ESTIMATING DIRECT USE VALUE OF KILOMBERO RAMSAR SITE BASED ON MARKET PRICE METHOD

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ABSTRACT

Kilombero Valley Flood Plain Ramsar Site (KVFPRS) with an area of 796 735 ha supports about 400 000 inhabitants. The valley is subjected to extensive expansion in direct resource based extractions threatening its ecological integrity due to limited use of valuation of ecosystem services in decision making on its sustainable management.. This study estimated the direct use value using a market price method. Sources of information were household questionnaire in which a sample of 490 households was used. Other sources of information were from literature searches, focus group discussions and visits to local markets. For each studied activity, the percentage of participating households was identified, data on what they produce, and cost of production, and net benefit, were calculated at household level and the values were aggregated across the whole population. The total aggregate value of the wetlands was TZS 152 billion. The largest contribution came from rice production (56.6%), sugarcane production (20.8%), forest products (13.2%), fishing (2.9%), livestock (2.6%), bush meat (0.5%), brick making (1%) and thatch grass (2.1%). This information can be used in designing management options associated with costs and benefits involved in each option for wise use of KVFPRS.

Key words: Valuation of ecosystem services, wetland resources, market price, utilization status, society welfare

INTRODUCTION

Wetlands are among the Worlds biological productive ecosystems that supports life. They provide multiple direct and indirect ecosystem services such as food, fuel wood, fish, wildlife and many more benefits which represent important part of the economy (ten Brink *et al*. 2013 MA 2005). In Tanzania, 10 % of the total land area comprise of river flood plains, lake systems and deltaic mangroves. But these resources are continually being degraded due to expansion of irrigated agricultural land, urbanisation and pollution both at international and local level (Brink *et al*. 2013, de Groot *et al.* 2006, MNRT 2004).

Global wetland conservation efforts were initiated through the Ramsar Convention of 1971, which called for "wise use" of all wetlands through local, regional and national actions and international co-operations. Tanzania ratified to the convention in 2002 and to- date, has designated four Ramsar Sites with 4,868,424 ha. These sites are Malagarasi-Moyovosi (3,250,000ha), Lake Natron (224,781 ha), Kilombero Valley Flood Plains (796,735 ha) and Rufiji-Mafia-Kilwa Marine Ramsar Site (596,908 ha), Lake Nyasa is a proposed Ramsar Site and efforts are being undertaken for designation(MNRT, 2004). Designation of wetland is not the end in itself, rather is to have a it's sustainable use and functioning of its ecosystem services. This is important aspect in fostering development and wellbeing which rests on the management and policy decisions.

Sustainable management of wetland resources depends on among other factors understanding of their economic values (de Groot *et al*. 2006; Schuyt 2005). Economic valuation not only helps to raise awareness among the surrounding communities about wetland benefits in decision-making, but also awareness helps to improve local institutions that manage resources; identify better markets and resource management options for wetlands and their products; and investigate people's livelihood strategies and how these determine the constraints and options for making wise use of wetlands (Guijt and Hinchcliffe 1998).

Despite being a declared Ramsar site, KVFPRS is still under degradation (Munishi *et al.*, (ibid), Mombo 2013, McCartney and van Koppen 2004, MNRT 2004). Based on the economic nature of activities being carried out in the wetlands, Barbier *et al.* (2007) suggest for economic valuation to be undertaken in order to sustainably manage the resources for the present and future generation through providing the extent to which the resource is being exploited and be able to advise on effective management options. Based on Brutland report, there is no development that can be achieved on deteriorating environmental base. Absence of valuation information is among the constraint to sustainable management of KVFPRS. This study therefore, aimed at estimating the direct use values of KVFPRS based on resource economic activities using a market price method.

METHODOLOGY

Description of study area

According to Ramsar Information sheets, KVFPRS is covering approximately an area of approximately 796 735 ha. The central point coordinates are 8 °40' S and 36 °10' E. KVFPRS lies between 210 and 400 m.asl with the main part of it lying at 210 - 250 m.asl. KVFPRS is the largest inland fresh water wetland in low altitude and is divided by the Kilombero River and falls into two districts: Kilombero and Ulanga. KVFPRS boundary is a watershed boundary rather than administrative boundaries; as such KVFPRS is treated as one entity. The KVFPRS has a total of 108 villages with 72 villages in Kilombero and 36 villages in Ulanga. This means not all the villages in Ulanga and Kilombero Districts are covered in Ramsar boundaries as indicated in Figure 1.

