THE ROLE OF BAHI SWAMP WETLANDS IN ENHANCING HOUSEHOLD FOOD SECURITY AND INCOME OF ADJACENT COMMUNITIES

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ABSTRACT

The study was conducted to assess the role of Bahi swamp resources in enhancing household food security and income of adjacent communities. Specifically, the study assessed the socioeconomic activities in the swamp with a potential contribution to local livelihoods, the contribution of the swamp in enhancing household food security and income and the level of local dependence on the swamp. Two villages (Makulu and Nagulo-Bahi) were involved. Data were collected through questionnaire, PRA techniques (resource mapping, key informant interviews and focused group discussions) and direct observation. Data were summarized and analysed using Microsoft Excel, SPSS and content analysis. Other data from discussions were analysed through relative ranking. The socioeconomic activities with potential contribution to food security and income of adjacent communities in order of importance included crop cultivation, fishing, livestock grazing and collection of thatching grasses. Cultivation of paddy rice contributed significantly to household food security generating 65.4% of total household food crop production compared to other crops grown in drier areas adjacent to the swamp. Fishing played a substantial contribution to household food security through household consumption of 10% of fish caught. For household income, sales of paddy rice from the swamp contributed 59.6% while fish sales contributed 36% of the total annual household income. Multiplier activities emerging during fishing season facilitate income to a wider group of communities. On average, 56.2% of the population depend on the swamp for daily socio-economic activities associated with generation of household food and income. The Bahi swamp and related products play a significant role in enhancing local livelihoods for the adjacent communities. Planning for wise use of the swamp in respect of the dominant socioeconomic activities will likely improve its contribution to livelihoods.

Key words: Bahi swamps, food security, income, wetlands

INTRODUCTION

A wetland may be defined as an area of land in which soil is saturated with moisture either permanently or seasonally. Such areas can also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others (PBS 2009). The presence of abundant water causes the formation of hydric soils and favours the dominance of either hydrophytic or water tolerant plants. Wetlands, particularly, tropical wetlands are of great importance to many people who live adjacent to them.

Generally, wetlands in semiarid regions support adjacent communities through three major activities: flood plain agriculture, dry season grazing and extraction of some tree products (Kilungu and Munishi 2010; Zoungrana and Temu 1996). The main activities in the wetland, which supplement community livelihood, include fishing, crop production, livestock keeping, harvesting of wetland resources and trading (Kibwage *et al.* in press). In many parts of the world particularly in developing countries, wetlands are vital resources for improving livelihoods through achieving food and water security (DFID 2007). Wetlands provide opportunity for agricultural intensification through irrigation and livestock production. Wetland soils favour crop growing due to presence of long lasting soil moisture. Also, green pastures and water for livestock can only be obtained in wetlands during the dry season (Yanda *et al.,* 2006).

Food insecurity is one of the main problems in Tanzania rural population, and about 27% of the people are food insecure (FAO 2005, FAO 1989). There is a heavy dependence on agriculture for livelihood by utilizing wetlands to cope with problems of droughts and unreliable rainfall, a characteristic of arid and semi-arid areas. Livelihood activities in floodplain wetlands such as livestock grazing and fishing are largely integrated with other activities, thereby, resulting in diversification of incomes for adjacent communities (Shemdoe *et al.,* 2007).

The semi-arid regions of Tanzania experience unreliable and low rainfall resulting in low and unpredictable production of both crops and livestock. In many instances, wetlands are key coping strategies during times of drought. Most peasants use wetlands to cope with this risk, and tend to establish their settlements around the wetlands. Minimal scientific research has focused on wetland ecosystems, (especially swamps), in spite of their increasing role in supporting livelihoods (Thenya, 2006). Generally, wetlands located in semi-arid regions support surrounding communities by enhancing flood plain agriculture, fishing, providing the dry season grazing and allowing extraction of some tree products.

Fisheries is an important source of income and proteins in the Tanzania. Many people near the shores practice a lot of fishing (Bogers, 2007). However, the contribution of the wetland fisheries to household economies is not well documented as it is characterized by seasonal variability and is mostly at the subsistence level: many people harvest fish from permanent or seasonal pools or from the littoral wetlands shortly after the floods. Catches are rarely recorded and do not appear in official catch statistics.

