

SOCIO-ECONOMIC, CULTURAL AND LIVELIHOOD FACTORS INFLUENCING LOCAL PEOPLE PARTICIPATION IN WATER RESOURCE MANAGEMENT IN THE ULUGURU MOUNTAINS EASTERN TANZANIA

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ABSTRACT

The social and economic circumstances prevailing in Tanzania today have made particular demands on water resource base and the environment and its sustainability is threatened by human induced activities. This study assessed the socio-economic, socio-cultural and livelihood factors that influence community participation in restoration and management of water resource in the Uluguru Mountains Eastern Tanzania. Land ownership patterns and cultivation of seasonal crops were among the major factors that influence water resources as they entail more frequent soil disturbance, inadequate ground cover and increased risks of soil erosion and watershed degradation. Free range and semi – zero grazing system along stream banks is a potential problem in watershed management especially with increasing human and livestock population. Water resource management in the Ulugurus is mediated by both formal and informal institutions the strongest informal institutions being cultural. Majority of the population has had an opportunity to participate in watershed protection and conservation and tree planting was the major practice adopted. Increased capacity for conservation skills was the most important driver of community participation in conservation activities. The major livelihoods with regard to water use are various types of domestic use and irrigated agriculture especially during the dry season. Training and education opportunities to local communities can be powerful incentive to protection and management of water resources. Clear policies on water use and priority activities in the Uluguru catchments are important in order to avoid conflicts between water users.

Key words: Water resources-watershed-livelihoods-participatory-management-conflicts-riparian-ecosystems

INTRODUCTION

The social and economic circumstances prevailing in Tanzania today have made particular demands on water resource base and the environment and its sustainability is threatened by human induced activities. Water scarcity is experienced at many places in Tanzania due to unreliable rainfall, multiplicity of competing uses, degradation of sources and catchments. Water scarcity threatens food security, energy production and environmental integrity that results into water use conflicts between the sectors of the economy (Ministry of Water and Livestock Development 2002; Munishi *et. al.*, 2003; Kusiluka *et. al.*, 2003)

Most probably, watershed management problems in Tanzania have institutional, technological, and socio-economic roots. Further, watershed degradation problems in Tanzania may lie in the type of conservation innovations, their sources, and methods used to convey the innovations and how conservation strategies are implemented. Most conservation approaches have rarely addressed the issue of participatory approaches to water resource management (Munishi and Temu 1992; Ministry of Water and Livestock Development 2002). Proper water resource conservation and management can partly be achieved through biological conservation means such as tree planting and vegetation management in riparian ecosystems (Stuart *et al.*, 1993; Newberry, 1993; Colleti *et. al.*, 1993; Schultz *et. al.*, 1993; Alexander, 1993; Munishi, *et al.*, 1998) among others. Such measures have been accomplished elsewhere (Patricia *et al.*, 1992; Perham, *et. al.*, 1993; Perkey, 1993; Gregory, 1993). The acceptance of tree planting and forestry innovations by farmers in Tanzania has been very positive (Mnzava 1983; Munishi and O’Kting’ati,

1993; Kajembe, 1988, 1994) giving an opportunity for tree planting as a measure to combat watershed degradation. It is theoretically known that a part of the riparian ecosystem should be left under intact vegetation cover to safeguard water resources. However, there is neither clear management strategies on the practice nor regulations that govern its implementation at the grass roots level. The success of a conservation program on the other hand greatly depends on how effective local initiatives and participation are utilized, including the use of existing indigenous knowledge in conservation. Although the Tanzania water resource policy has changed dramatically to put more emphasis on active participation of communities and the private sector in water resource management, its implementation is still at an infant stage and opportunities for this have not been identified. The benefits of water are numerous though many of them have no market value. Such benefits can be used as indicators for water productivity in a given area. The benefits of water use may include area irrigated, number of families depending on a particular source of water, number of jobs created as a result of presence of water among others (RIPARWIN and Bruce 2003). Increased land inequality (either real or perceived) or rising land scarcity act as triggers to conflict which can escalate into violent collective action (Dejanvry, 2000). According to Mvena *et al.*, (2000), Munishi *et al.*, (2003) conflicts ensue when resources become scarce and that the more unequal the distribution of scarce resources in the system the greater will be the conflicts of interest between dominant and subordinate segments in a particular system. Some conflicts between forests and other land uses arise as a result of non-interference by the government and lack of a clear policy on what should be a priority land use in a watershed area.