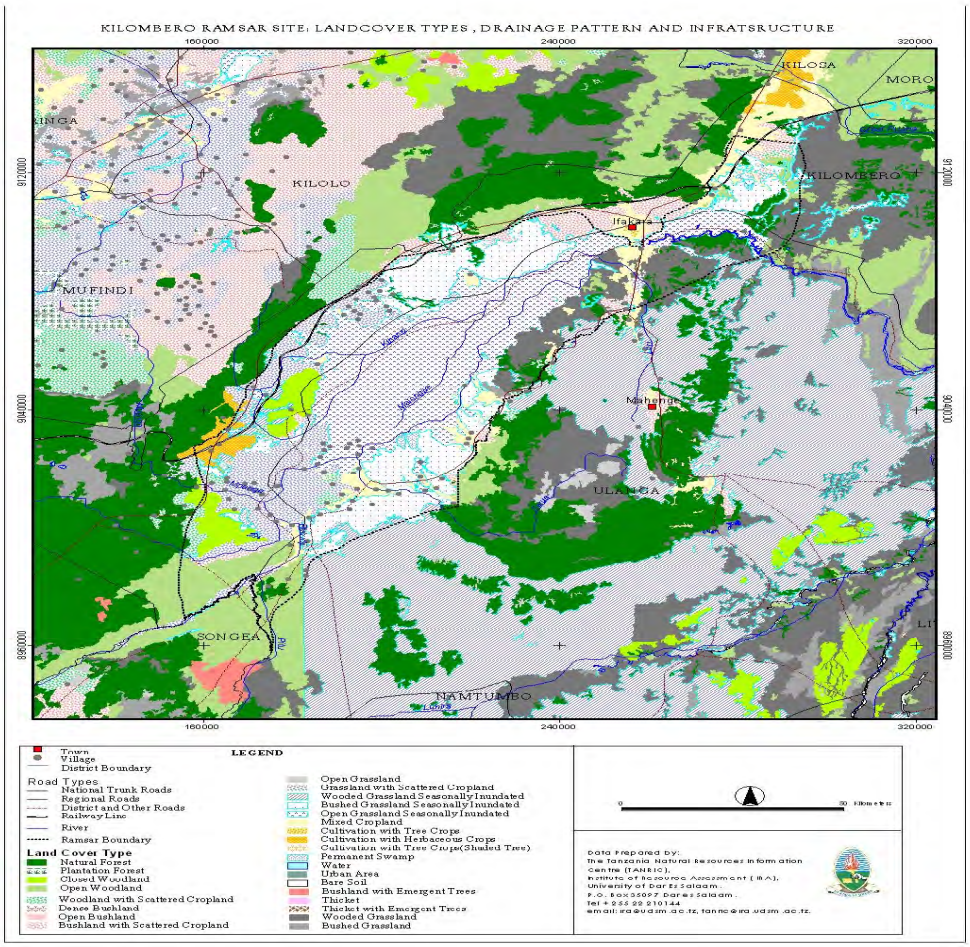

Figure 1: Map showing the Ramsar site resources and infrastructure.

Source: Institute of Resource Assessment, Dar es Salaam (2008)

The KVFPRS supports human population of about 400 000 people equivalent to 80,000 households who depend on direct and indirect ecosystem services from the KVFPRS. In the KVFPRS, there is a noted population increase of 3% per annum (URT 2008), poverty levels of about 60% (NBS 2011), and increase in upstream activities which may impact negatively on KVFPRS.

Methods for data collection

Total economic value

A Total Economic Value (TEV) framework was used in the valuation of the direct use of KVFPRS. The TEV of a change in quality or quantity of ecosystem function is measured as the aggregate of affected individual preferences stated in terms of their willingness to pay/willingness to accept to get or avoid the change. TEV has been used as the most common framework for wetland values (Barbier *et al.,* 1997, de Groot *et al.,* 2006). Broadly speaking, values of wetland ecosystem as it is for other ecosystems can be grouped, as human values and non-human values. Human values refer to what people consider to be the values of the wetland to them, and include (a) *use value*: direct use value, indirect use value (ecological values), quasi-option values, and (b) *passive (non-use) value:* existence value (satisfaction that the resource is there), quasi-option values, and vicarious values i.e. future use for the present generation, and use by the future generation-also called bequest value (Bateman *et al.* 2003; Pearce and Özdemiroglu 2002).

