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Determinants of access patterns to goods and services from wetlands in Tanzania and the impact on sustainable wetland management

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Wetlands perform vital role in providing useful goods and services to mankind. Because of their importance, human beings interactions with the wetlands' physical environment have caused some of them to be highly degraded. Due to characteristic nature of wetlands being a common pool resource (CPRs), most researchers claim their degradation to be a result of poor institutions governing the interactions. Wetlands in Tanzania are very useful especially, in areas where agriculture is most prevalent. High pressure to exploit fertile and moist land in those areas has caused wetlands to be highly degraded. This study focused on the rules and regulations governing the resources access from the wetlands using Kilombero Valley as a case study. The study used choice modelling to identify the determinants of the access patterns and their impacts on wetland sustainable management. The results showed that physical nature of resources and characteristics of the users such as location, income and education determine what type of access one chooses to accrue products and services from the wetlands. To ensure wetland sustainable management, the policy makers and conservationists should consider these factors in enacting rules and regulation which would govern human interactions in the wetlands. Payment for environmental services could be used to enhance such options.

Key words: Wetlands, goods and services, institutions, choice modelling.

INTRODUCTION

Wetlands have many functions that provide useful goods and services to human beings such as production of electricity, recharging ground water, controlling floods, preventing eutrophication of rivers and lakes and supporting specific biota. Wetlands are very useful for crop and livestock production, through provision of water and water related resources even in semi-arid areas. As such, wetlands are of great potential in poverty alleviation in developing countries (Costanza et al., 1997; Munishi

and Kilungu, 2004; Silviu et al., 2000).

In Tanzania, wetlands are important in sustaining much of the country's population. With much of Tanzania lying within arid and semi-arid climates, biological productivity is dependent upon the availability of water and nutrients (Majule, 2007). Despite their ecological importance, wetlands face many challenges warranting management attention (Baron et al., 2002). New technologies, population, and economic growth have lead to the interaction of both natural and social systems whose impact on ecosystems poses a threat to the existence of the resource base (Hagedorn, 2007). If the state of degradation is to be keenly observed, then attention should be given to a set of rules governing the interactions (Hagedorn, 2007; Quinn et al., 2006). In the

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Institutions of Sustainability (IoS) framework (Hagedorn, 2007), the nature of transactions among actors and properties of actors are considered as determinants of institutional innovation leading to property rights on ecosystem functions and governance structures. Property rights¹ define actions that individuals can take in relation to other individuals regarding a resource. Thus, if one has access right, someone else has a duty to observe that right (Schlager and Ostrom, 1992). The authors identify five rights relevant for the use of common pool resources (CPRs)², namely; access, withdrawal, management, exclusion, and alienation.

However, Sandberg (2007) counter argues that somehow, the type of property right depends on the productivity of the resource. The author claims further that, different possible combinations of bundles of rights largely determine who can use the attributes of certain resources and in what ways. It is therefore possible to have public wetlands ownership where people have certain user rights, but the right to exclude others or sell the wetlands is a public prerogative. It is also possible to have common-type ownership where the co-owners have access, harvest, management, and exclusion rights, but not the right to alienate the resource. Most wetlands in Tanzania fall under the first category but are commonly managed by the Ministry of Natural resources and Tourism. Since according to Hagedorn's framework (2007), natural properties of goods and services from the wetlands determine the property rights of the users, the physical properties of the resources have somewhat led to the development of various strategies in the choices of rules and regulations governing access of wetland resources.

Consequently, some users of the Kilombero Valley wetlands access resources through formal institutions thus, making management of such resources easy and not over exploited. Other users especially those with a direct link to resources, and are highly dependent on natural environment for their survival have developed various ways of access to suit their immediate needs. It follows that due to the wetlands nature of CPRs and the lack of appropriate infrastructure, the households (HHs) with a direct link to wetlands have developed informal ways of access to these CPRs. However, the informal access has resulted to wetlands degradation (MNRT, 2010). Husain and Bhattacharya (2004) argued that most studies on wetlands degradation have been on the observable factors and specifically those which are internal to a particular community. According to the authors, the external factors which also highly contribute to wetland ecosystems degradation are often neglected.

