck of preparedness on the part of the government, as everything was treated as urgency. There was no infrastructure necessary to support livestock in those areas where the livestock were to be moved to, that's Lindi and Kisarawe district.

CHAPTER 3

Valuation methods and data

3.1 Economic valuation perspectives

Natural ecosystems, such as wetlands, that provide a wide range of valuable goods and services directly or indirectly and contribute positively to human wellbeing as such, have an economic value. However, if these values are ignored in the decision making process they result to degradation of the ecosystem (Barbier, 2001; Turner *et al.*, 2008). Economic valuation refers to the assignment of money values to non-market assets, goods and services, where the money value has a particular and precise meaning (Pearce *et al.*,2002). Economic valuation provides a tool to assist decisions regarding alternative uses of the environmental resources. Economic valuation attempts to assign quantitative value to goods and services provided by the environmental resources whether or not market prices are available (Barbie *et al.*, 1997). With economic valuation it is possible to reveal the total economic value (TEV) of the good and services offered by wetlands ecosystems.

The TEV helps to identify all changes in human wellbeing that accrue from a change in the provision of goods and services. It divides the value of the ecosystem into the use value and non-use value. The use value refers to the value of ecosystem services that are used by humans for consumption or production purposes. These include tangible and intangible services that are either currently used directly or indirectly or that have a potential to provide future use value (Pearce, 2002). Three types of use value are obtained in the TEV framework (Figure 1). The direct use value (DUV) which is related with the direct consumptive and non-consumptive use of ecosystem goods and services. Consumptive use refers to the use that results to the reduction of the resource available for use by other users, e.g. harvesting of wood products, water abstraction etc. on the other hand, the non-consumptive use refers to the direct us of resource where no reduction of the resource available to other users e.g. hydropower production, tourism, water sports etc. The second category is the indirect use value (IUV) which is related to the intermediate use of goods and services provided by the ecosystem used by humans for production of final goods or services. These include water, soil nutrients, and pollination and biological control services for food production. The IUV also includes regulating and supporting services such as water purification, carbon sequestration, reduced health risks, protection of soil quality, recreation, air quality and biodiversity. The third category is the option use value. This is the value that is related to the potential future benefits. Goods and services may be valued for the potential to be available in the future. One can attach value, considering the future benefit for oneself, for others or for the bequest.

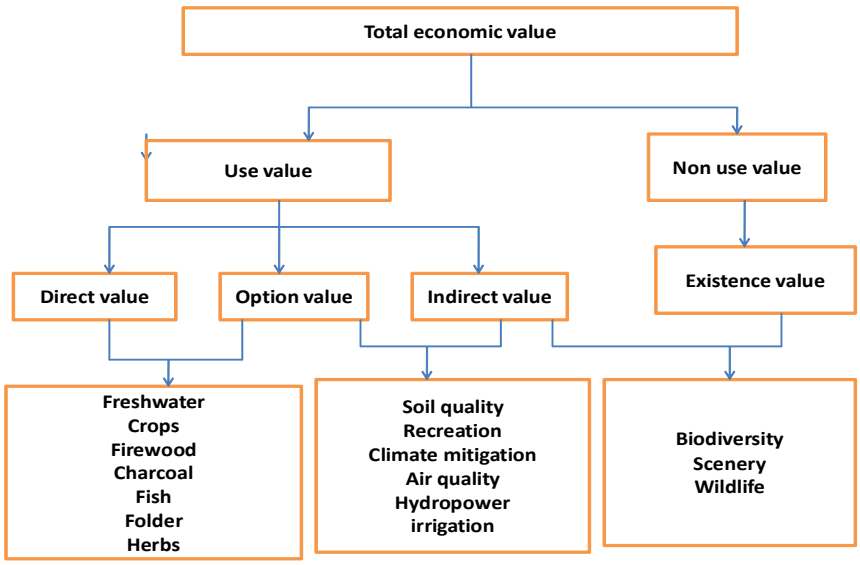


Figure 1: Components of total economic value (Adopted from Pearce et al. (2002))

The second type of the TEV is the nonuse value. This is the value that individuals may attach to the mere knowledge of the existence of something, as opposed to having direct use of that thing. It is value that does not concern our use, either direct or indirect, of the environment, its resources or service. The nonuse value is discussed in terms of the existence value. In this context, the existence value is the benefit often reflected as a sense of wellbeing, of simply knowing that e.g. aquatic biodiversity exists, even if it is never utilized or experienced (Hageman, 1985; Loomis & White, 1996). The existence value reflects the satisfaction felt by an individual just by knowing that wilderness exists (Cordell *et al.*, 2003). An individual may express value for the resource without having visited the wilderness in the past or even without having the intension to visit it in future. The existence value is related to the amount that one is willing to pay to preserve wilderness, regardless of visitation (Blomquist and whitehead, 1995).

Three approaches or issues most relevant to the economic analysis of wetlands are noted in the literature. The first is the i*mpact analysis* which is appropriate if a specific external impact is to be evaluated. The second one is the *partial valuation*, which is mainly applicable if the problem is that of making a choice between wetland use options (e.g. conversion of wetland to residential land or sport complex, whether to divert water from the wetlands for other uses or to convert/develop part of the wetlands at the expense of other uses). The third one is the *total valuation*, which is more appropriate if the problem is more general *(*e.g. developing a conservation/restoration strategy requires assessment of total net benefits of the wetland system*)*.

Valuation of marketed goods and services from the wetlands (e.g. fish and other aquatic products, fuel woods, etc.) is relatively easy, as unit prices of these products are easily available in the local markets. Even in the absence of market, one can readily derive unit values of these products. Unlike valuation of marketed resources, valuation of non-marketed resources of wetlands is more complicated, even though the later is more important in building arguments and public policies in support of wetland conservations. Economic value of any good or service is measured in terms of

what consumers are willing to pay for the commodity, less the costs to supply the commodity. But, environmental goods and services such as wetland ecosystems are provided by nature, (the costs of supply are almost zero); so the consumers' willingness to pay for an environmental resource is also the total value of the resource. There are several approaches to the valuation of the environmental resources. What follows is a brief discussion of the valuation approaches employed in this study.

3.2 The Economic valuation of the Ihefu wetlands

Economic valuation involves the assignment of monetary values to both market and non-market goods and services offered by the wetlands to the community. The aim of the economic valuation is to reveal the total economic value (TEV) of the goods and services offered by ecosystems and establish the extent of household dependence on wetlands resources. To arrive at the economic values of different categories of wetlands environmental resources the TEV framework (section 2.1) is employed with modifications to capture the economic value of the Ihefu wetlands. Therefore goods and services obtained by communities from water, forests and land resources within the study are are valued. The necessary valuation information was obtained from the interviews of farmers, livestock keepers, basin water office, regional agricultural office, catchment forest and nature reserve offices, village environment and natural resources committees, key informants, households' respondents.

The methodology used in this study recognizes that the first stage in the evaluation process is to choose appropriate economic assessment approach. Ideally, the TEV which recognizes several components of wetland products and functions in monetary terms, is the appropriate measure. However, TEV framework requires a priori, full range of information on ecological and hydrological functions of the wetlands. If the TEV of wetland resources is not feasible, then information on partial value of wetlands, and/or, partial impacts assessment of wetlands, can also convey equally useful information and messages for policy intervention in support of wetland conservation (see, Barbier, et al., 1997). Thus the current study uses the impact analysis and the partial valuation approaches.

The estimation of the economic value is based on the fact that the wetlands environment provides both use-related benefits and environmental benefits. Use related benefits are benefit values that accrue as a result of the direct production in the wetlands. These include crop production, grazing and harvesting of wood and non-wood products for sale and home consumption. We estimated the income generated from all activities supported by wetlands resources at the household, district and national level. These values are then compared with the total income from all sources and see the proportion of wetlands based income in relation to overall income sources. In order to evaluate the economic value of wetlands, we first define and specify the spatial boundary of the wetlands in question following the International Union for Conservation of nature (IUCN) definition of a wetland. This was then followed by the identification of all services (benefits) of the wetlands ecosystem under study. The assessment of actual provision level (health status or quality) and perform a what if analysis, i.e. what effect would be if wetlands were converted into another use. Furthermore, we perform a stakeholder analysis to identify who are the key stakeholders of the Ihefu wetlands and their role in terms of the conservation and also harvesting of the wetlands resources and finally, the study estimated the economic value of Ihefu wetlands. Particular attention was made on the hydropower production, fishing, agricultural produces, livestock, building materials

(such as poles, grasses and withies), fuel extraction (e.g. charcoal making, firewood collection), bushmeat, mushrooms collection, medicinal plants, wild fruits and vegetables.

Households in the study area do not have records on the production costs information and most of the production works are undertaken using family labour[6]. This made them to rely on memory recall when asked for information about production costs. The use of recall information culminates to data quality problem thus the study estimated the wetlands values at the gross values.

3.3 Data

The information on inputs and outputs for all economic activities supported *directly* or *indirectly* by Ihefu wetland ecological functions were collected. This includes the costs of the inputs (e.g., labour-time, materials and physical assets) and the prices of the outputs. A distinction was made between purchased inputs (e.g. tools, licenses, hired labour) and non-cash inputs (e.g. use of own or family labour and hired equipments/tools). Similarly, distinction was made between outputs traded at the market and those which are consumed at home). In addition, the information on the producer prices, the transportation, other intermediary costs, and the final market prices were collected. Furthermore, the social and the economic data that are relevant to the communities living adjacent Ihefu wetlands were also collected. These includes population growth rates, income levels, credit facilities and rates of interest, harvested quantity of forest vegetables, fruits, mushrooms, medicine, poles, ropes, withies, timber, weaving materials, grasses,bushmeat, firewood, clay soil and so on. Given this diversity of the data, a variety of collection methods and sources were used[7]. Quantitative and qualitative data were obtained through interviews with the head of household and the focus group discussions conducted in all sampled villages. The data from these two primary data sources were then augmented by the statistics from government offices and the conservation agency – Tanzania National Parks Authority (TANAPA).

