Tanzania Journal of Forestry and Nature Conservation, Vol 90, No. 3 (2021) Special Issue*: Embracing Science and Technology in Nature Conservation. pp 156-167*

Power Relations Between Upstream and Downstream Common Pool Resource Users: Winners and Losers in The Uluguru Mountains, Morogoro Tanzania

[1]N.S. Amanzi, [2]G.E. Mbeyale, and [3]L.P. Lusambo,

[1]Kibaha Lowland Afforestation Research Centre, Tanzania

[2]Department of Forest Resource Assessment and Management
Sokoine University of Agriculture, Tanzania

[3]Department of Forest and Environmental Economics
Sokoine University of Agriculture, Tanzania

ABSTRACT

Power relations often determine who manage resources, who have access to and who makes important decisions. Understanding power relations is important considering its importance in mitigating resource use conflicts as the result of power imbalance. This study was conducted to analyse power relations between upstream and downstream Common Pool Resources (CPR) users in Uluguru Mountains (UMs), Morogoro Tanzania. The study was conducted in Ruvuma and Peko Misegese villages representing the upstream communities and Mafisa and Mlali Streets representing the downstream communities. Qualitative and quantitative data were collected using Participatory Rural Appraisal and structured questionnaire. Content analysis was used to analyse qualitative data while descriptive and inferential statistics were employed for quantitative data analyses using SPSS. Findings show that, strategic, institutional and structural powers embody people's livelihoods in UMs. Strategic power was found to be dominant in the upstream while institutional power in the downstream. Furthermore, the results showed that conflictive power relations created winners and losers, whereby upstream dwellers were considered to be the winners due to virtue of their position and weakness of existing institutions in enforcing rules and regulations governing CPRs. To have a win-win situation, the study recommends the need of improving institutional arrangements.

Key words: Uluguru Mountains - common pool resources - power relations.

INTRODUCTION

Background information

Common Pool Resource (CPR) is a class of resource, either natural or manmade, which share two important characteristics: excludability (or control of access) and subtractability. The first attribute, excludability, arises mainly due to physical nature of the resource which makes controlling access by potential users costly and, in the extreme, virtually impossible. Under a market structure, the high exclusion cost characteristic of CPRs enable free riders who would tend to benefit from the conservation efforts undertaken by other users without cutting down their own levels of consumption (Gopalakrishnan 2005). The second attribute, subtractability, that is, each user of the resource is capable of subtracting from the welfare of other users. The resource units (e.g., bundles of firewood or fodder) that one user extracts from a CPRs are not available to others. Each user is thus capable of subtracting from the benefits that others derive from CPRs (Williams 1998). The classic examples of natural CPRs include migratory resources (wildlife, groundwater and fish), water, agricultural land, wetlands,

grazing land and forests. Man-made CPRs include communal irrigation schemes, communal fishing ponds and charco-dams (Msangi *et al.* 2001).

CPRs directly or indirectly provide livelihood to millions of poor people all over the world. It provides economic goods and services; in the development context they may have a primary function for much of the society. In developing countries, millions of people depend on CPRs including forests, fisheries, rangelands, water and wetland for food, shelter, medicines and fuel and as means of income generation. For instance, the International Energy Agency (IEA 2002) revealed that around 2.4 billion people are still depending on fuel from forests as their main source of energy for domestic use. In addition, CPR is the means of income generation of many people in developing countries. FAO (2004) reported that the fisheries sector employ more than 36 million people.

In Tanzania, CPRs specifically forest and water provide a vital contribution to the national economy and food security for many vulnerable societies. At national level, forests and water have vital contribution to the national economy, therefore, its exploitation is considered as a key factor in the socio-economic development and the fight against poverty (URT 2002). The national poverty strategies such as National Strategy for Growth and Reduction of Poverty (NSGRP) recognise the heavy dependence of the poor Tanzanians on CPRs (URT 1998, 2002). At household level, especially for vulnerable societies including those living within and around Uluguru Mountains (UMs), forests and water provides food, shelter and cash income (Rodgers 1993). Forests are directly benefits those living within 10 Km radius from the forests (*Ibid*). From the forests, they obtain firewood, building poles, tool handles, medicine, food and honey (Lulandala 1998). Apart from the production of wood and non-wood forest products, UMs act as water towers and as ultimate source of water for most river systems which flow downstream. Rivers flowing downstream such as Ruvu River provide essential freshwater for agriculture, industrial and domestic use for a rapidly growing urban population in Dar es salaam and Morogoro (MNRT 2006).

