

**PAYMENT FOR WATER SERVICES AS A MECHANISM FOR  
WATERSHED MANAGEMENT: THE CASE OF THE SIGI RIVER  
CATCHMENT, TANGA, TANZANIA**

**A RESEARCH REPORT SUBMITTED TO WWF- TANZANIA  
PROGRAMME OFFICE**

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## **EXECUTIVE SUMMARY**

### ***Introduction***

*Payment for Environmental Services (PES) is a new concept, which is gaining momentum as a strategy for natural resources management and conservation. This study focused on payment for water as one of the Environmental services. It looked into the Sigi River, which is included as part of the Pangani Basin and it is a principal source of water for the Municipality of Tanga with a population of about 250,000 people. The river originates from the East Usambara Mountains/forests renowned as one of the world biodiversity hotspots. The study investigated on various issues including socio-economic issues, Environmental and water resources management issues and Hydrological and payment for water services issues.*

*The objectives of this study were to:*

- ❖ Contribute in the making of decisions regarding forest and water resources management.*
- ❖ Suggest how part of the revenues from water sales can be used for forest management as part of watershed management.*
- ❖ Look into the possibility of rewarding upland communities who are stewards of catchment areas.*
- ❖ Gather lessons of Payment for Environmental Services (PES) from around the world where payments for water are linked to the conservation of water resources.*

### ***Methodology***

*The methodology used to gather information included several techniques namely Literature Review, Household Interviews, Key Informant Interviews (KIIs) and Focused Group Discussions. The information were obtained from many stakeholders including communities in the East Usambaras who are the stewards of the catchment areas, water /customers in the Municipality of Tanga, officials for the Pangani Basin Water Office (PBWO), and Officials with the Ministry of Water and Livestock Development. In total some 112 respondents were met for interviews and discussions. The data obtained were coded and analysed using two major techniques namely content analysis and the Statistical package for Social Sciences (SPSS) programme. After the data were analyzed the following results were obtained:*

### ***Study Results***

#### ***-Socio-economic issues***

*The findings show that the EastUsambaras experiences an increasing population attributed to natural increase and immigration. It was noted that around 36.6% of the respondents came from outside the East Usambara. Growing population exerts pressure into the existing natural resources particularly forests and water. Majority (83.3%) of the respondents mentioned agriculture as their main economic activity. However there are other income generating activities such as lumbering and mining within the forest*

reserves and also around water sources, all of which are “illegal”, it was also noted that in some cases the expansion of the farmlands is made at the expenses of the forest. This situation was evident during fieldwork.

The forests in the East Usambara Mountains form an important base for people’s livelihoods. All the respondents (100%) named firewood as their major source of energy. A considerable proportion (22%) of the respondents said they obtain firewood from the forest reserve and the rest (78%) said they obtain firewood from their farms and public land.

Majority of the respondents engage themselves in unskillful and low pay jobs. This is explained by the status of education in the study area. Around 85% of the respondents acquired primary education, some 10% attained secondary education and the remaining 5% have completely not been to school.

On average annual incomes for the respondents are considerably low. Some 70% of the interviewees said they earn around Tshs 400,000/- per year, about 17% earns less than Tshs 100,000 and the rest (13%) have an average income of around Tshs 850,000/- Such income levels explain the state of poverty and high possibility for the community to exploit environmental resources unsustainably in order to make ends meet.

As to who benefits more from environmental services and especially water the respondents said they feel the down-stream water users benefit more, linking their observation with the presence of major water consumers down stream such as industries, hotels and sisal plantations. They said while they are the ones who take part in managing and conserving water and forest resources, what they get in return is negligible as compared to their counterparts.

The findings also revealed that currently there is nothing which is put back to the communities in the East Usambaras as incentives to motivate them to effectively manage forest and water resources. A large proportion of the respondents (62%) said they are not getting any incentives. About 25% of the respondents noted that they do get some incentives and the remaining 13% said they were not sure whether they get any incentives or not. However those who said they get some incentives referred to the 20% given to the village governments by the Amani Nature Reserve (ANR) authority accruing from various income generating activities such as eco-tourism, they also mentioned of being allowed to enter into the forest reserve on every Wednesday and Saturday to collect firewood. However, being allowed to collect firewood doesn’t sound as an incentive but rather their right.

The respondents were asked to mention types of incentives that they would prefer in order to effectively participate in the management of forest and water resources. A variety of incentives were mentioned including being assisted to search for markets for their agricultural products, to be provided with soft loans, improvement of social services such as schools, roads and dispensaries, to be allowed to harvest forest products such as timber, the forest guards to be recruited from respective villages and rewarding those who excel in environmental conservation activities.

### ***Environmental and Watershed Management Issues***

*Majority (95%) of the respondents said they know very well the importance naming a number of benefits such as climatic regulation, sources of water and many others. Despite this high level of awareness, the people have little interest in conservation. This is attributed to the general feeling that they are losers instead of being the first beneficiaries of the resulting forest-based products and services. Such situation suggests the urgent need to have in place a mechanism for providing incentives to these stewards of the catchment areas.*

*A large proportion (80%) of the interviewees said they participate in forest and water resources management and the remaining 20% said they don't participate. Those who said they participate mentioned a number of activities which they carry out from time to time including planting trees around water sources, protecting the forest reserve against illegal activities such as mining and timbering, using energy-serving stoves and refraining from farming and cutting trees around water sources. However, in some places people complained about activities which have impact on water resources. In Mbomole village people had a concern on the impact of the eucalyptus on water resources. Eucalyptus plantations has been established in the area by one investor, they said they have been informed by the experts that eucalyptus has serious impact on water resources and that they have already started to see this impact as streams are drying up. They also noted that the impact on water resources is attributed to the tendency of some local people to cultivate around water sources.*

*A surprising observation made during fieldwork was when the respondents were asked to say to whom the forest reserve (the ANR) belong and a considerable number of people said "ni msitu wa FINNIDA huo" meaning the forest belongs to Finish International Development Agency (FINNIDA). This is a clear indication that there is lack of the sense of the forest ownership and hence the community might see it impractical to effectively participate in conserving forests, which play an important role for the continuous flow of water.*

*In the Municipality of Tanga major water users/customers were asked whether they contribute to the East Usambara forests management and put back anything as incentives to the stewards of those forests. Majority (80%) said "no" and the rest (20%) said they do contribute since they pay for the water tariffs. Those who said they don't contribute were asked for their opinions on contributing to the conservation and management of those forests and the response was very positive. About 73.3% said the idea was good and further noted that they were aware that the consistent flow and availability of water in Tanga wouldn't be possible in the absence of East Usambara forests. Some 20% said they were not in favour of the idea as they were already contributing through water tariffs and the rest 7.7% said they were not sure whether the idea was good or not.*

*On their part the officials for the Tanga Urban Water Supply and Sewerage Authority (TUWSSA) said they were very much concerned about conservation of the East Usambara forests and they feel they have an obligation to participate in its management. They said they are full aware that their business would not run smoothly if there was no*

*smooth and continuous flow of water into the Sigi River. They said it was on such grounds that they pay some Tshs 11million annually to the Pangani Water Basin Office believing that part of the money is spent for the conservation and management of the East Usambara forests. On whether they would be ready to pay a little extra fee specifically for the management and conservation of the East Usambara forests, Engineer Aram remarked: "The idea of paying some extra fee for conservation purposes is definitely good, however, before this is put in place all stakeholders should meet and discuss on the rationale of doing so and how it should be implemented"*

*On the allocation of funds for the catchment forest management it was noted that some Tsh. 338,000,012 equivalent to \$338,000 is allocated for the four regions with catchment forests which are Tanga, Arusha, Kilimanjaro and Morogoro implying that each region get around Tshs 84,000,503, equivalent to just \$ 84,000. Practically such amount is considerably low for sustainable management of those forests. Moore et al 2004 in Burgess and Kilahama 2004 show that , the mountain forest habitats in the tropical of the continent require around USD 364/km<sup>2</sup> or 370,000 Tshs/km<sup>2</sup>/annum for effective management. A study that was conducted in the Luangwa National Park in Zambia indicated that effective conservation and management of one hectare would require 250-300 USD per annum. Basing on these quotations the East Usambara Mountains covered by around 45,000 ha or 450km<sup>2</sup> of forest would require about USD 163,800 or about Tshs 182,800,800, annually for effective management.*

### ***Hydrological Issues and Payment for Water Services***

*It was deemed important to know whether water customers in Tanga town know where the water they use originates. Interestingly majority of the water customers are aware that the water is abstracted from the Sigi River and that the river itself flows from the East Usambara Mountains. On abstraction it was found that the TUWSSA abstracts around 26000m<sup>3</sup> of water per day. Tanga Cement Company is the major water consumer, consuming around 6% of the total water abstracted daily, which is equivalent to 1515m<sup>3</sup>. The second largest water consumer is the Tanzania Harbours Authority consuming around 475m<sup>3</sup> daily. Also Mjesani sisal estates abstract around 100m<sup>3</sup> of water mainly for sisal leaves decortications.*

*Majority (73%) of the water customers in the Municipality of Tanga said water supply services was good and the remaining 27% had it that the services was very good, they further noted that perhaps the water services in Tanga was much better than in any other Municipality or town in Tanzania. This revelation was substantiated by the fact that all the respondents (100%) said water flows from their taps for 24 hours Since people are assured of the better and recurrent water services, something important that comes out is the existing potentiality for introducing a mechanism whereby water users can contribute for the Sigi River Watershed conservation and Management without many difficulties.*

*There are around 13964 water customers in the Municipality of Tanga categorized as domestic (13140), institutional (235), commercial (464) and industrial (115). The TUWSSA officials said the customer's response on paying for the water services is very positive, the water taps system is 100% metered and hence revenue collection efficiency is 93%.*

*The TUWSAA collects an average of Tshs. 140 million monthly or Tshs 1.68 billion a year equivalent to \$1,680,000. However, in return the Authority only pays to the Pangani Water Basin Office (PWBO) Tshs 11 million annually as an abstraction fee, which is just 0.65% of the total revenue collected by the Authority every year. In other words each water user pays just an average of Tshs 765 the whole year. Realistically the amount payable to the PWBO is quite minimal and of course the PWBO does not give any of this to forest management. The available information shows that most of the money collected goes to the Treasury.*

*Similarly as compared to elsewhere the tariffs charged by the TUWSSA are relatively low. In Same district for instance water tariffs are Tshs. 500/m<sup>3</sup> for domestic use, Tsh 750/m<sup>3</sup> for commercial use (e.g. hotels), and institutions (e.g. schools), and Tsh 1000 for industrial use (e.g. sisal plants), though flat monthly rates are also levied in some cases (Turpie et al 2003). In Nzega district, Tabora region they charge flat rate of Tshs. 1000/m<sup>3</sup>. Conversely in Tanga water for domestic use is charged Tshs 300, Tshs 300 for institutional customers, and Tshs 336 for commercial customers and Tshs 420 for the industrial use, literally the implication here is that water is yet to be given its due value. Setting these tariffs in a higher side would be critical if customers are to contribute for the watershed management.*

#### ***Payment for Water Services: The Case Studies***

*The study also looked into the cases where payment for water services has been linked to the conservation of catchment forests. One of these cases is Costa Rica where the government has been involved in a scheme to help users such as hydropower companies to pay farmers to maintain forest cover in watersheds, while in Quito, Ecuador, water companies are helping to pay for the management of protected areas that are the source for much of the capital's drinking water and the hydroelectric utilities finance upstream restoration, which has lead to the increased forest cover on private land, expansion of forests through protection and regeneration. In Colombia they have what they call **Environmental Services Tax for Watershed Management**-through this mechanism industrial water users and municipalities pay some extra fees, which is given back to the managers of the watersheds as incentives. This has resulted to the improved forest management and forest expansion and hence continuous flow of water.*