Bahi wetlands in Dodoma supports production of a variety of crop production, particularly rice (Assenga 2001). However, rainfall unreliability remained a major problem leading to droughts that affects productivity. Bahi swamp is also famous for the production of fish, which is a major source of nutrients and income to the people. The extent to which the Bahi swamp contributes to household food security and income and level of dependence on the wetland by the adjacent communities has not been established. This study seeks to address and fill this knowledge gap. It looks at various interacting activities associated with the wetland an information that will inspire different stakeholders and the society's interest to devote more efforts in conservation and protection of the wetlands.

MATERIALS AND METHODS

Study Area

The study was conducted in two villages, Makulu and Nagulo-Bahi that are situated adjacent to Bahi swamp. Bahi swamp is an endorheic seasonally inundated wetland found in Bahi district, Dodoma and extends to some parts of Singida region in Tanzania**.** It lies between latitudes 5°51'S and 6°16'S and between longitudes 34°59'E and 35°19'E (Fig. 1), at an altitude 796 m above sea level (*www.fallingrain.com/world/TZ/Bahi*). It covers over 1250 square kilometres of an area (approximately 125 000 ha) and about 21 villages surround the swamp.

The area is dominated by long dry spells with cool nights and warm and sunny during the day times. Maximum and minimum temperatures are 27.5°C and 15.5°C, respectively and the rainfall ranges from 350 to 800 mm per annum (WB, 1994) which is normally a short single wet season lasting between December and March (Mboera *et al.,* 2007).

Data Collection

A multi-stage sampling was used where both purposive and random samples were drawn from the population in selected villages adjacent to the swamp. Selection of villages was based on accessibility and utilization of the swamp. For household surveys, selection of households was random in which 9% of total households in each village were selected for questionnaire survey, which sufficed a significant population representation. According to Boyd *et al.* (1981), significant population representation is achieved when a random sample of at least 5% is taken for study. The sampling unit of analysis in this study was the household.

Both PRA techniques and questionnaire surveys were used to collect primary data. The PRA techniques used were focus group discussions and resource mapping. During PRA exercises joint meetings were conducted between the researcher and a sample of ten (10) people, which comprised of Village Natural Resource Committee (VNRC), village leaders and other villagers with extensive knowledge on the swamp. An arbitrary period which could be remembered by participants (historical periods) was used to investigate the trend of utilization of the swamp and livelihood activities. In this study, PRA methods used were direct observation, focus group discussions, preference/relative ranking. In relative ranking people were asked to rank activities done around the swamp and their importance in on a scale of 1 to 5, 1 being the lowest rank and 5 the highest. Duangsa (1996) acknowledges the usefulness of PRA as a flexible technique, which draws on community expertise and involvement to get action-based, timely, cost effective and reliable information that complements other research techniques.