This study assessed the socio-economic, socio-cultural and livelihood factors that influence watershed and water resource management focusing on knowledge, awareness, and attitudes of the local people on conservation and watershed management practices in the Uluguru mountains, Eastern Tanzania.

MATERIALS AND METHODS

Study Site

The study was conducted in nine (9) villages on Mwere and Mlali River catchments on the western slopes of the Uluguru Mountains. The two rivers are tributaries of the Morogoro River, which has its source in the North Uluguru forest reserve.

Data Collection

Data were collected through structured questionnaire administered to households at a 13% sampling intensity. A total of 73 out of 580 households (13%) were randomly sampled for interview. The questionnaires sought the information on socio-economic, socio-cultural, institutional and livelihood factors that influence watershed and water resource management focusing on practice, participation, knowledge, awareness and attitudes of the local people towards water resource conservation.

Data Analysis

The data were analyzed using Statistical Packages for Social Sciences (SPSS) and results presented using descriptive statistics and tables.

RESULTS AND DISCUSSIONS

Socio economic characteristics of respondents

Majority of the respondents were peasants (97.3%) while a small number were government employees (2.7%) (Table 1). Twelve percent of the households had less than 3 people (12.3%) while 87.7% had more than 3. The average household size was 5 people. The population has an even age distribution with 35.6% of the population having less than 30 years, 32.9% between 30 and 45 and 31.5% were above 45 years. About 45.2% of the respondents were males while 54.8% were females. Married respondents were 68.5%. Single, separated, divorced, and widowed respondents were 17.8%, 1.4%, 9.6% and 2.7% respectively.

About 74% of the respondents had primary school education, 2.7% secondary school education, 11% adult education, and 12.3% having no formal education. This may have implications on conservation and community participation in conservation activities.

According to Katani (1999), education creates awareness, positive attitudes, values and motivation for better natural resources management among the people. Kajembe and Luoga (1996) assert it further that there is no development without education. This might also entail a need for watershed conservation and environmental education and extension to boost conservation awareness among the communities in the Ulugurus.

Table 1 Socio-economic characteristics of the respondents

	Percentage response
Household Size	
< 3 people	12.3
> 3 people	87.7
Gender	
Male	45.2
Female	54.8
Marital Status	
Married	68.5
Single	17.8
Separated	1.4
Divorced	9.6
Widowed	2.7
Education Level	
No formal education	12.3
Primary education	74.0
Secondary education	2.7
Adult education	11.0
Main Occupation	
Peasants	97.3
Government Employee	2.7

Land use, land ownership and land use conflicts

Every member of the community own a piece of land under the customary land tenure system. However, there is great variation in the size of the land owned where 9.6% own less than 0.5 ha, 35.6% between 0.5 – 2 ha and 54.8% more than 2 ha. It was observed that about 56.2% have their pieces of land in riparian areas. About 19.5% of those with land in the riparian areas own less 0.5 ha, 73.2% between 0.5 -2 ha and 7.3% more than 2 ha. Land ownership within riparian ecosystems makes conservation process relatively complex although such populations can be a good focus for involvement in the management and conservation of the riparian ecosystems under participatory approaches. The majority of the

population however own land close enough to the riparian ecosystems and within the catchment areas of the river systems, which requires a conservation approach that will target the whole population in the watershed.

Over 97.6% of the population that own land in riparian areas use this lands for cultivation of seasonal crops. Major crops grown near riparian areas are maize (mihindi), banana (ng'owo), sugarcane (miguwa), Cinnamomum sp. (mdalasini), cassava (mihogo), beans (maharage), tomatoes (nyanya), potatoes (vimoka), groundnuts (ng'aranga) strawberry, yams (magimbi) and vegetables (mboga).