*The study also looked into the challenges and problems facing the PWBO. They include difficulties in monitoring abstractions, inadequate funding, and difficulties in dealing with defaulters. There are as twice as many illegal abstractions as legal water rights (Turpie et al 2003). In Tanga region where the Sigi River is located there are 488 water abstractors without water rights (IUCN, 2003).*

#### ***Conclusions***

*It was observed that the International community has been funding forest management based on the "global values of biodiversity", and locally the benefits have been consistent flows of water and cheap water.*

*Consideration must be given to rewarding upland communities around the forests to obtain sustainable management of the catchment. It is by so doing that sustainable management of the catchment forests will be realized and hence guaranteeing the continuous flow of the Sigi River.*

*It is crucial that part of the revenues collected from water users should be used to establish and improve various social services and boost economic status of the upland communities by making the East Usambara Communities access loans and establishing alternative Income Generating Activities (IGAs).*

*The findings show that, most water users see the idea of watershed management as critical for the continuous flow of water and have shown an interest to contribute to it and hence the possibility of rewarding the upland communities who are the stewards of the Catchment areas.*

*While payment for environmental services-water as a watershed management mechanism is a new concept in Tanzania, there are several cases, whereby watershed management have been sound and successful as a result of linking payment for water services to watershed management. Such cases are in Colombia, Costa Rica and Ecuador. These are the successful cases worth borrowing a leaf.*

*While the findings show that payment for environmental services (water) has been possible elsewhere, the modalities of payment have yet to be worked out in Tanzania.*

*Payment for environmental services and water in particular is not a panacea or a universally applicable solution to forest loss: rather it should be regarded as one of many tools in a toolbox. If used well, however, it can provide concrete support for both good forest management and forest protection (.Dudley and Stolton 2003)*

### **Recommendations**

*Following the study findings a number of recommendations are made.*

*There should be incentives to the East Usambara communities in terms of schools, medical centers, creating alternative income-generating activities and enhancing the existing environmental friendly income generating activities.*

*There should be a shift in the mindset of consumers to appreciate and recognize that environmental services and water in particular has an economic value and that should not be provided free or at minimum cost.*

*Education to the potential consumers and suppliers of ecosystem services is very much needed to expand the willingness of consumers and suppliers to use market-based instruments. As such water users should be educated about the valuable economic services that, healthy, properly managed watersheds provide and realize that the services will continue to be provided if sustainable land management practices are made at least*

*economically. As such they should be prepared to pay some little extra fee, which will be used, for watershed conservation and management.*

*The government through the Ministry of Water and Livestock Development in collaboration with other stakeholders should review the current water use/abstraction fees paid by various users and abstractors to the PBWO and use the obtained revenues as incentives to the stewards of the environment-upland community and for watershed management.*

*There should be legal and regulatory system in place to enforce the payments for water services mechanism.*

*Water-related ecosystem services are often thought of as public goods flowing from a mixture of private and public lands, which people are understandably reluctant to pay for (Perrot-Maître and Davis 2001). For these reasons governments and Tanzanian government in particular should retain an important or even predominant role in protecting water-related ecosystem services.*

*Since the East Usambara Forests contribute to global existence and option values, and global climate control, it is important that the international community put more contribution in terms of funding to be used specifically for watershed management and incentives to the stewards of the forests.*

*In-depth and detailed studies should be conducted in the area of water use fee sand propose on more reflective fees and justifiable for Catchment management. The current water fees payable to Pangani Basin Office does not reflect the real cost of production of water and indeed other environmental services.*

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## ABBREVIATIONS

|          |  |
|----------|--|
| ANR      | Amani Nature Reserve                                 |
| CFR      | Catchment Forest Reserve                             |
| DC:      | District Commissioner                                |
| EUCFP    | East Usambara Catchment Forest Program               |
| FBD      | Forest and Bee-keeping Division                      |
| FGDs     | Focused Group Discussions                            |
| FINNINDA | Finnish International Development Agency             |
| GDP      | Gross Domestic Products                              |
| HEP      | Hydro -Electric Power                                |
| IUCN     | International Union for Conservation of Nature       |
| IWRM     | Integrated Water Resources Management                |
| KIIs     | Key Informants Interviews                            |
| MNRT     | Ministry of Natural Resources and Tourism            |
| NGOs     | Non-Governmental Organizations                       |
| NORPLAN  | Norwegian Organization for Research and Planning     |
| OECD     | Organization of Economic and Cooperation Development |
| PBWA     | Pangani Basin Water Authority                        |
| PBWO     | Pangani Basin Water Office                           |
| PES      | Payment for Environmental Services                   |
| PRB      | Pangani River Basin                                  |
| RAS      | Regional Administrative Secretary                    |
| RC       | Regional Commissioner                                |
| RPC      | Regional Police Commander                            |
| SIS      | Strategic Informant Sampling                         |
| SNRM     | Sustainable Natural Resources Management             |
| SPSS:    | Statistical Package for Social Sciences              |
| TAMTA    | Tanga Muslims Organization                           |
| TEV      | Total Economic Value                                 |
| TFCG     | Tanzania Forest Conservation Group                   |
| THA      | Tanzania Harbours Authority                          |
| TMC      | Tanga Municipal Council                              |
| TUWSSA   | Tanga Urban Water Supply and Sewerage Authority      |
| URT      | United Republic of Tanzania                          |
| USD      | United States Dollar                                 |
| WWF      | World Wide Fund for Nature                           |

## 1.0 INTRODUCTION AND BACKGROUND

Water as an environmental resource is often times regarded as a free good. In some instances this resource is referred to as a “gift from God” or a “gift of Nature”. Water users pay little or pay the amount, which does not reflect the real economic value of this resource. There are no incentives to the stewards of the catchment forests, which are critical for the continuous flow of fresh water.

In 1992 the International conference on Water and Environment that was held in Dublin put forward a principle that *water has an economic value and that it should be recognized as an economic good*. However, much have yet to be done on the ground to realize this principle. Studies on payment for water services can significantly contribute in proposing how the river catchments can be managed and hence continue to provide the services they provide especially water, in a more sustainable manner. Many studies have been conducted in the East Usambaras but none has specifically focused on the payment for water services.

This study focused on the East Usambara Forests and the Sigi River. Despite the significant role of supplying water to both rural and urban areas of Tanga and Muheza, source of water for industries and to the farmers that the Sigi river plays, there are little or no incentives provided to the stewards of the East Usambara forests, which would motivate them to do this task more effectively so that the water can continue to flow and support development and communities’ livelihoods, especially in down stream areas. This has resulted into a situation whereby, although the government, together with national and international Non-Governmental Organizations strives to address environmental problems in the East Usambaras, environmental degradation occurs through unsustainable activities such as lumbering, poor farming practices on the hill slopes and illegal mining within the forest reserves.

The most notable environmental degradation, which affects water sources, is the cutting down of tree for erecting temporary shelters and in opening mine pits. Water sources become highly polluted since most of the alluvial mining is done in streams and rivers. Mineral processing is also done in the rivers (Mruma and Kinabo in Nikundiwe *et. al.* 2004).

Meanwhile the Tanga Urban Water Supply and Sewerage Authority (TUWSSA) collect a fair amount of money from water sales, for instance in 2004 around Tshs 1.69 billion was collected. None of this, however, is set aside by the TUWSSA for any conservation and management activities of the catchment or for rewarding the upland poor-stewards for carrying out activities that are not detrimental to the catchment functions. The Sigi river is included as part of the Pangani Basin and that the Pangani Basin Water Office (PBWO) charges abstraction fees from the water abstractors, an aspect which is also emphasized by the National Environmental Policy (URT, 1997), but again none of this revenue is put back by PBWO for conservation of the watershed/forests. This is one of the many issues that need to be addressed within the context of sustainable management of water resources.

One potential solution would be to apply the concept of Payment for Environmental Services. Putting in place and applying judiciously a payment for water mechanism might significantly contribute in the protection and sound management of the river catchment and consequently guarantee the continuous flow of the Sigi River, while at the same time rewarding those who have been and continue to be responsible for protecting the catchment forest.

Payment for Environmental Services (PES) and especially water is a mechanism for watersheds protection that is gaining momentum in various places around the world. It is in use in some countries around the world such as El Salvador and Costa Rica in the Central America where it has started to bear fruit. The City of Tanga with a population of about 243,580 people (2002 census) is one of the areas where this mechanism can bring about positive results.

### **1.1 PROBLEM STATEMENT**

Although in Tanzania there is no mechanism in place for the users of the water to make contribution to the management of the resources that supply this service to them, payment for water services seems to be an important tool that might play a significant role in Watershed management and at the same time contribute to the economic development and the improvement of the communities livelihoods.

For many years the East Usambara Mountains and Sigi River catchment have been undergoing serious land use changes including cutting logs for timber, forest clearing in search of more land to grow food and cash crops and just recently destruction of water sources (forest) through uncontrolled gold mining that altogether impacts the flow of the river.

While the government capacity to manage the watersheds is limited, it is also true that donor funding is not sustainable and cannot be guaranteed. To have any form of sustainability, managing the watersheds requires introduction of economic incentives for the forest stewards to add into the limited government funding. Tanzania Environmental Policy, water policy as well as Forestry policy encourages sustainable management and protection of water sources to ensure the continuous flow of water that consequently improves and supports human and economic development. Payment for water services is a potential mechanism to achieve this objective.

As a long-term mechanism this can be achieved through making all key water users pay for water services and set aside funds specifically for conservation and incentives for the environmental stewards. This study sought to investigate in this area, how the mechanism can be put in place and suggest policy recommendations.

## **1.2 OBJECTIVES OF THE STUDY**

The main objective of this study was to assess payment for water as a mechanism for river catchment management. Specifically the study seeks to:

- Contribute in the making of decisions regarding forest and water resources management.
- Suggest how part of the revenues from water sales can be used for forest management as part of watershed management.
- Look into the possibility of rewarding upland communities who are stewards of catchment areas.
- Gather lessons of Payment for Environmental Services (PES) from around the world where payments for water are linked to the conservation of water resources.