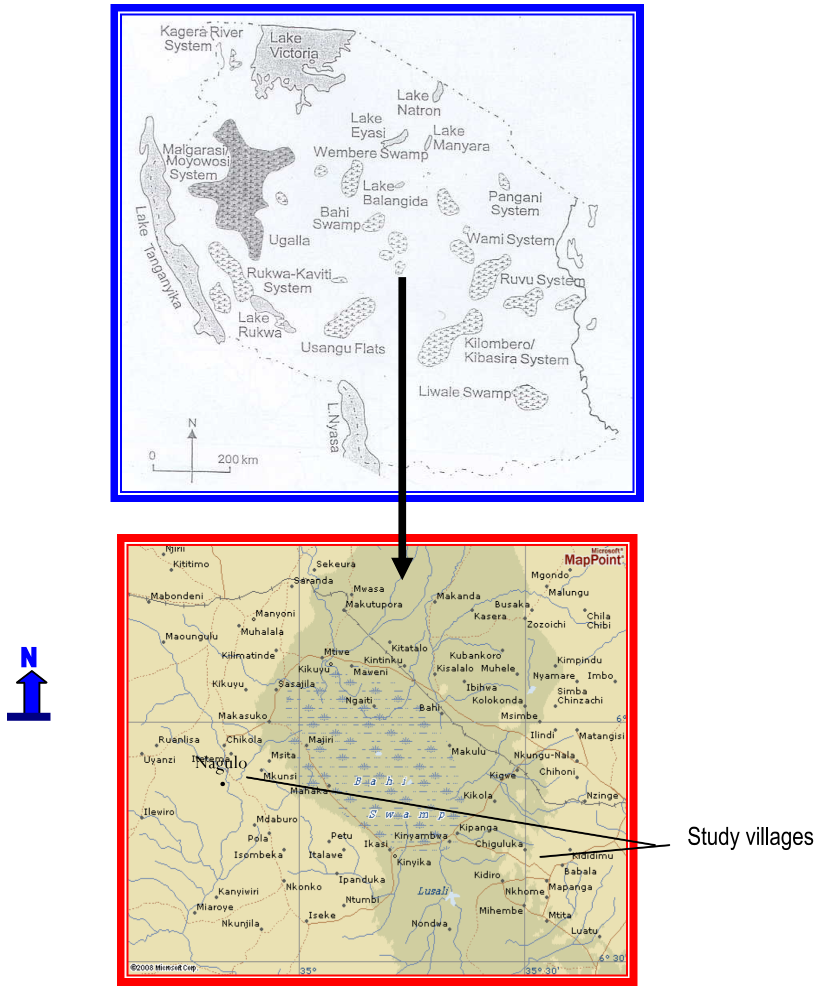

Figure 14: A map showing location of Bahi swamp and adjacent villages

Direct observations were made on various issues around the swamp, including farmlands, fishing and grazing lands. This involved also informal conversation with villagers to get more information on the Bahi swamp utilization and history of the swamp. During resource mapping was done a team of village members first obtained overview of the village and the swamp, by overlooking it from the highest point. Thereafter, the village map was drawn on paper using marker pens by placing different signs to indicate the position of houses, farms, roads, wells, seasonal rivers, grazing and fishing areas. This exercise was done in order to understand the spatial variability of land and natural resource use in the swamp.

In focused group discussions, a checklist was used as guidance. This targeted key informants who had greater knowledge on the issues under discussion related to wetlands. Different groups were gathered depending on the information required. Groups of fishermen, peasants and livestock grazers were gathered differently to get information on their utilization and dependence on the swamp. Groups of elders were gathered to obtain more information on the utilization and history of the swamp. In case of fishing and its contribution to livelihoods, a group of eight (8) fishermen were used to give statistics on fisheries on their last years experiences on the production of fish and income accrued from fishing. Another group comprised of village leaders with the purpose of getting additional information on average households crops production and income and consensus of what respondents stated during questionnaire survey.

An open-ended questionnaire was administered to representative sample of 109 households (9%) randomly selected using the village register as a sampling frame. The information collected through questionnaires include socioeconomic characteristics of respondents such age, gender, occupation, composition, land holding, economic activities around the swamp like agriculture, fishing, livestock keeping, production and sales of wetland products and their role in enhancing household food security. Also, assessment of wetland products which contribute to household income, including their production, markets and sales and the level of dependence of households on the swamp was assessed by setting questions on how and what activities are done and products from and around the swamp do people depend on.

Secondary Data

Secondary data such as number of households in villages were collected from Village Executive Officers' records. Others were obtained from the Bahi division agricultural department office. Different sources such as books and official reports regarding previous studies conducted in Bahi swamp were used to get supplementary information on the swamp use and peoples' livelihoods.

Data Analysis

The data collected were grouped into quantitative and qualitative forms to make easy analysis. Microsoft Excel and SPSS 12.0 packages were used to summarize data. Quantitative data were analysed to generate descriptive information such as frequency tables and means, which enabled discussions and conclusions on the contribution of the swamp to household food security and income. Microsoft excel spreadsheets were used to compute the average production of crops and other products harvested and the revenue from their sales. Contribution of different crops to household income was presented in monetary terms in order to determine what income will be earned if the entire crop yields are sold. The %age contribution was calculated from total annual average household crops production. This is because most of households failed to give statistics on what amount was either sold or exchanged with other products.

Qualitative data generated from discussion with groups and individuals were subjected to content analysis to generate meaningful themes and tendencies related to study objectives. Market survey analysis based on products price and revenue, was used to analyse data on wetland products traded by households (crops and fish) to enhance their income. Other data from PRA exercises (discussions) were analyzed through relative ranking.

RESULTS AND DISCUSSION

General Socioeconomic Characteristics of Households

Demography

The total number of households in the studied villages was 1202. The villages were Nagulo-Bahi and Makulu with 618 and 584 households respectively. Overall, the dominant tribe in the villages was Wagogo (92%), followed by Wanyaturu (3%), Wataturu (3%), Wamasai (1%) and Wasukuma (1%).