Cultivation of seasonal crops may entail more frequent soil disturbance and increased risks of soil erosion and watershed degradation (Munishi *et al.* 1998). Further, most of the crops grown do not provide good ground cover increasing the risks of soil erosion and water resources degradation given the fact that in tropical regions, most watersheds contain a large farming population (MNRT, 2000).

Vegetation degradation and soil erosion problems on steep terrain in watershed areas are often associated with unsustainable land use practices, such as poor cultivation techniques and overgrazing. Shifting cultivation, cultivation on hilly slopes without application of soil erosion control measures and grazing very close to stream banks is evident in most villages in the study area and such practices have lead to the degradation of most of the riparian ecosystem. Reforestation in areas degraded by farming and grazing needs special attention in consultation with local people. Improved agricultural practices will often lead to natural regeneration and enable riparian ecosystem to be restored in many instances. Watershed management, however, embodies both agriculture and livestock farming activities. Therefore, coordination of these activities and clear policies on integration into the existing farming systems are essential inputs to restoration efforts in the area.

About 42.5% of the population is engaged in livestock keeping. The type of livestock feeding system adopted by the farmers were free range grazing (48.4%), zero grazing (32.3%) and semi-zero grazing (19.4%). Free

range and semi – zero grazing system imply that animals are released and search for their own food specifically green pastures along rivers/streams and in water sources which can cause trampling effects, soil erosion, deforestation and hence watershed degradation.

More than 30% of the population have a serious shortage of land though it was generally difficult to establish a direct link between land inequality or scarcity and conflicts in the area. Increasing population and decreasing arable land with subsequent degradation may soon lead into land conflicts. The most visible conflict is that one between farming and water resource conservation. Cultivation along riparian ecosystems probably linked to increasing scarcity of arable land and its effect on water resource management has created conflicts between the local people themselves fighting for acquisition of prime lands (land that is in access to water) and between local communities and government officials /conservationists over environmental degradation. Further, water abstraction and diversion for dry season irrigation creates conflicts between upstream and downstream water users and between upstream users and regional water authorities. Increased land inequality (either real or perceived) or rising land scarcity act as triggers to conflict which can escalate into violent collective action depending on circumstances (Dejanvry, 2000). Some conflicts between forests and other land uses arise as a result of non-interference by the government and lack of a clear policy on what should be a priority land use in a watershed area. Currently the issue of land scarcity is not a big problem, however the extent of land scarcity has been increasing in the Uluguru Mountains gradually due to population increase.

Local people have used various ways to solve the issue of land scarcity and related conflicts. Such conflict resolution approaches include borrowing or renting land from their neighbours (widely practiced) (61.9%), buying land (28.6%) and clearing more land (9.5%). The third option may not be a visible one as it may lead to more degradation of fragile areas creating more conflicts among different groups.

Institutions governing watershed management and conservation

Water resource management in the Ulugurus seem to be mediated by rules and regulations, which in this study are referred to as institutions. It was observed that institutions governing joint action for watershed restoration are both externally and internally sponsored and there are both formal and informal institutions. Internally sponsored institutions were mainly traditional/local institutions, which include local rules and regulations governing water resource use and regulations. Externally sponsored institutions are rules set by different government and non governmental agencies such as the Ministry of Natural Resources and Tourism, Ministry of Water, Livestock and Ward Environmental Committee and agreed by local communities through their representatives.

According to Gupta (1996) building technical competence and providing institutional incentives for conservation have to go hand-in-hand. Communities and individuals can conserve resources without being aware of the value of the resource or its potential contribution to their life support system. The way the benefits accruing from a resource are distributed among those who conserve as well as those who add value in the resource may still depend upon institutional conditions. This need be explored and used as a stepping stone towards local peoples' involvement in conservation. Such opportunities need be internalized into government resource management systems. Due to the importance and fragility of some ecosystems and resources, participatory approaches to management with the government having an upper hand will likely be feasible. According to FAO (1986), watershed management projects act also as demonstration areas and are useful for on-the-job training of watershed managers, and conservation awareness for politicians, planners and administrators. They also serve to cultivate and motivate positive conservation attitudes among the local communities through extension services.