Direct use value is further subdivided into *direct extractive use value* e.g. agriculture, fishing, forest products harvesting, thatch grass collection; and *direct non-extractive use value*, Indirect use values (ecological values) include: flood control, water catchment, and waste assimilation. The quasi-option value (which is more frequently confused with "option value") refers to the value the *society* would place on the forest if all new its complex functions. On the other hand, "option value" refers to a future *personal* value due to uncertainty according to Bateman *et al.* (2003). Fackler *et al.* (2007) also introduced a new concept called *real option value* which, according to them, is equivalent to quasi-option value, and is concerned with the value of the resource contingent on whether decision making on the resource use is now or delayed. Bateman *et al.* (2003) posit that the forest/woodland resources have their intrinsic value (non-human values)-value of the resource in its own right. The TEV framework is presented in Figure 2.

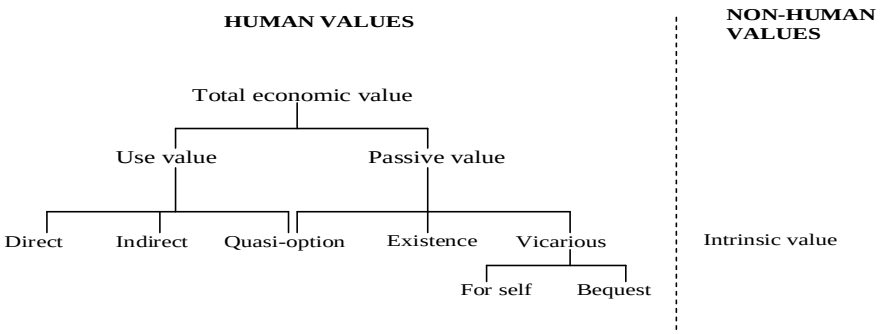

Figure 2: Components of total economic value of wetlands As used in the valuation of KVFPRS
Source: Adapted from Bateman *et al.* (2003)

The market price method

Market price method was used to determine total direct benefit of the economic activities taking place in the wetland. This method estimates the economic value of ecosystem products or services that are bought and sold in commercial markets (Barbier *et al.*, 1997). The market price method can be used to value changes in either the quantity or quality of a good or service. The welfare change associated with a change in the price of a marketed commodity is often measured using the change in consumer surplus, derived from the Marshallian demand curve with a constant level of income in welfare economic theory.

Challenges of using market price to reflect environmental costs and benefits stands from the fact that wetland resources are seen as public good and externalities. Public goods are characterized by the fact that: (i) no one can be effectively excluded from consuming them and (ii) increased consumption of the good by one individual does not diminish the amount available to another person. Where prices do not reflect all costs and benefits, the so called "invisible hand" pioneered by Adam Smith, is that the market does not work and resources may be used inefficiently, resulting in a loss of human welfare. Externalities are uncompensated costs or benefits arising from economic activity. Emerton, 1998 highlights issues of market price distortion due to imperfect completion which may arise due to price ceiling setting, taxes, exchange rates controls, monopolies and subsidies. Thus, making its ground in welfare measures inconsistency which may lead to over or underestimation of values (Brander *et al.*, 2013).

Household survey

Data for the valuation exercise were collected from representative sample of households in the KVFPRS. A total of 10 purposely selected villages were used for the study in Kilombero Ramsar site. In selecting villages, a random sampling was employed and had representation from each sub-village using village register. Then, with the help of village leaders, identified selected household for the interview. The sampling intensity of 5 % was employed. A total of 490 households were used in the study. Household questionnaire covered: identification variables, household characteristics (gender, age, marital status, education level, and main occupation), land issues (size, type of ownership, price and location), economic activities engaged, quantities produced and consumed, time used to collect their materials and their prices. The prices of different products were collected at farm level and from the markets. Other means of data collection include literature search in KVFPRS offices, focus group discussions, district councils' office and Sokoine University library.