## **1.3 SIGNIFICANCE OF THE STUDY**

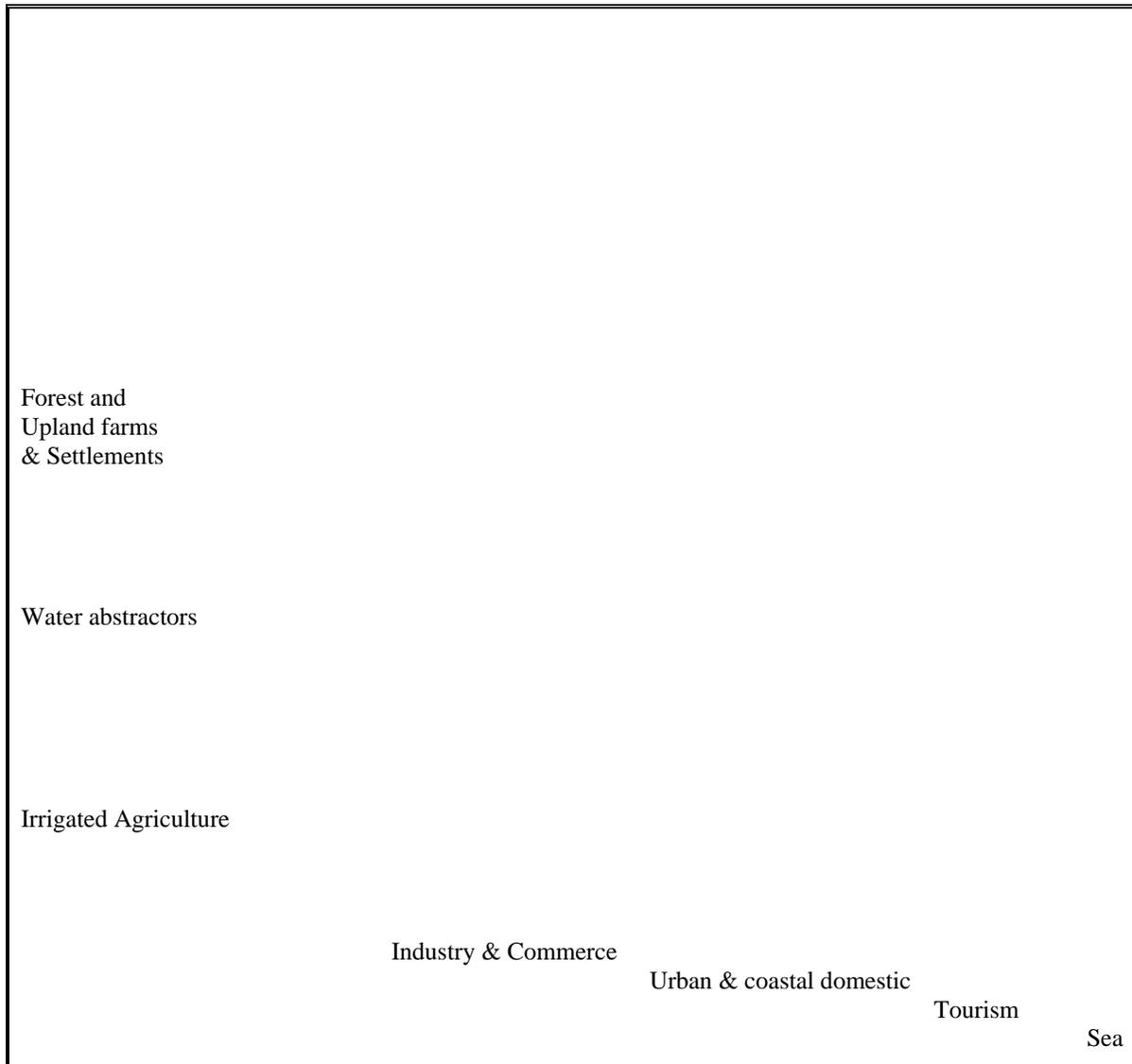
The study sought to:

- Indicate potential benefits that might be gained if the Payment for Water for watershed management mechanism is to be established in Tanzania.
- Give more insights of how Payment for water can be established and operational zed in Tanzania.
- Suggest ways through which communities around catchment forests and especially the upland poor can be rewarded to actively participate in catchment protection and management.
- Add into the existing literature (if any) about payments for water services in Tanzania.
- 

## **1.4 HYPOTHESIS**

The conservation of the East Usambaras and the resulting environmental goods and services especially water are a benefit of conservation for biodiversity and not forest management for production of water.

**Figure 1.1: Conceptual framework  
Money flow and Water flow Scenario**



Water flows  
Money flows

**Source: Bass, S and Geoghegan, T (2002). This Conceptual Framework was adopted and slightly modified to suit the intended purpose.**

Figure 1.1 is a sketch of the watershed which demonstrates the prevailing situation in terms of water and money flows. As indicated by the blue arrows water originating from the upland forests is supplied to various sectors down stream. In return the suppliers of water namely water supply authorities and water basin offices receive money as payments for provision of the service. However, while the water originates from the uplands forests

where the catchment forest stewards are found and play a significant role to conserve the forests, there is no a flow of money towards these stewards. Similarly the diagram demonstrates the situation whereby funds for forest/watershed conservation and management is obtained through bilateral Aid, Non Governmental Organizations and from the Government. Making major water users downstream understand the need for more funds for conservation and contribute directly to watershed management might make the system more sustainable and improve the situation.

## **2.0 RESEARCH METHODOLOGY**

### **2.1 The study area**

#### **2.2 Location**

The study was conducted in the East Usambara Mountains, which fall into two districts of Muheza and Korogwe both situated in Tanga Region. About 80% of the East Usambara falls within the administrative unit of Amani in Muheza District. The Forest reserves and their associated genetic diversity are also concentrated within Amani. Likewise the vast majority of the East Usambara's population resides in Amani division (Mission Report 1985). The East Usambara mountains lie between latitude  $4^{\circ} 48'$  and  $5^{\circ} 13'$  and longitude  $38^{\circ} 32'$  and  $38^{\circ} 48'$ .

Mashauri in Nikundiwe et al, (2004) indicate that various estimates of the original forest area in the East Usambara and changes have been documented (e.g. Rodgers and Homewood 1982, Anon 1988, Iversen 1991). A comprehensive of area estimates was made by Iversen (1991). It appears that the area may have been reduced from an original block of around 100000 ha (Anon, 1998) to the present 45,000 to 50,000 ha (Mashauri in Nikundiwe *et al*, 2004). One of the problems with estimates is lack of agreement on what constitute the East Usambara. 18 villages surround Amani Nature Reserve, one of the Forest Reserves in the East Usambara Mountains with the estimated population of 31469 people (Muheza District Planning Dept). Three villages namely Mbomole, Shebomeza, and Mlesa were purposely selected (Figure 2.1) for the purposes of this study.

**Figure 2.1: A map showing Study Villages, Sigi River and the Amani Nature Reserve (ANR)**

### **2.3 Sigi River Catchment**

The perennial Sigi River drains the eastern slopes of the Usambara Mountains, and has two main tributaries flowing from north and south (Muzi and Kihuhwi). After their confluence, the Zigi drains eastwards into the Indian Ocean via the Mabayani Dam, a source for the Tanga Municipal Water Supply. The upper reaches of the catchment are mountainous, consisting mainly of dense forest interspersed with tea plantations. Its lower parts are hilly, comprising dry savannah-type bushes and low trees, as well as sisal estates. Along the coast, coconut and palm trees are common. As such, the entire catchment is fairly well vegetated, and the risk of erosion is minimal. Rainfall in the Sigi catchment is bi-modal. However, its distribution varies from 1,000 to 2,000 mm. Yearly average rainfall is estimated at 1200 to 1400 mm (IUCN, 2003). The Catchment is about 1050km<sup>2</sup> (Mwasha, 1989a, 54).

### **2.4 Climate**

The climate of the East Usambara is characterized by two rain seasons with high relative humidity. March to May is the long rain period while Octobers to Decembers mark the short rains. Occasionally long rains tend to be heavy but the annual average varies between 1000mm to 2000mm. These rains contribute in increasing the volume of the Sigi River. The Amani division where this study was conducted enjoys annual rainfall of 1945 mm with recorded extremes of 1377 mm and 3505 mm; the humidity is very high with an annual mean temperature of 20.8°C degrees. The mean daily maximum is 24.6° C and the minimum is 16.3°C

### **2.5 Research Methods**

The study was conducted both in Tanga town and the East Usambara. Data were also obtained from the Forest and Beekeeping Division, Ministry of Water and the Pangani Basin Water Office in Moshi.

Both primary and secondary sources were used to obtain data for this study. With the primary sources, two types of a structured questionnaire were administered targeting major water users/consumers in Tanga town and communities surrounding the East Usambara Forests-Amani Nature Reserve. Data were also obtained through Focused Group discussions and Key Informant interviews. With Key informant interviews *Strategic Informant Sampling (SIS)* was used where the people who were thought to have most information were consulted for discussions. By using this method information was obtained from the Forest and Beekeeping Division, Ministry of Water and Livestock Development and Pangani Water Basin Authority. In addition an extensive literature survey was conducted where books, publications, brochures and documents related to the topic under study were reviewed. These methods were supplemented by physical observations where the remote parts of the study area were visited to appreciate and perceive the extent of forest and water sources destruction as a result of human activities.

## 2.6. Types of Data

(a) **Fund allocation for forest management and conservation:** This information was obtained from the Forestry and Bee keeping Division in Dar es Salaam and Tanga.

(b) **Revenue Collection:** This information was obtained from the Tanga Urban Water Supply and Sewerage Authority.

(c) **Hydrological data:** This data was obtained from the Ministry of Water and Livestock Development and Tanga Urban Water Supply Authority.

## 2.7. Sampling

### 2.8 The Sample Size

Two types of structured questionnaires were administered, one in Tanga town and the other one in the East Usambara. The list of major water customers/users was obtained from the Tanga Urban Water Supply and Sewerage Authority (Table 2.1) and also the list of water abstractors from the Sigi River was obtained from Pangani Basin Water Office (PBWO).

**Table 2.1: Identified 60 Major Water Customers, amount of water consumed and the monthly tariffs**

| SN  | Customer Name                | Category      | Amount (Tsh) | Consumption (m3) per month |
|-----|------------------------------|---------------|--------------|----------------------------|
| 1.  | M/S Tanga Cement Co. Ltd.    | Bulk consumer | 11893420     | 30,892.0                   |
| 2.  | M/STanga Cement Company      | Commercial    | 4892496      | 14,561.0                   |
| 3.  | M/S T.H.A. (Port Manager)    | Commercial    | 3839136      | 11,426.0                   |
| 4.  | M/S. T. M. Council           | Institution   | 3317370      | 11,057.9                   |
| 5.  | 37KJ Kambini                 | Institution   | 2621400      | 8,738.0                    |
| 6.  | M/S Police lines             | Institution   | 2148000      | 7,160.0                    |
| 7.  | M/S Skua Kambini             | Institution   | 1715200      | 5,717.3                    |
| 8.  | M/S Maweni Prison            | Institution   | 1695600      | 5,652.0                    |
| 9.  | M/S T.H.A (Bandari House)    | Commercial    | 962304       | 2,864.0                    |
| 10. | M/S Principal Lit Buhuri     | Institution   | 686100       | 2,287.0                    |
| 11. | Mr Mohamed Hassan            | Domestic      | 581400       | 1,938.0                    |
| 12. | M/S Chuo cha ufundi          | Institution   | 517800       | 1,726.0                    |
| 13. | M/S Tanzania Railways Corp.  | Industrial    | 622440       | 1,482.0                    |
| 14. | M/S Police lines             | Institution   | 440000       | 1,466.7                    |
| 15. | M/S Chuo cha Uuguzi          | Institution   | 395700       | 1,319.0                    |
| 16. | M/S Sohanpal metal works Ltd | Industrial    | 513240       | 1,222.0                    |
| 17. | Tanga Municipal Council      | Institution   | 353700       | 1,179.0                    |
| 18. | M/S depot (T.M.C)            | Institution   | 311700       | 1,039.0                    |
| 19. | M/S R.P.C                    | Domestic      | 310200       | 1,034.0                    |