The study collected primary data using key informant interviews and focus group discussions based on participatory rural appraisal (PRA) techniques (for example life histories, semi-structured interviews, wealth ranking, seasonal calendars, resource mapping, food diary, mapping movements). The focus group discussions were held to collect the general information on production/harvesting trends and seasonality, markets and prices. The importance of these data was to make preliminary quantitative estimates of wetlands resources harvesting and processing and the associated economic values.

The participants in the focus group discussion were asked to list (i) the commonly harvested wetland products (medicinal plants, grasses, reeds, palms, fuel-wood, wild animals, honey, mushrooms, wild fruits, wild vegetables); (ii) who mainly collects them (e.g. women, children); (iii) main uses; (iv) if sold: location of markets and average prices; (v) average yield; (vi) perceptions on the sustainability of the wetland resources. Other information collected includes agricultural practices, with emphasis on the use of water, fishing, and use of wood products. The discussions were semi-structured to

[6] Most households use family labour, and those who occasionally use hired labour – it is hard to recall what exactly was paid for the work. The hired labour is not used consistently in all production processes eg farming (farm preparation, cultivating, weeding, harvesting). On the other hand some payment for production costs are also made in kind, where one provides labour and the return is paid in the form of goods – this complicates further the monetizing process of all production costs by rural households.

[7] The full extent of the data is evident from the questions contained in the household and community questionnaires.

allow for the maximum participation of members to provide information on the matters and issues related to the livelihoods, types of wetland resources used, and type of use, quantity used, proportion sold and home consumed. The relationships between peoples welfare and the wetlands resources and their dependences; wetland costs that is the existence of pests, human-wildlife conflict, disease; the user of the wetlands resources in terms of gender and age composition, available markets, extension services, credit availability and accessibility, businesses operating in study areas. Other information collected were the sources of energy, water sources and use, the availability and access of the health services, education and transport in the study area.,

The focus group discussion engaged village leaders, district officials, including agricultural extension officers, forest officers, water resources management officials, members of village environmental committees. A total of ten (10) people formed a focus group in each village. In all cases, the age-sex composition was considered in order to have the balanced views. The group composed of both members who are village government officials, and the non government officials. This was important to have opinion from both government and non-government. Information from the focus group was used to generate important data the validation of information from the respondents at the household level. In addition the information from the focus group discussion were used as basis of extrapolating some data to get standard values that were important for the estimation purposes.

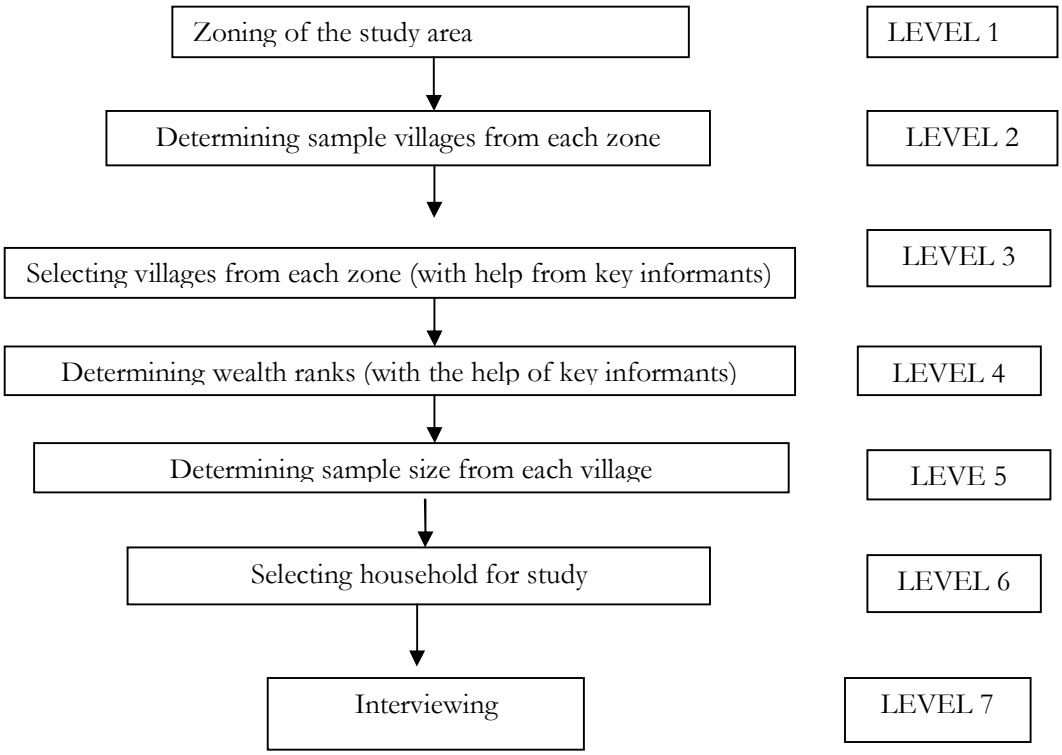
3.3.1 Household survey

Primary data for the economic valuation of the watershed have been collected through household surveys. The total economic value framework (TEV) for economic valuation of watershed resources was adopted. This necessitated data collection instruments and procedures to adhere to the guidelines for the TEV framework and methods of valuation. The study used direct interviews of households using a structured questionnaire. The questionnaire consisted of several sections aiming at the collection of the information for the valuation of water and forests resources in the study area. The questionnaire covered the information about the respondent and the household as whole. For the respondents information the questionnaire had questions regarding the age, sex, migration and education level. These were followed by the general questions regarding the household members, such as gender and age; economic activities; average income, expenditure and extraction of wetlands resources. The questions on the wetlands resources relate to the harvesting and use of forest and water resources, types of crops grown, size of land owned and the quantity of goods harvested from water and forest resources. The questionnaire also explored the conservation related information from the households. In this case the information on the awareness of the respondent on resource values and conservation issues were asked. Also the respondents were asked on the understanding of the general status of water flow and forest conditions and conservation issues. The other part of the questionnaire asked about the households' wealth, ownership of physical and financial assets, access to credit facilities and possession of a saving account, households' sources of income and the estimated income from each source. Questions on the market organization and prices of different goods within the village and outside the village were asked in order to track the value chain of the product from the producer to the consumer outside the study area.

3.3.2 Sampling strategy

The selection of the households to be interviewed was based on a combination of stratified and random sampling techniques. The sample was stratified according to the five levels following the administrative

structure in Tanzania. These levels are: district, ward, village, hamlet and household. The first stage was a purposive sampling of districts into which the Ihefu wetlands are found. From the district, wards were selected. The stratification started at ward level, where only wards within the wetlands were included for the study. The second stage was the selection of villages. Here, village proximity to the wetlands was considered. Thus in each ward, a number of representative villages were selected for study. A total of 20 villages were identified and sampled from the 6 wards. The third level was the selection of households. The systematic random sampling of households from each village was employed. These households were selected randomly from the village registers provided at the village office. In each selected household, a head of household or elder member of the household was interviewed using a structured questionnaire. From the selected villages, the aim was to interview 30 households and thus a total of 600 households were sampled (Appendix 3). During selection, village and hamlet leaders were kept around and were to assist in validating the households names picked from registers. This proved important in cases where the register was not updated in time or appropriately and where the selected household was nonexistent (deceased or migrated).



The study also collected community/village level data. The aim of collecting village level data was to get general data at high level which form the basis for validation of information from individual respondents for the valuation. The village data collected include main economic activities, population data, available facilities such health, schools, extension services, environmental management practices, general welfare of communities etc.

3.3.3 Secondary data

Secondary data collection began with a *literature survey* of available statistics and the existing studies in the region. Some of the documents reviewed include: Resource economic analysis of catchment forest reserves in Tanzania; Economic surveys; Tanzania national forestry policy document; Tanzania forest conservation and management project; Forest valuation and economic eolicies; The Usangu catchment baseline 2000, Economic analysis of water supply options in Kilosa, Mpwapwa and Rufiji District; The use and economic value of natural resources for the Rufiji river floodplain and delta. The above secondary data will also be complemented with data from field visit to various sources of data such as Ministry of Natural resources and Tourism, Ministry of Energy and Minerals, Ministry of Agriculture and Food security, Ministry of Livestock and fisheries development National Bureau of statistics and among others who are actors in the forestry and water sectors.

3.3.4 Field visit

Field observation was also done in each village to have general understanding of the actual situation on the ground regarding the resource use (firewood, poles etc), crop grown (by visiting rice farms in some villages), state of infrastructure such as schools, dispensaries, water sources etc. At the end of village visits, we further visited District Administrative office and the prevention and combating corruption bureau (PCCB) office for some discussion on matters related to Ihefu and peoples welfare. This was important and formed a basis of establishing the validity of what the individual households' members and focus group discussion have given during interviews.

3.3.5 Stakeholder participation and monitoring/ evaluation of the study

As part of its methodology, this study stresses the importance of the participation of key stakeholders, right from the preparation of the study, execution of the fieldwork, data analysis, and report sharing. During the preparation, comments from VPO-Division of Environment, UNDP and UNEP, etc. has been sought on the study proposal. Furthermore, the fieldwork visit included some experts from the regional and LGA levels and few experts at the national level (e.g. VPO – DoE). Such composition of the team was necessary to ensure quality control and avoid ephemeral conclusions, which lack feels of the situations on the ground (the feel that is not captured in the questionnaire). In the same vein, the study findings have been shared with a wide range of stakeholders as way of quality assurance and monitoring/evaluation of the study, including selected representatives from Ihefu communities, experts at district headquarter, TANAPA, etc.

CHAPTER 4
Policies, strategies and legal framework governing natural resources in Tanzania

4.1 Introduction

The policies concerning the environment have gained increasing attention at sectorial, national, and international level. The attention is in the light of the observed negative consequences such as the rapid depletion and degradation of natural resources. The natural resources degradation and depletion manifest in terms of biodiversity loss and the harmful impacts of climate change, health and livelihoods to the present and future generations. In response to these concerns, the environment issues now features prominently in different national and sectoral policies and strategies. This section reviews policies, strategies and legal framework related to issues of environment in Tanzania, with particular emphasis on wetlands resources.