Data analysis

The study estimated the direct use value derived from resource based economic activities carried out by local communities in KVFPRS such as agriculture (rice and sugarcane production), livestock production, fishing, forest product harvesting, bush meat hunting, brick making, thatch grass collection and water for domestic use. Microsoft Excel computer program was used to analyze the participating households in each activity. For each studied activity, quantity produced (units), quantity consumed at home units), overall cost of production (units) and quantity sold in the market (unit price) was determined. Labour was defined as 1 working day mostly 8 hours with payment of TZS. 2500 in 2010 based on the government rate of hired untrained labour in villages. The net value was a result of subtracting total costs of production from gross benefit for each activity. Then, aggregation of net benefit of studied activities was done based on affected population in KVFPRS. Calculations were guided by formulae 1 and 2.

$$DNUV_i = \sum \left(P_i Q_i - C_i\right) \quad \ldots\ldots (1)$$

Where: DNUV*i* = Direct net use value for activity *i*, P_i = Average prices of products, Q_i = Amount of product i, C_i = Cost involved in producing product i.

Therefore, the aggregated net value of direct benefit derived from KVFPRS was calculated guided by equation 2.

$$\sum \%hh_i x DNUV_i x HH \quad \ldots\ldots (2)$$

Where: %hh- Percentage of sampled households engaged in direct activity *i*, HH = Total household in the KVFPRS, $DNUV_i$- Average net income earned from activity *i*.

RESULTS AND DISCUSSION

The results are presented from direct resource based economic activities which were carried out in KVFPRS. These were agriculture (rice and sugarcane production), livestock production, fishing, forest product harvesting, bush meat hunting, brick making, thatch grass collection and water for domestic use.

Direct use value of rice production.

Rice growing was practiced by 90% %of the sampled population. Rice production was mostly done in swamps and flooded alluvial fans. The production period mostly starts in October and ends in May. Land holding under

rice mostly ranged from 0.25 to 1.6ha and differed in terms of access and size across villages. Msolwa and Lumemo have much constrained lands within vicinity of their villages. Msolwa residents migrate to Katulikila and Mgeta because the areas which were once used for rice in Nyange were converted to sugarcane production. Lumemo residents have to travel 30-50 km to Nyamhala and Namwawala in search of rice farms. There was noted increase trend on increased incidences of detrimental flooding to alluvial fans to the extent that farmers call them as "*Kufa basi*" meaning there is no alternative rather than using the depleted and flood prone fan which make even the security of harvesting in jeopardy noting the extreme flooding of 2008. The importance of maintaining ecological environment for paddy production was also noted by Kato,(2007).

The costs of rice production included fixed and variable costs totalling to TZS 300,000 per acre as indicated in Table 1. Major costs of production incurred were on labour, farm inputs and transportation. Land rent has been included in calculation based on the fact that majority of household own small patches of land and the trend was towards renting. The same trend also was observed by Kadigi *et al.*, 2004. These costs calculated were based on acre of land which is the common land size used at village level.

Table 1: Estimated cost of production for rice in KVFPRS

Estimated Input cost	Unit Cost
Land rent TZS/ acre	30 000
Farm preparation TZS/acre	35 000
Water	-
Sowing TZS/acre	30 000
Seeds per acre	5 000
Fertilizer	18 000
Hand hoe	15000
Weeding per acre	25 000
Pesticide	3 000
Bird scaring	-
Harvesting per acre	20 000
Heaping per acre	15 000
Packaging per acre	20 000
Winnowing @2 000/bag	20 000
Bags@ 600/bag	12 000
Winnowing mats	10 000
Transportation@ TZS. 2 500/bag	30 000
Crop levy @ 500 per bag	6 000
Storage @ 500/bag/month	6 000
Others*	
Total cost	**300 000**

*Include costs of transport, building hut in the field provided by household

It was found that at the start of the season a considerable number of farmers do not have funds to start up their farming activity. They have to borrow money from business men who in turn are paid in terms of rice bags. For example for every TZS. 45 000 one has to pay back 3 rice bags. Such borrowing indicates high interest rate. Average production was about 12 rice bags/acre (30 bags/ha).The price of rice ranged from between TZS. 30 000 to 70 000 per bag during harvesting season, the variation was in reverse along the gradient as you go deeper into core wetland areas. The average price was TZS. 50 000 per bag of rice of 70 kg the average farm gate price. Estimated household benefit was TZS. 300 000 per acre lower bound based on land size of 0.2 Ha to TZS. 1 200 000 for higher bound of 1.6ha. Corresponding benefit at the sampled household and the total population in the KVFPRS were as presented in Table 2.

