

Conservation And
Livelihoods: Where Do
We Strike A Balance To
Sustain The Wetlands In
The Kilombero Valley?

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ABSTRACT

Wetlands deliver goods and services important for people's welfare. In Kilombero valley where this study was conducted the ecosystem provides fertile lands for crop farming and pasture for grazing local breeds livestock. These tradition practices coupled with unsustainable management strategies lead to undervaluation, overutilization and the decay of wetlands. Basing on conservation values perceived by the Kilombero valley local communities that were determined in the other study trough choice experiment and questionnaire survey, this study aims at estimating the total amount which can be collected from peoples' willingness to pay (WTP) to improve Kilombero wetlands status, specifically conserving flood plain areas currently used for crop production and un controlled livestock grazing. The results revealed that farmers receive higher incomes when they use the flood plain in crop farming and livestock keeping than if there would be conservation restrictions. This implies that if the wetlands will be completely preserved the cost will be too high to be bearable for these communities and there would be big resistance to cooperate. However the attached conservation values indicate the amount they are willing to give up for conserving wetlands that can be collected as the fees for the specified uses of the wetlands for crop farming and grazing. This is important information for the policy makers and conservators since the amount collected through fees can be channelled to finance conservation activities as throughout this paper.

Key words: Wetlands, Willingness to pay, crop farming and Livestock keeping, livelihoods, conservation

1. INTRODUCTION

Wetlands deliver several important functions and contribute considerably to the welfare of many people (Junk, 2002). Wetlands provide services to communities such as climate regulation, flood control and provision of food and fibres (Rebelo *et al.*, 2010). Besides, they offer provisioning, regulating, cultural and supporting services (Millennium Ecosystem Assessment, 2005). Moreover, in many developing countries, the livelihood of most rural people depends, to a large extent, on the productivity of the natural wetland system (Silvius *et al.*, 2000).

In spite of this great importance of wetlands, Adger and Luttrell, 2000 assert that the global area of wetlands is decreasing enormously since the last decade; wetlands have been converted to agriculture, urban and other uses, which have had a great impact at the global scale but also on the local resource users. The reason for this demise is threefold. Firstly, there is a lack of complete and correct information on the exact services and functions of the wetlands. This leads to wetlands functions incorrectly or insufficiently quantified and therefore often neglected in policy making (Costanza *et al.*, 1997). This, in turn, leads to a suboptimal management of the wetland (Rebelo *et al.*, 2010) because wetlands are often managed by public institutions. Secondly, wetlands have high opportunity costs of their maintenance compared to other goods which have an effective demand.

Since the demand for conversion to agricultural or urban land is very high, especially in developing countries, the conversion of wetlands is very attractive. Thirdly, there seems to be a great distortion between who bears the costs and who enjoys the benefits from the maintenance or conversion of the wetlands. Adger and Luttrell (2000) show that a lack of good institutional framework and clear property rights of the wetlands can easily lead to overutilization of the properties of the area. All the three reasons lead together to ill-management, undervaluation, overutilization and the decay of wetlands.

In filling the gap of information on wetlands, many studies have focused on the first two reasons, and have tried to value wetlands in different circumstances and in different ways (Ghermandi *et al.*, 2010). Since 2000, a lot of studies have also focused on the third reason, that is on the institutional context of managing wetland areas, especially in ecological and environmental economics (Paavola and Adger 2005; Paavola 2007). However, as asserted by Balland and Platteau (1996), there is an important link between the three reasons, namely: the property relations and the institutions involved determine the values and the market structure of wetlands.

This study focuses on Kilombero valley wetlands in Kilombero Ulanga and Malinyi districts in Tanzania. As in other areas in Africa, these wetlands play a significant role in the livelihoods of the rural communities of this region (Kangalawe and Liwenga, 2005; Jogo and Hassan, 2010). The ability of wetlands to store water during the wet season and release it during the dry season provides farmers living in semi-arid areas with opportunities to grow crops all the year round. This improves food security and increases farmers' incomes. Besides the possibility of crop production, the wetlands in Tanzania also provide other services that support human welfare such as livestock grazing and watering, water supply and supply of fish, game and natural products. However, high cattle densities, expanding human settlements and the up rise of farms and teak plantations are threatening the wetlands in the region (Jenkins *et al.*, 2002).