¹A property right is defined as an enforceable authority to undertake particular actions in a specific domain (Schlager and Ostrom, 1992).

²A common pool resource is defined as a valued natural or man-made resource, from which it is difficult to exclude or limit users once the resource is provided (exclusion problem) and one person's consumption of resource units make those units unavailable to others (subtract-ability problem) (Ostrom and Schlager. 1996).

The findings in their study showed how the historic and economic context shape targets resource users and affects the feasibility of alternative courses to achieve the target by determining opportunity and transaction costs of actions. In this study, we analyzed how a decision on access to resources accrued from wetlands is influenced by both exogenous (observable) and endogenous (latent) factors. According to Rao and Qaim (2010) studies using exogenous and endogenous variables to explain factors influencing choices are rare to find in developing countries.

This study focuses on the rules and regulations (hereby referred to as Institutions³ following (Hagedorn, 2007) governing the resources use in the wetlands using Kilombero Valley as a case study. The objective is to analyze the factors that determine the access pattern of the resources accrued from the wetlands. The main assumption is; Primary users⁴ and Secondary users⁵ of the wetlands that have developed various ways of access to the wetlands resources which in turn have implication on the sustainability of wetland ecosystems. In this respect, access to wetlands products and services is thought to be either formal or informal. Accordingly, interactions with government structures are used for the categorization of access rules. Thus, all access coordinated by the constitutionally established government structures are regarded as formal access, while access through structures designed by the users based on their experience and suitability are regarded as informal. The prevailing type of access gives a picture of the efficiency of the control and coordination mechanisms by government institutions; however, insight in the determinants of the type of access and how this efficiency can be improved remains useful.

METHODOLOGY

Study area

This study was conducted from August 2009 to March 2010 in Morogoro Municipal, Kilombero and Ulanga districts of Morogoro region in Tanzania focusing categorically on the Kilombero Valley Wetlands located in the region. The region is in the southern part of the country. The Kilombero Valley wetlands are located in Southern-East Tanzania (Latitude 7° 40' to 9° 7' South, Longitude 35° 37' to 30° 00' East). The wetlands lie between the Udzungwa Mountains and the Mahenge escarpment, which is part of the Eastern Arc Mountains. The wetlands area is designated as a Ramsar site. The valley is divided by the Kilombero River and falls within two districts of Kilombero and Ulanga. The wetlands area covers 7,967 km² with a catchment's area of about 40,000 km².

³ Institutions refers to set of rules which are equivalent to constraints that can and actually do imposed on human being interactions with nature and this is what is called "Institutions of Sustainability" (Hagedorn, 2007) .

⁴ HHs living in rural area and are directly dependent on wetland resources for their welfare.

⁵ HHs living in urban and are not directly dependent on wetland resources for their welfare.

Many rivers, permanent and seasonal, feed the floodplains. The area is characterised by sub-humid tropical climate (Mean 70 to 80%) with an annual rainfall of about 2000 to 3100 mm. It has two rainy seasons namely; the long rains from March to May and the short rains from October to December. Temperatures normally vary from 20 to 30°C (United Republic of Tanzania, 2007).

Sampling techniques and data collection methods

The sampling frame consisted of all rural communities in and around the Kilombero Valley wetlands who are the primary users of the wetlands. Since the study was meant to advice the policy makers on how wetlands can be sustainably managed in Tanzania, it was deemed important to include secondary users of the wetland and hence, Morogoro municipal was selected for that purpose because it provides a secondary market for goods and services accrued from the wetlands. The sampled HHs randomly picked from the village and street registers where a total of 408 HHs were interviewed. The interview was a face to face using structured questionnaire.