Table 2: Direct benefits from rice production in KVFPRS

Sample Household		490
Percentage of sample		90
Households in KVFPRS		80 000
Land used (acre)		
Household	Minimum	1
	Maximum	4
Sample	Minimum	441
	Maximum	1 764
Population	Minimum	72 000
	Maximum	288 000
Productivity bags/acre	Average	12
Production cost/acre		300 000
Average Price TZS/bag.		50 000
Net benefit		
Household	Minimum	300 000
	Maximum	1 200 000
Sample	Minimum	132 300 000
	Maximum	529 200 000
Population	Minimum	21 600 000 000
	Maximum	86 400 000 000

In terms of contribution of rice production to household income, considerable income is derived from rice production, the same was observed by Yanda, *et al.* 92005) and Kato (2007). The result on productivity was in agreement with what Kato (2007) found, however differs from what Yanda *et al* (2005) found in Ngaiti wetland of 10.27bags and 2.81bags in Kitaalo wetland. Reasons for difference may be attributed to wetland type, ecological function of the wetland, price of inputs, types of seed varieties used and diseases. Low productivity results also concurred with the results by Match Maker Ltd (2010) which indicates the gross margin profitability in rice production in the variation from negative to 27%.

Direct value of sugarcane production

According to the current study, sugarcane was only cultivated in lowlands of Msolwa Station and Ikwambi villages and is practiced by 11 % of the sampled households as out growers. Production costs include land preparation costs, farm inputs (herbicides, fertilizers), labor (farm preparations, weeding, cutting, loading and offloading of sugarcane), crop levy, cooperative fees, infrastructure and transportation costs. The total cost per acre was estimated at TZS 600/-. The household net benefit was estimated at TZS 1 440 000 per year. Corresponding value for the sample and entire population was as indicated in table 3. In the study area, Sugar cane production was increased in year 2001/02 following privatization of Kilombero Sugar Companywhich required much supply of sugarcane from out-growers.Thus, due to attractive price of sugarcane, the nearby villages in both Kidatu and Mang'ula Division put considerable land under sugarcane production with most of respondents producing sugarcane under 2 Ha. The study found that for properly managed sugarcane farm produces between 50 and 60 tons/acre while most of farmers manage to produce between 21and 30tons/acre and sold at 32 000 per ton depending on sucrose levels (10 being the best and hence good price and between 9and 8 having low levels and hence low price). Despite the low productivity, the industry also suffers from limited processing plants. In focus group discussions respondents revealed that not all sugarcane is purchased from out growers in particular year this depends much on what is required by the sugarcane processing plant. This is because Illovo Company is the sole processor of sugarcane in the area.

Table 3: Direct use benefit and area used for sugarcane production in KVFPRS

Sample households	490
% of sample engaged	11
Household engaged	54
Area cultivated by household (acre)	
Minimum	4
Maximum	10
Area under sugarcane by sample(acre)	
Minimum	216
Maximum	539
Average production cost /acre	600 000
Average production tons per acre	30
Average price/ton(TZS)	32 000
Area under sugarcane by population (acre)	
Min. acreage	35 200
Max. acreage	88 000
Estimated household value	
Minimum	1 440 000
Maximum	3 600 000
Estimated sample value	
Minimum value	77 760 000
Maximum value	194 040 000
Estimated population	
Minimum	12 672 000 000
Maximum	31 680 000 000

Sugar cane production is the main source of sugar for both export and domestic consumption. Currently, sugarcane is grown both by the sugar processing factories (SPF) as well as out growers (CG). In Tanzania, sugarcane production per year is 1.5 million tons. The total current sugarcane production in Tanzania is below the country's annual demand for the commodity (URT 2009). Currently, investments in sugarcane are attracted into other villages and divisions within the floodplain. Records for example in Kilombero District indicate that a land bank of about 13 923 Ha has been set aside in Ruipa River Basin, Mofu, Mbingu, Namwawala and Ngalimila that can be used for different uses such as construction of sugar processing company, sugarcane farming, and rice farming (DED 2008).

Direct use value of thatch grass

In the study area, 5 % of respondents were engaged in thatch grass business. The main grasses used are *Panicum maximum* and *Pennisetum* spp. These are found and harvested from grasslands. Grass provides roofing materials to most of the households in the study area. The business was carried out annually mostly after rain season May-June. That grass harvesting lasts for about three months before setting of wildfire by farmers when opening up new farms. The production costs involve harvesting tools such as sickle and ropes, transportation and labor.

For traders, this activity usually is carried out in family or hired labor or piece work. In a day one can harvest up to 30 head loads. The annual average benefit for the household is estimated at 800 000 with a sample value of TZS. 19 600 000 and population value of TZS. 3,200,000,000.