Due to the practice of shifting cultivation in the Kilombero valley, the emergence of large scale farming and population growth, currently more than 50% of the flood plain areas in the valley is converted into agricultural land (Kato, 2007., 2007, Kangalawe and Liwenga, 2005). Major food crops cultivated in the Kilombero valley include maize, paddy rice, banana, and cassava. Cash crops include sugarcane, and paddy rice. Other minor crops also used as sources of food and supplemental income include sweet potatoes, maize, vegetables, peas, pigeon peas, groundnuts and sesame. At this moment, some people are even cultivating areas which were previously considered marginal such as the river banks and around the swamps. As a result, there is increased soil erosion, which has resulted into siltation of downstream hydropower dams and the drying up of streams and swamps. Several permanent streams in the Kilombero valley such as Kiberege, Idete, Kikwawila, Namawala and Idandu are now becoming ephemeral. Furthermore, there is speculation that water pollution and depletion are increasing due to the use of pesticides by large scale farmers (Mombo, 2013, Kangalawe and Liwenga, 2005)

Wetlands in the Kilombero valley are also used as grazing land for livestock. The livestock population has been increasing during the past 10 to 15 years. This increasing population of livestock requires large grazing areas, which are unfortunately not readily available in the Kilombero valley. This has resulted in a number of conflicts between livestock and crop farmers (KDC 2016; UDC, 2016). Furthermore, in some parts of the flood plain, the spongy character of the soils is changing as the soils become more compacted due to livestock trampling. . The livestock is also held responsible for the seasonally drying up of a number of water sources. Other negative effects of overstocking are overgrazing and water pollution with the chemicals used to treat the livestock against tick borne diseases (Kangalawe and Liwenga, 2004, Mombo 2013).

Basing on the study by Mombo (2013), this paper aims at estimating the total amount which can be collected from peoples' willingness to pay (WTP) to improve Kilombero wetlands status, specifically conserving flood plain areas currently used for crop production and conserving grazing lands in the Kilombero valley. The estimated WTP values for improving Kilombero wetlands status are then compared with the total amount of income that people living in wetland areas of the valley obtain from crop production and livestock grazing activities. Then it will be decided whether to opt for a conservation role through paying conservation charges for conserving flood plains and grazing areas or to opt for a developmental role through crop production and livestock grazing in the valley. Another option is to integrate the two options, that is, to continue with agriculture while ensuring sustainable management of wetland areas in the Kilombero valley.

Specifically, the objectives of this study were to: estimate the peoples' Willingness To Pay (from now on WTP) per year to conserve flood plain areas in the Kilombero valley, estimate peoples' WTP per year to conserve grazing areas in wetlands of Kilombero valley, estimate the amount of income which could be obtained per year from crop production carried out in the flood plain areas of the Kilombero valley, estimate the amount of income which could be obtained per year from livestock grazed in wetland areas of the Kilombero valley, compare the WTP values for conserving flood plain areas against the amount of income which could be obtained from crop production carried out in flood plains, compare WTP values for conserving grazing lands against the amount of income which could be obtained from livestock grazed in wetland areas of Kilombero, and to decide which option (s) to adopt whether institutionalising WTP charges for conserving flood plains and grazing areas in the Kilombero valley and decrease or stop crop production and livestock keeping, continuing with crop production and livestock grazing in the Kilombero valley or integrating the two options by introducing WTP charges for conserving flood plains and grazing areas in the Kilombero valley, and continuing with their usual crop production and livestock keeping activities in the valley.

Results of this study are valuable from a policy perspective: they give policy makers insights on how people depend on the Kilombero valley for food and cash generation, the total income which can be collected for conserving Kilombero wetlands from the amount of income that is received from agricultural activities practised

in this valley. By using this information, policy makers and conservators will be able to arrange better management plans to manage the wetland areas in the Kilombero valley and to rehabilitate the already degraded wetland areas. Furthermore, this information will be useful in creating agricultural policies for improving crop and livestock production in wetland areas of the Kilombero valley and other places in the country and outside with the setting likened to this of Kilombero valley. Besides, the study is useful in looking for better markets for agro-products which in turn will improve livelihoods of people living in the said wetlands.

2. METHODOLOGY

2.1 STUDY AREA

The study was done on the Kilombero Wetlands in Morogoro region, South Tanzania. The Kilombero valley was designated as a Ramsar site in 2002, recognising the international importance of this wetland. The wetland is located in the valley between the Udzungwa Mountains and the Mahenge escarpment. The valley is divided by the Kilombero River and falls within the districts of Kilombero and Ulanga. The wetland area covers 7,967 km² with a catchment area of about 40,000 km². Many rivers, both permanent and seasonal, feed the floodplain. The area is characterised by a sub-humid tropical climate with an annual rainfall of about 1200-1400mm. It has two seasons of rain, where the long rains start from March to May, and the short ones from October to December. Temperatures normally vary from 20°C to 30°C (MNRT, 2007).

This study involved three districts of Morogoro region, namely Kilombero, Ulanga and Malinyi. The three districts were chosen due to the fact that the Kilombero valley lies between the two. According to the Tanzania National Population and Housing Census (2012), the total population living in Morogoro region is 2.2 million of which 18.4% is in Kilombero district and 11.9 % is in Ulanga district which has recently been split into two, the Ulanga and Malinyi districts. It has been reported that 430,135 people (83%) of the population in Kilombero and Ulanga districts live in the Ramsar site (MNRT, 2007).