|     |                                |             |        |       |
|-----|--------------------------------|-------------|--------|-------|
| 20. | M/S Pee Pee Tanzania           | Industrial  | 417060 | 993.0 |
| 21. | M/S Police line                | Institution | 287700 | 959.0 |
| 22. | M/S Motel Panor                | Commercial  | 309456 | 921.0 |
| 23. | M/S Amboni Spinning Mills Ltd. | Industrial  | 384720 | 916.0 |
| 24. | M/S Mkuu wa Chuo cha Afya      | Institution | 255900 | 853.0 |
| 25. | M/S Tanga General Hospital     | Institution | 255300 | 851.0 |
| 26. | M/S T.M.C (Machinjioni)        | Commercial  | 285936 | 851.0 |
| 27. | M/S Mkonge Hotel               | Commercial  | 285264 | 849.0 |
| 28. | M/S Galanos Secondary School   | Institution | 254700 | 849.0 |
| 29. | m/s police district            | Institution | 250500 | 835.0 |
| 30. | M/S Masjid Elirshaa (TAMTA)    | Domestic    | 232000 | 773.3 |
| 31. | M/S Police line                | Institution | 222300 | 741.0 |
| 32. | Regional Medical Officer       | Institution | 220500 | 735.0 |
| 33. | M/S Medical.Ass.Training       | Institution | 217800 | 726.0 |
| 34. | Principal Labour Officer       | Institution | 216000 | 720.0 |
| 35. | M/S. Tsetse Research Unit      | Institution | 209100 | 697.0 |
| 36. | M/S African Muslim- Pongwe     | Institution | 191400 | 638.0 |
| 37. | M/S T.H.A [Police Quarter]     | Institution | 183000 | 610.0 |
| 38. | M/S Hotel Kola Prieto Ltd.     | Commercial  | 192192 | 572.0 |
| 39. | M/S Mamujee Products Ltd       | Industrial  | 225960 | 538.0 |
| 40. | M/S Tanga.Pham.Plastics        | Industrial  | 222600 | 530.0 |
| 41. | Regional medical officer       | Institution | 151800 | 506.0 |
| 42. | M/S Arthi River Mining Co.     | Industrial  | 208740 | 497.0 |
| 43. | M/s Popatlal.Secondary Sch.    | Institution | 143400 | 478.0 |
| 44. | A.B Hangida                    | Domestic    | 141900 | 473.0 |
| 45. | M/S Police lines               | Domestic    | 141900 | 473.0 |
| 46. | Mrs Gladness Silayo            | Domestic    | 141300 | 471.0 |
| 47. | Insp. Mwakanyamale             | Domestic    | 140400 | 468.0 |
| 48. | M/S RC Residence               | Domestic    | 139800 | 466.0 |
| 49. | Kituo cha Utafiti wa Mifugo    | Institution | 138900 | 463.0 |
| 50. | M/S Ikulu ndogo                | Institution | 138300 | 461.0 |
| 51. | Mr. M. M. Marupa               | Domestic    | 135300 | 451.0 |
| 52. | M/S Lime Stone Factory         | Industrial  | 184800 | 440.0 |
| 53. | M/S M.D. Residence (side 2)    | Institution | 129600 | 432.0 |
| 54. | M/S Arafah English Medium      | Institution | 129300 | 431.0 |
| 55. | M/S SDL limited                | Industrial  | 178500 | 425.0 |
| 56. | Mr Abdallah Noorbhai           | Domestic    | 126900 | 423.0 |
| 57. | M/S Tanesco                    | Institution | 126000 | 420.0 |
| 58. | Mr omari. M. Segumbo           | Domestic    | 124800 | 416.0 |
| 59. | M/S Usagara Sec School         | Institution | 123600 | 412.0 |
| 60. | Remand Prison                  | Institution | 122100 | 407.0 |

**Source: Tanga Urban Water Supply and Sewerage Authority (TUWSSA), 2005**

From the list, some fifteen major water customers/users were sampled as shown in table 2.2

**Table 2.2: Sampled Major Water Users in the Municipality of Tanga**

| SN  | Name of the Customer                      | Average Monthly Water Consumption (m3) | Tariff per Month (Tshs) |
|-----|---|--|-------------------------|
| 1.  | Tanga Cement Company                      | 45450                                  | 17,000,0000             |
| 2.  | Tanzania Harbors Authority                | 14290                                  | 4,000,000               |
| 3.  | Mjesani Sisal Estate                      | 3000                                   | 2,000,000               |
| 4.  | Maweni Prisons                            | 5652                                   | 1,695,600               |
| 5.  | Tanga Municipal Council                   | 4670                                   | 1,400,000               |
| 6.  | East Usambara Tea Company                 | 2100                                   | 630,000                 |
| 7.  | Tanzania Railways Cooperation             | 1482                                   | 622,440                 |
| 8.  | Vocational Education & Training Authority | 1726                                   | 517,800                 |
| 9.  | PEE PEE Company Ltd                       | 995                                    | 417060                  |
| 10. | Amboni Spinning Mills Ltd                 | 916                                    | 384,720                 |
| 11. | Motel Panor                               | 920                                    | 309456                  |
| 12. | Mkonge Hotel                              | 850                                    | 300000                  |
| 13. | Tanga Pharmaceuticals and Plastics Ltd    | 530                                    | 222,600                 |
| 14. | Hotel Kola Prieto Ltd                     | 575                                    | 192,192                 |
| 15. | Simba Lime Factory                        | 440                                    | 180,000                 |

**Source: Extracted from TUWSSA figures, 2005**

In the East Usambara, three villages of Mbomole, Shebomeza and Mlesa were purposefully selected and from each village 20 respondents were interviewed while in the Municipality of Tanga those sampled were 25%, equivalent to 15 major water consumers. The three villages in the East Usambara were selected with the knowledge that all of them are located adjacent and within the Amani Nature Reserve respectively and in each village there are several water sources /streams that subsequently join the main Sigi River. The idea was to get opinions from the people who have direct dependence on and impact to the forest reserve and that would be directly affected by any decision made that aims at managing the forests. The sample size was considered enough in that information were also obtained by using other methods as summarized in table 2.3. At the end the total sample size was 112 respondents.

**Table 2.3: Summary of methods of data collection and respondents**

| <b>Source of Information</b>  | <b>Respondents</b> |
|---|--------------------|
| <b><u>Interviews (Villages)</u></b>   |                    |
| Mbomole (20), Shebomeza (20), Mlesa (20)  | 60                 |
| Major water users in the Municipality of Tanga  | 15                 |
| <b><u>Other research methods</u></b>  |                    |
| <b><u>Key Informants</u></b>  |                    |
| 1. Forest and Beekeeping Division (FBD)   | 2                  |
| 2. Ministry of Water and Livestock Development  | 1                  |
| 3. Pangani Basin Water Office (PBWO)  | 2                  |
| 4. TUWSSA   | 2                  |
| 5. Muheza District Natural resources officials  | 3                  |
| 6. Village leaders, 2 from each village   | 6                  |
| <b><u>Focused Group Discussions with</u></b><br>(Environmental Committee representatives) |                    |
| 1. Mbomole Village  | 7                  |
| 2. Shebomeza Village  | 8                  |
| 3. Mlesa Village  | 6                  |
| <b>Total</b>  | <b>112</b>         |

**Source: Field Survey March 2005**

## **2.9 Data Processing and Analysis**

After all the data were coded, the socio-economic data was recorded and analyzed using the Statistical Package for Social Sciences (SPSS). The information were then tabulated and converted into percentages. Content Analysis was used to analyze qualitative information from group discussions and key informant interviews which basically could not be quantified.

### **2.9.1 Limitations of the Study**

Given the type of information required for this study, it was important to interview people who could give the most information. However, this was not an easy attempt as it was always difficult to get hold of these people at the right time. Although in most cases the researcher made appointment before hand it was no wonder to miss a targeted respondent for up to three times. This was costly in terms of time and money since the researcher had to spend more time than planned before and had to make phone calls before meeting the respondents. However, it is impressive to note that most of the respondents were met and provided the required information. In the East Usambara the villagers were always working in their farms and therefore it was difficult to get them at home at appropriate time, as such in some cases the researcher was compelled to administer the questionnaire during late hours of the day, this contributed to allocating more days for the fieldwork. Furthermore, villages in the East Usambara are scattered and the researcher had no means of transport. This engineered to the hiring of a motorcycle for transportation within the

study villages but within the same limited budget line. Moreover Payments for Environmental Services is a new concept in Tanzania as such, it was always difficult to obtain more relevant information.

Despite these limitations the researcher managed to obtain data that will hopefully contribute towards meeting the study objectives.

### 3.0 RESULTS AND DISCUSSIONS

#### SOCIO-ECONOMIC ISSUES

##### 3.1 Gender

The researcher ensured that both genders were involved in interviews and discussions; the idea was to gather information in a more balanced way and have opinions from both males and females. Of all people that were interviewed in the study villages 57% were males and 43% were females as shown in figure 3.1.

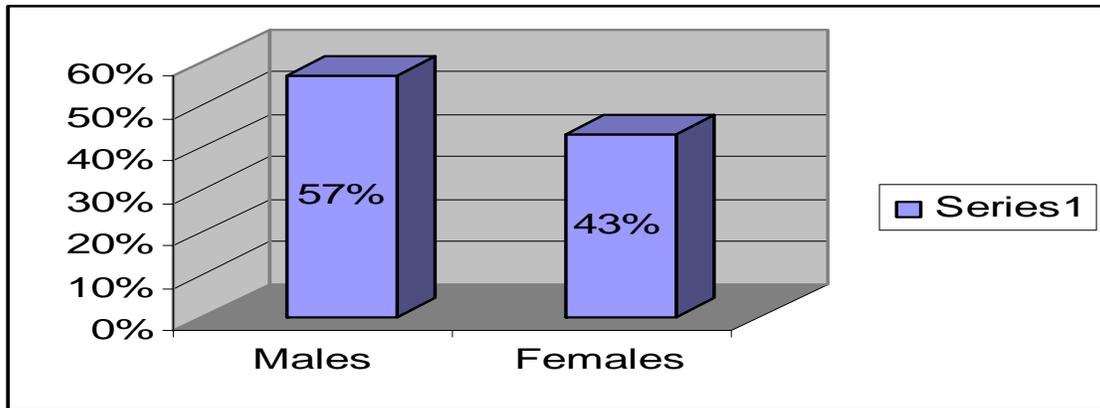


Figure 3.1: Sex of the respondents.

##### 3.2 Household sizes

The findings revealed that about 58.3% of the family sizes in the study area fall under the category of 1-5 people, while some 31.7% is in the group of 6-9 people in a household and the remaining 10% fall under 10-15 people category (table 3.1). Also the findings revealed that the study area is attracting more people from outside who come to involve themselves in various activities. This is a clear signal that any natural resources management strategy in this area should take this issue on board and include it in the management plan. The discovery of goldfields in the East Usambaras is another factor that recently has attracted thousand of people who came to the area for mining. The concern is the increasing operational costs required to have in place a type of management which will be sustainable and which would result into a win-win scenario whereby both the upland poor and downstream water users benefits.