The formal (externally organized) institutions governing water resource and environmental management in the Ulugurus are shown in table 2. Except for the Morogoro Water and

Sewage Authority (MORWASA), the institutions cater for general environmental conservation and not specifically for water. Water conservation may therefore be implied in the activities of these institutions. The study revealed that about 61.6% of the population has been visited by the various organizations/government agencies with regard to conservation and water resource

management issues (Table 2). The frequency of visitation was however rated low, as majority of the population (84.4%) seems to have been visited few times while 15.5% indicated several times of visitation. The frequency of visitation by extension officers and professionals has a profound impact on awareness creation in local communities with regard to environmental conservation.

Table 2. Formal institutions governing watershed conservation in the Uluguru Mountains Eastern Tanzania

Organization/Agency	Role (s)
Morogoro water and sewage authority (MOROWASA)	- Water treatment. - Control of water abstraction from rivers
Wild life conservation society of Tanzania (WCST)	- Educate community on biodiversity conservation and habitat restoration - Tree planting for environmental conservation
Regional Natural Resource (Maliasili)	- Law enforcement - Tree planting along forest boundaries
Ward Environmental Committee	- Supervision Conservation Activities
Sokoine University of agriculture (SUA) through VLIR Programme	- Agricultural extension - On farm tree planting for fertility improvement
Morogoro Environmental Conservation Association (MECCA Group)	- Environmental Education - Tree planting
<u>Regional Police Force</u>	- <u>Law enforcement with regard to water abstraction</u>

The local (informal internally organized) institutions that govern water resource management in the Ulugurus may be categorized into four groups (Table 3).

Table 3 Local people knowledge of institutions regulating water use and water resource management in the Uluguru Mountains Tanzania

Institution	% Population		
	Yes	No	Not sure
Taboo and cultural restrictions	75.3	24.7	NA
Religious believes	15.1	84.9	NA
Local rules regulations	94.5	5.5	NA
By-laws	74.0	5.1	21.9
Formal organizations	61.6	38.2	NA

About 75.3% of the population is aware of existing taboos and cultural believes governing water resource management, 94.5% are aware of local rules and regulations and 15.1% are aware of religious believe. The proportion of population that is unaware of existing rules and regulations for watershed management may represent the proportion of the community that probably do not participate in joint natural resource management. Such groups may possibly have negative attitude towards conservation. More than 74% of the populations are aware of by-laws that govern watershed conservation in the Uluguru Mountains.

Despite this awareness the study revealed that in some cases rules and regulations are not followed, as cases of people cutting trees, bathing and laundering in rivers are still common. About 89.1% of the population know that it is strictly prohibited to bath/do laundry in rivers for sanitary and health purposes while only 10.9% are aware of the consequences of cutting trees in

riparian areas on water quality and quantity. Local institutions are likely to be more effective in water conservation because of the associated beliefs and benefits and commitments of the local people to their own decisions and cultural ties. Such institutions are likely to be good entry points for conservation involving the local people. Several local restrictions that are likely to have impact on water resource management/conservation and their roles in water conservation are shown in Table 4.

Table 4 Local restrictions governing use of water source/resources and catchment areas in the Uluguru Mountains

Restriction	Role (s)
Bathing and laundry in rivers strictly prohibited	- To avoid water borne and epidemic diseases to downstream water users
Strictly prohibited to cut trees along water sources and rivers	- To conserve watersheds - Prevent soil erosion
Strictly prohibited to cultivate 20 m of a stream/river	- To avoid soil erosion and enhance clean water to downstream water users.
Strictly prohibited to abstract water from streams/rivers	- To conserve water resources
Strictly prohibited to produce gravels or sell stones from the river/streams	- To conserve watersheds and stream ecosystems

Joint agreement, rules and regulations between regional government institutions, non governmental organization and local communities and the recognition of local institutions' roles in resource management are indications that the community rights are respected with respect natural resource management. The survival of joint natural resources management initiatives depends very much on the respect of the rights of communities as joint managers.