The majority of the households living in the Kilombero wetlands are generally poor farmers and fishermen highly depending on crop cultivation, livestock rearing, fishing and hunting (MNRT 2004). Since most people depend on agriculture to support their living, agriculture is the main activity practised in the Kilombero valley by both small- and large-scale farmers (e.g. sugarcane plantations) and both rain fed and irrigated agriculture is practiced at various scales. Grazing is also highly practised in the valley, cattle being the most grazed livestock. All in all, the floodplains are of great importance to the livelihoods of the surrounding villages in the Kilombero valley (Kangalawe and Liwenga, 2005). The continued crop production and livestock keeping in the valley have degraded fragile ecosystems in the wetland areas of the Kilombero valley which necessitates a need for management intervention to sustainably conserve the valley while supporting lives of the people living in the wetland areas of the Kilombero valley.



Fig. 1: Map showing the location of Kilombero valley wetlands in Tanzania. (KILORWEMP, 2016)

2.2 SAMPLE SIZE AND SAMPLING PROCEDURES

The target population comprised all primary users of the wetlands in the Kilombero Ramsar site. A sample size of 5% was picked from the total household population in nine randomly selected villages (Sonjo, Mofu, Idete, Mahutanga, Kivukoni, Milola Mwaya, Sanje and Kikwawila) in Kilombero and Ulanga districts in Morogoro region. The sample consisted of 436 households and for this case the sampling frame was a village and sampling unit was a household, defined as all people living under one roof and are sharing the same pot for cooking their dishes.

2.3 DATA COLLECTION

Both primary and secondary data were collected for this study. The primary data were collected through households/farmers face-to-face interviews using semi structured questionnaire and checklists. The questions mainly asked the households' dependency on the Kilombero valley for crop production and livestock keeping, a total of 300 randomly selected households were visited. During the survey/data collection focus group discussions and interviews were also done with key informants and other wetland beneficiaries such as relevant non-governmental organisations (NGOs), community -based organisations (CBOs), companies and enterprises within Kilombero and Ulanga districts. Secondary data were sourced from various literature materials from web resources, scientific papers and documents from NGOs and government departments or Kilombero Ulanga and the recently established Malinyi (after dividing Ulanga District) districts socio-economic profiles.

2.4 DATA ANALYSIS

Both quantitative and qualitative methods were used to analyse the collected data. Collected data were analysed using SPSS 16.0 software in which descriptive statistics were used to quantify the collected crops and livestock production data. The choice experiment results adopted from Mombo, (2013) were used to determine the WTP values for conservation of flood plains and grazing areas in wetlands of the Kilombero valley. However, the content analysis method was used for the qualitative data.

3. RESULTS AND DISCUSSION

3.1 WILLINGNESS TO PAY OF THE PEOPLE IN WETLAND AREAS OF KILOMBERO VALLEY TO CONSERVE FLOOD PLAIN AREAS IN KILOMBERO WETLANDS

According to Mombo (2013), farmers in Kilombero and Ulanga districts are willing to pay TZS 816.1 /ha/month to reduce the area under shifting cultivation in the Kilombero valley by increasing seasonal and permanently flooded streams, swamps and ponds in the flood plains which have greatly been impacted by the continued shifting cultivation practices. The total population living in wetlands area is 430,135 people of whom 83% depend on these wetlands for livelihood activities mainly crop farming (MNRT, 2007, URT, 2012). The average farm size for most of the farmers (90%) is 0.2 ha, while about 10% of the farmers have farm average sizes of 4.0 ha.

Table 1: Total acres/ ha cultivated by farmers in flood plain areas of Kilombero wetlands

| Number of farmers | Average farm size (ha) | Total farm size (ha) |
|-----------------------|------------------------|----------------------|
| 336793 (90%) | 0.2 | 67,358.7 |
| 37421 (10%) | 4.0 | 14,9689 |
| Total area cultivated | | 217,047.7 |

Table 1 portrays that a total of 217,047 ha of flood plain areas are used by farmers in Kilombero wetlands for the shifting cultivation which has reduced the seasonal and permanently flooded streams, swamps and ponds in the flood plain areas of the valley. This area makes about 27.24% of the total wetland areas in Kilombero, Ulanga and Malinyi districts which cover 796700 ha.