4.2 Policy and legal framework

The natural resources management in Tanzania is governed by policy, strategy and legal frameworks. In most cases, policies and legal frameworks are specific to a particular type of resource but also taking into account the cross cutting characteristics of the natural resources. The relevant policy and legal acts for watershed resources management include the Forest Policy (1998), the Forest Act (2002), The National irrigation master plan (2002), the National Water Policy (2002), the National Water sector Development Strategy (2006), the Water Resources Management Act n° 11 (2009), the Water Supply and Sanitation Act no 12 (2009), the National Environmental Management Act (2004), the Village Land Act (1999), The national population policy (1996), the National agricultural and livestock policy and the National strategy for growth and poverty reduction (NSGPR).

4.2.1 Water resources

Water resources management is governed by the National Water Policy (2002), the National Water Sector Development Strategy (2006), the Water Resources Management Act n° 11 (2009) and the Water Supply and Sanitation Act n° 12(2009). There are five management levels for water resources: the national, basin, catchment, district and community level. At national level, the ministry of water is the sole manager of water in the country. The key responsibilities include the development and review of policies and registrations and the coordination of all activities for the waters resources management such as planning, capacity building, data collection and dissemination, monitoring and evaluation. At basin level, water resources are managed by nine Basin Water Offices (BWO) (Table 6). The role of the BWO is to ensure data collection and processing, to prepare water utilization plans, to collect water use fees and charges and to resolve conflicts at basin level. In addition, the pollution control and quality standards are administered by the BWO. Underneath, there are two levels of management namely the Catchment Water Committees and the Sub-Catchment Water Committees. The function of these committees is to support the role of BWO, to implement the catchment plans and to solve water related conflicts at the catchment level. At district level there are district councils with the role of formulation and enforcement of bylaws, promoting efficient use of water resources and preparing district plans regarding water issues. At the community, there is Water Users Associations (WUA) responsible for local level management of allocated water resources, mediation of disputes among water users and between groups within their area of jurisdiction and participation in the preparation of conditions and terms of water rights.

Table 6: Table: Basin, size and year of establishment of the Basin Water Office

S.No	Name of the Basin	Size (km^2)	Office established (Year)
1	Pangani	53 600	1991
2	Rufiji	183 791	1993
3	Lake Victoria	115 400	2000
4	Wami – Ruvu	66 820	2002
5	Lake Nyasa	131 652	2002
6	Lake Rukwa	80 000	2003
7	Internal drainage	153 800	2003
8	Lake Tanganyika	151 000	2004
9	Ruvuma and southern coast	52 000	2004

Source: Ministry of Water and irrigation, http://www.maji.go.tz/basins/nine.php
The Rufiji Basin receives large part of water from Usangu Plain which Ihefu is part of the catchment

4.2.1.1 Water allocation

In Tanzania all productive use of water requires a water use permit. The water use permit provides a legal entitlement to access and use water for specified purposes and at specified times. The abstraction amount or volume is determined by considering a number of factors such as the intended water use (domestic use, industrial use or irrigation). The water policy (2002) address that water for domestic use is the first priority of water allocation. Another consideration is the environmental flow requirement8. After fulfilling the water requirement for the domestic use, any allocation that is made should ensure that the amount is available to meet the environmental flow retirement. For the specific use such as irrigation water, the amount or volume allocated is determined by considering the size of the farm to be irrigated, type of the crop grown, average crop water requirement and the quantity of water available in the system and the environmental flow requirement.

4.2.1.2 Irrigation agriculture

Tanzania has put the highest priority on the development of the agriculture sector as a means to meet both the Millennium Development Goals (MDGS) and the National Strategy for Growth and Reduction of Poverty (NSGRP). The pertinent goals include the reduction of food insecurity and halving the poverty by the year 2015. The irrigation is considered as a strategy that could lead to the achievement of these goals. Irrigation is important in protecting agricultural production against drought and also important to ensure household food security. As a consequence, in 2002, the government launched the National Irrigation Master Plan (NIMP) which identified a total of 29.4 million ha of land suitable for irrigation in the country. However the current land under irrigation is only 290,000 ha (Table 7). Rice is the predominantly irrigated crop, followed by sugarcane, coffee and tea.

Table 7: Irrigated land area in Tanzania for 2001 - 2008

Year	cumulative irrigated area (ha)	% of potential*
2001/02	191 900	0.65

[8] Efforts are underway to establish the environmental flow requirement tools for each basin.

2002/03	200 895	0.68
2003/04	227 486	0.77
2004/05	254 610	0.87
2005/06	264 388	0.90
2006/07	273 945	0.93
2007/08	289 245	0.98

Source: URT (2009) National Irrigation Policy

* Irrigation potential = 29 400 000 ha

4.2.2 Forest resources

The management of forests resources is governed by the Forest Policy (1998) and the Forest Act (2002). The main aim of the policy is to promote the local communities involvement in the resources management. The Forest Act aims to provide basis for communities to own, manage or co –manage forests. The Forestry and Beekeeping Division (FBD) of the Ministry of Natural Resources and Tourism (MNRT) is mandated to manage the forest resources at national level. The role is to support the implementation of the Forest Policy (1998) and the Forest Act (2002). FDB is also responsible for the collection of revenue from forest operations and harvesting; for the issuing of licenses and permits, the regulation of harvesting of forest products at the national level, the promotion of forest development, the provision of training in forestry and for forest research. The management of forests is divided into two main categories – reserved forests and unreserved forests. The forest Act recognizes four tenure regimes of forests in the country: the national reserves owned by the central government, the local authority reserves owned by the districts, the village forest owned by villages and the private forest owned by a group or individual. The Forest Act 2002 provides the opportunity for the communities to be involved into management of forest resources in the country under the system of the "participatory forest management" (PFM). This system provides legal basis for communities; group or individuals manage or co-manage forests. There are two forms of the PFM under which communities' takes place in the management of the forest resources namely the community based forest management (CBFM) and the joint forest management (JFM). The detail of each of this form is found in the description of the types of forest management as explained below.

4.2.2.1 National reserves

The reserved forests are managed by the central government and by local government authorities. There are four types of reserved forests: natural forests managed by the central government for protection (such as catchment forests); forests managed for production (e.g. plantation and mangrove forests); forests managed as nature reserve (preserving natural occurrence) and forests on general land managed by government. In this case, the management also involves communities in the form of Joint Forest Management (JFM). Hereby, the villagers can sign joint forest management agreements with the central government or the local government to share responsibilities for the management. Under this arrangement, benefits accruing from the managed forests are also shared with the local communities.

4.2.2.2 Village land forests

These are forests on general or village lands where forests and woodlands are not formally classified as reserves (URT 2001). They include the village forest reserves and the private forests. The

management of the unreserved forests involves the community participation through the community based forest management (CBFM). The CBFM takes place on village land or private land and trees are owned and managed by a village government through the village natural resources committee or by a group or by an individual. In this arrangement the villages carry most of the cost and accrue most of the benefit related to the management and the utilization of the forest under the CBFM.

Based on several studies that evaluated the impact of the PFM on the forest management and poverty reduction it may be concluded that this framework ensures forest management but does not lead to poverty reduction (Ngaga et al., 2009; Blomley & Iddi 2009, Lokina and Robinson 2010, Robinson and Lokina 2011). In cases where PFM involves the establishment of income generating activities, poor households are excluded due to the initial cost to be incurred by the household to start the activity. In addition, some benefits from the PFM accrue at the village level and are used for the development of public related goods such as schools. In this case, an impact to individuals could be not realized immediately.

4.3 The national environmental policy

In 1997, Tanzania adopted the National Environment Policy based on a national analysis. The analysis revealed the following environmental problems which called for urgent action (Maro, 2008):

i. Land degradation reducing the productivity of soils in many parts of the country.
ii. Lack of accessible good quality water for both urban and rural inhabitants
iii. Environmental pollution in towns and the countryside affecting the health of many people and lowering the productivity of the environment.
iv. Loss of wildlife habitats and biodiversity, threatening the national heritage and creating an uncertain future for the tourist industry
v. Deterioration of aquatic systems, particularly the productivity of lake, river, coastal and marine waters, which were increasingly being threatened by pollution and poor management.
vi. Deforestation, with forest and woodland heritage being reduced year by year through clearance for agriculture, wood fuel and other demands

The National Environmental Policy provides the framework for making fundamental changes that are needed to bring environmental considerations into the mainstream of decision-making in Tanzania. The overall objectives of the policy are:

i. To ensure sustainability, security and the equitable use of resources for meeting the basic needs of the present and future generations without degrading the environment or risking health or safety.
ii. To prevent and control degradation of land, water, vegetation and air which constitute our life support systems.
iii. To conserve and enhance our natural and manmade heritage, including the biological diversity of the unique ecosystems of Tanzania.
iv. To improve the condition and productivity of degraded areas, including rural and urban settlements, in order that all Tanzanians may live in safe, healthful, productive and aesthetically pleasing surroundings.

v. To raise public awareness and understanding of the essential linkages between environment and development, and to promote individual and community participation in environmental action.
vi. To promote international cooperation on the environmental agenda, and expand our participation and contribution to relevant bilateral, sub-regional.

4.4 The environmental management act

The *Environmental Management Act, Cap. 191* (EMA) enacted in 2004 provides for the legal and institutional framework for dealing with environmental issues. It also provides for environmental management instruments including Environmental Impact Assessment (EIA). In order elaborate on EIA requirements, the Government promulgated the *Environmental Impact Assessment and Audit Regulations, 2005*.

The EMA has provisions on enforcement outlining responsibilities of different institutions from the lowest level/grassroots to the national level. The Act and the associated regulations combine both "Command and Control" and "Incentive and Disincentives" approaches in inducing compliance. The EMA expressly states that its provisions (including EIA requirements) are binding on the government and government-funded projects.

4.5 Strategy for urgent action on land degradation and water catchments

All along the Government has been taking measures to address various environmental concerns. The recently developed National Strategy for Urgent Actions on Land Degradation and Water Catchments and the subsequent Government Statement issued by the former Vice President, Hon. Dr. Ali Mohamed Shein on 1st April 2006, is evidence of continuing environmental concerns in the country.