Management of CPR in UMs

Institutions managing CPRs in UMs underwent dramatic changes during the 20th century, mainly as a result of colonisation of indigenous societies. Those changes were influenced by changing of policies and practices of pre and post-colonial governments (Luoga *et al.* 2005). Before the arrival of Europeans, CPRs in UMs were traditionally managed using informal institutions. Traditionally, the *Waluguru* (inhabitants of UMs) their social structure was organised according to clans and lineage groups that were led by groups of elders who made the decisions for the areas within their territorial jurisdiction, hence the significance of a particular clan's land holdings. During colonial times structures such as headmen (*Akidas*: German period) and chiefs (*Mndewa*: British period) were imposed by the colonial authorities (Hartley and Kaare 2001). At that period, both customary (informal) and formal institutions displayed power and influenced power relations at various degrees in the management of CPRs. Formal institutions displayed powers by the virtue of the state and formal rule of law, while the informal ones acquired power through customary influences and beliefs (*Ibid*).

Forestry Policy adopted in 1953 by British administration was the first formal institution in the management of forest. Thereafter forestry ordinance enacted in 1957 with the main thrust being the government's monopoly over forest resources (Luoga *et al.* 2005). After independence in 1961, the Tanzanian government continued operating with the colonial forest policy with minor amendments. In 1963, the government abolished chiefdom system (traditional leadership) (Bukurura 1995). This led to breakdown of customary institutions that

were traditionally responsible for local resource management and forestland became state property under Forest Department. In this period, the whole country experienced severe deforestation (FBD 2005) and drying of some water sources since the government failure to manage forest resources properly all over the country (MNRT 2003). To overcome further degradation of forests and water sources, the government introduced co-management approach of CPRs termed as Community Based Natural Resource Management (CBNRM) with main objective of transferring management and decision-making powers from state to lower level (villages) (Pfliegner and Moshi 2007).

Changing policies and practices in the management of CPRs in UMs shaped power relations among resource users. Power relations often determine who may have access to and use of CPRs. Its knowledge is of useful for the achievement of more equitable CPR management and distribution of benefits. Nevertheless, despite of its importance, there is limited information in UMs. Many research done focused on ecosystem values (Burgess 2001), CPRs depletions (MNRT 2003) and the role of socio-economic incentives in biodiversity conservation (Lalika 2007). Therefore, this paper presents power relations between upstream and downstream CPR users and how they create winners and losers. The findings are useful to policy makers in planning effective CPR management, equitable distribution of benefits and mitigating resource use conflicts.

METHODOLOGY

Description of the study area

The Uluguru Mountains (UMs) are part of Eastern Arc Mountains that running from the Taita Hills in South-East Kenya to the Udzungwa Mountains in South-central Tanzania (Burgess *et al*. 2007). The UMs are found within Morogoro region mainly in Morogoro rural (largely), Mvomero and Morogoro urban districts. The mountains are at 07°00' and 10º 00′S and between 37º 40′ and 38º 22′ E and located at 45.5Km long chain that rises steeply from 150m rising to 2638m (Lovett *et al.* 1995).

Sampling procedures and sample size

The study was conducted in four villages; two in upstream and two in downstream. Purposive sampling procedures were used to select villages. Ruvuma Street and Peko Misegese village were representing upstream users while Mafisa and Mlali Streets representing downstream users. For this study, upstream resource users defined as all users found within 10 km radius from catchment forests. This is because users in the upstream directly depended much on the forest for more or less daily basis to maintain their livelihoods. Furthermore, their activities within or around catchment forest have negative impact to water quality and quantity flowing downstream. While the downstream resource users defined as users beyond 10 km radius from the forests along the stream or river systems originating from catchment forests. These were mainly water users and their activities have relatively low effect to the catchment forests located in the upstream.

A sampling unit for this study was households. Sampling frame was the names of all household heads from the village registers obtained from the village government offices; these were used in selecting the households for the interviews. The sampling intensity was 5% of households in each village. In villages where 5% of households showed a sample size less than 30 households, 30 households were randomly selected for detailed study irrespective of the population size. Random sampling procedure using a table of random numbers was used to select households for detailed questionnaire survey. A total of 120 respondents from four sites were interviewed in this study.