Table 2: Willingness to pay of the people in Kilombero Ulanga and Malinyi Districts to conservation flood plain areas

| Total number of ha cultivated | WTP per ha per month in TZS ¹ | WTP per ha per year in TZS |
|-------------------------------|--|----------------------------|
| 217,047 | 177,132 627. 97 | 2,125,591,535.63 |

(Source: Mombo 2013)

Table 2 above depicts that people living in wetland areas in Kilombero, Ulanga and Malinyi districts are willing to pay about TZS 2,125,591,535.63 per year to conserve flood plain areas by reducing the area under shifting cultivation so as to increase water volumes in seasonal and permanently flooded streams, swamps and ponds in the flood plains. On average, each farmer who practices shifting cultivation in wetland areas of the Kilombero valley is willing to pay about TZS 411.81 or TZS 4,941.68 per month or year to conserve the flood plain areas. This is a very encouraging amount for a community in a developing country like Tanzania where average consumption expenditures are around TZS 20,000 per month in rural areas and TZS 40,000 month in urban areas. Moreover, institutionalisation of such a conservation payment would make a big difference because up to now a meagre amount of money is set aside during budget allocation that goes specifically to conservation

¹ USD 1 is equivalent to TZS 2100, the exchange rate of 2015/16

activities in the wetlands ecosystems, which of course makes it difficult to develop a coherent and consistent management policy. The collected amount of money from conservation fee can be used by the conservators in collaboration or any specified institutions by the government to rehabilitate the already degraded flood plain areas. In turn, this could help to restore the degraded flood plains and increase water volumes and storage in seasonal and permanent streams, swamps and rivers around the wetland areas in the valley.

3.2 CROP PRODUCTION IN WETLAND AREAS OF KILOMBERO VALLEY

Table 3: Land allocation for crop production in flood plain areas of Kilombero valley

| Crop | Percentage of the total cultivated area (217047.7 ha) | Amount of ha used for each crop production |
|-----------|---|--|
| Maize | 34.07 | 73,948.151 |
| Rice | 48.16 | 104,530.172 |
| Sesame | 5.82 | 12,632.172 |
| Sunflower | 0.72 | 1,562.743 |
| Sugarcane | 7.44 | 16,148.348 |
| Banana | 3.79 | 8,226.107 |
| Total | 100 | 21,7047.7 |

Table 3 above shows that most of the land under shifting cultivation in wetland areas of the Kilombero valley is used to grow rice (104,530.172 ha) and maize (73,948.151 ha). This may be because the mentioned crops are major food and cash crops grown by farmers in the wetland areas of Kilombero and Ulanga districts. Given the fact that rice is usually cultivated in swampy or flooded areas, the continued increase in rice production in Kilombero and Ulanga areas will expand degradation of more fragile ecosystems and hectares in the valley, hence a need for conservation interventions.

Table 4: Amount of crops which can be grown per year from flood plain areas in Kilombero valley

| Crop | Land size used for crop production (ha) | Amount of crops which can be harvested from land (kg or bunch per ha) | Total amount of crops which can be harvested from the cultivated (kg or bunches per ha) |
|------------|---|---|---|
| Maize | 73,948.151 | 1,000 | 73,948,151 |
| Rice | 104,530.172 | 2,500 | 261,325,430 |
| Sesame | 12,632.172 | 200 | 2,526,548.6 |
| Sunflower | 1,562.743 | 300 | 468,822.9 |
| Sugar cane | 16,148.348 | 75,000 | 1,211,126,100 |
| Banana | 8,226.107 | 375 | 3,084,790 |

Table 4 details the total amount of crops which can be harvested per year if the total flood plain area under shifting cultivation (217,047.7 ha) in the Kilombero valley is cultivated. The valley has great agricultural potentials which attract most farmers to engage in shifting cultivation as maximum crop yields can be received from the valley (Table 4). Its great agricultural yielding capacity exposes wetland areas in Kilombero Ulanga and Malinyi districts to degradation from continued shifting cultivation.

Table 5: Amount of income which can be obtained per year from crops cultivated in flood plain areas of Kilombero valley

| Crop | Amount of crop which can be harvested (kg or bunches) | Price per unit (TZS/kg) | Income which can be obtained from harvested crops in TZS |
|------------------------------------|---|-------------------------|--|
| Maize | 73,948,151 | 500 | 36,974,075,500 |
| Rice | 261,325,430 | 600 | 156,795,258,000 |
| Sesame | 2,526,548.6 | 1,500 | 3,789,822,900 |
| Sunflower | 468,822.9 | 600 | 281,293,740 |
| Sugarcane | 1,211,126,100 | 60 | 72,667,566,000 |
| Banana | 3,084,790 | 3,000 | 9,254,370,000 |
| Total amount which can be obtained | | | TZS 279,762,386,140 |

A total of TZS 279,762,386,140 can be obtained per year from crops cultivated in flood plain areas of Kilombero and Ulanga districts (Table 5) only if the total area under shifting cultivation (217,047.7 ha) is cultivated. This amount can be used to support the livelihoods of about 430,135 people living in wetland areas of the Kilombero valley.