Gender

The proportion of respondents who participated in the survey, based on gender, is shown in Table 1. Females were 15.6% despite the fact that, they are key players in most of the household activities. The reason behind is that the study targeted the heads of households and except for few households, which were headed by females, majority were males (84.4%). Sometimes females had to respond on behalf of their husbands when they were not available.

Age

The proportion of respondents with the age ranging between 18 and 40 years was the largest followed by the age group of 41 – 60 years, which reflects permanent settlement of this age group in the villages with full engagement in different socio-economic activities. The proportion of people with age groups below 18 was relatively low because members of the group had not yet established families, thus regarded as only household members. According to Mtenga (1999), household members are considered economically productive from the age of 16 to 64 years.

Land holdings

Based on the household survey, the average land owned by each household was about 2.4 hectares (about 6 acres). Most of the respondents had land holding of between 0.4 and 2.4 hectares followed by 2.4 to 4.4 hectares. Relatively low proportion had holdings of more than four hectares of land.

Table 5: General socio-economic characteristics of respondents

Socio-economic characteristics		Percentage of respondents (N=109)			
		Makulu	Nagulo-Bahi	Overall	Total
Gender	Male	41	43.4	84.4	
	Female	7.6	8	15.6	100
Age (years)	< 18	2.4	2.2	4.6	
	18 – 40	20.3	21.0	41.3	
	41 – 60	15.6	22.0	37.6	
	> 60	8.1	8.4	16.5	100
Land holding (Ha)	0.4 – 2.4	21.0	24.0	45.0	
	2.4 – 4.4	17.9	20.6	38.5	
	4.4 – 6.4	6.6	9.0	15.6	
	6.4 – 8.1	0.4	0.5	0.9	100

Non-parametric bivariate correlation analysis showed a significant positive correlation between total land owned and age of respondents ($r = 0.448$, $P < 0.01$), meaning that older people owned bigger land size compared to younger ones. Moreover, household size determined size of land owned. Bigger families owned significantly large pieces of land compared to families which were relatively small ($r = 0.625$, $P < 0.01$). Table 2 below summarizes correlation between age, household size and land size (hectares) owned by respondents.

Table 6: Non-parametric bivariate correlation (Spearman's *rho*) between age, household size and land size owned by respondents

	Age (years)	Household size	Land size (hectares)
Age (years)	1	0.428**	0.448**
Household size	0.428**	1	0.625**
Land size (hectares)	0.448**	0.625**	1

Note: ** Correlation is significant at the 0.01 level (2-tailed) N = 109

Socio-Economic Activities and Associated Products with Potential Contribution to Household Food Security and Income

Uses of the Bahi Swamp

Bahi swamp is used by the adjacent communities for fishing, livestock grazing, irrigation, rice cultivation and other crops all providing people with economic benefits useful in sustaining their livelihoods. The swamp contributes, in some way, to the livelihoods of most households in 21 villages adjacent to it. Relative ranking during focus group discussions and PRA showed that agriculture was the highest in importance among the economic activities conducted in the wetland. The secondary level of importance was attached to fetching of water for various uses. Water is a crucial service brought by the swamp to the adjacent communities because the area is semi-arid and no permanent rivers. In this context, respondents attached relatively high value on water utilization from the swamp in which water is treated as a product and service. There is an extensive system of groundwater on which people are depending on for drinking water. The people living in the affected area are mainly farmers. Fishing and livestock grazing ranked third in their importance to livelihoods. Collection of weaving and thatching grasses, collection of wild plants and firewood and tourism were the least in ranking (Fig. 3).