Data collection

Both primary and secondary data were collected in this study. Primary data were

collected using a combination of methods: Participatory Rural Appraisal (PRA) methods (direct observation, Focus Group Discussions (FGDs) matrix ranking and key informant interview) and questionnaires survey. Direct observation was used to see socio economic activities such as farming practices. FGD was done with ten (10) people from each village. Issues discussed include socio economic activities and power relations. Matrix ranking was used to obtain dominant power underlying resource users in upstream and downstream, separately. Key informant interview was done with village leaders, village eminent elders, heads of institutions such as Morogoro Region Forest Officer, Wami Ruvu Basin Water Office (WRBWO) Morogoro Urban Water and Sewerage Authority (MORUWASA), Mlali Water Board (MWB) and Mlali Kipera Rice Irrigation Scheme (MKRIS). Socio-economic data were collected on management status of forest, uses of forests and water, water user rights and power relations. Structured questionnaires were administered to randomly selected households. Questions asked focused on socio-economic activities and embedded power in livelihood activities.

Secondary data were collected through literature review with the focus on socio-economic activities, power relations and winners and losers. Published and unpublished reports on related studies were gathered and relevant information summarized in order to supplement primary data.

Data analysis

Both quantitative and qualitative methods of data analysis were employed in order to address the study objectives. Content analysis was used to analyse qualitative data generated through PRA methods. Statistical Package for Social Sciences (SPSS) version 16 was used to analyse quantitative data collected through structured questionnaires. Descriptive statistical analysis was used in exploring the data for distribution of responses, central tendencies and dispersion. Cross tabulation and multiple response analyses was also performed to ascertain responses and percentages.

In analysing factors influencing dominant power in both upstream and downstream, inferential statistic was used. It was assumed existence of dominant power influenced by socio-economic and institutional factors. To test which variable in a set of socio-economic and institutional variables have strong influence; multiple regression models (Eq.1) were developed. Since dependent variable (y) in multiple regressions should be continuous data, index of dominance representing dominant power was calculated using 5-point Likert scale. Each value from 1 to 5 in the scale yielded a single number representing dominant power index. The dominant power in upstream and downstream was determined through pair wise ranking with the help of PRA groups.

$$Y_{1\text{-}2} = \beta_0 + \beta_1 X_1 \ldots\ldots + \beta_n X_n + \varepsilon \ldots\ldots (1)$$

Where; Y_1 is dominant power in the upstream, Y_2 is dominant power in the downstream, β_0 is a constant showing intercepts for regression equation, β_1- β_n are independent variables coefficients, X_1-X_n are independent variables and ε is an error term which represents unobservable factors assumed to be independently distributed over the survey period. Independent variables in the upstream included were residence duration, education level, wealth category, household size, farm size and distance to resource base while in the downstream were residence duration, education level, presence of infrastructures for capturing water and membership to water institutions.

RESULTS AND DISCUSSIONS

Power relations underlying forest and water users in the upstream of UMs

All (100%) households in the upstream of Uluguru Mountains (UMs) use either firewood or charcoal for cooking and heating. The use of building poles for construction accounted 47% in Ruvuma

Street and 41% in Peko Misegese village while timber accounted for 63% in Ruvuma Street and 33% in Peko Misegese village. Difference across villages was attributed to the distance to nearby forest reserve; households in Ruvuma are about 1 km from Uluguru North forest reserve as compared to 2-3 km from Peko Misegese. Cutting of live tress form forest reserves is illegal (URT 2002). Local people allowed collecting dead trees for firewood and non-wood forest products. However, tree cutting for building poles and timber were common in surveyed villages. Illegal timber trade was reported in Ruvuma and Peko Misegese not only done by inhabitants, but also with outsiders mainly from Morogoro town together with some village members. In illegal timber trade, cordial power relation was manifested between timber traders and some village members. Timber traders make informal arrangements with young men from the upstream villages for buying timber from them or financing pit sawing activities. This reveals strategic power of timber traders whereby they use their financial power to access forest products illegally.

Power relations in illegal timber trade also manifested between timber dealers and members of Village Natural Resources Committee (VNRC) and Village Government (VG). The VNRC and VG have institutional power while timber dealers have strategic power as the function of their financial power. In this case, supportive power relation was manifested whereby members of VNRC and VG use their institutional power to support illegal timber trade for personal gain. They do not report illegal activities to the respective institutions for legal actions to be taken. Thus, are considered to be power brokers. It was observed that VNRC and VG siding with timber traders and pit sawyers after being corrupted instead of siding with forest officers who enforcing existing laws. This indicates existence of corruptible institutions at village level which not abide with principles of good governance. There are several factors explaining for poor performance of institutions at village level in upstream. The government intention to relocate the upstream communities by the end of June 2006 (VPO 2006), which is not yet implemented was the main factor. The government intention on reallocation of upstream dwellers reduces the morale of communities in the upstream to participate actively in JFM consequently increasing illegal activities.