Table 6: Farmers' crop production in flood plain areas of Kilombero valley for year 2014

| Crop | Unit of measurement | Total amount harvested |
|------------|---------------------|------------------------|
| Maize | Kilogram | 31,595,520.527 |
| Rice | Kilogram | 184,223,139.243 |
| Sesame | Kilogram | 5,816,923.646 |
| Sunflowers | Kilogram | 462,534.633 |
| Sugarcane | Kilogram | 876,613 |
| Banana | Bunch | 1,246,420 |

Table 6 above shows the total amount of crops harvested by 96,031 households in Ulanga and Kilombero districts for the year 2014. About 83% of the total households living in Ramsar sites of Kilombero and Ulanga districts are farmers engaging in crop and livestock production. Rice was the most harvested crop followed by maize. Harvested crops are used for subsistence to support households' meals and some are sold to earn households' income.

Table 7: Amount of crops used by households in wetland areas of Kilombero and Ulanga districts for subsistence and cash generation in 2015

| Crop | Total amount of crops harvested (kg or bunch) | Total amount of crops used for subsistence (kg or bunch) | Total amount of crops sold/ used for cash generation (kg or bunch) |
|------------|---|--|--|
| Maize | 31,595,520.527 | 18,305,358.74 | 13,290,161.78 |
| Rice | 184,223,139.243 | 73,355,790.25 | 110,867,348.9 |
| Sesame | 5,816,923.646 | 110,127.293 | 5,706,796.352 |
| Sunflowers | 462,534.633 | 264,305.504 | 198,229.128 |
| Sugarcane | 876,613 | 16,000 | 860,613 |
| Banana | 1,246,420 | 188,978 | 1,057,442 |

Table 7 depicts that most of the crops grown by farmers in wetland areas of Kilombero and Ulanga districts are used for cash generation. Most of the grown crops are sold within and outside the two districts. The expanded rice market in Kilombero district has resulted in socio-economic development in areas such as Ifakara where various socio-economic infrastructures have been built and some are continuing to be established. Crop

production has helped to improve living standards of the people in respective districts though this practice degrades most of the fragile and vulnerable ecosystems in the Kilombero valley. Table 7 also highlights that most people living in wetland areas of the valley depend on flood plain areas to grow crops for their subsistence use; hence shifting cultivation practice in flood plain areas of the valley is inevitable for the existence of people in the districts.

Table 8: Total amount of income obtained by farmers in wetland areas of the Kilombero valley from crop selling in year 2016

| Crop | Total amount of crops sold (kg or bunch) | Price per unit of crop (TZS per kg or bunch) | Amount of income obtained (TZS) |
|---------------------------------------|--|--|---------------------------------|
| Maize | 13,290,161.78 | 500 | 6,195,080,890 |
| Rice | 110,867,348.9 | 600 | 66,520,409,340 |
| Sesame | 5,706,796.352 | 1,500 | 8,560,194,528 |
| Sunflowers | 198,229.128 | 600 | 118,937,476.8 |
| Sugarcane | 860,613 | 60 | 51,636,780 |
| Banana | 1,057,442 | 3000 | 3,172,326,000 |
| Total income obtained from sold crops | | | 84,618,585,014.8 |

A total of TZS 84,618,585,014.8 was received by farmers in 2015/16 in wetland areas of the Kilombero valley from selling their crop produces (Table 8). This amount of income is used to support households' living. Prices used for quantification were based on the farm gate prices which most farmers used for their crops to middle men. The prices may increase if the farmers decide to sell their products to urban areas within and outside their districts.

Table 9: Total amount of income which can be obtained by farmers from all harvested crops in 2015 in wetland areas of the Kilombero Valley

| Crop | Total amount of crops harvested (kg or bunch) | Price per unit of crop (TZS per kg or bunch) | Amount of income obtained (TZS) |
|---|---|--|---------------------------------|
| Maize | 31,595,520.527 | 500 | 15,797,760,263.5 |
| Rice | 184,223,139.243 | 600 | 110,533,883,545.8 |
| Sesame | 5,816,923.646 | 1,500 | 8,725,385,469 |
| Sunflowers | 462,534.633 | 600 | 277,520,779.8 |
| Sugar cane | 876,613 | 60 | 52,596,795 |
| Banana | 1,246,420 | 3000 | 3,739,260,000 |
| Total income which can be obtained from all harvested crops | | | 139 126 406 853.15 |

Table 9 shows the amount of income which farmers would have received if they had decided to sell all their crop produces. It can be deducted from Tables 8 and 9 that the total amount of crops used for food per year by farmers living in wetland areas of the Kilombero valley were worthy TZS 54,507,821,838. 35.