Analysis

Choice model was used to analyze the determinant of access pattern of goods and services accrued from the wetlands. In the choice modelling, the variables postulated by Hagedorn (2007), as described in the earlier were adopted for analysis of the determinant factors of access pattern. In the IoS theories (Hagedorn, 2007), the *Institution innovation* was measured in terms of 'rule in use'; whereas in this study, it is defined as either *formal* or *informal access*. The formal access refers to access through government structures which are established following constitutional laws justifying the formalities of these including permits and licences; entailing that all the resources was accrued based on established legal rules and through the constitutionally established government bodies. The informal access is realised when a community or an individual designs access mechanisms based on what is available to them. The variables of the study included:

Location which was given a binary dummy variable such that urban = 1 or Rural =0;

Environmental awareness was measured on a likert scale, and was composed of awareness level of the respondent regarding four commonly used terms in environmental education in the country namely, biodiversity, wetlands, environmental degradation, environmental conservation and global warming. For each of these terms, the respondents were asked to scale their awareness from 1 = *I don't know* to 4 = *I can explain*. These were later re-coded and the scales were changed into percentage where all respondents whose awareness level was above 50% were regarded as aware = 1 and those below were taken as unaware = 0.

Participation in environmental projects was given Yes=1 and No=0

Education was measured in six categories namely, (1) never went to school; (2) have adult education; (3) have Primary education; (4) have secondary education, (5) have college education and 6) have University education, that is, Bachelors/Masters/Doctorate. Those who did not attend school were later on merged with those who had adult education; in the end, there were only two categories where 1 and 2 made a group of the least educated and 3 and 4 of educated for the analysis.

Income was measured into four categories ranging from >

100,000 to <100,000,000 Tanzania shillings (TZS)⁶ annually. The categories were later merged into two with the two lower representing low income earners and the two upper groups making high income earners.

Gender was given a dummy variable with male=1 and female=0

Awareness, education and income were given binary variables instead of multi varied dummies for simplicity in modelling and clarity of the results to meet objective of this study. The descriptive statistics of these variables are presented in Table 1.

Probit model using *Stata 10* software was used to find out the determinants of the choice to *informal/formal* way of access of the household (HH). Similar models on the qualitative dependence between variables have been widely used in the literature for example, Sesabo (2007) and Rao and Qaim (2010). Olale and Henson (2012) used the choice model to determine a HH decision to support the establishment of marine protected area, participation in supermarket channels and income diversification among fishing communities respectively. The choice of the model was based on the type of data collected and the anticipated use of results for explanatory purposes. The general function of the model is:

$$A_i = f(x_1, \dots, x_n)$$

where A_i denotes *Institution Innovation* that supports access to the resource either formally or informally. x_1, \dots, x_n represents socio economic characteristics (Exogenous or observable factors) such as income, age and location of the resource users which determine the choices of the ways the products and service are to be accrued from the wetlands. Suppose A^* is the unobservable (Endogenous or latent influencing factors) decision that supports the innovation of either formal or informal ways to access resources from the wetlands; the decision on the way of accessing the resource would depend on the set of observed characteristics of the users x_i such that:

$$A_i^* = \beta x_i + \epsilon_i$$

where β a vector of parameters, x_i is a column vector of the variables that affect A^* and ϵ_i is an error term which is normally distributed with zero mean. The observed binary variable is related to A^* in the following manner:

$$A = 1 \text{ if } A^* > 0 = 0 \text{ otherwise.}$$

Given the normality assumption, the probability that A^* is less than or equal to A can be computed from the standardised normal cumulative distribution function as:

$$p_i = p(A = 1) = (A^* \leq A) = F(A_i) = \int_{-\infty}^{Bx_i} f(z) dz$$

where $f(z)$ is the density function, z is normally distributed with zero mean and unit variance and p_i is the probability that a household/individual will opt for formal against informal rules to

⁶ Tanzanian shilling (TZS) at time of data collection the exchange rate was 1US\$=1450 TZS

Table 1. The socio-economic analysis of the respondents.

