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

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ABSTRACT

Information on the contribution of wetland agriculture production to socio - economic in the Little Ruaha sub-catchment is scanty thus constraining the wise use and sustainable utilization of the wetlands. This study was conducted in the wetlands of the Little Ruaha sub-catchment to assess livelihoods and economic benefits of wetland utilization. The specific objectives of this study were to; (a) identify socio-economic activities undertaken by local communities dependence in wetlands of the Little Ruaha sub-catchment (b) identify crops grown in wetlands of the Little Ruaha sub-catchment during both wet and dry seasons, (c) assess the economic value of wetlands outputs to household income and food security, (d) determine factors that influence utilization of wetlands resources in the Little Ruaha sub-catchment. The assessment was carried out in four villages whereby 120 respondents were selected randomly for interviews. Data were collected through structured questionnaires and Focus Group Discussion (FGD). Tools for data analysis included gross margin analysis, food available for consumption method, contingent valuation method and linear regression analysis. Valley bottom activities included agricultural production practiced by over 98% of the population followed by livestock keeping and other wetlands outputs. Activities not directly related to utilization of valley bottoms included petty and major businesses and government employment. Valley bottom wetlands contribute 15% to household food security and 95% to household income that is equivalent to TZS 128 209 (US$103) and 3 234 721 (US$ 2588) per household per year. The age, farming experience, access to markets, number of dependants and household size significantly influenced wetlands utilization. Valley bottom wetlands contribute significantly to household economy and food security. Planning for wetland friendly agricultural activities to ensure wetlands conservation and sustainable contribution to household economy and food security is vital.

INTRODUCTION

Wetlands are defined as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, brackish or salty, including areas of marine water the depth of which, at low tide, does not exceed six meters "(Ramsar Convention 1971). Wetlands are among the world's most biologically productive ecosystems and rich in a diversity of species. In Tanzania, there are major wetlands systems forming the valley bottom

wetlands, and these include the Great Ruaha, Wami, Kilombero, Pangani, Malagarasi, Ruvu and Katavi river systems. The largest in this category are the Great Ruaha river systems with wetlands covering 6950 ha (MNRT 2003). All the wetlands are considered useful for agriculture and as a source of other natural resources, which are important to human wellbeing. Understanding the drainage of the cultivated wetlands may encourage farmers in adhering to more sustainable practices in sustaining their livelihoods.

PROBLEM STATEMENT AND JUSTIFICATION

Tanzania is endowed with exceptional wetlands resources ranging from lake systems, river floodplains, to deltaic mangrove formations that cover about 10% of the land surface (MNRT 2003). Contribution of agricultural production in wetlands of the Little Ruaha sub-catchment to rural livelihoods of the local people in terms of direct cash income and food security is not well quantified. The information on the extent, productivity, socio - economic role and the impact of wetlands in the Little Ruaha sub-catchment is scanty thus constraining a wise use and sustainable utilization of the wetlands. Also, there are frequent concerns that agricultural practices in wetlands of the Little Ruaha sub-catchment may amount to extensive wetlands degradation, which may have a negative impact on water resources and wetlands productivity.

As long as they are managed wisely, wetlands will continue to support the country's efforts in reducing poverty and maintenance of human wellbeing. The complexity of multiple uses of wetlands in the Little Ruaha sub-catchment calls for resource inventories and critical study of the socio-economic aspects of the wetlands, development on plans for a wise, efficient, and beneficial utilization of the wetlands resources using participatory approaches. This information will be useful in the poverty alleviation efforts as envisaged in the National Strategy for Growth and Reduction of Poverty (NSGRP).

Objectives

Overall objective

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

Specific objectives

The specific objectives of this study were to:

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

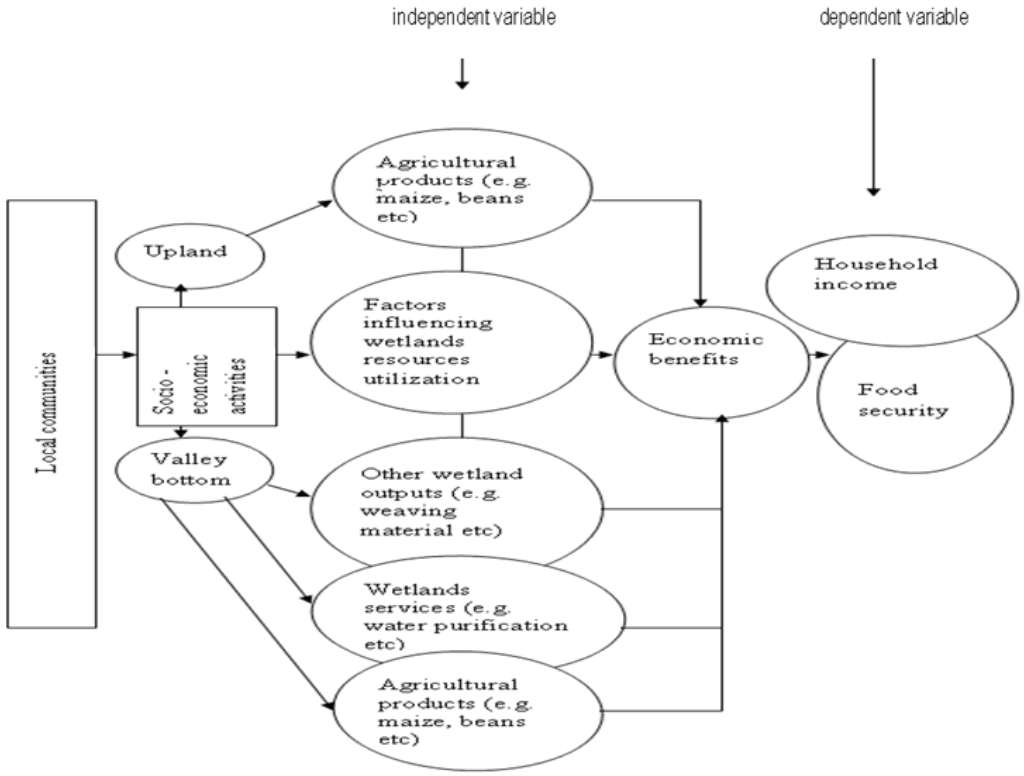

Figure 1: Conceptual framework

METHODOLOGY

Study site

This study was conducted in the wetlands of the Little Ruaha sub-catchment in Iringa region in southern Tanzania (Figure 1). Iringa region consists of seven districts namely Mufindi, Iringa Rural, Kilolo, Iringa Urban, Njombe, Ludewa and Makete. Mufindi district has an area of 7123 km^2 (URT 2000). The district is situated approximately 140km south of Iringa town along the Mbeya-Iringa highway. The district is in the altitude of around 1800 - 2000m above the sea level and lies around latitude 08^{0}00 - 09^{0}15S and longitude 34^{0}35 - 35^{0}55E. The district is bordered by Kilolo and Iringa Urban districts to the north, Njombe district to the south, Morogoro region to the east and Singida region to the west.

Data collection

The conceptual framework (Figure 1) was adopted to lead in data collection. Agricultural production is conducted in both uplands and valley bottoms. Such production interacts with the socio-economic setting to influence the availability of resources for local livelihoods improvement. The output of the interactions is economic benefits that contribute to food security and household income.

Primary data (qualitative and quantitative) were collected through field observations, Focus Group Discussions (FGD's) and questionnaires (household surveys). Local communities were asked to identify socio - economic activities undertaken by local communities' and which depended on the wetlands of the Little Ruaha sub-catchment, these were used to determine economic value. Primary data were collected from farmers practicing farming in the valley bottom and those dealing with agricultural activities in the upland farms. Secondary data were obtained from various sources of information including the Mufindi District Council, Non - Governmental Organizations (NGO) in the area, the Ministry of Agriculture, Food security and Cooperatives (MAFC), the Ministry of Natural Resource and Tourism (MNRT), Sokoine National Agriculture Library (SNAL), electronic sources such as the internet and other documented sources of information.

Data analysis

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

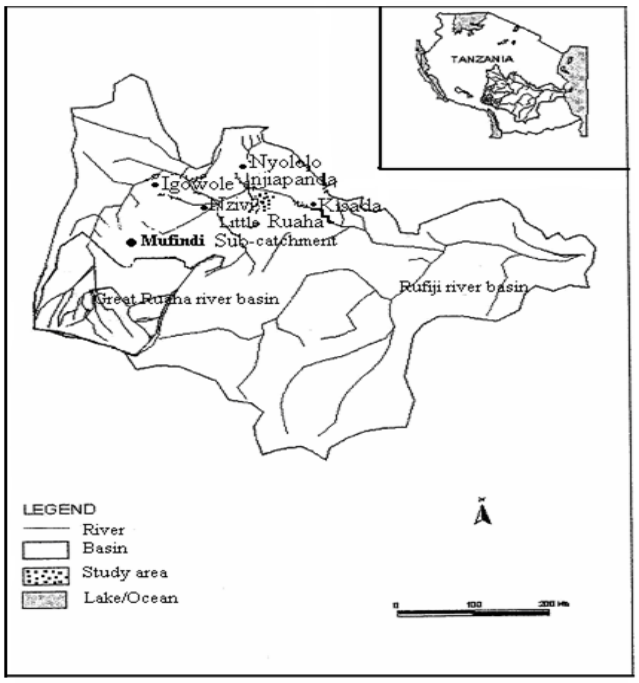

Figure 2: Map showing the Little Ruaha Basin Mufindi District Tanzania

The gross margin analysis was computed as**:**

GM = TR - TC

Where;