Recognition of the rights of local communities to organize and define their

local institutions for natural resource management is a fundamental policy principle that enhances co-management strategies. The success for local level management depends critically on the recognition and legitimization of community initiatives. It is important to note that watershed management rules and regulations need to be clear to all stakeholders in order to avoid unintended violation

Local people's watershed conservation knowledge

The study showed that about 93.2% of the population has heard about watershed conservation and management though the practice is not yet realized. The major source of information on watershed conservation campaigns being radio that accounted for 66.2% followed by government officers 19.1% and television 1.5%. About 13.2% admitted to have heard from both radio, government officers and television. On the other hand, 100% of the populations seem to have received no any teaching/extension materials on watershed conservation. The use of some of the above extension media may not be very effective as very few people have access to radio or TV. Visits by extension staff and provision of extension materials such as brochures may be more effective in extension education

The study revealed that there are changes in the riparian ecosystem due to deforestation caused by various human activities. About 89% of the interviewees expressed concern over the deterioration of water resources and catchment areas compared to what it was in the past. This shows that majority of the residents around the watersheds are aware of changes occurring in water resources and awareness could contribute when it comes to taking action to conserve if given chance or are used as an entry point for conservation. Assessing their views on the solution to watershed deterioration, 63.6 percent believe that watersheds deterioration can be solved and restored through tree planting along the riparian areas. On the other hand environmental education was seen as a major force for watershed restoration (12.2) while 12.2 percent proposed that watershed deterioration problems can be solve by imposing strict

rules and regulations on human uses of fragile ecosystems on watersheds. A combination of the three in appropriate ratio of effort can be a good approach to solving watershed degradation problems in the Uluguru Mountains

Among the activities suggested by the community for development and sustainable watershed management in the Uluguru mountains are establishment of watershed restoration projects in collaboration with the local people. Other suggestions include enrichment planting in watersheds, protection against detrimental human activities, provision of extension services to surrounding communities and research aimed at providing information to meet management objectives. FAO (1986) asserts that watershed management practices should solve soil and water degradation problems and at the same time be economically feasible, socially and politically acceptable. Inadequacy of water resource extension materials may be a big obstacle to awareness creation on water resource conservation in the Ulugurus.

Local people's participation in watershed conservation

The Uluguru mountain community is willing to be involved in different activities that target watershed conservation because of their close proximity to this resource and the livelihoods that accrue from use of water resources. The respondents pointed out that their main expectations for being involved in conservation activities are to be able to practice proper watershed conservation (50.7%) and be able to establish tree nurseries and plant trees in riparian areas (49.3%). However, the study revealed that several factors influence their involvement in such conservation activities including lack of water management extension and education services and ignorance. The Tanzanian water resource policy has changed dramatically to put more emphasis on active participation of communities and the private sector in water resource management, the implementation of which is still at an infant stage and opportunities for this have not been identified (Ministry of Water and Livestock Development, 2002)

The survey shows that people are willing to participate in watershed conservation but need be educated on proper conservation practices and tree planting in watersheds (86.1%), be involved in decision making (8.3%) and to have access to tap/piped water (5.6%). The skills and knowledge acquired in building a community's capacity to manage its water supply and sanitation has been seen as a stimulus for other development activities (Katsi, 2003).

Water related livelihoods, accessibility and utilization conflicts

The study revealed that in principle there is equal right in water utilization by all members of the community for their livelihood. The major livelihoods with regard to water use are domestic consumption (72.6%) and agriculture especially irrigation (27.4%). Irrigated fields are normally through water diversion into farms or cultivation near streams/water sources along riparian ecosystems. Such utilization of water has severe impacts on water supply and water quality to downstream users especially during the dry season when water flows dwindle down and is often a source of various types of conflicts. Such conflicts can be resolved through education on water utilization rules/regulation and policies that ensure equitable use of water as a natural resource. The study revealed further that over 93.2% of the population has free access to water resources with the estimated distance to access to water resources being 52.1%, 26% and 21.9% for 0.25 km, 0.5 km and more than 0.5 kilometer respectively. Despite the fact that water is an important resource, many areas particularly in poor countries, face the problem of access and availability of safe water (Munishi *et al*, 2003). According to Rangel *et al* (2003) one billion persons in developing countries do not have access to safe drinking water.