Variable	Categorical values	Urban (%)	Rural (%)	Total (%)	χ^2 Value	Degree of freedom	Level of significance
Income (TAS * 1000)	>100	9.30	15.08	24.37	56.01	4	0.000
	100-1000	20.60	31.41	52.01			
	1000-10,000	15.08	3.52	18.59			
	10,000-100,000	3.27	0.50	3.77			
	<100,000	1.26	0.00	1.26			
	Total	49.50	50.50	100.00			
Education	Never gone to school	0.00	2.96	2.96	70.03	5	0.000
	Adult education	2.22	2.72	4.94			
	Primary Education	22.72	37.28	60.00			
	Secondary	15.06	5.19	20.25			
	College	5.93	1.98	7.90			
	University	3.95	0.00	3.95			
	Total	49.88	50.12	100.00			
Environmental awareness	Not aware	7.11	9.80	16.91	8.90	3	0.031
	Somewhat aware	8.09	7.84	15.93			
	Aware	22.30	15.69	37.99			
	Very much aware	12.50	16.67	29.17			
	Total	50.00	50.00	100.00			

access resources and the probability that the constitutional rule/regulation will positively affect the household's access to the products and services from the wetlands.

RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents

The sample consisted of the individuals with various socio-economic characteristics. Most (60%) of the respondents had at least primary education, while 4% had adult education and 20% had secondary education. The remaining 26% had attained higher education, including tertiary education. The households with less than TZS100, 000 of annual income were only 24.4% while those with annual income of between TZS 100,000 and 1 million (M) were 52% of all respondents. Those with income above TZS1M but less than 10M were 18.6% of the total sample. A few (5.1%) HHs had an annual income of about 10M and above. The analyses revealed that majority of the respondents had annual income which was above the national average of about TZS 400,000 per year implying a good purchasing power for wetlands goods and services if access is warranted. Highest educational level and highest household income were encountered in Morogoro municipality (Table 1). The gender distribution was almost same with the male respondents representing only 58% of the total respondents. The respondent's age ranged from 17 to 81 years.

Descriptive analysis of the factors influencing access pattern in the wetlands

In determining access to wetland resources, energy, land, water, and timber products were used to establish whether the access was formal or informal. It is however important to note that in Tanzania, there are formal authorities established by law to oversee the management and use of these resources. Examples of such bodies include Tanzania Electricity Supply Company (TANESCO); Water use authorities such as Morogoro Urban Water Authority (MORUWASA), Land Commission and Forest division. Formal access implied access through established bodies including formal markets while informal access implied direct collection from the wetlands.

In analyzing the access pattern, we first looked at how specific products and services were accessed by the users. The data revealed that except for the land resources and timber/poles, other products and services were largely accessed through informal ways by rural dwellers. Most of the urban dwellers have formal access through various markets and government bodies (Table 2). The findings revealed further, that most of the HHs/individuals that accessed the products and services through established bodies were the ones paying for the goods and services accrued from the wetlands. The institutions involved included the MURUWASA; TANESCO; Land Commission and village governments, and existing markets. All other types of direct access to the wetlands were not paid for. The most common products and services

Table 2. Ways of access to specific products and services accrued from the wetlands.

Type of resources	Sources of access	Urban (%)	Rural (%)	Proportion to the total sampled population (%)	χ^2 Value	Degrees of freedom	Significance level
Land	Inheritance	18.8	79.2	24.8	141.39	2	0.000
	Bought from individuals	17.5	82.5	14.9			
	Land allocation by Central Government (Land Commission) or Village Government	60.2	39.8	60.3			
Water	Nearby spring/river	12.5	87.5	2	4.59	1	0.032
	Nearby well	6.1	93.9	16.2	60.81	1	0.000
	Own well	16.7	83.3	7.4	14.39	1	0.000
	Community tap	31.7	68.3	34.1	28.38	1	0.000
	Private tap	90.3	9.7	40.4	180.00	1	0.000
Energy	Direct from catchment forests	4.5	95.5	27.2	126.25	1	0.000
	Market (local sellers)	64.8	35.2	71.1	88.81	1	0.000
	Other sources	0	1.7	1.7	7.49	1	0.000
Timber products	Direct from the wetlands catchments	35.3	63.7	63.3	63.97	2	0.000
	Market	90.1	9.9	26.9			
	Both direct from Wetlands and market	30.8	69.2	9.8			

accessed freely included the fire woods, poles, farms for crop cultivation, fodder, and water.