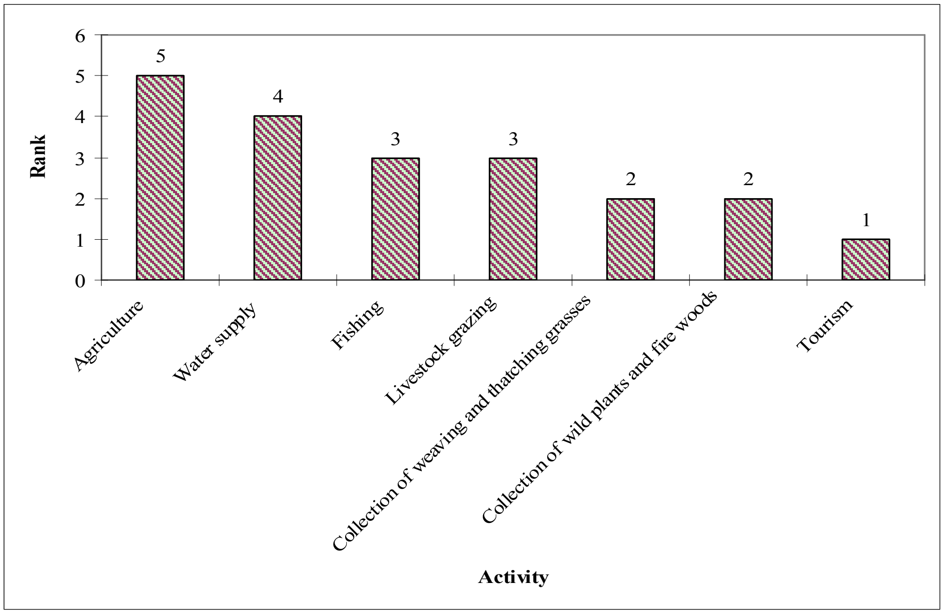

Figure 15: Ranking of the wetland related activities with economic significance in Bahi Swamp wetlands, Bahi District Dodoma. Note: HE highest score is 5

These results are similar to the study conducted to the communities around by Kalpana *et al.* (2007) observed that farmers ranked agriculture as the highest socio-economic activity in Kabartal wetlands in India, followed by fishing while ecological functions and tourism ranked the lowest.

In Makulu village agriculture, water supply and fishing were ranked high by majority of respondents (80%, 78% and 62% respectively), while livestock grazing was mentioned by relatively low proportion of respondents (47%). In Nagulo-Bahi, activities such as agriculture, fishing and water supply were mentioned by majority of respondents (82%, 76% and 72% respectively), while livestock grazing was stated by relatively lower proportion of the respondents (37%). Comparatively, Nagulo-Bahi village had more respondents on fishing and agriculture than Makulu village because of relatively more valley bottom wetlands in Nagulo-Bahi that allow accumulation of water for longer time. Tourism as an activity done around the swamp was acknowledged by the lowest (9% in Makulu and 6% in Nagulo-Bahi) (Table 3).

Table 7: Relative significance of socio-economic activities around the Bahi swamp

	Percentage of respondents (N = 109)		
Socio-economic activity	**Makulu**	**Nagulo-Bahi**	**Overall**
Agriculture	80	82	81
Water supply	78	72	75
Fishing	62	76	69
Livestock grazing	47	37	42
Tourism	9	6	8

Note: Multiple responses allowed

These findings are similar to those in the study conducted in Bhoj wetlands, India by Verma (2001), where by agriculture and fishing were stated by majority of respondents as the most important activities compared to other activities done around the wetland.

Wetland Products

Several wetland products were listed as significant in sustaining local livelihoods for communities adjacent to the swamp. These products included crops and other species (86%), water (85%) followed by fish (70%), weaving and thatching grasses were utilized by relatively lower proportion (31%) of the population In Makulu village, much more respondents acknowledged fodder than in Nagulo-Bahi because majority of households in there are livestock keepers. Conversely, majority of respondents in Nagulo-Bahi village mentioned to obtain fish more compared to Makulu village households (Fig. 4). Furthermore, many areas close to the swamp were observed to have shallow underground water table hence shallow wells provided adequate water supply to households and their livestock after slight soil excavation, thus made many people to acknowledge water as an important product they accrue. In addition, high water holding capacity of soils observed helps cultivated crops to sustain longer dry periods without sudden wilting.

According to Kipkemboi *et al.* (in press), 92.3% of the respondents at the shores of Lake Victoria in Kenya indicated that they harvest several products from wetlands. Only 29.9% of the households obtained water for household consumption from the wetland. The proportion of people obtaining water from the shores of Lake Victoria was lower compared to that of Bahi swamp wetland because no permanent rivers flow through the villages and from direct observation there were also few wells, thus the swamp is of great significance as water reservoir to the adjacent communities.