This strategy was produced in 2006 as a response to the severe drought in Tanzania to address power production problems and degradation of water bodies caused by the drought. The strategy, which is consistent with the Environmental Management Act (EMA) of 2004, identified 12 challenges that call for urgent actions to address land degradation and desertification in water catchments as well as areas with disproportionately large number of livestock, particularly in the arid and semi-arid areas of the country. The environmental challenges to be addressed under this strategy include:

i. Unsustainable agricultural activities in water catchments and mountain ecosystems
ii. Overstocking
iii. degradation and frequent wild fires
iv. Unsustainable irrigation practices
v. Waste management
vi. Unsustainable mining activities
vii. Limited awareness
viii. Community participation in environmental activities

The strategy was an important landmark in the efforts directed to conservation of wetlands in Tanzania, and Ihefu in particular.

4.6 International commitment

Mwandosya (2006) noted that in essence the need to reverse environmental degradation is a direct concern of the Millennium Development Goals (MDG) number 7 (MDG7). This goal emphasizes environmental sustainability and targets to "integrate the principle of sustainable development into country policies and programmes and reverse the loss of environmental resources". Henceforth, in Tanzania, the environment now features prominently, with an increasing level of emphasis in the different national and sectoral policies and strategies.

Tanzania is party to a number of Regional and Multilateral Environmental Agreements including the following:

i. United Nations Convention to Combat Desertification (UNCCD);
ii. United Nations Framework Convention on Climate Change (UNFCCC), and its Kyoto Protocol; and
iii. The Convention on Biological Diversity (CBD) and its Cartagena Protocol.

Tanzania has 3 special protected areas of Wetlands of International Importance in terms of ecology, botany, zoology, limnology or hydrology (Ramsar Sites) with an area of 4,272,000 ha; and three biosphere reserve sites with an area of 5,228,000ha. These area include the Ihefu wetlands.

4.7 National commitment through the national strategy for growth and poverty reduction

The international commitments have been translated in median term national commitment to environmental protection through the national strategy for growth and poverty reduction (NSGPR). This overarching national framework asserts that sound economic governance of natural resources is critical for poverty reduction, not only for the communities in the locality, but also for the whole nation. It acknowledges that the poor depend significantly on the environment and natural resources for the basic needs and livelihoods. Due to limited incentives for sustainable management (property rights etc), limited alternative livelihoods and unsustainable land management practices environmental degradation continued further to propagate the poverty cycle. It proposes to implement strategies that will curb over utilisation of environment and natural resources, which has been driven by commercial interests, weak regulation and fragmented policy frameworks. It also set strategies to address environmental-related conflicts.

CHAPTER 5
IMPORTANCE OF NATURAL RESOURCES IN THE RURAL HOUSEHOLDECONOMY

5.1 Livelihoods and values

Economy of the Mbarali community depends mainly on agriculture, which include crop production and livestock keeping. There four main types of economic activities by households in the study area. These are agriculture, livestock, petty business and wage employment. The large percent (92%) of households are engaged in agriculture as the main economic activity (Table 8). The paddy is the main food and cash crops grown in the area. Other crops grown include maize, vegetables, millet, ground nuts, potatoes, sunflowers, sorghum, onions, cassava and beans. Rice and sunflower are the main cash crops; they are sold within and outside the Mbarali District. The common animals reared include local cattle, goats and sheep. Other economic activities (in very small scale by some households) including sale of firewood, charcoal, furniture, local brew, leasing of farm land and supplying casual labour to estates.

Table 8: Household main economic activity in the study area

Type of activity	sample households	Percent
Farming	536	92.3
Livestock	18	3.1
Business	13	2.2
wage employment	14	2.4
Total	581	100

Table 9 shows the distribution of activities at the household by gender. The table shows that farming is the dominant activity in the area with the participation of male and female being fairly equal at almost all productive age categories. This is not a surprising result given the rural nature of the area and good climatic condition. Livestock is mainly a male dominated occupation, with 3% indicating to have live stocking keeping as their main economic activities. Ubaruku is the ward with more livestock keepers (about 8% of the total ward population) compared to other wards

Table 9: Distribution (in percentage) of economic activities by gender and age

Main activity	Sex of the household head		Age of household head (yrs)			
	Male	*Female*	*20 to 35*	*36 to 50*	*51 to 65*	*Above 65*
Farming	94	93	95	94	92	96
Livestock	3		3	4	4	
Business	2	7	2	2	3	2
Wage or Salaried work	0.8		0.7		2	2
Sample Observation	530	41	152	253	112	49

5.1.1 Agriculture

As indicated in Table 7 the economic development in the study area depends mainly on agriculture. It is estimated that over 92% of the population are engaged in agriculture. Paddy is the main food and cash crops grown. Other crops including maize, sweat potatoes, sorghum sunflower, onions, cassava, beans, groundnuts and vegetables. In the study area majority of the household are engaged in rice and maize farming with more than 33,000ha of the land is devoted for the two crops (Appendix D). In terms of productivity sugarcane, cassava and onions appear to be the leading crops. The production of maize per hectare in Mbarali district was 1.5 ton/ha (Figure 4 and appendix D) and is slightly higher than the nation average of maize yield which is at 1.2ton/ha. Since the maize production is practiced by majority of the households, this implies that a significant opportunity costs would arise as agricultural land is converted to the national park. .

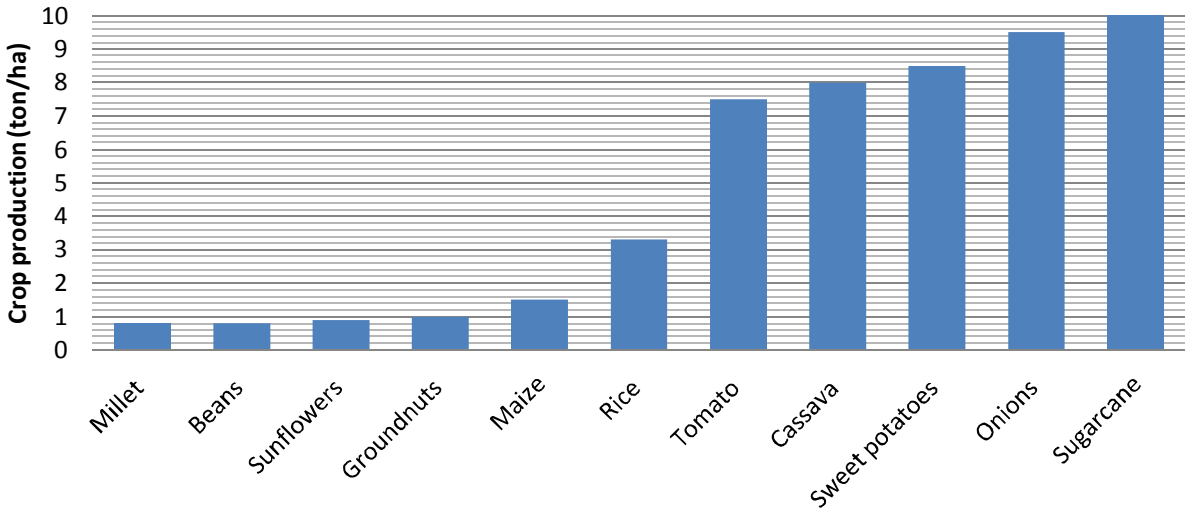


Figure 4: Crop yield for 2008/09

5.1.1.1 Agricultural mechanization

As has been pointed out earlier, agriculture is the main stay of the Mbarali Economy. It is however, noted that the level of mechanization is relatively low in the study area. For the whole study area there are only two household in the sample with a tractor. There are 10 with a tractor harrow or plough. Most of them own only one of these items. 47% (272 households) indicated that they have animal plough/harrow. 3.2% indicated that they have power tillers. Those reporting to own a power tiller have only one.

The large proportion of the households using animal plough/harrow has implication on the density of the animals in the area, with probable consequence on the environment or encroachment to the park. It is noted that only 33 of the household do not have a head of cattle/large animal. The rest have and in large quantities (See Table 19). Average head of cattle per household is 22, which is relatively higher than the national average of 14.

This figure reflects the des-stocking and the eviction of cattle keepers in the area. It indicates excess carrying capacity is still an issue in Ihefu area. The survey shows that the average number of large

animals before eviction was 620. The average for households who only own at least one head of cattle or large animal was 717. These numbers seems to have over-estimated the average – to attract sympathy. However, there was certainly large loss in the welfare at the household level (where one compares the level of stock before and after).

Was dis-stocking proportional? (Retaining the ranks!), if perfectly proportional, non-diagonal entries would be zeros.

Table 10: Cattle ownership after eviction

	Quintiles of cattle ownership after eviction					
	1	2	3	4	5	Total
1	**16.7**	2.2	1.5	0.4	0.0	20.7
2	2.6	**9.3**	2.2	2.2	1.5	17.8
3	1.9	5.9	**4.8**	4.1	3.0	19.6
4	0.4	0.0	8.5	**7.8**	5.6	22.2
5	0.4	0.0	1.5	6.3	**11.5**	19.6
Total	21.85	17.41	18.52	20.74	21.48	100

Departure from proportionality can be measured by ratio of diagonal entry to the column or row total!

5.1.1.2 Agricultural inputs

Table 11 shows the ranks of the most important farm implement used. Apparently, hand hoe is less used/considered as the most important implement. As noted early, draft animal is considered as the most important one. Power tiller is less. The implications of di-stocking campaign needs to also be packaged with the alternative source of agriculture power – e.g. the power tillers – to substitute for the decreasing stock of cattle and other large animals.