The effect of grass extraction to ecological health of KVFPRS is not directly established; rather it is the conversion of grassland to agricultural lands which threatens their availability. Scarce availability may lead to shooting in local price and shift to other roofing materials like iron sheet which may not be reached by most farmers, if so the value of thatch grass is equivalent to the value of iron sheets through a replacement cost approach.

Direct use value of forest products

The KVFPRS is endowed with forests and woodlands which cover about 11% of the area. (MNRT 2005). There are sixteen forest reserves in the catchments of the Kilombero valley with ungazetted patches of low altitude, ground water and strips of riverine forests. Miombo woodland is found on the lower and mid slopes of the valley. The forest within

Udzungwa National Park were still in relatively good condition but degradation has taken place in all of the other reserves as well as public forests as the result of illegal logging and farmland encroachment. Sampled households depended on these forestry resources through sale of various wood products including charcoal, timber, carvings, traditional medicines, withies and poles.

This study estimated direct values from timber and fuelwood and charcoal. The actual harvest was partly estimated from the questionnaire and information from catchment forest manager in Ulanga and Kilombero districts.. Potential values, in the form of allowable cuts and maximum sustainable timber yields, were taken from the literature. Results from the study indicated the wood based dependence of 90 % for firewood and construction materials mainly poles and timber and 70 % for charcoal.

Based on Kaale (2005), $1m^3$ of wood is equivalent to 725 kg of firewood and Amous (1999) estimates that $1m^3$ of wood is equivalent to 165 kg of charcoal. The study results indicated that 3 tins of charcoal about 0.5 kg were used per day the price for tin was TZS. 500 while 1 bundle of firewood about 6 kgs was used for two days. Cost for 1 bundle was TZS. 1 000. The average use of timber per household was 0.00190m3 in year and the price of timber was TZS/m^3 450 000. Thus, the value of charcoal stood at TZS/year 15,330 000 000. The value of firewood stood at TZS/year4 730 400 000 TZS. /year and the value of timber stood at TZS/ year 68 400 000. Aggregate value of wood based resources on conservative estimates stood at TZS/year 20 128 800 000.

The revenue from forests and related products realized by the district councils based on the district councils report was TZS. 32 766 310 in 2007 and about 27 299 356 in 2008 for Kilombero district. This amount is far below of the calculated value indicating that a considerable amount of forest products which were harvested were unregulated. The result may be deteriorating forestry resources. The deterioration was also noted by the inventory report by MNRT (2005) conducted in forests in Ulanga and Kilombero districts. The report revealed illegal activities such as wood harvesting and encroachment into the forest areas. Illegal and legal procedures are being followed in the harvesting of forest products. Legal in the sense that one has to be registered trader and pays all the related fees and royalties despite the fact that in catchment forests no harvesting is allowed but due to lack of capacity by the catchment office to undertake patrols the conditions continues.

Direct value of fishing

The Kilombero river system is of crucial importance as a breeding and nursery ground for fish in the whole of Rufiji basin.. Fish in Rufiji river system migrate upstream to spawn usually at the beginning of rain in November. The peak spawning activity has been recorded in the valley in between November and December period. Some fish species found in the River are *"Kitoga"(Bagrus docmack), "Kambale"(Clarias gariepinus), "Perege"(Oreochromis niloticus), "Njege" (Hydrocynus vittatus), "Ndungu"(Distichodus petersii), "Perege" (Oreochromis ssp)* and *"Bura"(Schilbe moebiussi*

The results show that fishing activities were mainly carried out by 22 % of the sampled population. Fishing was mainly carried out in both permanent and temporary fishing camps along the Kilombero River and its tributaries. At the time of the study, there were 33 permanent camps some in the upstream and others downstream. Currently, a total of 26 Beach Management Units (BMU) have been established with minimum of 30 fishing boats in the following villages signal (Mbuti), Kivukoni (Mikeregembe, Mhehe, Abdalangwila, Ilua, Migude, Senga, Funga), Lumemo (Kahema), Mahutanga(soko madola), Spiti- milola, ngwesi fungusi, Ngwamba DC Idete Gundu and Ruipa Mbingu, Butihama Iragua, shetela Kilongwe – Mofu Kihanji itembo – Itete njiwa, Mamba Mkangawalo, Fibwe - Dinari Mngeta, Dungu, Nailimbo, Keta - Merera.