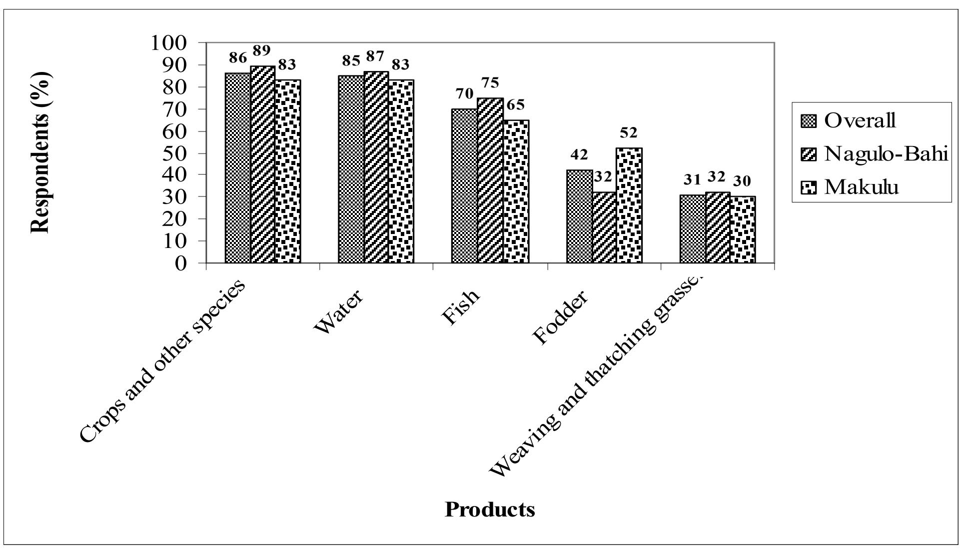

Figure 16: Major products obtained from the wetland by households

Note: Multiple responses allowed

Bahi Swamp and Household Food Security

Bahi swamp being seasonal plays a vital role in the lives of people in adjacent villages by creating an enabling environment to achieve food security during periods of food insecurity caused by weather/climatic variability. Household food security is enhanced through crop production and fishing being done in the swamp.

Crop production

Agricultural crop production is one of the major economic activities around the swamp.

There is no permanent cash crop produced, due to the nature of the swamp environment. Major crops produced are rice, groundnuts, sorghum and maize (Table 4). Crops produced in adjacent dry areas are mainly groundnut, sorghum and maize while paddy rice (*Oryza sativa*, L.) is produced in wetter areas, where there is rich clay soils and good water retention capacity. According to respondents, much more paddy is produced in rice-beds established within the swamp than other crops. Part of the rice produced is either sold and/or exchanged with maize or sorghum from other villages for food. Therefore, households with larger rice stocks had assurance of high food security and a variety of food types as they can exchange with other crops to match their food preferences.

Table 8: Crop types and yield by households in the Bahi swamp wetlands

Crop type	Annual yield (kg) per household	Percentage of the total production
Paddy rice	1636	65.0
Groundnuts	536	21.0
Sorghum	225	9.0
Maize	146	6.0
Total production	**2543**	**100**

Key informant interviews with village executive officers (VEOs) showed that average annual household crops production was 2,500 kg equivalent to 2.5 tonnes. Thus, from the survey, rice produced in wetter areas has higher yield of 1636 kg compared to other crops that are cultivated in adjacent uplands with lower yields of 536, 225 and 146 kilograms for groundnuts, sorghum and maize respectively. Paddy rice showed the highest yield of all crops with significant contribution to household food security, contributing more than 60% of the total annual households' food crop production. Hence, the swamp crop products especially paddy rice appeared to play an important role in the food security of the local population.

These results are similar to observations by Yanda *et al.* (2006) in Ngaiti village which is also adjacent to the Bahi swamp who revealed an average annual yield of paddy rice grown in wetlands to be 10.27 bags per household, while other crops grown in adjacent uplands had the lowest yields. High yield in paddy rice was enhanced by presence of water in rice-beds thus allowing it to grow healthier and generating high yields.

Fishing

Fishing plays a substantial role in enhancing household food security. Fish is the cheapest source of protein and during fishing season, this source of protein becomes available to households more cheaply. Although the swamp is seasonal, it becomes suitable breeding site for fish after heavy rains and flooding. Focus group discussion with fishermen showed that areas such as Nondwa and Surungai experience intensive flooding/inundation and hence form important fishing grounds. Fish species available in Bahi swamp include *Oreochromis urolepsis* (perege) and *Clarias spp* (kambare).