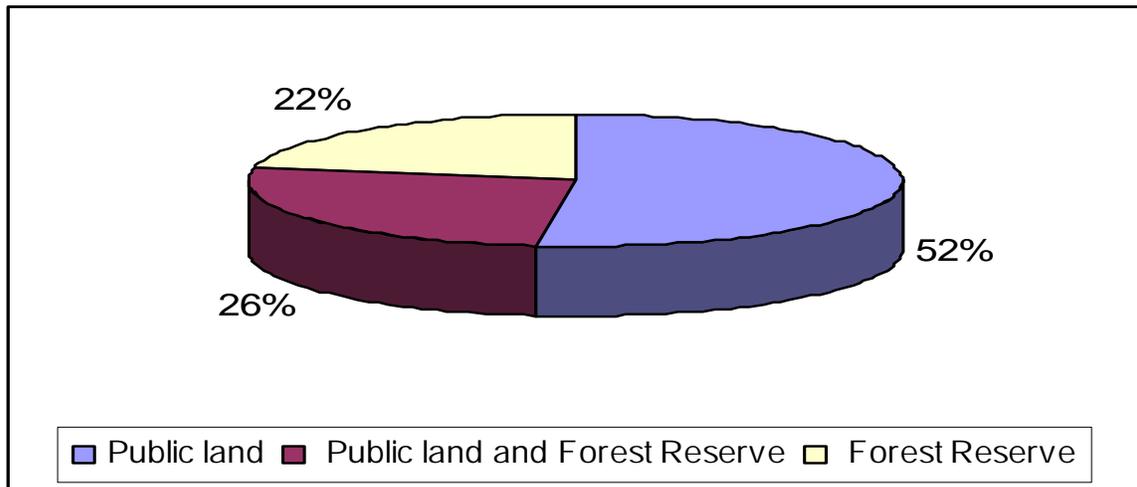
Table 3.1: Family Sizes in the Study Area

| Family Size  | Frequency | Percentage |
|--------------|-----------|------------|
| 1-5          | 35        | 58.3       |
| 6-9          | 19        | 31.7       |
| 10-15        | 6         | 10         |
| <b>Total</b> | <b>60</b> | <b>100</b> |

Source: Field Survey March 2005

### 3.3 Sources of energy (firewood)

About 100% of the respondents use firewood as their source of energy and more than a half of all the respondents i.e. 52% noted that they get firewood from their own farms/public land; around 22% said they obtain firewood from the Forest Reserve and the remaining 26% said, they get firewood from both Forest Reserve and Public Land. These results are presented in figure 3.2:

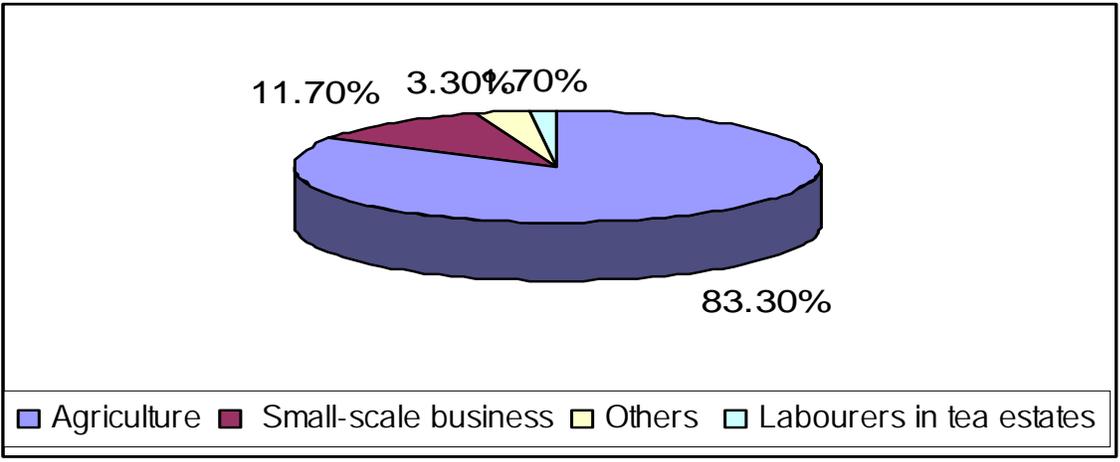


**Figure 3.2: Sources of Firewood**

Although there are restrictions and rules for people not to enter into the forest reserve uncontrolled, still people get into the reserve illegally or unofficially to acquire various basic needs such as timber, fuel wood, ropes, and poles and since population is likely to increase over time in the East Usambaras, demand for the forest products and services is also likely to increase and hence exert more pressure into forest and water resources.

### 3.4 Economic activities

Economic activities habitually tend to have negative impact on natural resources. Hence it was important to know the main economic activities in the study area. The findings revealed that majority (83.3%) practice agriculture as their main economic activity, about 11.7. % of the respondents said they do small scale business, some 1.7% work as laborers in tea estates and the remaining 3.3% do other activities such as employees in schools and other public sectors, carpentry as well as mining (figure 3.3).



**Figure 3.3: Respondents' Economic Activities**

Almost all of these activities impacts on forests and water resources. For instance most of the farmers said at times they encroach into the forest in order to increase the size of their farmlands. It was learned that gold mining is also conducted illegally in the Forest Reserve causing destruction of the water sources. The field visit witnessed serious forest and water sources destruction attributed to illegal mining (See Plate 3.1).



**Plate 3.1: One of the seriously damaged water sources/streams as a result of gold mining in Sakale village.**

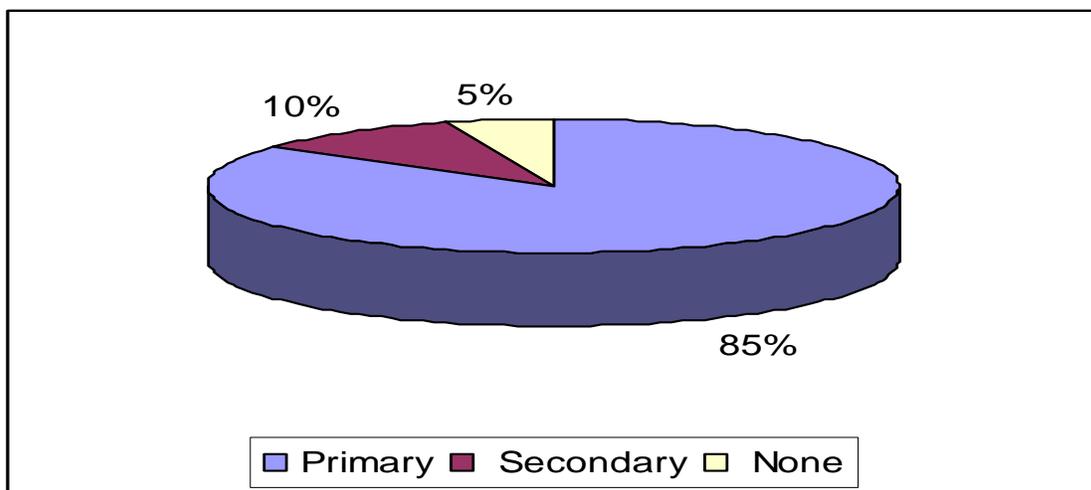
Source: Field Survey 2005

A group of miners that availed themselves for informal discussion at Sakale village, had their concerns and stated openly that they find it much better to engage themselves in mining rather than working in tea estates because through mining they earn more money. “When I work as a labourer in the tea estates I receive just Tsh 1500 as my wage a day, but if I succeed to get gold I sell one unit at Tsh 12500, just imagine“. Elaborated one Youngman who was captured processing gold in one of the streams at Sakale village. They suggested that, instead of being expelled from the area, the government should conceivably provide them with training on how to do their job (mining) in environmental friendly manner since mining has formed an important source of their incomes. This is a very challenging situation in that while it is crucial that water sources must be conserved for the continuous flow of water, the welfare and the livelihoods of the communities who are also the stewards of the environment highly depend on the exploitation of the very environmental resources to achieve their basic needs.

One scholar once noted: “People who are starving will have no interest in conservation and without conservation people will eventually starve“. Brandon and Wells quoted in Bloch (1992) in Jambiya and Sosovele (2000). This is one of the conservation dilemmas with management cost implications in so far as forests and water resources management are concerned. On the other hand we need to conserve the water sources, while there is an urgent need to address socio-economic problems of the communities around water sources. This is a challenge that all stakeholders need to understand clearly and have them contribute towards watershed management and setting aside incentives for the guardians/stewards of the forests and water sources.

### 3.5. Education Status in the Study area

The results showed that the majority (85%) of the respondents in the study area acquired primary education, just 10% of the respondents acquired secondary school level and the remaining 5% never attended school. These results are represented in figure 3.4.



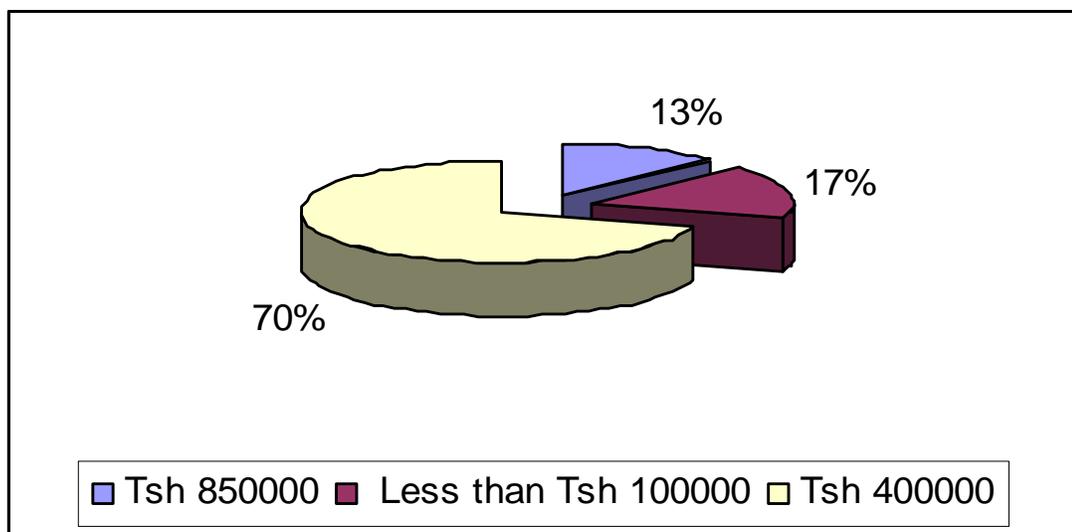
**Figure 3.4: Education Status in the Study Area**

Given the level of education that majority of the people in the study area have acquired, something which is clear is that, these are the people who cannot engage themselves in

skillful jobs and instead will largely depend on doing unskillful and low pay jobs which always have impact on natural resources especially harvesting forest and water resources and this was evident in that a larger proportion of people (83%) named small holder farming as their major economic activity. Creation of various non-farm activities which have less or no impact on the environment would be crucial for generating incomes for the communities in and around the Forest Reserve, at the same time conserving and managing forest and water resources.

### 3.6 Household Incomes

Majority (70%) of the respondents earns an average of Tshs. 400,000/- per annum. A considerable proportion (17%) of the respondents earns less than Tshs. 100,000/- per annum and just 13% of the respondents earn an average of Tshs 850,000/- the whole year. These results are represented in figure 3.5.



**Figure 3.5: Peoples average annual incomes in the study area**

As shown in figure 3.5, income levels in the study area are considerably low implying that people will always strive to make ends meet, but often times at the expenses of the environment escalating into misuse of the forests and water sources through activities such as farming, mining, illegal hunting and timber harvesting which are dominant in the study area. Deliberate efforts to boost people's income through environmental friendly activities in the study are crucial for environmental sustainability and guarantee of the resulting environmental goods and services. Non- traditional activities such as fisheries, bee keeping and poultry keeping would be instrumental. Butterfly farming for instance is one of the more promising environmental friendly activities, which have already taken off as a pilot project in a few villages under Tanzania Forest Conservation Group (TFCG).

According to TFCG currently there are over 300 butterfly farmers, TFCG further indicated that depending on species each butterfly pupae is worth between 1 and 2.5 US dollars. Allocating more funds for these activities will not only be an important conservation

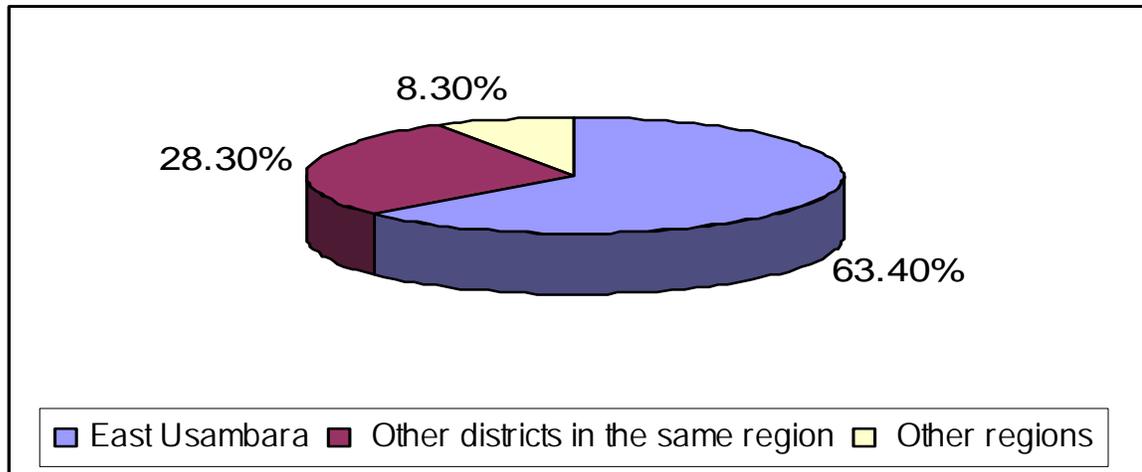
strategy but also a critical source of income for the East Usamabara upland farmers. Another activity, which is potential for income generating, is livestock keeping. Having many people keeping cattle in the study area will make them increase their incomes and thus reduce their dependence on farm and forest-based products. Field survey observed a number of people from different locations in the study area carrying jerry cans and buckets of milk for sell at a center in Amani Township implying that cattle keeping is one of the alternative activities that could boost people's incomes in the East Usambara. In other places villagers were found practicing zero grazing which is an important initiative for environmental sustainability and communities' livelihoods respectively.