Table 11: The importance of various farm implements in Ihefu

	hoe	draft/animal	tractor	power tiller
First	23.7	86.8	55.6	34.7
Second	70.2	13.2	20.0	30.6
Third	6.1		24.4	32.7
Respondents	574	463	45	49

In the sample, 39% (of 581 households) reports using fertilizers, mainly on paddy and maize plots. Of those using fertilizers, 83% use inorganic fertilizers and 14% use organic fertilizers. 3% reports to use a combination of the organic and industrial fertilizers. This is a surprising result. With such large number of herds of cattle one would expect large proportional of farmers to be using organic fertilizers. One of the possible explanations to this situation is the fact that the majority of farmers does not keep large herds of cattle, and at the sametimes almost all pastoralists are not doing the farming. On the other hand using organic fertilizer is constrained by the costs due to transport to farm land. Furthermore, with the annexation of the Ihefu Wetlands to Ruaha National park, the majority of the pastoralists were evicted; hence the availability of organic fertilizers has reduced significantly. Obviously the use of fertilizer is called for as one of the important input in the effort to increase productivity. With increased productivity one would be sure that there will be less pressure

on the need to increase farm land to the marginal lands. It is however to be noted that the use of fertilizer needs proper guidance from the extension officers. The absence of extension services may lead to the misuse of the fertilizer which might lead into serious environmental consequences. The survey results suggest that about 4% of the household in the sample had been visited by the extension officer during the previous season. This would suggest that the majority of the farmers are applying agricultural inputs without proper guidance from the extension officer. Probably this could explain why farmer do not see the advantage of using organic manure over the use of commercial fertilizers.

The average industrial fertilizer used per household is 637kgs but the median is rather low (100kg) which indicated large skewness. Average industrial fertilizer use is 104kg/ha. The median is 25kg/ha. These quantities are relatively higher than the national average of 9kg/ha. However the figure for the sample population is well above the SADC regional average of 16 kg/ha. The largest consumer of fertilizer in the developing world is Viet Nam at 365 kg/ha, followed by China at 279 kg/ha. Malawi uses 27kg/ha. Productivity levels in those countries are correspondingly much higher than it is in Tanzania. Obviously the use of 104kg/ha of fertilizer do not suggest an overuse of the inputs, and therefore is not expected to have result into severe environmental consequences. However, the possibility of localized environmental damage from improper use of fertilizer might not be rule out completely– given that most fertilizer is applied without guidance from extension workers.

Number of livestock grazed in the study area has declined by more than 50% from about 300,000 in 2005 to about 140,000 in 2010. The decline is a consequence of the decision to relocate some of the livestock keepers to other places in Tanzania such as Kilwa and Kisarawe District in Lindi and Coast region, respectively. Under the current number of livestock distribution is summarized in Table 12. It is apparent from Table 12 that while the number of cattle has declined, that of small stock such as goats has gone up. Generally goats can easily graze in farm plots after crop harvesting. In this case, raising goats seems to one of the households' coping strategies to reduce the impact of reduction in cattle.

Table 12: number of cattle and goats in Mbarali district

Year	Cattle[9]	Goat
2003	299,863	25,818
2005	299,549	42,616
2010	138,102	52,842

Source: DALDO, 2010

5.1.2 Fishing

The District has several rivers that pass through Usangu plain and the Ihefu wetlands. Most of these rivers are rich in fishery resources. In the past, significant fishing was carried in the study area. However, the potential area that was used for fishing is Ihefu wetlands, which is now annexed to Ruaha National Park. According to the rules and regulations governing the National Parks the fishing is not allowed despite the fact that with proper regulation and enforcement fishing could be done without imposing the detrimental consequence into the wetlands. Therefore fishing activities

[9] Include both local and dairy cattle.

in the District is done under very small scale on few constructed ponds and in some portions of the rivers especially in open areas. The restriction on fishing grounds has resulted in catch declining to the lowest level. This in turn has diminished supply of fish, which used to be an important source of protein.

5.1.3 Tourism

The area is considered tourism potential as it is rich in different wild animals. The perennial swamp and surrounding wetland act as a regulator on flows downstream from Usangu. The perennial and seasonal flooding of the wetland is also important for biodiversity; in particular, the wetland supports an exceptional bird population, with species diversity within Usangu. Ihefu wetland is famous to have wildlife resources, including wild animals such as leopards, lions, cheater, elephants, buffalos, eland, crocodiles, snakes, tortoises, bushbuck, roan antelope, zebras, waterbucks, greater kudu, jackals, impalas, hippos and a variety of birds like ostrich and water ducks.

5.2 Energy

5.2.1 Fuel wood (firewood)

Fuel wood is the main source of energy for majority of the people in Mbarali District. It is used for commercial and households purposes. Both households and institutions like prison and secondary schools highly depend on fuel wood as source of energy. Firewood has been used for cooking and bricks burning purposes. Nearly to 100% of households in the study area, use firewood as source of energy for cooking.

5.2.2 Charcoal

In addition, the study area also is one of the main areas where charcoal is produced. Charcoal produced in this area is used in the neighboring townships like Rujewa, Ubaruku, Chimala, Igurusi and Madibira. Apart from domestic use, the commercial use includes restaurants, guesthouses and bars. Unlike fuel wood, very small proportion of charcoal is used by individuals around Ihefu area. It is only section of individuals (government employees – e.g. teachers) who use charcoal and they only use it in some special occasion. As such, it was also noted that making charcoal for both home use and business is not the tradition practices of people in Usangu. Charcoal making in the area is mainly carried out by people who have migrated from other districts.

5.2.3 Electricity and kerosine

The District is connected to the National grid and it was estimated that only 2 percent of the households are connected in 2001 (PHDR, 2005). Within the District, one power station generates electricity of about 100 MW which is supplied to Mbarali Estates. Rujewa, Ubaruku, Igurusi and Chimala townships, which are connected to the national grid, use electricity mainly for lighting purpose. Households and institutions that have no access to electricity use kerosene for lighting and cooking purposes.

5.3 Water use

5.3.1 Consumptive water use

Water in the catchments area is used for domestic, industrial, agricultural, livestock, generation of hydroelectric power and wildlife uses. Irrigation farming is by far the greatest economic activity utilizing the waters of the catchments. About 98% of water use in the catchments is for irrigation. Since only 4% of the land is under irrigation (Table 7), potential of increasing area under irrigation is limited unless there is change in technology. Water use for livestock and domestic is relatively in small proportion (Table 13). The quantity of water abstracted from the catchments for domestic and livestock use do not differ significantly between the dry and wet season. The mean water use during wet season is about 35% of the mean annual runoff and that of dry season is estimated to be 80% of the mean annual runoff.

Table 13: Water use in the catchments (millions cubic meters)

Water use category	wet season	Dry season	Total	%water use
Irrigation agriculture	775.6	64.8	840.4	98.50
Livestock	3.5	3	6.5	0.76
Domestic	2.6	3.5	6.1	0.71
Industries		0.2	0.2	0.02
Total	781.7	71.5	853.2	100.00

Source: WWF, 2010

5.3.1.1 Irrigation schemes

Mbarali District is one of the main paddy producing area in Tanzania. It is also among the leading districts in the country using irrigation for agriculture. In the district there are three basic categories of irrigation schemes, namely tradition, improved and modern. Generally, there is diversity ownership of land under irrigation comprising large enterprises and small scale enterprises. Currently the district has total of 78 irrigation schemes, among them 57 are traditional, 17 are improved and 4 are modern. Table 14 summarizes the details. The Table 14 further shows that a total of 40,500ha of land is under irrigation in Mbarali district and this is equivalent to 14% of the irrigated land (290 000 ha) in the country. The large proportion of the irrigated area (62%) in Mbarali district is still under traditional irrigation scheme. The tradition methods are mainly practiced by Small holder farmers and these farmers are faced with absence of storage structures and low use of water saving and appropriate technologies. The irrigated land under the modern irrigation is only 6 000 ha or 14.8% of irrigated land in the district. Modern irrigation System is used mainly by Mbarali Highland Estates Company and Export trading Company LTD. Improved Irrigation Schemes accounts for about 24% of the irrigated land in the district. These schemes are Madibira, Igomelo, Ipatagwa, Ruanda Majenje, Kimani, Mbuyuni and Uturo. The low proportion of irrigated land under the modern irrigation scheme is an indication of inefficiency of water use in the area.

Table 14: Different of Irrigation Schemes in Mbarali District

Type of scheme	schemes	area (ha)	% area
Traditional	57	24,900	61.48
Improved	17	9,600	23.70
Modern	4	6,000	14.81
Total	78	40,500	100.00

Source: Mbarali District Investment Profile, 2010

Modern Irrigation scheme in Mbarali District

Irrigated Rice and Maize farms in Mbarali

5.3.1.2 Water use efficiency

In general there is high inefficiency in irrigation water use due to poor irrigation infrastructure. Poor infrastructure results to about 85% of water diverted or pumped for irrigation not reaching the crops. The overall water use efficiency in the country is at an average of about 15 – 20% (URT, 2002). In Tanzania more than 85% of land is under small holder farmers with poor irrigation infrastructure design, construction and also lack of maintenance.

5.3.2 Non-consumptive water use

The non-consumptive use is another category of water use in the catchment. The non –consumptive use is related with the water use in generation of Hydro electric power (HEP). The study area is the main supplier of water used for HEP generation in two dams – Mtera and Kidatu. Therefore, the

importance of the study area - Ihefu wetlands - is coined through water flowing out to Mtera dam and Kidatu dam via Great Ruaha River. The Mtera – Kidatu reservoir system has a total generation capacity of about 280MW (Table 15). The generation of power from both dams depends on the water that flows from rivers originating from Kingere, Uporoto and Chunya mountains via the Ihefu wetlands and the great Ruaha river. Great Ruaha river is the main contributor of water used for HEP generation in Mtera dam. During dry season, the great Ruaha river dries up this situation leaves the power generation in Mtera dam to depend on other rivers . Other rivers supplying water to Mtera dam include Kisigo river and little Ruaha river (Table 15).

Table 15: Distribution of Non-Consumptive use of Water

River	% contribution
Great Ruaha	56
Kisigo	26
Little Ruaha	18

Source: Yawson *et al.* (2003) in WWF, 2010

Table 16: Installed capacity of HEP generation in the Mtera – Kidatu reservoir system

Parameters	Mtera	Kidatu
Installed capacity (MW)	80	200
Spillway capacity (m^3/s)	4,000	6,000
Turbine discharge(m^3/s)	96	140

For the period 2000–2009, the Mtera-Kidatu reservoir system has generated an average of 1,290 GwH or 54.9% of the total HEP in the country (Table 17). The average HEP generation at Mtera dam[10] is 14.8% of the national HEP production for the periods 2000–2009. On the other hand, Kidatu dam generates about 40.2% of the national average HEP production for the last 10 years. Table 17 summarizes the production trend of HEP from the major dams.