It was of interest in this study to examine the form in which the goods and services were accessed from the wetlands. It is generally acceptable that if the goods and services are accessible in a semi or processed form, they attract additional cost in terms of value addition. In this aspect, water, energy and timber products were the goods withdrawn from the wetlands, innovations. In order to determine these two categories of users, it was important to involve the organizations where the payments were made to justify the formalities of the access patterns. Accordingly, these institutions were the ones used to re-code the data and categorize the access into formal and informal ways for choice modelling. The description of the

results and their implications are subsequently discussed. processed and provided in an easier form than is the case with land. This is partly because all land in Tanzania belongs to the state where individuals can have various rights to use of a particular land (Land Act, 1999; Village Land Act, 1999). Processes that add value to land in terms of demarcation titling and formalization of land are less common in rural areas. In this regard, we had to do a deeper analysis to find out what users (based on their socio-economic characteristics) are paying and who are not paying. This follows the claims of Hagedorn (2007) about the characteristics of the users and the properties of transactions (linked to the physical forms of the resources) as the determinants to property rights innovations. In order to

determine these two categories of users, it was important to involve the organizations where the payments were made to justify the formalities of the access patterns. Accordingly, these institutions were the ones used to re-code the data and categorize the access into formal and informal ways for choice modelling. The description of the results and their implications are subsequently discussed.

Determinants of access patterns to goods and services from wetlands

This study considered location as an important factor in determining the type of access (Table 3). The study revealed that most of the people living

Table 3. The determinants of HHs' choices to ways of access (formal/informal) to products and services accrued from the wetlands.

Variables	Estimated coefficient	Std. error	P-Value	95% C. I.	Marginal effect (df/dx)
Constant	-2.832	0.496	0.000	(-3.805, -1.860)	—
Age	0.003	0.007	0.610	(-0.010, 0.018)	0.0004
Gender	-0.446	0.189	0.019	(-0.817, -0.075)	-0.052
Education	0.267	0.099	0.006	(0.075, 0.458)	0.031
Participation in conservation project	0.349	0.228	0.126	(-0.098, 0.797)	0.049
Income	0.388	0.194	0.045	(0.009, 0.768)	0.054
Location	1.863	0.352	0.000	(1.173, 2.552)	0.257
Awareness	0.273	0.199	0.170	(-0.117, -0.663)	0.030

Number of observation = 408; LR $\chi^2(7) = 108.64$; Prob > $\chi^2 = 0.0000$; Log likelihood = -129.50655; Pseudo $R^2 = 0.2955$.

in rural areas access the resources using informal structures. This is shown by a positive and significant coefficient for the variable (the positive correlation is for urban residence). Education was also found to have a significant influence on access where the probability of those with education in accessing resources formally is higher than that of those with little education. This supports the argument that in rural areas most of the people have informal access with no formal structures. With respect to overseeing the management and use of these resources, the findings also show that individuals with the highest level of education are located in the urban area (Morogoro Municipality) (Table 1).

Income was also revealed to be significantly influencing decision on the choice of the way to access resources from wetlands (Table 3). The positive and reasonable marginal effect of income shows that the probability of those with high income to access resources using formal ways is higher as compared to the HHs with low income. This could be due to the fact that the capacity of these HHs with high income to pay for the value added goods and services accrued from the wetlands. There is linkage between poverty and environmental degradation (Cavendish, 2000). The problem is very much visible in developing countries due to what Duraiappah (1998) in his study calls simultaneous increase in poverty and environmental degradation. Since CPRs exhibit free riding characteristics (Ostrom and Schlager, 1996; Ostrom, 2005) the visible solution is always to improve the access pattern where there would be restraints to these behaviours. However, Husain and Bhattacharya (2004) claimed that although appropriation of the benefits of CPRs is a rival, it is difficult and costly to apply the exclusion principle like in the case of public goods to potential users of such resources. It is therefore important to think on the ways where this rural poor HHs can be aided to develop appropriate infrastructures that would impose restraints to their free riding characters.