### **3.6.1 Migration and its implications on natural resources**

The East Usambara Mountains have been destination of many migrants for decades. Sisal and tea estates have attracted large numbers of people from areas outside Tanga from German Colonial times (Jambiya and Sosovele, 2000). The geology of the East Usambara Mountains is dominated by high-grade metamorphic rocks of the amphibolites and granulites facies which belong to the Pretorozioc Mozambican Belt of the age of 800 to 500 ma old (Mruma and Kinabo,2004) in Nikundiwe (2004) They argue that on the basis of the geology of the East Usambaras, there is a great potential of an increase in mining activities for wide varieties of minerals including gold, kaolinitic clays, bauxite, varieties of gemstones and minerals with good amounts of rare earth elements. This is another potential factor that attracts more people into the East Usambaras and hence more pressure exerted onto the existing natural resources including water and water sources. Large tea estates, and factories, forest plantations, institutions, researchers, tourists, speculators and other users are the actual and potential uses that tend to draw populations to the area (Jambiya and Sosovele, 2004).

The study revealed that about 36.6% of the interviewees originated from outside the East Usambara. Of these some, 28.3% said they came from other districts within Tanga region, and some 8.3% came from other regions. About 23.4% of the respondents said they came from other villages within the East Usambara and the remaining 40% were born in the study villages. These results are shown in figure 3.6.

It was further learned that for those who migrated to the East Usambaras came for various reasons including seeking for farming land and involving themselves in other income generating activities such as cultivating cardamom, cinnamon and black pepper.



**Figure 3.6: Sources of migrants to the study area**

In Mlesa, a village located very close to the Forest Reserve, about 70% of the respondents came from outside the village. In their study Jambiya and Sosovele (2001) indicated that 77% of those who migrated to the East Usambaras came from the same district-Muheza and referred this to as a classic case of **movement towards environmental resources** and/or that enjoy exceptional environmental services.

The existence of exceptional environmental services in the East Usambaras is an important factor that will attract more people for the next many years. During this study cases of illegal entry into the forest reserve in search of gold were reported. At one time the population in Sakale village where mining was taking place rose to around 40,000 from just few hundreds people mostly by people from outside the district. Although measures were set to get them out of the area and that they stayed for just a short period of time the environmental destruction caused by the mining activities were substantial (see plates 3.2 and 3.3).

**Plate 3.2: Gold mining and its impact, Destruction of streams and part of the Forest Reserve**

Source: Dr. Neil Burgess, 2005

**Plate 3.3: Mining going ahead. The activity has caused a substantial impact on water sources in the East Usambara area.**

Source: Dr. Neil Burgess, 2005

With such events within and around the forest reserves in the East Usambara, managing the forests for production of various environmental goods and services and especially water become more difficult leading to increased management and conservation cost. As such, guaranteeing the critical role of fresh water production that the East Usambara forests play will not be possible in the absence of a mechanism that make all stakeholders

and especially water users in the Municipality of Tanga realize and appreciate that it is through proper management and providing incentives to the guardians of these forests that the flow of water will continue in the Sigi and provide a basis for their livelihoods and economic development.

### **3.6.2. Who benefits more from forest services-water?**

During Focused Group Discussions, one of the common issue was the feeling by respondents that downstream water users benefits more from environmental services and especially water. It was noted that the villagers have a feeling that while they are the ones who are being sensitized and asked from time to time to seriously take part in conserving the forest and water sources they don't benefit from the resulting environmental services as compared to their counterparts down stream water users. Their argument was linked to the presence of major water consumers such as industries, hotels and sisal plantations. The actual situation shows that the peoples' concern is valid. This situation is evident elsewhere and scholars have documented about this. Worah and Franks (2003) in (Turner 2004) put it this way: Where these forest resources lie in developing countries, it is cash-starved government agencies and poor rural communities that bear these costs whilst the benefits of the environmental services accrue largely to the relatively wealthy within urban centers of the country and outside the country. Financial mechanisms that capture this environmental interdependency clearly have great potential both to support conservation and provide poor rural communities with new sources of livelihood. The fact remain the same that unlike the un conserved forests, the conserved forests are critical for the provision of various direct and indirect benefits such as timber, fuel wood and soil/water conservation and carbon sequestration respectively in a more sustainable manner.

However, individual interviews obtained the following information. About 54% of the respondents said they feel that the upstream water users benefit more from the environmental services-water than the down stream users. About 23% said they were not sure, while the rest 23% had it that the downstream users benefit more from the use Sigi river water than their counterparts upstream users. While the fact is that downstream water users benefit more from the water, the differing opinions among villagers is possibly emanating from the fact that the two groups have different levels of understanding what is happening, where and why.

Water policy in Tanzania insists on developing a comprehensive framework for promoting the optimal, sustainable and equitable development and use of water resources for the benefit of all Tanzanians. One of the specific objectives is to have in place fair and equal procedures in access to and allocation of water resources so that all social and economic activities are able to maximize their capacities (URT, 2002 (b)).

However, the situation on the ground suggest that there is an unequal sharing of the environmental benefits accruing from the East Usambara forests/mountains between the downstream and upstream users. Sustainable management of water resources and related resources will be achieved through encouraging and putting in place a win-win scenario where both downstream and upstream water users equally benefit from these resources to

make them motivated and develop a sense of being responsible to the conservation and management of these resources.

### **3.6.3 Provision of incentives to the upland communities**

Emerton (1999) as cited in Turpie *et al* (2003) defines an incentive, as a specific inducement designed and implemented to influence government bodies, business, NGOs, or local people to conserve natural resources in a sustainable manner, noting that many of goods and services associated with natural resources (including water resources), and the premium attached to conserve them- are undervalued by the market and tends to be under priced, over consumed and under conserved because they are treated as free goods which can be mined, converted, depleted or degraded at no cost. Turpie *et al* see the provision of economic incentives and dismantling of perverse incentives as necessary conditions for sustainable water resources management in the Pangani River Basin for which Sigi river is included.

The respondents were asked if they receive incentives for taking part in conserving and managing the forest and water resources. Majority (62%) answered “no”, some 25% answered “yes” and the remaining 13% said they were not sure. Those who said they receive incentives mentioned the 20% paid to the village governments by the ANR authority out of the revenues obtained from activities such as eco- tourism. The funds are normally used for various village developmental projects. The respondents also mentioned being allowed to fetch firewood from the forest reserve every Wednesday and Saturday (Plate 3.4) which basically in reality it is not an incentive but rather their right as they have been obtaining firewood, timber and other Non Timber Forest Products (NTFPs) freely even before the establishment of the Amani Nature Reserve. The respondents were also asked to name the type of incentives that they would require as motivation in order to effectively manage and protect the forest reserve and their responses are as shown in table 3.4.



**Plate 3.4: It is Saturday, women returning home with dead woods collected from the Amani Nature Reserve.**

**Source: Mwanyoka. I, Field Survey 2005**

**Table 3.2: Proposed Incentives for the villagers in the study area**

| Type of incentives preferred   | Frequencies | Percentage of respondents |
|--|-------------|---------------------------|
| Market search assistance   | 1           | 2                         |
| The best people in conservation to rewarded  | 2           | 3                         |
| Loans for income generating activities   | 11          | 18                        |
| To be provided with social services, namely Schools, school buildings and dispensaries | 11          | 18                        |
| To be allowed to harvest timber and other Forest products                              | 14          | 23                        |
| Forest guards recruited from the respective villages                                   | 2           | 3                         |
| No Idea  | 5           | 8                         |
| NA   | 14          | 23                        |
| Total  | 60          | 100                       |

**Source: Field Survey, March 2005**

Table 3.2 shows the type of incentives that villagers would prefer for them to effectively participate in forest conservation. When ranking the responses one realizes that many respondents wish to be permitted to access forest products such as timber from the Reserve. This is an indication that while they accept to be the guardians of the Forest Reserve, they feel they miss some of their basic needs they used to derive from the forest. Such a situation has implications in so far as management of the ANR- water and forest resources is concerned. In Mlesa village one villager had this to say: *“It is ok that the forest is conserved for various benefits of which all of us are aware of, but something that irks people all around is the issue of being prohibited to even cut down old trees which are about to fall into our houses”*. Remarkd Mr. Jumanne Salum (67) while, pointing to an old tree just next to his house. *“We are even not allowed to get timber from the reserve at the same time we are asked to construct modern houses using burned bricks, something we cannot do without timber and enough firewood. How then do you expect us to survive in the existing situation”*? He questioned. This shows lack of participatory approach in creating forest conservation regulations. Nevertheless, according to Jambiya and Sosovele (2000) official documentation claims that the community is involved in every step of management of ANR



**Plate 3.5: Mlesa, a village located closer to the ANR; the availability of Forest-services and products requires effective involvement of the local community.**

**Source: Field Survey 2005.**

The same situation was observed in Mbomole village where almost all the respondents indicated that although their village is located next to the forest reserve they feel they are not benefiting from the forest, they said it is very embarrassing in that the ANR officials go to the extent of confiscating timber that villagers obtain from trees cut from their farms/public land. Almost every respondent narrated about an incident where about thirteen pieces of timber were seized from the village government. The timber was obtained from the public land for the purposes of making desks for the only primary school in the village. Speaking to the villagers in Mbomole village something that one can quickly learn is a kind of silent conflict existing between the community and the ANR officials. This is one of the existing forest management challenges, which does

have impact on conservation efforts. One of the important ways to manage sustainably the Amani Nature reserve is to address the existing conflict, perhaps through education and finding out ways of making the communities surrounding the ANR and the East Usambara forest reserves in general feel comfortable by having a say and decision over their natural resources.

## ENVIRONMENTAL AND WATERSHED MANAGEMENT ISSUES

### 3.6.4 The importance of forest conservation and accruing benefits

It was interesting to note that a fairly big number (95%) of the respondents know the importance of conserving forests and just 5% said they don't know. Despite this high level of awareness about the importance of conserving the forests, communities surrounding the forest reserves in the East Usambara Mountains have little interest to seriously take part in conservation. This is largely attributed to the feeling that they are losers instead of being the first beneficiaries of the innumerable benefits accruing from these forests. However, successful and sustainable watershed management will mainly be achievable if the stewards of the forest reserves-local communities benefits from these resources and hence their commitment and willingness to protect them. Table 3.3 shows the benefits and importance healthy forest as given by the respondents.