Table 17 Hydropower Generation (GWh) by Mtera-Kidatu system and total HEP 2000 - 2009

Year	Kidatu	Mtera	Total HEP*	% Kidatu	% Mtera
2000	829	286	2,142	38.70	13.35
2001	1,132	446	2,602	43.50	17.14
2002	1,192	480	2,720	43.82	17.65
2003	1,149	532	2,549	45.08	20.87
2004	718	236	2,011	35.70	11.74
2005	683	233	1,778	38.41	13.10
2006	488	97	1,436	33.98	6.74
2007	1,028	422	2,512	40.92	16.80

[10] Receiving about 56% of water from great Ruaha river whose main source are Upoloto, Utengule and Kipengele mountains flowing into western and eastern wetlands and then via Ihefu wetlands

2008	1,062	344	2,649	40.08	12.99
2009	1,098	451	2,640	41.59	17.08
Average	938	353	2,304	40.18	14.75

Source: (Tanesco, 2010)
* Total production in the country.

5.4 Household cash income

As should be expected in many rural areas, farming is the main source of income to majority of people in the study area. About 84% of the household in the sample earns their income from farming activities (Table18) . Only 7% of the household the main source of their income is from livestock keeping. Almost none of the household depends on harvesting non-timber forest products. This however, is after the annexation of the Ihefu wetland into the Ruaha National Park. Before the policy decision a greater number of households were engaging in fishing in the wetlands, harvesting of medicinal plants, fruits, vegetables. About 60% of the household reported that before the transfer of the status of the Ihefu wetland, it was the major sources of wild fruits and vegetables to majority of the households. This is no longer possible as the area is no access zone. This would suggest that with the transfer of the Ihefu wetland to the Ruaha national park, the major impacts to the household is on the reduction of grazing land, farming land and also limited of the wetlands products such as wild fruits, grasses, wild vegetables, firewood, poles, honey, fish, wild meat etc. This will imply therefore that with the annexation of the Ihefu into the Ruaha National park the natural benefits that one would expect communities around the wetland to extract has completely disappeared.

Table 18: Main sources of income

Source of cash income	Percent
Sales of crops	83.5
Sales of livestock and their products	7.4
Sales of NTFP	0.2
Business income	4.3
Wages or Salaries	2.4
casual works	1.9
Cash remittances	0.3
Total	100.0

The distribution of the income by sex and age indicates that male headed household receives most the income from crops and the female headed household get most the income from sources such as livestock, petty business, wage employment and remittences (Table 19). In terms of the age of the head of the household, there is no significant difference of households who receives their income from these sources.

Table 19: The household's main source of cash income by Sex and age of the household head

Main source of cash income	***Sex of the household head***		***Age of household head (yrs)***			
	Male	***Female***	***20 to 35***	***36 to 50***	***51 to 65***	***Above 65***

Sales of food crops	85%	52%	87%	81%	80%	88%
Sales of livestock	7%	10%	5%	8%	9%	6%
Sales of cash crops	1%		1%	1%		
Sales of other non-timber products (e.g. honey, medicinal pl	0.4%	2.40%			1%	
Business income	3%	9%	3%	4%	3%	
Wages or Salaries in cash	2%	10%	4%	2%	2%	2%
Other casual cash earnings	1%	5%	1%	2%	1%	2%
Cash remittances		5%	1%			2%
Selling of local brew	1%	5%		2%	2%	
Other (Specify)	0.40%	2.40%			2.40%	
Total observations	539	42	156	256	114	55

Cash income from sales of charcoal, sales of timber/poles, sales of firewood, and sale of medicinal plants, wild vegetables/fruits, etc, did not feature at all as important sources of cash in Ihefu. This is particularly so, after the area has been declared as reserve under the Ruaha National Park, and therefore is no access zone. Most of these NTFP used to be collected/harvested in what is today declared as a reserve land. One of the household reported to have 300 beehives which indicate that potentials are there. The production of honey for the season before the annexation ranged from 3 liters to 240 liters in the 7 household reporting to own beehives. The price per liter ranges between Tshs 600 to 3,000. Thus the household could earn an average of Tshs 9,000 to 720,000 per annum from beekeeping activities. With the conversion of the Ihefu wetland into a national park, will mean that this is the lost income to the household. This due to the fact that the national park is no access zone, thus household will not be able to get into the reserve to harvest their beehives. This is substantial sum of income given the fact that in most cases beekeeping is taken as an extra/secondary activities at the household level. Therefore there is potential for improved livelihood if community access to the park could be considered especially for activities which are likely not to cause detrimental effects to the wetland such as beekeeping and fishing. This however, will call for the change of regulations governing the national parks, as under the current regulation this is not possible. Hunting wild bird is negligible! Likewise, collection of Reeds, papyrus and grasses, palm leaves is negligible. In terms of reeds and grasses, 2% of respondents indicated to have at least one member engaged in making mats baskets or any other products from reeds, grasses or palm leaves. The prices of the articles range from TSHS 800 to TSHS 20,000. Furthermore, clay work is also negligible. Of the few producing the clay articles, the price range TSHS 1000 to 3000.

Table 20: Importance of natural resources to the local households

Type of resource	% of household collecting		What would cost
	Last week	Last season	TSHS last week (average)

(a) Forest vegetables (Kg)	16.49	24.40	2,136
(b) Forest fruits	6.19	18.04	1,881
(c) Forest Mushrooms (Kg)	1.37	11.86	1,050
(d) Forest Medicine (Kg)	4.98	10.48	15,869
(e) Poles	1.37	8.59	6,800
(f) Ropes (Kg)	0.34	5.67	5,786
(g)Withies (Fito)	2.58	11.34	6,625
(h) Timber	0.0	0.17	
(i) Weaving materials (Kg)	0.0	0.17	
(j) Grasses (Kg)	2.58	13.75	23,468
(k) Bush meat (Kg)	0.17	0.34	
(l)Firewood (Kg)	7.73	69.59	3,739
(m) Clay soil (Kg)	0.0	0.17	

The Table 20 shows significant contribution (imputed) of wetlands natural resources to incomes. Average contribution is mostly coming from grass collection and medicine and least so from collection of mushrooms (Figure 3). The grass collection is mainly for housing construction. Thatched houses are widely common in many of the villages surveyed. Thus significant income earned by those household used to collect grasses and medicinal plants from the forest.

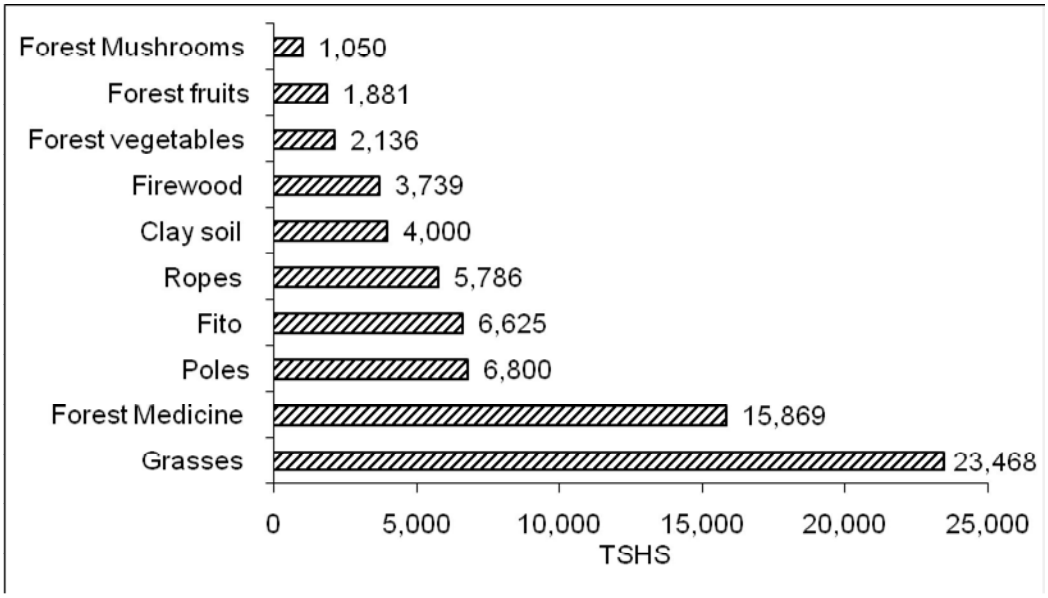


Figure 2: Contribution of NTFPs to household income per annum

With the conversion of wetland to a National Park this is a forgone income to those households involved in the activities. As indicated in Table 18, there are basically none direct use value of the Ihefu wetlands to the local community. It is basically less than 2% who have indicated to at least extract something from the wetland albeit illegal. As pointed out earlier is important that the conservation also take into account the livelihood of the local communities. Several options could

be provided to ensure that communities can benefit of the wetland resources if proper incentive and enforcement mechanism that involve the local communities are in place. From Table 21 is obvious that direct use value of the Ihefu wetland to the local communities is none existence. However, it can still be argued that reliance on the environmental resources is still critical for livestock keepers, and subsequently on crop production through animal power.