Apart from forest products, upstream communities benefit from water resources. Water is used for domestic and crop production. In crop production, water is regarded as natural capital and used by 83% of households in the production of vegetables. Ruvuma Street is famous for production of vegetables such as radish, cabbage, spinach, beetroot, green bean, salad, coriander, and leeks. The vegetables produced are sold in Morogoro town and Dar es salaam. The vegetable production in Ruvuma Street is done along river valley employing traditional and semi mechanized irrigation systems. The traditional irrigation system involves the use of furrows or using water canes and is common for people who are adjacent to rivers/streams. Semi mechanized irrigation system involves the use of water pipes inserted at the water source and fitted with sprinter in the field. Water flows throughout the day in the water pipe by gravity and mainly used by individuals with relatively higher income. The length of the water pipes ranges between 50m to 400m depending on distance from the water source to the field. In Peko Misegese village, crops grown include cabbage, carrots, beans, water melons, spinach and tomatoes. Unlike Ruvuma Street, households in Peko Misegese grow vegetables along streams and water diverted to the field using either furrows or bamboo. Farm size for both sites range between 0.25 and 0.5 ha. The produce in Peko Misegese was sold at weekly market (Sunday and Wednesday) in Mlali village. Power relations among water users in the upstream are centred on access of water for irrigation.

It was revealed that community members in upstream differ in strategic power and hence access to water for irrigation especially during dry season. Wealthier households were found to have more access to water than resource weak households. In such situation skewed power relations manifested whereby wealthy households in the community use their money strategically to paralyze the poor. The Wealthier households were found exploiting the poor by using their financial power to buy land in strategic position, which manifesting strategic power of wealthier households whereby power is a function of relative wealth. Wealthier households access more water resource through the use of water pipes or owning land near water sources as compared to resource weak households.

Dominant power among CPRs users in upstream

Unequal access to forest and water resources among users in the upstream as the result of their differences in wealth, strategic positions to resources and their relationship to different institutions led to power disparity. Amongst strategic, institutional and structural powers underlying access and use of forest and water resources, strategic power was highly embedded in peoples' daily interaction. This implies that strategic power has higher influence in the access and use of forest and water resources. Majority, 66.7% of households accepted the fact against 34.3% who disagreed.

Factors influencing strategic power in upstream forest and water users

Table 1 shows socio economic factors underlying strategic power. The model was significant (P<000), explaining 88.7% variance in strategic power. Factors with positive regression coefficient are influencing strategic power in the upstream. These include residence duration, wealth category, farm size, education level and household size. Magnitude of influence for residence duration, wealth category and farm size are statistically significantly as compared to education level and household size. Distance to resource base has negative regression coefficient, thus hindering strategic power.

Table 1: Factors influencing strategic power in the upstream

Factors X_i	Coefficients (a)		R^2 = 0.887	
	β	S. E	t	Sig.
Residence duration	.567	.023	8.203	.000*
Wealth category	.183	.344	3.454	.001*
Farm size	.145	.154	2.034	.047*
Education level	.046	.358	.935	.354NS
Household size	.039	.117	.640	.525NS
Distance to resource base	-.212	.123	-3.417	.001*
(Constant)		1.091	8.077	.000*

a Dependent Variable: Performance level index of Strategic power (dominant power in upstream) (Y_i) SE =Standard error of the estimate.

*Statistically significant at 0.05 and 0.01 level of significance, NS = not statistically significant at 0.05 level of significance, β = Beta weight

Residence duration (the number of years an individual has stayed in the study area) was significantly correlated (p=0.000) with the strategic power (Table 1). The findings implies that an increase in number of years of residence in the upstream influencing strategic power of individual by strengthening his/her social capital hence becoming more influential to the community. It has been revealed from the study that people having been born in an area describe themselves as belonging "mimi ni mzaliwa hapa". Individuals born in an area exercise a greater level of influence than outsiders who have moved into the area. This further highlights the importance of territoriality and claims on the resource being a defining characteristic for the Waluguru**.**

Wealthy category was significantly correlated (p = 0.001) with strategic power (Table 1). This entails that increase of relative wealth increase strategic power of individual in access and use forest and water resources. In this case, their strategic power based on financial or ability to raise capital necessary for harvesting and transporting products to the market by using the low-income groups. It was found that wealthier people mobilized their resources and

investing in dry season vegetable production by employing poor to perform all farm operations including tilling land, transplanting, weeding and harvesting. Resource weak individuals depend much on vegetable production during rainy season as water become plenty, the rest of the time engaging in casual labour.