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

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

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

The empirical linear regression model used was as follows:

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + ... \beta nXn + \mu$$

Where;

Y = dependent variable (utilization of wetlands resources); α = constant; $\beta 1$ - $\beta 11$ = parameters estimated; X1 - X11 = independent variables , X1 = access to market, X2 = extension services, X3 = access to credits, X4 = number of dependants, X5= household size, X6= land size, X7= age of the respondents, X8= farming experience, X9 = off farm activities, X10 = gender of the respondents and X11 = marital status and μ = error term

RESULTS

Socio - economic characteristics of the respondents

Table 1 summarizes the socio - economic characteristics of the respondents in the Little Ruaha sub- catchment. It was revealed that about 54% of males and 46% of females were involved in valley bottom and upland farming activities. Majority of the respondents were aged between 18 and 59 years. This is considered the most active age group in a community. Most (83%) of the respondents interviewed were married followed by singles (8%) and lastly widows and widowers (10%) all of who shouldered substantial responsibilities with implications on household economy and food security. It was learnt that about 52% of the households had less that 4 family members.

Table 1: Socio - economic characteristics of the respondents in the wetlands of the Little Ruaha sub-catchment

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

Main socio-economic activities

Table 2 shows the major socio-economic activities related to wetland utilization in the catchment. It was clear that agricultural production was the most dominant socio-economic activity in the area, undertaken by 44% of the respondents, followed by livestock keeping undertaken by 31% and fishing undertaken by only 1%. About 45% and 42% of the respondents admitted to be involved in agricultural production both in the valley bottom and uplands respectively. Other socio-economic activities that do not directly relate to wetland utilization included government employment, petty and major businesses.

Table 2: Main socio - economic activities in the wetlands of the Little Ruaha sub-catchment

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

Crops grown during dry and wet seasons

The information obtained shows that various crops are grown in the valley bottom wetlands during the dry and wet seasons, implying that the wetlands are being cultivated throughout the year. Crops commonly grown during the dry season include maize (63%), beans (75%) and vegetables (93%) while those grown during the wet season were maize (91%), beans (93%) and vegetables (53%) (Table 3). . The three crops were the most grown crops because there were produced for both household consumption and for sale to generate household income.

Table 3: Crops grown during dry and wet seasons in the wetlands of the Little Ruaha sub-catchment

Type of Crop	% Population				
	Igowole (n=30)	Kisada (n=30)	N/Njiapanda (n=30)	Nzivi (n=30)	Average (N=120)
Dry season					
Vegetables	97	83	93	100	93
Beans	87	70	63	80	75
Maize	70	40	70	70	63
Irish potatoes	53	20	20	0	23
Sweet potatoes	7	0	30	3	10
Wheat	0	0	23	0	6
Wet Season					
Beans	93	97	100	80	93
Maize	93	100	70	100	91
Vegetables	37	40	87	50	53
Sweet potatoes	43	17	27	63	38
Wheat	43	0	43	13	25
Sunflower	17	37	27	17	24
Irish potatoes	23	3	20	7	13

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

Household income

Table 4 shows the average use values of socio-economic activities in the wetlands of the Little Ruaha sub-catchment. The total benefits of wetlands in the Little Ruaha sub-catchment can be determined by considering the values accruing from agricultural crops cultivated in the valley bottom and other wetlands outputs. The total values of all the socio-economic activities undertaken in valley bottoms in the five villages of the Little Ruaha sub-catchment were estimated at TZS 38, 211, 759, 173 (US$ 30, 569, 407) per year, which is equivalent to TZS 254 745 061 (US$ 203 796) per month. The contribution of valley bottom agriculture and other wetlands outputs in the wetland of the Little Ruaha sub-catchment to the household income within the five villages is

(1%). The values of agricultural products from the valley bottom and other wetland outputs amounted to TZS 3, 234, 721 (US$ 2,588) per household per year. Farming in the valley bottoms and other wetlands outputs in the wetland of the Little Ruaha sub-catchment contribute 95% to household income, and this is a substantial contribution to the economic welfare and rural livelihood to adjacent communities especially during the dry season or drought years. Though the contribution of valley bottom wetland activities such as farming valley bottom, and other wetlands outputs within the five villages to the household income is relatively low (1%), the role of these valley bottom wetland activities in enhancing household food security is relatively high (15%) and becomes of higher significance especially during the dry season or drought years.