Table 21: Use of resource by households

Use/access of the resource		Frequency	Percent
Is there anyone in this household a full - time, part time or occasional fisher, or employed to work as a fisher? (circle one)	**Yes**	7	1.2
	No	575	98.8
Does anyone in this household buy fish to trade?	**Yes**	3	0.5
	No	579	99.5
Does any member of this household harvest or produce wood products? (circle one)	**Yes**	14	2.4
	No	568	97.6
Does anyone in the household make furniture carvings or any other products from wood? (circle one)	**Yes**	7	1.2
	No	574	98.8
Does this household have any beehives?	**Yes**	7	1.2
	No	575	98.8
Does anyone in the household collect wild honey?	**Yes**	7	1.2
	No	573	98.8
Does any member of the household engage in hunting animals and birds during the year?	**Yes**	2	0.3
	No	580	99.7
Does anyone in the household make mats baskets or any other products from reeds, papyrus, grasses or palm leaves?	**Yes**	12	2.1
	No	570	97.9
Does anyone in this household collect clay to make pottery?	**Yes**	4	0.7

6.0 THE IHEFU WETLANDS AND THE HOUSEHOLD WELFARE

6.1 Overview

The economic importance of the Ihefu Wetland must be explained in terms of its impact on the welfare. Generally, such impact must be looked at both from the local perspectives as well as at the global perspectives. That is to say that both the value that people in the vicinity of the Ihefu place on the wetland as well as the value that people elsewhere in the world ascribe to the wetland needs to count. For this matter, obtaining the economic importance of this wetland is a complex undertaken. The approach that this chapter takes is to assess the way the people in Ihefu evaluate the changes in their welfare in connection to the changes in the access to the Ihefu Wetland. Thus, we focus on the subjective assessment of the households' welfare before and after the eviction from Ihefu wetland. This approach has the disadvantage in that it does not encompass all households that are affected in one way or the other by the steps to conserve the wetland. The households that were relocated from Ihefu are not included in this sample, even though they were perhaps even more adversely affected than those remaining in the area. Only households that are still within the vicinity of the wetland were interviewed for this purpose. Further, changes in the welfare can be caused by factors other than the restriction in the access to Ihefu Wetland. Attributing such changes purely to the Ihefu conservation is admittedly tenuous. However this approach has one strong advantage; it is based on peoples evaluation of changes in their welfare during the time that actual changes took place in the access to the wetland which most of them have been making use of. This evaluation is therefore not hypothetical; it is based on actual changes that took place. Secondly, this analysis does not rely on asking people to put monetary value on the wetland, which is a correct approach but prone to errors and difficult to implement. The approach rather focuses directly on people's welfare, which is in any case important on its own right and is useful for making inference on the welfare implication of the conservation of the wetland.

A recall question is used for this purpose, so even though there was no baseline data, a measure of change is still garnered through the interview. Of course it is not wholly correct to attribute the perceived changes in the welfare exclusively to the changes in the utilization of the wetland; no doubt that some changes in welfare will be due to other factors. However, since restriction to the access to Ihefu is the major socio-economic event that took place in the last 5 years it must be the key explanation for any average changes in the welfare during this period.

The data is analyzed using ordered logit regression. This this regression analysis is suited to the case where the dependent variable is ordinal, categorical and has more than one possible outcome. In this case, the dependent variable is based on the response to the question on how they compare their welfare now as compared to the last five years. The response is categorical which we labeled it with the number as follows;

i.	Much worse now	(1)
ii.	A little worse now	(2)
iii.	Same	(3)
iv.	A little better now	(4)
v.	Much better now.	(5)

In the questionnaire there is an option of stating "*I Do Not Know*". This option was dropped in this analysis because it does not permit any ranking. The option that were used can be ranked in an ordinal way, that is to say, it is possible to infer which option is preferred to the other even though we cannot know by how much the preference differs.

We invoke the concept of latent variable to motivate the ordered logit model. It is assumed that there is a conceptual variable that is unobserved but the quantity of which influences the categorical variable that is observed. Let the latent variable be y^* and the observed categorical variable be y and that the two are related, in the context of the model used in this study, as follows;

$$y_i = \begin{cases} 1 \Rightarrow much\ worse\ \ if\ \ -\infty \le y_i^* < \tau_1 \\ 2 \Rightarrow a\ little\ worse\ if\ \tau_1 \le y_i^* < \tau_2 \\ 3 \Rightarrow the\ same\ if\ \tau_2 \le y_i^* < \tau_3 \\ 4 \Rightarrow a\ little\ better\ if\ \tau_3 \le y_i^* < \tau_4 \\ 5 \Rightarrow much\ \ better\ if\ \tau_4 \le y_i^* < \tau_5 = \infty \end{cases}$$

The following model is therefore estimated;

$$y_i^* = \alpha + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \varepsilon_i$$

Where the variables are defined as follows;

y^*=a latent variable capturing the intensity with which the responded feels that his/her welfare is better now than five years ago. The variable increases with the feeling that the welfare now is better than before.

x_1=*Sex of the head of the household; 1 if male, 0 if female.*
x_2=*Age of the head of the household in years*
x_3=*If the head of the household is a farmer, 1, if not, 0.*
x_4=*If the head of the household is a livestock keeper, 1, if not, 0.*
x_5=*Years of residence in the area.*

The respondents were asked to assess their welfare now as compared to five years ago. This means that a comparison is made between before and after the eviction from Ihefu and restriction of access to Ihefu. It is postulated that the main explanatory variable is the length of time that a person has lived in the area. The longer a person has lived in the area the more dependent to the wetland he/she is likely to have been. The restricted access therefore is likely to impact more to those who have lived longer in the area. Further, it is postulated that the type of economic activity that a household depends for eking out a life has a bearing on the way restriction of access to the wetland to the household. Other variables that are used for control are age and sex of the head of the household.

The ordinal regression analysis results are reported in Table 22. Two coefficients of the explanatory variables are significantly different from zero; these are the age of the head of the household and the years of residence in the area. The variable Age of the Household Head has a negative coefficient, indicating that the older the head of the household is, the more likely he/she is to feel current welfare is worse than welfare five years ago. This may signify the pessimism that comes with age tinged with the nostalgia for times gone by. However, it can also be argued that the older a person is, the more likely it is that he/she is deeply connected to the natural environment in which he/she lives, and therefore the restriction in the access to the Ihefu Wetland is more likely to be felt by such a person.

The two dummy variables for occupations, that is, livestock keeping and farmers, do not have coefficients that are significantly different from zero. This means that occupation does not explain the changes in the perception of welfare in any significant way. This indicates that it is the connection that a household establishes with the natural resources over time that count more in determining whether restriction for access to Ihefu Wetland impinges on the welfare on not. The result of estimation are reported in Table 22.

Table 22: Result of Ordered Logit Regression

Variable	**Coefficient.**	**z-Statistics**
Sex of the Head of the Household	0.420636	1.34
Age of the Head of the Household	-0.0298***	-4.74
Farmer	0.232574	0.62
Livestock Keepers	-0.41872	-0.74
Years of Residence in the Area	0.02099***	4.24
Cut Off 1	-0.98681	
Cut Off 2	0.413208	
Cut Off 3	0.847687	
Cut Off 4	3.035908	

*** Significant at 1% level

Interpretation of the coefficient as appears in Table 22 is a not straightforward because the dependent variable is a latent variable, which itself is based on some assumptions which some people may consider tenuous. It is more straightforward to interpret the results of the estimation of the ordered Logit model by using the probabilities. This ways of interpretation has an advantage in that it allows for various innovative ways of looking at the results. In Table 23 the predicted

probability on a specific household response to the question on its relative welfare today compared to five years ago is presented in relation to the age of the respondent, while the other explanatory variables are kept at their mean values.

:

Table 23: The Estimated Probability of Welfare Perception vs Years of Residence

Probability that the individual respond→ The number of years that the household has been resident in the area↓	Much worse now	A little worse now	Same	A little better now	Much better now
1	0.44	0.32	0.07	0.15	0.02
10	0.39	0.33	0.08	0.17	0.03
20	0.34	0.34	0.09	0.20	0.03
40	0.25	0.33	0.10	0.27	0.05

Table 24 suggest that the perception of the households on their welfare impacts as results of the annexation of the Ihefu wetlands into the Ruaha National parks differs depending whether a particular household are crop farming or livestock keepers. As should be expected livestock keepers were the one severely hit with the declaration of the Ihefu wetland into the National parks. Livestock keepers have a high probability of perceiving welfare deterioration as a result of the policy decision compared to crop farmers. About 46% of the respondents believe that their welfare status is much worse now than it was five years ago. The majority of the livestock keepers used to feed their livestock inside the wetland and it was believed that grasses available in the wetland were more nutritious compared to those available in other places. Field evidence suggests that there is belief among the livestock keepers in the adjacent villages that feeding livestock inside the wetland gives more milk and also the reproductive rate is much high compared to those feeding elsewhere. Furthermore the majority of the livestock keepers who remained in the adjacent villages to the wetland have to travel long distance in search of feeding ground besides being forced to reduce the number of their livestock.

Table 24: Perception of the Households Welfare over the last five years

Probability that the individual respond→ Occupation of the respondent↓	Much worse now	A little worse now	Same	A little better now	Much better now
Farmers	0.30	0.34	0.09	0.23	0.04
Livestock keeper	0.46	0.32	0.07	0.14	0.02

6.2 Negative impacts of wildlife on agricultural income

Despite the loss in term of land and livestock following the reallocation, losses caused by animal invasion into the crop land has also been reported. 27% of households have sustained crop loss due to wild animals –the focus group discussion revealed that such animal invasion are on the increase as a result of increased conservation. During the study year, the average estimated loss was TSHS 172,632 (median is 70,000) per household.

Mawindi and Madibira wards seem to be severely affected by the wild animals compared with other wards in the district. About 35% and 32% of the household from the two wards respectively have reported the experience of crop losses due to wild animals/birds. This is substantial amount if one could quantify the lost quantity (See Table 25).

Table 25: The experience of crop losses to wild animals/birds in the last year by ward

Type of wild animals	Households	Percent
Wild pigs	66	11.3
Antelopes	7	1.2
Monkey	90	15.5
Hippopotamus	9	1.5
Elephant	4	0.7
Birds/Queleaquelea	26	4.5
Others	2	0.3

In terms of the value of the crop lost dues to wild animals again for the two wards (i.e. Mawindi and Madibira, more than 56% of the total value of the grown crops is lost due to the wild animals. This is significant income losses to the households. The figure is likely to increase as with the conversion of the wetland lands the number of wild animals is also increasing. Thus encroachment of the animals into the villagers' farms is likely to increase. Table 26 summarizes the details.