Farm size also significantly correlated (p=0.047) with the strategic power (Table 1). This implies that increase in farm size increases strategic power. A plausible explanation is that farmers with large farm sizes could produce more agricultural products and sell the surpluses which make them financially better off as compared to those with small farm sizes. It was found that people with large farms had higher income earned by selling of crops. Farm size portray positively correlation with annual income of household though not statistically significant (r^2 = 0. 191; p=0.152). Average farm size was 1.6 ± 1.73 ha, however, majority, 48% of households had farm size between 1.26 and 2.4 ha, 35% had less than 1.2 ha, 13% had 2.46 and 3.6 ha, the rest 3% had more than 3.6 ha. Land acquisition differs although dominated by inheritance from parents as indicated by 57% of households. In matrilineal system which practiced by *luguru* inheritance is from mother to daughter. Other means of acquiring land include purchasing from owner, renting and allocation by government as indicated by 2%, 18% and 3%of households, respectively.

Distance from residence to resource base (forest and water in upstream) was statistically significant (p=0.001) with (Beta=-0.212) (Table 1). The negative correlation indicates that increase in distance from residence to the resource base tend to weaken individual strategic power in access and use of resources. The plausible explanation is that increase of distance to resource base makes exploitation of the resources costly. Households adjacent to the resource base had strategic power as the function of position to resource base. In this situation, strategic power is derived from ones' endowments and entitlements (Mbeyale 2009). In line to this, three quarters of households located <1.5 km from the resource base practised dry season vegetable production.

Power relations underlying water users in the downstream

It was revealed that communities in the downstream were highly depend on water from upstream for domestic, industrial and agricultural sector development. In Mafisa Street, water infrastructures were in place along Morogoro River used to capture water for domestic and industrial use. The use of water for rice, vegetable production and brick making done by communities in Mafisa Street to sustain their livelihoods was also revealed along Morogoro River. Vegetables grown include spinach, cabbage, tomatoes, okra and eggplant. All produce were sold in the local market. In Mlali village, there were two main water sources: Mgela River for domestic use and Mlali for crop production. Mgela River originates from Uluguru North Forest Reserve (UNFR) and empts in Mindu dam. Mlali River formed by several tributaries including Obwe from Peko Misegese village and Mbalala from Mbalala village. Mlali Kipera Rice Irrigation Scheme (MKRIS) was established along this river. During dry season, water from the river is supplemented by water from wells and used for production of vegetables specifically tomatoes.

In Mafisa Street, power relations were centred on the access and use of water for domestic and irrigation purposes. For example, complimentary power relation was manifested between communities in Mafisa and Urban Water and Sewerage Authority (MORUWASA). In such relations both institutional and strategic powers were portrayed. MORUWASA have water user right, thus granted institutional power to supply water in Morogoro Urban while communities have strategic power because of their financial power. The strategic power enables community to be connected to water supply system which is coordinated by

MORUWASA. Conflictive power relations were manifested among vegetable growers in access and use of water for dry season farming. In this case, the access and use of water for irrigation is not regulated by any entity, makes the resource free for everyone. Free access to resource granted rich farmers using water pumps to access and use more water. To avoid violent conflicts, some poor farmers tend to cultivate small plots and irrigate using water canes while the majority cultivate during rainy season only.

In Mlali village, strategic and institutional powers were revealed in interaction among communities and communities with water institutions: Mlali Water Board (MWB) and Mlali Kipera Rice Irrigation Scheme (MKRIS). The conflictive power relations were manifested among community members in the use of water for vegetable production due to differences in strategic power. Water for vegetable production is free; therefore, wealthier individuals were in advantage. Rich farmers were buying land along rivers and block river flow while poor seek casual labour to sustain their life. During the peak of dry season, rich people drill water wells to overcome water shortages while poor hire water pumps by offering labour power or by paying cash. Power relations also manifested between communities and MWB and MKRIS. Communities in Mlali village have strategic power because of the economic exploitation while MWB and MKRIS have water user rights from Wami Ruvu Basin Water Office (WRBWO), thus granted institutional power. MWB supplying water for domestic use while MKRIS for allocating of water in the rice irrigation scheme. In this case, complimentary power relations manifested as community associate with water institutions in supplying and maintaining water infrastructure.