Table 4: Contribution of socio - economic activities to household income in the wetlands of the Little Ruaha sub-catchment

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

Household food security

Table 5 shows the contribution of food crops from valley bottom and upland/main fields in the wetlands of the Little Ruaha sub-catchment to household food security. Wetland cultivation contributes 31% of the total annual food production per household in valley bottom and upland/main fields. Valley bottom wetlands contribute 15% to household food security, which is equivalent to TZS 128 209 (US$103). This production is dominant during the dry season and in the absence of valley bottom wetlands the food insecurity would be even worse.

Table 5: Contribution of valley bottom wetlands to household food security and income in the wetlands of the Little Ruaha sub-catchment

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

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

Factors Influencing Utilization of Valley Bottom Wetlands

Table 6 shows factors influencing utilization of valley bottom wetlands resources in the Little Ruaha sub-catchment. These included accesses to markets, extension services, access to credits, the number of dependants, household size, land size, the age of the respondents, farming experience, off farm activities, the gender of the respondents and marital status. The age of the respondents, farming experience, access to markets, the number of dependants and household size significantly influenced the utilization of wetlands resources ($p<0.01$). On the other hand, some factors that would be thought to influence the utilization of valley bottom wetlands were not significant. Such factors include extension services, access to credits, land size, off farm activities, gender of the respondents and marital status.

Table 6: Linear regression results of the factors that influence utilization of the wetlands resources in the Little Ruaha sub-catchment

Variables	B	Std. error	t-value	Sig.	Sig.
Constant	3.136	2.947	1.064	0.294	ns
Market (dummy)	-3.471	1.209	-2.871	0.007	S
Extension services (dummy)	-1.750	1.262	-1.387	0.173	ns
Credits (dummy)	0.214	1.341	0.160	0.874	ns
Number of dependants	-1.281	0.158	-8.113	0.000	S
Household size	-0.699	0.166	-4.211	0.000	S
Land size	0.085	0.290	0.293	0.771	ns
Age	4.393	0.124	35.459	0.000	S
Farm experience	0.031	0.003	8.817	0.000	S
Off farm (dummy)	-1.316	2.083	-0.631	0.531	ns
Gender (dummy)	0.021	1.221	0.017	0.987	ns
Marital status	0.135	0.702	0.193	0.848	ns

s- Significant at **p< 0.01
ns- non-significant at *p< 0.05
Adjusted R^2 = 84%
F-value =11020.7

DISCUSSION

The total benefits of wetlands in the Little Ruaha sub-catchment can be determined by considering the values accruing from agricultural crops cultivated in the valley bottom and other wetlands outputs. The total values of all the socio-economic activities in the five villages of the valley bottom wetland in the wetland of the Little Ruaha sub-catchment were estimated at TZS 38 211 759 173 (US$ 30 569 407) per year, which is equivalent to TZS 254 745 061 (US$ 203 796) per year. The contribution of valley bottom wetland activities from the valley bottom and other wetlands outputs in the wetland of the Little Ruaha sub-catchment to the household income within the five villages is (1%). The values of agricultural products from the valley bottom and other wetlands outputs amounted to TZS 3 234 721 (US$ 2588) per household per year. Farming in the valley bottom and other wetlands outputs in the wetland of the Little Ruaha sub-catchment contribute 95% to household income. These results are in agreement with the findings by Munishi (2007) that the value of the wetlands in the Mara river (Masurura) swamp biodiversity services was high estimated at TZS 27 637 000 000.0 (US$ 22 109 600.0) per year. This value of benefits is given from the perspectives of the communities adjacent to the swamp. The value of the wetlands in domestic water supplies in the Pangani basin for instance has been estimated to be in the order of TZS 37 - 46 billion (Turpie *et al*. 2005).

Wetland cultivation contributes about 31% of the total annual food production per household in valley bottom and upland/main fields. Valley bottom wetlands contribute 15% to household food security, which is equivalent to TZS 128 209 (US$103). These results are in agreement with the findings by Kyando (2007) that the *vinyungu* farming plays a significant role in generating income as well as providing a buffer food stock to the local communities during drought periods and which are frequent these days. The age of the respondents, farming experience, access to markets, the number of dependants and household size significantly influenced the utilization of wetlands resources ($P<0.01$). On the other hand, some factors that would be thought to influence the utilization of valley bottom wetlands were not significant. Such factors include extension services, access to credits, land size, off farm activities, gender of the respondents and marital status.

CONCLUSIONS

The study has shown that different crops grown in the valley bottom wetlands contribute variably to household income and food security. Generally, valley bottom wetlands utilization by wetland adjacent communities contributes significantly to economic welfare and rural livelihood.

ACKNOWLEDGEMENTS

Authors would like to acknowledge the financial support from the Department of Forest Biology, Sokoine University of Agriculture through the project NUFU-TZ 2007/10229. This work would not have been possible without this support.

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