On average each camp has a minimum of 80 fishermen. Fishing season mainly started in June and ends in February, lasting for almost about 250 days. However, in this study, basing on the fact that 16 days are recommended per months for fishing, we used a total of 125 days as effective fishing days. The production cost for fishing involve hiring/buying a dugout canoe, fish nets, ropes, fish trap, paying

registration fee, labor cost, bringing the average cost of TZS. 22 000 per trip with average 2 trips within 24 hours. The average catch per trip was about 16 fish. Pricing is according to fish size regardless of species type. Grading was done based on fish width established locally by fishermen Grade one fetched TZS. 1 200 to 2 500, grade two fetches TZS.800 to 1 100 and grade three fetches TZS. 500to 700 at fishing camps. Average price at fishing camp was TZS. 2 000. The estimates gave an average annual net benefit of TZS. 2 500 000 per fisherman. Gross income per fisherman was in area range of TZS. 30 000 - 300 000 TZS. per day depending on the season. Net benefit estimated for the sampled population was TZS. 269 500 000 with population estimate of TZS. 4 400 000 000.

Plate 2: Fishing at Mikeregembe Fishing Camp in Kilombero River

At the fishing camp, women were mostly involved with fish cleaning and smoking. Smoked fish were transported to other regions of the country including Dar es Salaam, Ruvuma, Morogoro and Dodoma.

The industry is constrained by an increase in siltation levels caused by upstream woodland clearing, climate change factors, use of improper techniques which has implications on the resilience of wetlands themselves and their allied biological resources like fish. For example, the use of *seine* nets in the Kilombero River have led to the over exploitation of fish, and destruction of riparian areas thus reducing the productive capacity this wetland impairing its support to local peoples' livelihoods. Other serious issue includes the use of poison (such as Furadan) in fishing which does not only affect biodiversity but it also affects water quality (MNRT 2004).

Direct use value of brick making

Brick making is practiced by about 5 % of the sampled households. In studied villages, there are specific areas used for soil extraction and mud brick making. Good housing was one of the indicators of wealth in the studied villages. Improved housing by using mud bricks has boosted business in mud brick making in villages. In Katindiuka village, Mgwalu area an approximately area 2.73 ha was used. The cost of production included cost for moulders, labour cost and firewood and rice husks. The cost estimates for producing 10 000 mud brick was as follows:

Moulders TZS. 10 000, labour for molding at is TZS 15 per brick, labour for shifting per brick, labour for arranging in a tunnel is TZS. 10 000 for every 2 000 bricks, firewood approximately $4m^2$ (two tellas) at TZS. 20 000, labour cost for surveillance TZS 200 000. Bringing a total cost at TZS. 600 000. Price

per brick is T shs 70 - 100 for wood based energy and TZS. 30 - 50 for rice husks based energy. Net benefit from brick making is about TZS 400 000 and one can make a maximum of 2 brick tunnels in a year. The net benefit estimated at sampled household level was TZS 9 800 000 and at population level was TZS 1 600 000 000.

Plate 3: Brick firing in Katindiuka village in Kilombero Valley Floodplains Ramsar site

Direct use value of livestock keeping

About 5 % of the population is engaged livestock keeping; and include livestock kept include goats, sheep and cattle. The study focused on cattle. Free range grazing is practiced in grasslands, bushlands and swamps. However not all villages have cattle in KVFPRS. Households had herd sizes of about 1 to 100 cows per household. The study found that the price for livestock ranged from TZS.100 000 - TZS. 600 000 per cattle and for milk is between TZS. 200-TZS. 300 per litre. Livestock keepers also engage in agricultural activities and are allocated with grazing areas within their villages based on village land use plans. Estimated cattle in study villages are between 245 and 24 500. The data show that on average two cattle are sold per herd. Cattle sale is done in organized local markets and supports the booming '*nyama choma*' industry in the surrounding regions. Calculated the annual population benefit stood at TZS. 4 000 000 000.

Direct use value of bush meat

In the study area about 5 % of the sampled population are engaged in bushmeat business especially trophies though some do it for subsistence. Sources of bushmeat was from both Kilombero South and North hunting blocks., catching of stray animals especially those which tramp onto crops, swamps, river, wooded grassland, national parks and from Selous Game reserve. Sale of bushmeat sale was done locally within villages and Ifakara town and in some fishing camps. This study could not establish the quantity of bushmeat transported to other parts of the country.