It was observed that a fisherman could conduct 24 catches per year, which gives an average 2,866 fishes annually. Households consume about 10% of this (286 fishes) as food, thus making a notable contribution to household food security. Because of unreliable storage techniques for fish at household level, relatively small amount is left for household consumption. The study by Abila and Othina (2005) along Yala swamp in Kenya, observed that only 7% of respondents utilized fish caught for household consumption and the rest is used for trade due to similar reasons.

Household Income

There are several sources of income for communities adjacent to the swamp. Among the sources include sales of crops (87.5%) followed by other business (52%) and livestock sales (44.2%). The swamp supports livestock grazing during both dry and wet seasons thus enabling people to have healthier livestock that can yield high incomes through sales. Sale of fish is seasonal though a relatively high proportion (41.8%) of the population sees it as income earner. However, this may imply that relatively low proportion of the population practice fishing it seems to contribute substantially to household income (Fig. 5).

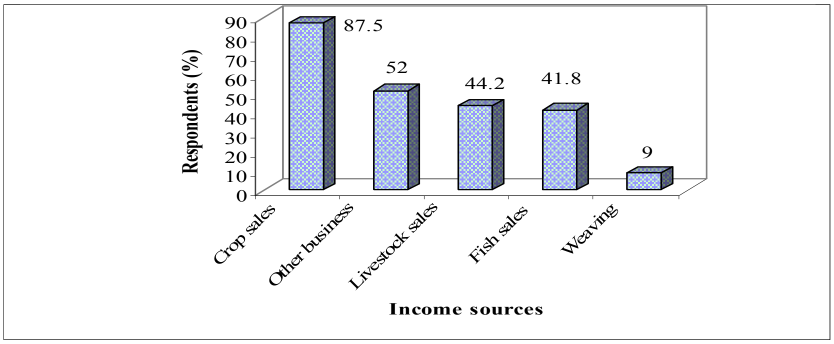

Figure 17: Sources of income for communities living adjacent to the Bahi swamp. (Note: Multiple responses allowed)

Sale of Agricultural Crops

Sale of agriculture crops is the major source of income to the households. This is because agriculture is the major economic activity in the area and especially crop production from wetlands, as the swamp supports a variety of crops cultivation leading to remarkably higher crops yields than other areas situated away from Bahi swamp. Key informant interviews with VEOs showed that on average the annual household income was about TZS 800,000/- with rice production contributing the highest income, about 60% of the total annual household income (Table 5). According to the World Bank (2009) database on world's economic indicators, per capita income of Tanzanians for year 2008 was US$ 430 (equivalent to TZS 559 000/-). Thus income from sales of the entire amount of paddy rice produced contributes more than eighty % of national per capita income in the area annually.

Table 9: Average annual contribution of different crops to total household income among communities living adjacent to the swamp

Crop type	Annual income from crop sales (TZS)	Percentage contribution by crops to the total annual household income
Paddy rice	477 169.80	60.0
Groundnuts	138 042.45	17.0
Sorghum	45 198.10	6.0
Maize	5377.40	1.0
Total	**665 787.75**	**84**

According to Kasthala *et al.* (2008), agricultural production along the Mtanza-wetland in the Rufiji basin generated annual cash income of TZS 695 689/-. This income is almost similar to that for Bahi swamp though a bit higher because of higher variety of crops grown along Mtanza wetland like sesame, cowpeas and vegetables. Shabaan *et al.* (2004) observed that crops grown in the Bumbwisudi wetland in Zanzibar typically provided from six to twenty % of the total household income generated. These contributions is lower than that of Bahi swamp because people around Bumbwisudi wetland consume most of crops harvested and sell smaller amounts, as there are other additional income generating activities around the wetland such as fishing and crafts making.

Fishing and fish sales

Fishing also contributes in enhancing the income of the households around the swamp. It was found that a fisherman can obtain between 50 to 200 pieces of fish per catch depending on the condition of the area and amount of water. For the amount caught, about 90% is sold. Each fish can be sold at a price of 100/- to 200/- TZS depending on size, generating an annual income of TZS 12, 794/- per catch. A fisher can make about 8 catches per month which is equivalent to 24 catches for 3 peak months per year, which make an annual income of TZS 288 000/-. This amount is substantially high for a single economic activity considering the nature of the rural economy in Tanzania. This income contributes about 36% of the total annual household income and about 50% of the national per capita income of the area annually (World Bank 2009). Therefore, fisheries although in small scale, provide an important contribution to fishermen's household cash income at Bahi swamp.