Water conflicts are related to a wide range of other socio-political tensions, such as border disputes. About 47.9% of the population in the Ulugurus has water resource conflicts with Morogoro water authority specifically related to water rationing and water diversion during the dry season. Imbalance, not only of scarcity but

of abundance, may distort environmental and socio-economic policies, leading to social friction, though newer approaches to social problems do not see scarcity as leading necessarily to conflicts (Tamas, 2003). According to Mvena *et al.*, (2000) and Munishi *et al.*, (2003) conflicts ensue when resources become scarce and that the more unequal the distribution of scarce resources in the system the greater will be the conflicts of interest between dominant and subordinate segments in a particular system.

Most villages in the Uluguru Mountains are located in the mountainous terrain characterized by steep hilly slopes and river valleys. Since water is a basic natural resource for sustaining life and socio-economic development, many social and economic activities rely heavily on availability of adequate supply of water (Ministry of Water and Livestock Development 2002). Deliberate efforts are needed towards protection and sustaining this recourse and to ensure that it is used efficiently and effectively for the benefit of the present and future generations.

Extension, education and outreach in watershed conservation

It was revealed that there is inadequate watershed conservation education and extension in the villages surrounding Uluguru Forest Reserves. Majority of the population (74%) seem to have received no advice on watershed conservation. Of those who have received watershed conservation advice (26%) over 68.4% agreed to receive such extension and education service from government officers and 31.6% from Ward Environmental Committee. Seventy seven percent of the people admitted to have received water policy advice from MORWASA officials, 12.9% from Luguru Chief (Chief Kingalu) and 9.7% from Morogoro District Commissioner.

Visitation frequency by government officials for advice was said to be low (57.5%) compared to expectations. Major emphasis of extension personnel was on tree planting in degraded watersheds and proper water utilization that ensures clean water supply to downstream water users. The possible reason for watershed conservation officers not visiting the villagers may lack of funds to cater for education and extension costs such as transport and material costs, though insufficient number of staff may also

be a contributing factor. Capacity building programmes on watershed conservation knowledge and skills are required for integrated water resources management in the Uluguru Mountains. Principles of water resource conservation and the interrelationships between various techniques in water conservation should be emphasized so as to enable tying up the various segments of conservation towards a cohesive whole and practice.

Willingness to conserve and conservation practices

It was observed that more than 87.7 percent of the population has had an opportunity to participate in tree planting as an effort towards watershed protection and conservation. The study showed also that 51.6 percent of people raised seedlings themselves, 35.9% obtained tree seedlings from Regional Natural Resource programmes and 12.5% obtained tree seedlings from Sokoine University of Agriculture. Trees were planted in farmlands (70.3%), riparian areas (10.9%) and both in farmlands and riparian areas (18.8%).

A big proportion of the population expressed willingness to restore and conserve degraded watersheds. About 71.4% have incurred costs in watershed conservation activities worth less than 10,000 TAS (US\$ 10) and 28.6% worth more than 10,000 TAS (US\$ 10). This is an indication that people may be willing to pay more than they currently do if are motivated. This study suggests that the costs of watershed management could be covered, at least in part, by capturing its associated local benefits. This has significant implications for the decentralization of water resource development and encouraging local people participation with an aim of translating legal provisions, local commitments and scientific principles into common sense stewardship actions that will ensure integrity of hydrologic function, riparian areas, sediment control, soil productivity, and water purity (http://www.fs.fed.us/r2/psicc/spl/ea/WCPA_ppendixA.htm). Fortunately, local people in the study area have expressed an interest of participation in watershed conservation activities such as on farm tree planting done under various programmes.