The price for bushmeat ranged from TZS. 2 000 to 5 000 per Kg depending on availability on average one can earn an average of TZS. 200 000 per year. Cost of production involved hunting tools and labor. . Estimated net earnings for the sampled households per year was TZS. 4 950 000 with estimated population net benefit of TZS. 800 000 000.

Direct use value of domestic water

In the sampled population about 70 % of the population gets domestic water from tap, well and directly from the river. Local people were organized in water users association (WUAs) in a community well which is paid 500/month regardless of number of bucket of buckets collected. We are using this fee as price of water. If one buys a bucket of water was sold at TZS. 10 – 20 per bucket of 20 litres this was only labor cost. Estimated use of water was about 15 buckets per day per household. On average household uses about 108 000 litres per year which gave a price of TZS. 0.056/lt. Sample water consumption was estimated at 37 044 000 litres of water per year, extrapolated to population living in KVFPRS of 80 000, then litres of water consumed was 6 048 000 000 litres per year with the total value of TZS. 338 688 000. The current data indicated a deforestation rate of about 30 %, thus a reduction in available water for 30 % (MNRT 2005). If the reductions continues then, the communities may be forced to use other sources of water such as borehole construction was estimated to cost about TZS. 20 000 000.

Aggregation of direct use value for the KVFPRS

Aggregating the direct use values from the studied activities stood at TZS 152, 545,680,090. The value can be translated at TZS 1,906,821.00 per household per year. These results are different from what the study by IUCN in Mtanza – Msona village found when estimating direct wetland use value which was TZS 226 million and TZS 528, 353 per households per year (Kasthala *et al*. 2008) can be due to the omission of other benefits derived from the KVFPRS and the socio-economic setting of the area. Analysing the dominance contributions of these activities in %age, rice cultivation contributes about 56.6 %, sugarcane growing 20.8 %, forest based products 13.2%, Fishing 2.9%, cattle sale 2.6%, thatch grass 2.1%, brick making 1% bushmeat hunting 0.5%, water for domestic use 0.22%. The dominance represented in figure 3 below:-

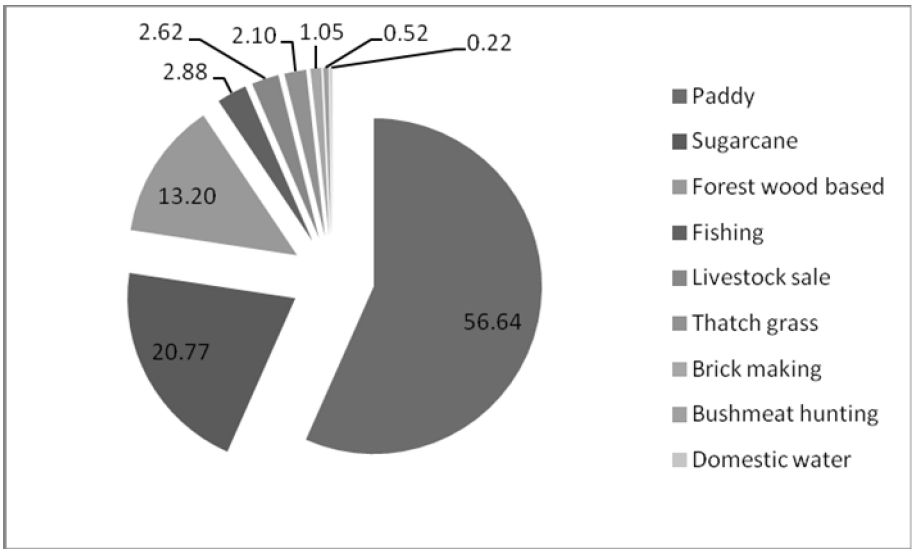

Figure 3: Dominance of direct economic activity to the total benefit realized in KVFPRS.

CONCLUSION AND RECOMMENDATION

Assessing activities in terms of contribution to local welfare, rice cultivation is leading, followed by forest based activities, fishing, sale of livestock, thatch grass, brick making, bushmeat hunting and domestic water. It should also be noted that this value is highly is very sensitive to change in price of inputs and prices of products. Based on poverty levels of local communities, this means more use of economic activities which do not require higher investment capital such as fishing, forest products harvesting and livestock keeping. The issue of improving net benefits for households through increased productivity

is of importance while contributing to the national and international values. Information provided from market price method may help decision makers when deciding among alternative management options depending on specific costs and benefits involved in each management options on KVFPRS.

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