**Table 3.3: Perceived importance and benefits of the forests**

| <b>Responses</b>           | <b>Frequency</b> | <b>%Respondents</b> |
|----------------------------|------------------|---------------------|
| Attract Rains              | 23               | 38                  |
| Conserve Water Sources     | 15               | 25                  |
| Stabilize/Regulate Climate | 9                | 15                  |
| Source of Fuel wood        | 8                | 13                  |
| Habitats for the Wildlife  | 3                | 5                   |
| Retain Soil Moisture       | 1                | 2                   |
| NA                         | 1                | 2                   |
| <b>Total</b>               | <b>60</b>        | <b>100</b>          |

**Source: Field Survey, March 2005**

From the results in table 3.3, it is evident that the communities surrounding the Forest Reserve are generally aware of the importance of conserving forests. But conservation of these forests means reduced dependence on these forests as a source of livelihoods by the very communities. The forests constitute an important source of income and livelihood for people living in the surrounding areas, especially for poor people. In fact there are many benefits that result from forest conservation both at local and international levels. Production of water is one of the benefits at local level, which however, is largely enjoyed by the offsite beneficiaries. This suggests that there should be ways through which the impact of conservation to the local communities can at least be addressed. Providing incentives generated from the water users is one of the important ways to address this problem.

### 3.6.5 Water Resources Management and Forest Conservation

About 80% of the respondents said they participate in various activities to manage water resources and conserve forests and the rest 20% said they don't participate. Those who said they participate in forest and water resources management were asked to say how they participate and they gave the following responses as shown in table 3.4.

**Table 3.4: Forest and Water Resources Management activities**

| <b>SN</b> | <b>Activity</b>  | <b>% respondents</b> |
|-----------|--|----------------------|
| 1.        | Planting trees around water sources                            | 45                   |
| 2.        | Protecting the forest against illegal activities               | 20                   |
| 3         | Refraining from farming and cutting trees around water sources | 12                   |
| 4         | Using energy serving stoves                                    | 3                    |
| 5         | NA   | 20                   |
|           | <b>Total</b>   | <b>100</b>           |

**Source: Field Survey, March 2000**

In Mbomole, village people complained bitterly about the establishment of the eucalyptus plantation in their vicinity and near water sources. They stated that they hear from experts that eucalyptus trees consume a lot of water from the soil. They said what they currently experience at their village is a clear evidence of what science suggests. *“We have started to see the impact of this tree species as the stream from which villagers have been fetching water for many years is now drying up. This has never happened before. The investor is planting more trees of the same species. There are also some rumors that he is intending to open up more plantations for the same tree species and sell them at the end, and leave. The owner is from India and since he is not in his country of origin he doesn't feel guilty of his actions, his interest is to get wealthy but at the expenses of the environment and indeed the communities around”* Lamented Mr. Frank Mbiu (75) a resident, who has stayed in Mbomole village for more than 30 years. Field survey witnessed the drying streams and eucalyptus plantations (See plates 3.6a and 3.6b). Mr. Mbiu advised that measures be taken in order to serve people and the environment.



**Plate 3.6a: A section of eucalyptus plantation, named as one of the major factors for the drying up of the streams in Mbomole village, East Usambara Mountains.**

**Source: Field Survey, 2005**



**Plate 3.6b: One of the drying streams which is an important source of water for one of Mbomole Sub village, the situation said to have been exacerbated by the eucalyptus plantation.**

**Source: Field Survey 2005**

Interestingly, Mr. Mbiu also remarked that the drying up of streams in their locality is attributed to the tendency of people to clear vegetation when striving to expand their farmlands, including cutting down type of trees that have never been cut since time immemorial. This observation explains the demise of indigenous norms and practices used to govern the management of natural resources.

Environmental impacts of the eucalyptus have been documented substantially. As such the Mbomble villagers' concerns should not be ignored nor should be overemphasized. In

their study Abbasi et al (2004) indicated that Eucalyptus lower the water table, dry up perennial streams, deplete soil moisture, exhaust nutrients, reduce soil fertility, discourage undergrowth and are susceptible to pest attacks allegations galore. Phantumvaint *et al* (1990) categorically indicate the impact of eucalyptus when states that the main conclusions of scientific research, both Thai and international, is that eucalyptus, like acacia and a number of other tree crops, reduces the water table and affects neighboring crops, where moisture and nutrients are in short supply. Eucalyptus is not recommended for protection of watersheds, for regulation of water flows, or as a crop for good soil. Such findings underscore the impact of eucalyptus on the environment and local people livelihoods.

Numerous streams spread and running all over the East Usambara Mountains are the ones that subsequently form the main Sigi River. Since the impact of the eucalyptus and indeed other unsustainable human activities are already felt by the upland people, in the long run this is likely to have a spillover impact and hence affect the flow of water in the Sigi River, if the current situation is left unabated.

### **3.6.6 To whom does the Forest Reserve Belong?**

In the East Usambara most of the respondents said the forest reserves and especially the ANR belonged to the Finnish International Development Agency (FINNIDA). FINNIDA contributed financially to the establishment of the ANR and overseeing conservation activities. Such a response is embarrassing, in that it tells plainly that people lack sense of forest ownership. This has been the feeling some 4 years ago when Jambiya and Sosovele got the same response. Clearly this is a critical situation, which possibly emanate from the fact that people feel they don't benefit from the forest, and that unless this is reversed community is likely to be spoilers of conservation efforts instead of being good managers of the catchment forests. Deliberate efforts to make people understand that the forest is theirs are called for.

### **3.6.7 Poverty and Environmental Degradation**

East Usambara Catchment forests constitute an important source of income and livelihoods for people living in the surrounding areas and especially poor people and yet they are critical for the production of water not only for the use of the people upstream but also for many more water users downstream. The National Environmental Policy asserts the linkages between poverty and environmental degradation that: "There is a clear cause-and-effect relationship between poverty and environmental degradation: environmental degradation leads to widespread poverty and poverty is a habitual cause of environmental degradation as it undermines people's capacity to manage resources wisely" (National Environmental Policy 1997, Pg. 1). The Policy further states, that satisfaction of basic needs is therefore an environmental concern relevant to environmental protection because the environment is the first victim of acute poverty, urban overcrowding, overgrazing, shrinkage of arable land and desiccation.

URT (2003) cited in Kulindwa (2005) show the sizes of various Forest Reserves and degradation percentage in three regions of Tanga, Arusha and Kilimanjaro. The Amani Nature Reserve has been degraded for 5% and the situation is even worse for other forest

reserves within the East Usambaras. Given the prevailing social-economic activities taking place in the area accompanied with the increasing population this percentage is likely to increase and hence affect further the flow of water.

Jambiya and Sosovele, (2000) categorically summarize the linkages between the existence of ANR and poverty that one major precondition for the creation of the ANR has been the restriction of forest adjacent communities to the forest products of the ANR, and yet the very survival and sustainability of the ANR is likely to be dependent on the participation of the local communities in conservation efforts. In fact the forest management authorities, the East Usambara Catchment Forest Project (EUCFP), note that the people of the East Usambaras depend on the forests and the major challenge of the EUCFP today is participatory management of these forests. This is a contentious situation since access restriction, which is perceived as alienation from the forest resources, is likely to have exacerbated the communities' poverty in general and that of more vulnerable groups in particular.

The Forest policy emphasizes the satisfaction of basic needs as an environmental concern relevant to environmental protection. Obviously this is a policy statement underscoring the urgent need to ensure that communities around forest reserves achieve their basic needs if they are to take serious responsibility to protect the forest reserves and subsequently ensured continuous flow of water. Given the existing situation the need to seek for or enhancing the alternative ways of addressing poverty among the East Usambara communities is very urgent. However, in order for this to be realized, political commitment and sense of responsibility are critical. It is always argued that the political leadership in many places has failed to develop and implement effective policies and institutions to sustain public benefits from forests. Otherwise the catchment forests are at risk as the communities surrounding these forests will continue harvesting forest based products such as timber, firewood, poles and mining within the forest reserves and even increasing the sizes of their farmlands through forest encroachment. In due course such activities affect the production and provision of various services and especially water. Forest management thus, should be social, economic and environmentally oriented entailing improving the livelihoods for the communities surrounding the forest reserves, through alternative income generating activities, prevention of overexploitation of forest resources and proper understanding of the Total Economic Value (TEV) of the forest reserves that forms a basis for proper forest management.

### **3.6.8 Contribution for the Conservation of the East Usambara forests**

Major water users were asked whether they put anything back for watershed management as incentives to the stewards of the Catchment forest. Majority (80%) of the respondents said “no” and the remaining 20% said “yes”. When they were asked to give their opinions with regard to contribution for conservation of these forests a considerable number (73.3%) of respondents said the idea was good, they pointed out that they were fully aware that the availability of water in Tanga municipality wouldn't be possible in the absence of the East Usambara Forests. The 20% who were not in favour of the idea said that they were already contributing through water tariffs and the remaining 6.7% said they were not sure whether the idea was good or not. These results are shown in table 3.5.

While most of the major water users supported the idea of contributing towards watershed management and forest conservation, the government institutions (Tanzania Railway Authority, Maweni Prisons and Tanga Municipal Council) officials said it would be logical for those using water for profit-making to contribute and not them for they doesn't not make profit from the water.

**Table 3.5: Water Customers opinions on contribution to watershed management and forest conservation**

| <b>Opinion</b> | <b>Frequency</b> | <b>Percentage</b> |
|----------------|------------------|-------------------|
| Good idea      | 11               | 73.3              |
| Bad idea       | 3                | 20                |
| Don't Know     | 1                | 6.7               |
| <b>Total</b>   | <b>15</b>        | <b>100</b>        |

**Source: Field Survey, 2005**

### **3.6.9 Tanga Urban Water Supply and Sewerage Authority (TUWSSA)**

When they were reached to give their opinions on watershed management and conservation, the TUWSSA officials indicated that they are very much concerned about conservation of the East Usambara Mountains/forests and that they have an obligation to participate in its management. They said their business would not run smoothly if there was no smooth and continuous flow of water in the Sigi River. On whether they contribute towards conservation, they noted that, they feel they indirectly do as they pay annually about Tshs. 11 million to the Pangani Water Basin Offices. According to them, they believe that part of the money they pay is used for conservation and management of the Sigi River Catchment. *“Our understanding is that since the authority is paying this fee for water abstraction annually then part of the money is used for the watershed management and conservation and for us, this is our contribution”*. Remarkd Engineer Aram, a Technical Manager with TUWSSA. When the researcher wished to know if the Authority would be ready to pay extra fee specifically for the watershed management and conservation Eng. Aram, had this to comment: *“The idea of paying some extra fee for conservation purposes is definitely good, however, before this is put in place all stakeholders should meet and discuss on the rationale of doing so and how it should be implemented”*. There was also a general comment that it was very important for the PBWO to allocate funds for conservation out of the water fees they collect annually. Current situation suggest that there is no funding which is put into conservation out of the annual water use fees, nor are there any incentives given to the managers of the Sigi River watersheds. The situation is also the same in the Wami-Ruvu catchment, in that there is no money at all that goes to conservation and people are of opinion that such a trend needs to be reviewed. NORPLAN (1995) in Turpie *et al* (2003) proposed that PBWO should contribute some Tsh 10 million per year to forest management in the basin, which should come from the collected water user fees.

According to the PWBO officials the fees being collected are spent for various activities such as conflict resolutions, meetings and addressing problems such as the invasion of the forest reserve for the activities such as mining as it happened in Sakale village and other places around the East Usambaras and within Amani Nature Reserve.

### **3.6.9.1 Allocation of funds for forest conservation and conservation costs**

The World Bank (2001) indicate one of the main challenges facing Tanzania's forest policies as inadequate systems for revenues collected to be used for forest management or shared with local communities. Putting in place a proper system for revenue collection would form an important benchmark for sustainable watershed management.

Although the East Usambaras have received considerable biological attention, their potential has yet to be effectively valued (Rodgers & Homewood 1982, Hamilton 1989 in Jambiya and Sosovele 2000) and its value translated to the benefit of local communities adjacent to the mountains.