Among watershed conservation practices by the local people, over 90.4% have adopted tree planting, 8.2% terracing and 1.4% both tree planting and terracing. Other watershed conservation practices include cultivation 20 m away from watersheds (21.9%), Ngoro agriculture systems (5.5%), use of tap/piped water (1.4%). People proposed various solutions to watershed degradation including, avoiding trampling effects by man to the riparian ecosystems (3.4%), avoiding soil erosion due to poor agriculture practices (69%) and/or both (27.6%). When questioned about their comments on watershed restoration measures 41.5% went for environmental education, 56.6% for tree planting in riparian areas and 1.9% for both. Such responses may be used as a basis for watershed restoration programs.

Opinions on responsibilities for riparian areas management

Majority of the population in the Uluguru Mountains (98.6%) know that the responsibilities of watershed management are vested to the government. Major responsibilities include education and awareness creation on watershed conservation. However there is a general agreement that decisions regarding watershed conservation activities should involve the local people (68.1%). Further responsibilities of the government would be provision of tree seedlings to be planted in riparian areas (12.5%) and provision of tap/piped water to villagers (19.4%) to reduce water diversion and abstraction. As for the village government responsibilities 47.9% proposed that village governments should make sure those by-laws that govern riparian ecosystems are enforced, make sure provided trees are planted in riparian ecosystems (43.8 %) and supervision jobs to ensure adequate implementation of watershed conservation programmes (8.3%). Individual responsibilities were said to be adherence to watershed/water resource conservation regulations/rules (47.9%) and planting of available trees (43.8%) and be willing to learn and practice appropriate watershed conservation innovations (32.9%). All these are possible responsibilities for the various groups. Provided each group plays its part the responsibilities can be molded into a harmonic stewardship action towards water resource conservation. What is needed is participatory

approach to decision making and participatory planning in water resource conservation and management with adequate cost and benefit sharing in the process. Identification of the costs and modalities for cost sharing is a challenge. Further, clear identification of benefits and internalization of the benefits that do not have market values into the local, regional and country economy and development of modalities for sharing the benefits is an even bigger challenge

CONCLUSION AND RECOMMENDATIONS

Several factors influence water resource management and conservation in the Uluguru Mountains. Such factors include but not limited to the various uses and livelihoods related to water use. The major livelihoods include water for domestic consumption and other related uses. Water for irrigation becomes a big issue especially during the dry season when water supply becomes relatively scarce.

The local people in the Uluguru are aware of the deteriorating water resources in the area and can work to provide the means for sustainable management and conservation of water resources. This is clearly demonstrated by the fact that they have been living with the resources and consequently developed various traditional management systems manifested through local institutions and practices for water management. Enhancement of their initiatives for action is however important. Watershed management activities which are not based on people's participation and which are not in line with their aims and expectations will likely not succeed and participatory approaches to water resources management can motivate local stakeholders in management.

Training opportunities, study visits and education to local communities can be powerful incentive to protection and management of water resources. Clear policies on water use and priority activities within a watershed area are important in order to avoid conflicts between water users. A balance between short and long term management objectives and people's aspirations must be found so as to protect and conserve other values, which may be viewed by people as unimportant. What is needed is a more holistic and integrated approach to water planning that is based on an understanding of people's

livelihood strategies and the role of water in their daily life. However, the carrot and stick method is also relevant and law enforcement should also prevail where necessary in order to safeguard these fragile and important ecosystems such as riparian ecosystems of Uluguru Mountains. A combination of environmental education, strict rules and regulations on human uses of fragile ecosystems at appropriate ratio of effort can be a good approach to solving watershed degradation problems in the Uluguru Mountains

A means of addressing different conflicts especially those related to dry season water supply, water abstraction, cultivation on riparian ecosystems should be sought through proper water resource management planning based on scientific data. Water demand analysis, water demand management, analysis of water productivity indicators and water related livelihoods are good inputs to proper water resource planning.

There is a need for effective research on environmental, social and economic indicators for sustainable water resources management. Incentive schemes and legal instruments with regard to water resources management need be reviewed to address the current water resource degradation.

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