The study results further showed that the probability of women accessing resources formally was higher than that of men (Table 3). The implication here is simply that most women abide to lay down access procedures as

compared to men. However, it is a fact as pointed out by Ashley et al. (2002) that men's development practices including wetland resources do affect the quality of the wetlands.

Ways of access to wetlands resources and their effects in sustainable wetlands management

While in this study, location was found to be the most important determinant of the type of access to wetland products and services (Table 3), awareness and level of education are important determinants of the level of knowledge regarding the rules and regulations on wetland management (Mombo et al., 2012). Consequently, while the government control structures are not optimally functioning in rural areas, the probability of people with education to observe rules and regulations was negatively correlated with greater understanding on the rules and regulation as opposed to the probability of people with little education. These findings have an implication to the status of wetlands sustainability.

From these findings, one anticipates a deteriorating status of wetlands if these important control structures are only available in the urban areas and not in rural areas where primary users dominate. Because these structures are available in urban areas, the probability of highly educated people residing in the urban (location) influencing the performance was negatively correlated with the institutional performance as opposed to the probability of poorly educated people living in the rural (Mombo et al., 2012). This seems to contradict the logic. However, there is a possible explanation for this; most environmental awareness programs are conducted in the rural areas and mostly by NGOs (MNRT, 2004; MNRT, 2010); in this respect, one could suggest that rural people with little education are more aware of the environmental issues than their urban counterparts. As such, it is inconceivable to see this kind of a pattern where, while people are aware of what is to be done, there are no legal bodies which would enforce the rules and coordinate the users into a sustainable management and

use of the resources. In the rural areas, communities are organized into forming various committees to manage the resources using the enacted by-laws; however, often than not, such arrangements lack legal backing. This finding is analogous to what Wade (1998) in his study perceives to be ineffective rules of restraints on access and use of CPRs when the users are many. According to the author, this happens when several factors are not considered in the management system, among the common ones being the fact that the detection of those who break the rules is difficult. There is much evidence (for example, United Republic of Tanzania, 2010), which indicate cases where these informal structures have failed to penalize the illegal use of the resources in Tanzania especially, when the culprits are taken to court for prosecution. Furthermore, Wade (1998) classifies several variables to be considered in facilitating successful management of the commons such as technology, user group, visibility, relationship between resources and user groups and relationship between users and the state. All these factors are relevant for the successful management of Kilombero valley wetlands as well as others with similar features to Kilombero valley.

The study therefore, revealed various ways of access and uncoordinated mode of resources management in wetlands ecosystems, something that calls for the harmonization of legal instruments such as governance structures. If there is a legally established body to oversee the use of electricity which caters for only 14% of the people residing in the urban area, there is no reason why there should not be a similar body to regulate the biomass energy supply and use which is depended by over 90% of the Tanzanian population. This is the conundrum that needs to be addressed by policy makers. Moreover, the over dependency on biomass is already costing the vegetation in the catchment areas and wetlands in Tanzania. According to the FAO (2010), the deforestation rate for which energy use is one of the contributing factors, is already at an alarming rate of 412,000/ha/year.

In order to reverse the current trend of deforestation figures, there is a need to have a proper institutional set-up which would employ the effective rotation of the biomass by balancing demand and supply as is the case with hydropower electricity. This could be the most preferable solution as biomass energy use is CO₂ neutral and hence, an environmental friendly investment.