The conflictive power relations were also manifested between village government and MWB. Village government had strategic and structural powers while MWB had institutional power. Conflictive relations arise due to tendency of some corruptible members of MWB to allocate water to vegetable growers at night. In such relation, village government used her structural power to overthrow the MWB. Such conflictive relation was also manifested in interaction between communities in Mlali village and MKRIS. This is due to the miss use of institutional power done by leadership of MKRIS in allocation of irrigation plots to new applicants for personal gain. It was reported that some members MKRIS allocated irrigation plot to their relatives or friends. Furthermore, the study revealed members of MKRIS do not operate according to the constitution of the institution. According to the constitution of MKRIS, individuals applying for plot should pay 20 000 TAS as application fee. In reality more than 100 000 TAS paid to MKRIS. This creates opportunity for rich people who are able to corrupt leaders of MKRIS to acquire irrigation plots and marginalizing the poor depend on rain fed agriculture.

The dominant power in the downstream

Unlike in upstream where access and use of water resources for domestic and irrigation was free, access and use of water for domestic, industrial and agricultural in the downstream were regulated by formal institutions. The resource users were abided to the rules and regulations of the respective institutions including paying of monthly bill for domestic and industrial water use and annual water fee for agricultural use. Wami-Ruvu Basin Water Office (WRBWO) was institution responsible in the management of water resource in Wami and Ruvu River Basins, issuing water use permit and collection water use fees. Despite of the presence of institutions, 62% of respondents blamed lack of equity in access and use of water because their allocations are influenced by individual power while 28% acknowledge the presence of equity. Problems of water allocations were high in Mlali village whereby water is used for both domestic and crop production. Three categories of power namely strategic,

institutional and structural were observed in access and use of water in the study area. Matrix ranking revealed that institutional power is dominant in the downstream with the score of four, followed by strategic power with score of two.

Factors underlying institutional power relations in downstream

Table 2 shows factors underlying institutional power in the downstream of UMs. The coefficient was highly significant and the models explain 78.8% of the variation in institutional power, as measured by R^2**.** Table 2 further shows that positive correlation was depicted between institutional power and education level, membership of institutions, residence duration and presence of infrastructures. However, only education level and membership of institutions were statistically significant.

Education level was positively correlated (β=0.430) and highly significant (p = 0.000) with institutional power (Table 2). Positive correlation implies that people with high education are likely of holding position in institution, therefore using their institutional power to access water resources. This is due to the fact that an increase in education tends to increase people's chances of being employed in institutions or contest for political positions in the society as compared to less educated ones.

Table 2: Factors underlying institutional power in access and use of CPRs in the downstream.

Factors X_i	Coefficients (a)			R^2= 0.788
	β	S. E	t	Sig.
Education level	.430	.274	5.219	.000*
Membership to institutions	.523	.516	6.276	.000*
Residence duration	.121	.015	1.901	.063NS
Presence of infrastructures	.112	.445	1.754	.085NS
(Constant)		.923	9.755	.000*

a Dependent Variable: Performance level index of Strategic power (dominant power in upstream) (Y_i)
SE =Standard error of the estimate.
*Statistically significant at 0.05 and 0.01 level of significance, NS = not statistically significant at 0.05 level of significance, β = Beta weight

The study revealed that education is the significant condition for holding position in water institutions. For example, constitution of Mlali-Kipera Rice Irrigation Scheme (MKRIS) article 11 (iii) requires any person who contesting for leadership should have at least primary education. This condition favours educated ones and automatically ignored illiterate. About 78.7% of population had formal education which enable them compete for the leadership while 21.27% not.

Table 2 further shows the effect of being a membership of water institution to dominant power in the downstream. Membership in water institution significantly correlated with institutional power (p=0.000). Being a member of water institution has positive Beta weight (β=0.523) suggesting that respondents' membership in water institution increase his/her institutional power in access and use of water resources. This is because, members of water institutions pay water bills and other charges therefore are institutionally obliged to claim for better water service they paid for.