Kasthala *et al.* (2008) observed that fishing contributes an average of TZS 353 612/- per household annually along Rufiji River catchment in Mtanza-Msona wetland. Meanwhile, in Stung Treng Ramsar Site, Cambodia fishing generated US$ 425 per household annually from fishing (Allen *et al.*, 2008). These figures are higher than those of Bahi swamp due to difference in fishing seasons and amount of fish per catch. Fishing season in Bahi swamp is shorter than in Mtanza-Msona wetland or Stung Treng Ramsar Site.

The cash income obtained from fishing has a multiplier effect in terms of other benefits to the community including education, health services, clothing and other food as well as investment in other assets or enterprises such as land, livestock or fishing gear, which in turn can further reduce vulnerability to poverty. Fishing at the swamp also has multiplier effects on the economy of different groups including multiple temporary employments such as suppliers of firewood to fishermen, scrapping fish scales, preparing fish and frying them for sale and cleaning of nets, boats and assistance in fishing. This is a multiplier effect to a wider segment of the community, which would not have been there if it were not for the swamp.

Extent of Household Dependence on the Swamp

It was observed that the population was highly dependent on the swamp due to different products and services offered by the wetland. About 82% of the population depend on the swamp in their daily socio-economic activities. This shows that the swamp and adjacent communities are ultimately interdependent, with local community livelihood being highly dependent on the wetland. Similar findings were observed by Schuyt (2005) who indicated a high dependence of local riparian communities on natural wetlands in Yala swamp in Kenya. Moreover, Kalpana *et al.* (2007) found that 67% of people around Kabartal wetland in India depend on the wetland for different types of subsistence and commercial goods provided by the wetland. In many circumstances, wetlands are regarded as economic strongholds for communities living at their verge (Adams 1993; Turner *et al.* 2000). The dependence of the local communities is based on the products and services offered by the swamp and it differs slightly in the two villages because of variation in the available products or services. In Nagulo-Bahi village, high dependence was on fertile soils for crop production (89%), water (76%) and fish (61%). Thatching and weaving materials were the least important. While in Makulu village, high dependence on the swamp was observed in fertile soils for crop production (82%), water (78%) and fish (51%) and dependence on fodder (44%). Thatching and weaving materials were also the least important (Table 6). A high percentage of people in Nagulo-Bahi depend on the swamp for fishing because of their proximity to the fishing ground compared to the Makulu villagers. Most of Makulu villagers are livestock keepers, meaning that their dependence on the swamp for grazing is higher than Nagulo-Bahi.

Table 10: Percentage of population depending on the Bahi swamp wetlands for various products and services

Item of dependence	Percentage (N = 109)		
	Nagulo-Bahi	Makulu	Overall
Fertile soils for crop production	89	82	86
Water for irrigation and home use	76	78	77
Fish for sale and home use	61	51	56
Fodder for livestock	39	44	42
Thatching and weaving grass materials	19	21	20

Note: Multiple responses allowed

Valuable products influence dependence on wetlands or services offered to the adjacent communities and their accessibility, thus differential dependence in the two villages emerged. According to Kipkemboi *et al.* (in press), over 90 % of households around Lake Victoria in Kenya depend on natural plant biomass (mainly papyrus harvesting) and 60 % on seasonal cultivated crops along the shores of the lake.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

There are variety of socio-economic activities undertaken in Bahi swamp and related products/services which make significant contributions to food security and income of adjacent communities. The swamp contributes substantially to household food security through crop production and fishing. In crop cultivation, much contribution comes from paddy rice cultivated in wet areas. Fishing also contributes substantially to household food security through domestic utilization of fish caught. Moreover, the swamp supports livestock grazing throughout the year thus enhancing households to have additional meat supply and income through livestock sales.

Bahi swamp also contribute significantly to household income through sale of crops especially paddy rice and fish. Moreover, variety of socioeconomic activities emerging during fishing season are done by other groups associated with fishermen facilitate an income generated to a wider group. Dependence on the swamp is due to valuable products or services offered to the adjacent communities.

RECOMMENDATIONS

- In order to improve and maintain rural income using resources from the swamp in conjunction with conservation, planning and development of wetland friendly investments is essential.
- Diversification of sustainable livelihood activities especially alternative income generation activities which can be done around the swamp such as fish ponds so as to expose communities around on benefits of the swamp.
- Planning for wise use of the swamp in respect of the dominant socioeconomic activities will likely improve its contribution to livelihoods.

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