Examples of this kind of schemes can be found in Sweden, China, and Brazil. Sweden in particular, is investing highly in biomass energy as a solution to country's security in energy and also for environmental purposes (Collier and Lofstedt, 1997; Jacobsson and Johnson, 2000; McKendry, 2002; Wright, 2006). A study on how this can be achieved in Tanzania's context is important, hence, further research on this aspect is highly recommended.

Similarly, while there are legally established structures

for water management and use which are only regulating the urban or secondary users; primary users on the other hand are left with informally established structures such as water user groups to regulate the water uses. This is because these are using by-laws which sometimes lack legal backing if not passed by the district councils (the most common situation) hence, ending up being caught in a dilemma of free riding. Moreover, there is a big relationship between the existence of good vegetation and availability of enough and quality water throughout the year. Thus, if the bodies concerned with water and energy provision would only concentrate on water without considering the sources where this water comes from, it will reach a point where there would be nothing to provide. This is a situation which currently exists in most parts of the country as revealed by Quinn et al. (2006); Dungumaro and Madulu (2003); Franks et al. (2004) and van Koppen et al. (2004). The authors suggest various reasons as to the cause of the current situation in all of the wetlands ecosystems, whereby mis-management is cited as one of the major causes.

Features of transactions and characteristics of actors are important variables in analyzing problems related to natural resources management (De Leo and Levin, 1997; Hagedorn, 2007, 2008). According to IoS theories, properties of transactions and characteristics of actors determine the direction to which the wetlands ecosystem management would go in terms of sustainability. We have thoroughly explained in this study, as to how characteristics of the actors such as the primary users, secondary users and government structures have resulted into strategizing two different ways of accessing the resources accrued from the wetlands. As a result, these characteristics have led to fragmented and uncoordinated ways of accessing resources and which have ultimately led into difficulties in sustainable management of the concerned ecosystems. Because of this, we think that sustainability of Kilombero valley wetlands in providing its ecological services and resources to both primary and secondary users leaves a lot to be desired. We therefore, believe that these findings will provide policy makers with useful information that will guide them in decision making especially, on pertinent issues regarding sustainable wetlands management in Kilombero and elsewhere where applicable.

CONCLUSION AND RECOMMENDATIONS

The study concludes that sustainable management of wetlands as a common pool resource is very much linked to institutions that govern the interactions between the individuals and their physical environment. This is justified with what is revealed in this study where Kilombero valley wetlands are taken as a case study. The fragmented and uncoordinated mode of resources use from the wetlands ecosystems are directly associated

with the characteristics of the actors such as the primary and secondary users and in the way they are related to the governing institutions in Tanzania. It follows that the property rights of the users are highly determined by their socio-economic characteristics. Consequently, there are two different ways of accessing resources from the wetlands depending on location. While secondary users (those residing in the urban areas) are coordinated by government structures which to a limited extent follow policies that institute sustainable management of wetlands ecosystems and resources; primary users, which is the other group of users are left to organise themselves with informal structures designed to suit their immediate needs such as getting food and cash. Unfortunately, these informal structures lack legal backing, and as a result of free riding behaviour commonly experienced in common pool resources, wetlands have been over exploited and therefore degraded.

This trend calls for the harmonization of the relevant institutions responsible for the management of wetland resources so as to bring together into collective action the responsibility of the three main actors of wetlands ecosystems, namely, the primary users, the secondary users and government institutions. The trend also justifies the conclusion that sustainable management of common pool resources is very much influenced by the socio-economic characteristics of the actors, the relationship of the users with the governing institutions as well as, the physical features of the resource itself in designing management options. The management options which do not consider these realities will catalyse unsustainable management of such ecosystems. We therefore recommend that policy makers and conservationists should consider these factors in designing management options for ecosystems and other common pool resources such as wetlands. The factors would in the end help stakeholders come into collective action and responsibility. The possible ways could be through payment for environmental/ecosystems services since for the time being, the payment is only for the accrued goods and services of the providing/servicing bodies. The revenue collected can therefore be used to develop infrastructures in rural areas where individuals are not able to pay for those infrastructures. Further studies to analyze such possibilities are recommended.

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