3.3 CULTIVATED CROPS VALUES IN COMPARISON TO PERCEIVED CONSERVATION VALUES

With reference to Tables 2 and 5 above, it can be perceived that the total amount of income which can be obtained by farmers per year if all flood plain areas (TZS 279,762,386,140) under shifting cultivation is cultivated is more than the total amount which can be collected from the peoples' WTP per year to conserve flood plain areas (TZS 2,125,591,535.63) by reducing the area under shifting cultivation so as to increase water volumes in seasonal and permanently flooded streams, swamps and ponds in the flood plains. If farmers decide

to opt for a conservation intervention by sacrificing flood plain areas they are currently using for shifting cultivation, they will lose about TZS 277,636,794,600.39 per year from annual earnings in crop production. This huge loss may discourage farmers to opt for conservation goal of reducing areas under shifting cultivation and it may motivate them to continue uncovering fertile flood plain areas in the Kilombero valley for crop production.

Again quantification on the amount of crop sold by farmers in Kilombero and Ulanga districts for the year 2014 showed that the total amount of income obtained from selling crops was higher than the total amount of income for conserving flood plain areas in the valley. In a year, people are WTP a total of TZS 2,125,591,535.63 to conserve flood plain areas by decreasing/sacrificing the area currently used for shifting cultivation, yet in 2014 farmers living in wetland areas of the valley obtained TZS 84,618,585,014.8 from selling their crop produces (Table 8). Moreover, a total of TZS 139,126,406,853.15 could have been obtained by farmers living in the Kilombero valley in 2014 if they would have decided to sell all their crop products and not using any crop harvest for domestic uses (Table 9).

High income which can be obtained from crop production in flood plain areas of the Kilombero valley acts as an incentive to farmers to increase their agricultural activities in wetland areas. It motivates farmers to cultivate in more fertile land particularly in flood plain areas. This is because most farmers believe that the more they cultivate in the flood plain areas, the more food and cash crops they harvest; hence more income from selling the crops-the WTP value which is a proxy to the benefits they would accrue if they conserved the areas. The value declared for ecological benefit(for conserving flood plain areas) is too low to discourage farmers from cultivating these areas, and it cannot be enough to compensate or substitute they benefits farmers receive from degrading the wetlands.

Regarding the two folds, the developmental goal is worthwhile and attainable in the conservation of flood plain areas in the Kilombero valley through reducing the area under shifting cultivation orno shifting cultivation alternative and developmental goal through developing or expanding areas under shifting cultivation in the flood plain areas of the Kilombero valley. This is due to the fact that the amount of income which can be collected from peoples' WTP to conserve flood plain areas per year is too low which cannot be enough to justify to stop farmers from cultivating flood plain areas on which they have been depending for all their livelihoods. It will cost more to the government and other policy makers to deny farmers from cultivating the flood plain areas and tell them to pay the conservation fee through WTP for conserving flood plain areas. Most farmers obtain their income from selling crops. if the area under shifting cultivation is reduced, farm sizes will be reduced, which will in turn reduce crop harvests hence farmers' income as the result, farmers will have more reduced income to pay for conserving flood plain areas.

Again, these farmers depend much on their cultivated wetlands for food production. If the area is reduced or of shifting cultivation is stop there will be reduced food production which can lead to food insecurity to people living in wetland areas of the Kilombero valley. This will cause suffering to people and necessitate the government to use their limited finances to support rural communities in the valley. Moreover, reduced food production in the respective wetland areas due to reduced areas under shifting cultivation will affect food supply in other nearby urban areas and cities of Tanzania. It should be noted that the valley is among the major suppliers of crops especially rice to nearby urban areas and cities such as Dar es Salaam. Reduced rice production in the valley, according to the supply and demand theories, will cause scarcity of rice in the rice market and thus cause rise in price of rice; hence putting more pressure to consumers as they will have to raise more money to buy rice.

3.4 LIVESTOCK GRAZING VALUES IN COMPARISON TO CONSERVATION VALUES

According to MNRT (2007) 6.4% of the people living in wetland areas of the Kilombero valley own livestock and use wetland areas in the valley to graze their livestock. The total number of livestock owners in wetland areas of Kilombero valley is 27,528 persons, and the land used for grazing purposes is about 15,966.355 ha (Mombo, 2013). The continued grazing activities have degraded a significant portion of pasture lands and water resources in wetland areas of Kilombero and Ulanga districts. Overstocking of livestock have led to soil compaction, soil degradation, escalated soil erosion, destroyed river banks and water sources in the Kilombero valley; hence a call for sustainable management interventions. Again, a study done by Mombo (2013) found that the livestock WTP to conserve grazing lands in wetland areas of the valley for its better state is TZS 564.8 /ha/ month. Table 10 below shows the amount of income which can be collected in area to conserve grazing areas.