Power relations between upstream and downstream CPR users and creation of winners and losers

The study revealed conflictive power relation between upstream and downstream CPR users as the result of differences in the dominant power. In the upstream where water regarded as open access, strategic power was dominant whereby power was the functions of residence duration, distance to resource base and financial capability. In the downstream, institutional power was dominant whereby power was the function of education level and individual relation with water institutions like MORUWASA, MKRIS and MWB. The study revealed that differences in dominant power create winners and losers. The majority, 72% of households affirmed the presence of win-loss scenario in access and use of water. More than half (60%) of households reported that

upstream communities were the winners. This was attributed to presence of weak institutions in regulating and negotiating access and use of forest and water resources. Hardin (1968) argued that tragedy of the commons often results, not from any inherent failure of common property, but from institutional failure to control access to resources, and to make and enforce internal decision for collective use. The study revealed that institutional failure in the management and utilization of CPRs in UMs benefited the upstream users since are able to access and use them freely.

Institutional failure in UMs could be due to several factors including the inability of users to manage CPRs themselves especially water which connects upstream and downstream, population growth in both upstream and downstream that led to increase demand of CPRs, poor state intervention in resources management, increase of marketability of agricultural produce and an intrusion of outsiders especially seasonal farmers. All factors put CPR institutions under pressure, therefore failure to deliver better services. As a result, upstream become free rider of resources hence exploit more than downstream users who pay for using the resource specifically water.

The management of water resource flowing from catchment forests of UMs is under Wami/Ruvu Basin Water Office (WRBWO). The WRBWO was established in July 2002, under Water Utilization (Control and Regulation) Act No. 42 of 1974 and its amendments No. 10 of 1981, therefore granted institutional power to manage water in Wami and Ruvu Basins. Despite of presence of provision in the Water Resource Management Act No. 11 of 2009 that grants WRBWO authority to establish lower level water management organization such as Water Users Associations (WUAs), still there is no such organization in the study area. WUAs are the lowest level in water resource management. Lack of WUAs hinders coordination between upstream and downstream users in the management and utilization of water a situation, which benefits more upstream than downstream users. The study further found that presence of weak institutions also affects ability of the forest reserve to store water. This is due to forest degradation done by upstream communities. MNRT (2003) reported variations of water quantity and quality during rain and dry season at Morning side water gauge station in Ruvuma Street, which was attributed to human activities in the upstream. Furthermore, human activities contribute to the decrease forest/ vegetation cover. This was found to impair rainfall interception, stem flow, percolation and regulated discharge of water.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Forests and water are essential livelihood assets for both communities in upstream and downstream of UMs. Exploitations of these resources are only means for their survival. People in the upstream obtained wood and non wood materials from forest. Forests also are main source of water which flowing downstream. In upstream water from forest is used for crop production and domestic use. Water flowing downstream used for domestic, agricultural and industrial sector development. However, there is no equity in distribution of these resources. The differences are attributed to differences in power among resource users, powerful ones benefits more. In upstream, those with strategic power access more resources while in downstream people with institutional powers are the heroes. Differences in the dominant powers led to conflictive power relations and creation of group of winners and losers whereby people in upstream were winners. This scenario in UMs affects justice and equity in access and use of CPRs hence may lead to resource use conflicts.

Recommendations

In order to balance power, creation of win-win scenario between upstream and downstream water users, the study has two important recommendations. Firstly, the government and other stakeholders should put emphasis on law enforcement regarding to water usage. Lack of accountability among regulators in enforcement of existing laws benefits more water users in upstream. Water users in upstream are not bound have water use permit. Law enforcement for water users in upstream will improve water availability downstream.

Secondly, there is need of uniting all water users through establishment of a network. The network may start with users from sub catchments; Mgeta, Ngerengere and Ruvu in Ruvu Basin. Water user groups at village level may form Water Users association, which is formal institution. WUAs of all villages in sub catchment may join to form single network representing sub catchment. Furthermore, a bigger network representing catchment of Uluguru Mountains can be established that combine three networks from three sub catchments of Mgeta, Ngerengere and Ruvu. The network will be used to discuss water allocation and resolving water use conflicts. The meetings can be arranged regularly to discuss issues related to the management and sustainable utilization of the resources. This will enable users to build trust among them.

REFERENCES

Bukurura, S.H. 1995. Indigenous communication systems: Lessons and experience from among the Sukuma and Nyamwezi of West-central Tanzania. *Nordic Journal of African Studies* 4(2):1-16.