Table 26 Value of crops loss (TShs) caused by wild animals

Value of crops loss (TShs)	% households affected
less than 10000	11.7
10000 to 50000	28.6
50000 to 100000	20.8
100000 to 500000	36.4
1000000	2.6
Total	100

Chapter 7

Emerging issues and the way forward

7.1 Emerging issues

The findings presented in the previous chapters shows that (i) households access to natural resources has reduced and has negative effect on livelihoods and household welfare from the loss of nutrition (fish as protein); (ii) local communities are not fully evolved on the natural resources conservation programmes; (iii) agricultural productivity is significantly low as a result of low use of agricultural inputs such as improved seeds and nutrients (organic or inorganic fertilizers ; (v) tourism potentials of the area still remains unexploited; (vi) there is increasing human - wildlife conflicts and this jeopardizes the sustainability of conservation and household welfare development in the study area.

7.2 The way forward

The welfare of the local community is significantly depending on the wetlands resources. Given the high dependence of local households on the wetlands resources, it means that the effort to conserve the wetlands resources requires additional policies to prevent an increase of poverty that can arise due to loss of access to natural resources as a result of conservation. The future plans for poverty alleviation in the study area should try to strike a balance between the socio-economic needs of the local people and environmental protective objectives. To achieve this, full and active participation of key environmental related stakeholders, including local people at different levels of decision-making is one of the essential steps. Community awareness and outreach training programmes on the environmental policies, laws and environmental protection and management are essential. There is need to establish a mechanism to ensure some products such as fish and honey to be collected from the reserved areas as such activities would have no impact on water reduction. The energy sources in the area are only firewood. There is also a need to ensure access by households to collect firewood in the reserve. There is need to review the compensation scheme to reflect the actual cost that households need to be compensated during relocation to pave way for resource conservation. The Current expansion of the reserve areas towards the agricultural land and the settlements reduces further livelihoods and welfare development option for the communities and the district at large. Therefore, there is a need to abolish the programme to allow enough agricultural land in the area.

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Appendix ies

Appendix 1. Complaints and Concern on Ihefu Conservation

BOX 3: GOVERNMENT CRITICIZED FOR IHEFU EVICTIONS

The government has been criticized for forcibly evicting herdsmen from Ihefu valley in Usangu, Mbeya to the southern coastal areas. Representatives from Hakiardhi, Pingo`s Forum and the Legal and Human Rights Centre criticized the move, describing the action as human rights abuse. Speaking on behalf of other civil societies, a representative of Hakiardhi, Emanuel Mvula, said the act was against human rights. ``It will bring great economic problems to the herdsmen. The government should have exercised patience instead of forcing them out. They needed time to prepare themselves and the government should have allocated them another area before issuing the directive" Mvulla said.

Mvulla said pastoralists were shifted to Lindi Region, which had no livestock infrastructure such as cattle dipping facilities. As a result a good part of their stock has died for lack of pasture and water on the way.

There are reports that pastoralists are harassed by local government officials demanding bribes, as they trek their stocks to designated areas. They take five days to travel from the Usangu Valley in Mbeya to Lindi. ``In every station they stopped on their way, they were asked to pay Tshs 100,000 to 200,000 to the authorities", he said.

Moreover, the exercise is said to have separated pastoralist families. "Those moving from Mbeya to Lindi are youths. The elders, women and children are left behind",` he said.
Source: The Guardian, 5th April 2007

Appendix 2: Surveyed villages and the sample size.

S.No	Village	Ward	sampled
1	Igava	Mawindi	26
2	Igunda	Mawindi	27
3	Vikaye	Mawindi	25
4	Iwalanje	Mawindi	32
5	Manienga	Mawindi	33
6	Isunura	Mawindi	29
7	Ikanutwa	Mawindi	28
8	Ikoga Mpya	Madibira	33
9	Mahango	Madibira	23
10	Iheha	Madibira	30
11	Mapogoro	Madibira	36
12	Magigiwe	Madibira	36

13	Mlungu	Madibira	32
14	Mwanavala	Ubaruku	32
15	Imalilo-Songwe	Ubaruku	30
16	Urunda	Ubaruku	33
17	Nyelegete	Rujewa	26
18	Madundasi	Utengule	23
19	Magurgura	Utengule	27
20	Ukwavila	Mapogoro	20
	Total		581

Appendix 3: Major agriculture production 2007/2008 and 2008/2009 season

S/N	Crop	2007/2008			2008/2009		
		Production land (ha)	Harvest (ton)	Production per ha	Production land (ha)	Harvest (ton)	Production per ha
1	Rice	33,500	117,250	3.5	32,400	106,920	3.3
2	Maize	33,000	85,800	2.6	28,800	43,200	1.5
3	Millet	8,000	9,600	1.2	9,200	7,360	0.8
4	Cassava	3,000	27,000	9.0	1,200	9,600	8.0
5	Sweet potatoes	4,000	34,000	8.5	1,500	12,750	8.5
6	Groundnuts	20,500	20,500	1.0	14,800	14,800	1.0
7	Sunflowers	1,500	1,050	0.7	1,200	1,080	0.9
8	Onions	1,200	11,400	9.5	1,200	11,400	9.5
9	Beans	21,000	21,000	1.0	12,000	9,600	0.8
10	Tomato	1,050	10,500	10	1,500	11,250	7.5
11	Sugarcane	700	10,500	15.0	700	7,000	10

Source: DALDO

Appendix 4. Description of Iheru in relation to the Ruaha National Park

Ihefu is part of the Ruaha National Park covers an area of about 10,300 sq km and is part of an extensive ecosystem which includes Rungwe Game Reserve, Usangu Game Reserve, and several other protected areas. The Park gets its name from the great Ruaha River that runs through it. Almost all of Africa's large mammal species are to be found in Ruaha. It has the largest elephant population than any Tanzanian national park. Large carnivores are well represented; these include lions, leopards and cheetahs. Spotted hyena and wild dogs can be seen throughout Ruaha. The Park is also famous for its huge buffalo herds and variety of antelope species.The management of the Ihefu wetlands has been changing from one regime to another as a result of unhealthy condition of the wetlands. In 2000, the Ihefu and its surroundings were incorporated into the Usangu Game Reserve, five years later; the reserve has been incorporated into the Ruaha National Park.

Usangu Game Reserve with its mountains, valleys, grassland and Miombo woodlands where you will find elephant, buffalo, lion, leopard and plains game such as greater kudu, waterbuck, bushbuck,

topi, oribi and many more. It includes the Ihefu Wetland, the natural water reservoir for the Great Ruaha River.

In December 2006, Ruaha National Park in the Southern Circuit was combined with Usangu Game Reserve. The combined area increased in size by over 15,000 square kilometers, making Ruaha National Park one of the the largest National Park in Africa. One of the aims of the government in annexing Usangu to Ruaha is in part to save the biodiversity of that area as well as to increase tourism to the region. According to Gerald Bigurube, Director General, Tanzania National Parks (TANAPA), Tanzania is constantly working on upgrading its game reserves to National Parks. In a National Park there is no consumptive use of resources and this allows for the multiplicity of species, increasing the wildlife in the parks. This can best be accomplished if the area is administered and marketed by TANAPA

Appendix 5. Household opinion on how best can the Ihefu/Ruaha National Park can be managed and ensure resource availability

Household opinion on how best to manage the resource/National Park	Frequency	Percent
Elimu ya uhifadhi itolewe kabla ya mabadiliko na baada ya mabadiliko kuepuka adhari na uthibiti mzuri wa utunzaji (combined:Elimu ya Uhifadhi itolewe kabla ya mabadiliko yanazoathiri maisha ya watu kufanyika, Elimu ya uhifadhi itolewe namna ya kutunza mal Education on the importance of conservation is needed before and after major interventions to reduce conflicts. This will ensure effective conservation of the targeted areas.	66	11.3
Mahusiano ya TANAPA na wanakijiji yawe mazuri zaidi kuliko yalivyo sasa(Wapunguze manyanyaso, Askari wa TANAPA wasiwanyanyase wananchi e.t.c) The relationship between TANAPA and the communities should be cordial and harmony. TANAPA should show respect to the local communities	81	13.9
Wananchi na serikali ya kijiji washirikiswe kuhifadhi (Collaboative/Participatory management and decision making)-maamuzi, kuweka mipaka, kuweka sheria n.k. Participation of the local communities in decision-making and conservation is essential for successful conservation	138	23.7
Kutenga maeneo maalum ndani uya hifadhi yanayomilikiwa na vijiji	47	8.1

There is a need to have separate areas in the conserved area which is accessible to local communities for controlled harvesting		
TANAPA na serikali ziboreshe huduma za jamii, huduma za wafugaji na mifugo na pia kuimarisha miundombinu(combined: TANAPA na Serikali iboreshe huduma za jamii e.g schools, maji, dispensaries, roads, visima vya maji, mifereji ya umwagiliaji n.k., TANAPA TANAPA and the Government should provide social services, such as schools, water, dispensaries, roads, etc. to the local communities.	96	16.5
Wananchi/Wanavijiji washirikishwe kwenye swala la kuweka mipaka kati ya hifadhi na vijiji Participation of the local communities in demarcation of the reserved areas is essential	47	8.1
Mipaka iwe kwa ajili ya kutunza wetland (IHEFU) na sio kuchukua maeneo ya kijiji	132	22.7
The demarcated area should be limited to the wetland only and should not include village land	133	22.9
Anasapoti serikali kuendelea kusimamia eneo hilo The community support countinued conservation of the area.	86	14.8
Wananchi walioondolewa wafidiwe kulingana na stahili halisi Compensation should be realistic and in accordance with the law and regulation	63	10.8
Wananchi/wanavijiji wapewe vibali maalumu vya kuchukua rasilimali Ihefu, kama vile samaki kuni n.k The local communities should be given quotas for controlled harvesting of the natural resources from Ihefu	49	8.4
Maeneo ya kilimo na ufugaji kwa wakulima na wafugaji yatengwe (combined: Maeneo ya kilimo yatengwe na Maeneo ya mifugo yatengwe) There is need to separate crop land from the grazing land	104	17.9
Serikali itoe mikopo kwa wananchi There is need to privide credit to the local comminities	11	1.9