Table 10: Willingness to pay of the people in Kilombero valley to conservation grazing areas in the Kilombero valley into better/ natural state

| Total number of ha used for grazing | WTP per ha per month in TZS | WTP per ha per year in TZS |
|-------------------------------------|-----------------------------|----------------------------|
| 15,966.355 | 9,017,797.304 | 108,213,567.6 |

(Source: Mombo, 2015)

A total of TZS 108,213,567.6 can be collected per year from livestock owners in the valley to conserve grazing lands.(Table 10). This amount can be used to rehabilitate the already degraded pasture lands through range management, trees planting, land use plans for example, making zones or demarcations in some areas to restrict livestock keepers from grazing in those areas until they are fully rehabilitated.

On average each livestock keeper is willing to pay TZS 327.58 or TZS 3,931.03 to conserve grazing areas per month or year respectively. This amount is very realistic as in most cases the average household consumption expenditure in rural areas of developing countries like Tanzania is TZS 20,000 and TZS 240,000 per month and year respectively, so the grazing areas conservation charges fall within the household budget in rural areas.

Introduction of grazing areas conservation charges will create a win-win situation by improving the quality of pasture lands which will, in turn, improve livestock production and increase income to livestock keepers.

In addition, conservation of grazing lands will ensure availability of healthy pasture lands hence minimizing usual conflicts between livestock keepers and farmers in Kilombero valley as in most instances livestock keepers do invade farm lands in searching for greener pastures for their livestock. Farmers- livestock keepers' conflicts have resulted into loss of properties and fatalities to people in wetland areas of the Kilombero valley. The usual farmers- pastoralists' conflicts necessitate a need for joint efforts to conserve grazing lands so that pasture lands can be able to feed livestock even in dry conditions of the year.

3.5 LIVESTOCK PRODUCTION IN GRAZING AREAS/WETLAND AREAS OF THE KILOMBERO VALLEY

Table 11: Livestock production in wetland areas of Kilombero valley for the year 2015

| Type of livestock | Number of livestock kept/grazed |
|--------------------------|---------------------------------|
| Cattle | 260,000 |
| Goat | 216000 |
| Sheep | 43940 |
| Pig | 78408 |
| Chicken | 2,774,7000 |
| Others i.e. duck, rabbit | 41930 |
| Total | 3,414,978 |

(Districts data)

Table 11 shows a total of 3414978 livestock are kept/grazed in wetland areas of Kilombero valley. Chicken are the most kept by households in their homesteads while cattle are the most grazed livestock in 2014. These livestock are used by households for both subsistence and income generation purposes.

Table 12: Livestock used for subsistence and income generation purposes in Kilombero valley for the year 2015

| Type of livestock | Number of livestock kept/grazed | Number of livestock used for subsistence | Number of livestock sold | Number of livestock remained after selling and subsistence use |
|-------------------|---------------------------------|--|--------------------------|--|
| Cattle | 260000 | 28106 | 38428 | 193440 |
| Goat | 216000 | 16351 | 22896 | 176731 |
| Sheep | 43940 | 2271 | 9842 | 31816 |
| Pig | 78408 | 2265 | 41477 | 34656 |
| Chicken | 2774700 | 907327 | 856827 | 1010268 |
| Others | 41930 | 21493 | 6046 | 20403 |
| Total | 3414978 | 977813 | 975516 | 1461649 |

Table 12 details how livestock keepers in wetland areas of the Kilombero valley depend on livestock for their livelihoods as they use some of their livestock for subsistence uses such as food, bridal payment and making spiritual sacrifices. They also sell some of their livestock to get income to support their households, and they maintain a large number of their livestock for future uses. The significance of livestock to people living in the Kilombero valley implies that it is not plausible to stop them from grazing activities despite the negative

environmental effects resulted from their grazing activities as they obtain some of their food and material supports from livestock grazed/kept in the valley.

Table 13: Income generated from livestock selling in 2015 in wetland areas of Kilombero valley

| Type of livestock | Number of livestock sold | Price of each livestock (TZS) | Amount obtained from sold livestock (TZS) |
|--|--------------------------|-------------------------------|---|
| Cattle | 38428 | 350000 | 13449800000 |
| Goat | 22896 | 65000 | 1488240000 |
| Sheep | 9842 | 45000 | 442890000 |
| Pig | 41477 | 120000 | 4977240000 |
| Chicken | 856827 | 6000 | 5140962000 |
| Others | 6046 | 5000 | 30230000 |
| Total income received from selling livestock | | | 25529362000 |

A total of TZS 25,529,362,000 were collected by livestock keepers living in wetland areas of the Kilombero valley in 2014 from selling of their livestock (Table 13). This huge amount of income was used to support their living, to take a good care of their livestock and savings for future family expenditures. The great amount of income collected by livestock keepers shows a great potential of the Kilombero valley as grazing land area. This therefore supports sustainable management of the valley to accrue more agro- benefits for people living in Kilombero valley which will help to spur more socio-economic development within the area. Livestock also provided other products such as milk, manure and leather which all together add income to the farmers in the valley. In addition, livestock and livestock products were sold in markets within and outside Kilombero and Ulanga districts. The government through the ministry of Agriculture and Livestock development needs to look for better agro-markets outside the country and value chain addition techniques for livestock products such as meat, milk, and leather. This will help to improve the quality and value of livestock and other agro- products hence increasing farmers' income and improve their living standards.