Burgess, N.D., Butynski, T.M., Cordeiro, N. J., Doggart N., Fjeldsa, J., Howell, K.M., Kilahama, F., Loader, S.P., Lovett, J.C., Mbilnyi, B, Menegon, M., Moyer, D.C., Nashanda, E., Perkin, A., Rovero, F., Stanley, W.T. & Stuart, S.N. 2007. The biological importance of the Eastern Arc Mountains of Tanzania and Kenya. *Journal of Biological Conservation* 134 (1): 209 - 231.

Burgress N. 2001. Update on the status of forest and biodiversity values in the Uluguru Mountains. *The Arc Journal* 11(1)6-8.

Forestry and Beekeeping Division (FBD) 2005. *Joint review report on participatory forestry management programme in Tanzania.* Dar es Salaam, Tanzania. 40 pp.

Hartley, D. & Kaare, S. 2001. Institutional, policy and livelihoods analysis of communities adjacent to Uluguru Mountains Catchment Reserve Eastern Arc Mountains. CARE Tanzania, Dar es Salaam. 61pp.

Homer-Dixion, T. 1996. Strategies for the study of causation in complex ecological-political systems. *Journal of Environment and Development 5*(2): 132- 48.

International Energy Agency (IEA) 2002. Energy and poverty [http://www.iaea.org.htm] site visited on 21/7/2009.

Lovett, J.C., Pocs, T. & Wasser, S.K. 1995. *Biodiversity and Ecology of the Rain Forests of Eastern Africa*. Cambridge University Press. 64pp.

Lulandala, L.L.L. 1998. Meeting the needs of the people through species domestication. A basis for effective conservation of the Eastern Arc Mountains forest biodiversity. *Journal of Eastern African Natural History* 87 (1): 243-252.

Lund, S. 2007. Self governance for sustainable natural resources governance: A case study of Sundari community forest user group. Dissertation for award of MSc. Degree at Lulea University of Technology, Sweden. 65pp.

Luoga, E.J., Witkowski, E.T.F. & Balkwill, K. 2005. Land Cover und Use Changes in Relation to the Institutional Framework and Tenure of Land and Resources in Eastern Tanzania Miombo Woodlands. *Environment, Development and Sustainability* 7 (1):71–93 pp.

Mbeyale, G.E. 2009. The impact of institutional changes on the management of Common Pol Resources in Pangani River Basin: A case of Eastern Same, Kilimanjaro, Tanzania. Thesis for award of PhD degree at University of Dar es Salaam. 307 pp.

Ministry of Natural resources and Tourism (MNRT) 2003. *Assessment of water quality and quantity for rivers originating from Uluguru catchment forest reserve-Morogoro region report*. Management of catchment forests in Morogoro, Tanzania. 18pp.

Ministry of Natural resources and Tourism (MNRT) 2006. *Towards a Communication Strategy for the Eastern Arc Mountains–results of a stakeholder consultation process.* Information, Education and Communication Strategy Data Report. Dar es Salaam, Tanzania. 116pp.

Msangi S., Sulser T., Roswgrant M., Santos R.V. & Ringler C. 2001. Global scenarios for biofuels: Impacts and implications. International Food Policy Research Institute (IFPRI) pp 16.

Nkombe, M. 2003. *The Future of the Uluguru Mountain Forest, Tanzania.* Paper presented at XII World Forest congress, Quebec, Canada, 21–28, September, 2003. 21pp.

Pfliegner, K. & Moshi, E. 2007. Is Joint Forest Management Viable in Protection of Forest Reserves? Experiences from Morogoro Region. *The Arc Journal* 21 (1): 17-20.

Rodgers, W.A. 1993. *The conservation of the forest resources of Eastern Africa: Past influences, present practices and future needs.* Cambridge University Press. Cambridge, UK. pp. 283-331.

URT 1998. *National Forest Policy*. Ministry of Natural Resources and Tourism. United Republic of Tanzania. Dar es Salaam, Tanzania. Government printer. 59pp

URT. 2002. *National Water Policy*. Ministry of Water and Livestock Development, United Republic of Tanzania Dar es Salaam, Tanzania. Government Printer. 49pp.

VPO. 2006. Poverty and Environment. Government Takes Steps to Address Land Degradation and Safeguard Water Catchments. Vice President Office. [http://www.unpei.org] site visited on 21/7/2009.

Williams, T.O. 1998. Multiple use of common pool resources in semi-arid west Africa: A survey of existing practices and options for sustainable resources management [http://www.odi.org.uk/resources] site visited on 22/10/2021.