3.6 INCOME RECEIVED FROM LIVESTOCK IN COMPARISON TO PERCEIVED GRAZING LANDS CONSERVATION VALUES

Referring to Tables 10 and 13 above, it is obvious that people in Kilombero wetland areas were willing to pay a total of TZS 108,213,567.6 per year to conserve grazing lands while livestock owners earned a total of TZS 25,529,362,000 from selling their livestock in the year 2015. Again, Tables 10 and 13 reveal that more income is generated if the valley is used to graze livestock rather than if grazing practices are stopped and the valley is turned or conserved to its original natural state. Given peoples' dependency on livestock or livestock products for food and income generation in the wetland areas of the Kilombero valley, it is not economical to stop people from conducting grazing activities in the valley rather than the policy makers' need to integrate the two options, introducing payments of grazing areas conservation charges and continuing with sustainable grazing practices in Kilombero valley.

Introduction of grazing areas conservation charges will thus help to collect a significant amount of money shown in Table 10 which can then be used to rehabilitate degraded/ disturbed grazing lands in wetland areas of

the valley. The amount can also be used to train livestock owners on sustainable livestock keeping techniques which will then improve their livestock products and grazing land.

Either way, the responsible management can deduct the grazing land conservation charges from the total amount obtained from the selling of livestock and livestock products per year. The success of this will depend more on the marketing mechanisms which will be used to sell livestock products, more benefits are expected if livestock products are sold in cooperative markets or formal market systems. Integration of the two options will result in improvement of farmers' income or living standards together with sustainable management of pasture lands in wetland areas of the Kilombero valley.

4. CONCLUSIONS AND POLICY IMPLICATIONS

From the study we learn that, land use policies that do not consider policy mix are most likely to be unsustainable since the rural communities livelihoods in developing countries entirely depend on primary natural resources. This study thoroughly demonstrated that the Kilombero rural communities entirely depend on naturally rain-fed farms and graze their livestock on natural pastures.

The study found that, even when the WTP of the users can be regarded in instituting fees, the amount to be collected from the perceived conservation values to enhance conservation activities in the flood plain areas will not be enough to rehabilitate the degraded flood plains and compensate farmers who have always been depending on these flood plain areas to cater for almost 100% of their daily needs. The study therefore suggests that, it is better to integrate the two (conservation and livelihood) by introducing WTP for conserving flood plain areas and at the same time allowing the developmental goal through continuing crop production with appropriate technologies in flood plain areas of the Kilombero valley. It is therefore imperative before restricting people to access the natural environment to first device means through which they can depend on alternative livelihoods than the natural resources.

However, their livelihoods are culturally embedded (e.g shifting cultivation and pastoralism) implying that the introduced changes should not revolutionise their lifestyle but should rather evolve with their social structures. For example training of young generations through formal schools will transform the generation and make them adapted to appropriate technologies on crop and livestock farming. This means the enrolment to formal and technical schools of children from these communities should be aided with cash that is to be collected from the proposed fees for the conservation. Consequently, the government and other stakeholders should make sure they improve farming conditions and looking for better markets for farm produces within and outside the country. Once agro- markets are improved, farmers will be able to obtain high income, as the case of TZS 84,618,585,014.8 which was earned by farmers in 2014. From the collected amount from crop selling, the

responsible authority should collect peoples' WTP for conserving flood plain areas in which TZS 2,125,591,535.63 need to be collected per year.

Either way, they can start collecting a flood plain conservation fee of about TZS 411.8 or TZS 4,941.68 per month and year respectively from each farmer in the valley to conserve flood plain areas. The collected WTP amounts should be used by the responsible authority like Tanzania Wildlife Authority to rehabilitate the already degraded flood plain areas in the Kilombero valley. This can be done through introducing land management interventions, to train farmers on sustainable crop production methods and give environmental conservation awareness to farmers and people living in wetland areas of Kilombero Ulanga and Malinyi districts. In so doing, sustainable crop production and conservation of fragile ecosystems in wetland areas of the Kilombero valley will be ensured; hence increase in farm produces and sustainable management of flood plain areas.

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