Jambiya and Sosovele (2000) further note that underlying the scientific value is the value of the East Usambara water supply to lower areas and the Municipality of Tanga, an asset that is at the moment just taken for granted.

The information obtained from the Forest and Beekeeping Division (FDB) revealed that funds allocated by the government for forest conservation and subsequently production of water are quite minimal. According to the Catchment Forests Manager in the FDB, money for Catchment conservation is allocated to four regions per annum; he named the four regions with Catchment forests as Tanga, Morogoro, Kilimanjaro and Arusha. He said on average the funds allocated annually to the four regions is amounted to Tshs 338,012 million, implying that each region receives around Tshs 84, 503 million annually. However, the authenticity of this information is questionable as it is known that a lot more is used centrally and out of the same money there is money set aside for consultancies and other activities and hence a lot less than this goes to the regions. The manager said the funds are allocated to fulfill three important objectives namely **Conservation of water/watershed management, Conservation of nature and biodiversity/genetic resources and Soil conservation**. Practically, this amount does not reflect the cost of forest conservation and management.

According to a recent study by Moore et al (2004) in Burgess and Kilahama, the mountain forest habitats in the tropical of the continent require around USD 364/km<sup>2</sup> (around 370,000 Tshs/km<sup>2</sup>/annum for effective management. Another study conducted in the Luangwa National Park in Zambia indicated that effective conservation and management of one hectare would require 250-300 USD per annum. The amount allocated by the government for conservation in Tanzania, is not enough for sustainable catchment forest management. The Amani Nature Reserve covers 8,380 hectares or about 18.6% of the 45,000 ha forest covers of the East Usambaras (Jambiya and Sosovele, 2000).

For the ANR to be managed effectively around \$ 30212 or Tshs 33,716,392 would be required annually and around \$ 163800 or Tshs 182,800,800 for managing the whole of the East Usambara forests. However, current situation shows that there is just little funding allocated for Forest Management. The data from CMEAMF for the period

between 2003 to 2005 shows that some Tshs 70, 5000,000, which is an average of Tshs 23, 500,000 per year, were allocated for Muheza District where the East Usambaras and Amani Nature Reserve are located. Comparatively this amount is less than the actual amount required just for the effective management of the forests in the East Usambaras alone. These funds are being provided by FINNIDA to facilitate Participatory Forest Management (PFM).

According to Kulindwa (2005) the three regions of Tanga, Arusha and Kilimanjaro which share the Pangani Basin would require about Tshs 900 million per year for effective catchment management. However even the little money allocated for this purpose have been decreasing over the years and especially for Tanga region. For instance while the total capital and recurrent expenditures for Catchment Forests for Tanga region in 2001 was Tshs 100,078,988 the amount dropped to Tshs 86,950,004 in 2002 (MNRT, 2004) in Kulindwa (2005).

As noted from the outset that the government capacity to finance conservation is limited and that donor funding for conservation is not sustainable and cannot be guaranteed. Putting in place a proper mechanism where water users contribute to watersheds management is something urgent that to a certain degree will help to bridge the existing conservation financial gap.

## **HYDROLOGICAL ISSUES AND PAYMENT FOR WATER SERVICES**

### **3.6.9.2 Source of water for the Municipality of Tanga**

It was interesting to learn that about 80% are aware that the water they use is abstracted from Sigi River and that the source of river is the East Usambara mountains/forests. However, the remaining 20% did not know as to where the water is originating. Such a situation where majority of the water users know the origins of the Sigi River is important in that it might be easy to link up the existing relationships between freshwater availability and the catchment forests on one hand and the need to contribute for the watershed management on the other.

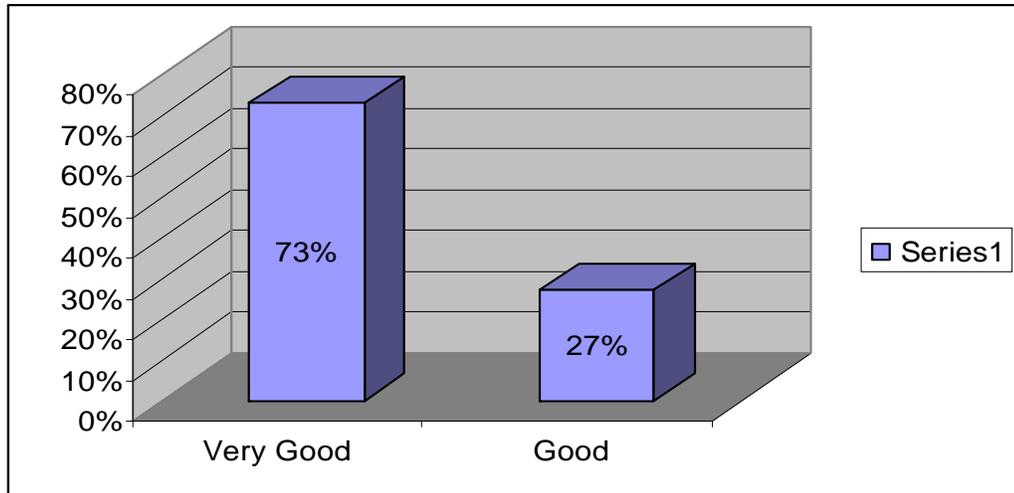
### **3.6.9.3 Water abstraction from the Sigi River**

According to the Tanga Urban Water Supply and Sewerage Authority (TUWSSA), about 26,000m<sup>3</sup> of water are abstracted daily from Sigi River for supply to customers in the Municipality of Tanga. Tanga Cement Company is the largest water consumer consuming around 6% of the total water abstracted daily. On average the factory consumes up to 45450m<sup>3</sup>/month or 1515m<sup>3</sup> a day, followed by the Tanzania Harbours Authority (THA), which consumes around 14260m<sup>3</sup> a month, equivalent to 475m<sup>3</sup> a day. The other abstractors of water from the river are the Mjesani Sisal estates, which abstract around 100 m<sup>3</sup> per day, and the water is mainly used for sisal leaves decortications and the East Usambara Tea Company mostly abstracting water for domestic purposes.

### **3.6.9.4 Customers' views on water supply services**

The majority of the respondents (73%) said water supply services in the Municipality of Tanga were good and further noted that most probably the service was much better than in

any other Municipality or town in Tanzania. The remaining respondents (27%) said the service was very good (figure 3.7). This tells clearly that water customers enjoy the service and as such they are always prepared to pay for the service. This revelation was substantiated by the fact that 100% of those who were interviewed said the flows of water from taps are for 24 hours. Although common problems such as overstated water bills, leakages and occasional lack of communication between TUWSSA and customers were also highlighted, generally the situation suggest that customers enjoy water supply services, and hence their willingness to pay.



**Figure 3.7: Customers' Comments on Water supply Services**

The critical observation and which might form an important point of departure with regard to customer's contribution to watershed management is the existing potentiality for introducing a mechanism whereby water users can contribute for the Sigi River Watershed conservation and Management without many difficulties. What is required in order to achieve this impressive undertaking is to arrange for education and awareness campaigns through which more customers will be enlightened on the importance of sustainable catchment management and why they should contribute.

The good prospects for introducing economic instruments for environmental management including paying for water services is indicated by Mkenda and Ngana (2003b) cited by Turpie.J *et al* (2004). They explain that the use of charges, fees, taxes, royalties and fines is widespread in the country even if they were not necessarily put in place for regulating behaviour with respect to the environment and water resources, but for revenue generation. The fact that such instruments are in place makes it easier to adopt them in various policies as economic instruments for sustainable water resources.

### **3. 6.9.5 Water customers' attitude on paying for water bills**

Statistics obtained from the TUWSSA show that currently, there are about 13964 water customers in the Municipality of Tanga categorized as Domestic consumers, Institutional, Commercial and Industrial water users (table 3.6).

**Table 3.6: Water User Categories and Tariffs in Tanga Municipality**

| S/N | Water user Category | Tariff per unit (M <sup>3</sup> ) (Tshs) | Number of customers |
|-----|---------------------|--|---------------------|
| 1   | Domestic            | 300                                      | 13140               |
| 2   | Institutional       | 300                                      | 235                 |
| 3   | Commercial          | 336                                      | 464                 |
| 4   | Industrial          | 420                                      | 115                 |
|     | <b>Total</b>        |  | <b>13964</b>        |

**Source: Tanga Urban Water Supply and Sewerage Authority (TUWSSA), 2005**

The TUWSSA officials indicated that, customer's response on paying for water service is very positive; adding that it is attributed to better water supply services which make customers receive water for 24 hours, it was also indicated that the water supply system is 100% metered and the revenue collection efficiency is 93%. It is true that the water supply system and the infrastructure in Tanga municipality are very good leading into better supply of water. Of importance however, is the need for water users and other stakeholders to appreciate that the existence of the catchment forest in the East Usambara Mountains is very critical for the availability of water and that there is an urgent need to conserve these forests as a crucial way to guarantee the continuous flow of water for the benefit of the present and future generations.

The study revealed that the tariffs charged in the Municipality of Tanga are very low (table 3.6) as compared to other towns in Tanzania. In Same district water tariffs are Tshs. 500/m<sup>3</sup> for domestic use, Tsh 750/m<sup>3</sup> for commercial use (e.g. hotels), and institutions (e.g. schools), and Tsh 1000 for industrial use (e.g. sisal plants), though flat monthly rates are also levied in some cases (Turpie *et al* 2003). In Nzega district, Tabora region they charge a flat rate of Tshs. 1000/m<sup>3</sup>. In the Municipality of Tanga, the situation suggest that reviewing the tariffs would be critical and that setting them in a higher side might be crucial for the TUWSSA to be in a better position to contribute to the watershed management.

### **3.6.9.6 Water Sales Revenue Collection**

TUWSSA officials said on average they bill up to Tshs 150 million a month and collect around Tshs 140 million in the same period. This implies that the authority earns an average of Tshs 1,680,000,000 annually and in return the authority pays only Tshs 11,000,000 million per year as water user fee to the PBWO. This is equivalent to just 0.65% of the total revenue collected by the TUWSA annually, implying that each water customer pays just Tshs 785/- the whole year for the use of water. While there is a general perception by the TUWSA and other major water users and abstractors that, part of the water user fees charged from them is used for conservation of the East Usambara Forests, it is also true that as compared to funds collected annually by TUWSA practically the amount of money payable to PBWA is too minimal to have any impact if it is to be used for conservation. It will be critical for the responsible authorities to review those rates.

## PAYMENT FOR WATER SERVICES: CASE STUDIES

### 3.6.9.7 Cases where payment for water services is linked to conservation

Projects using water resources as a springboard for Payment for Environmental Services schemes have been thoroughly developed in Latin America. In Costa Rica, the government has been involved in a scheme to help users such as hydropower companies to pay farmers to maintain forest cover in watersheds, while in Quito, Ecuador, water companies are helping to pay for the management of protected areas that are the source for much of the capital's drinking water. Similarly, hydroelectric utilities finance upstream restoration, which has led to the increased forest cover on private land, expansion of forests through protection and regeneration.

Elsewhere these are the ways used to ensure that the water users continue to be supplied with water and at the same time the water source guardians are rewarded for their work. The vivid cases are in Colombia where they put in place what they call **Environmental Services Tax for Watershed Management**—through this mechanism industrial water users and municipalities pay some extra fees, which is given back to the managers of the watersheds as incentives. This has resulted to the improved forest management and forest expansion and hence continuous flow of water. These are a few cases whereby payment for water services has been linked to watershed conservation and management resulting into sustainable water resources management and water supply services respectively. With political commitment and putting in place programmes for making water users be more informed about the importance of watershed management such mechanisms can be put in place in Tanzania and consequently lead into sustainable watersheds management.

Turpie *et al* (2003) argue that the dwindling water resources in Pangani River Basin are partly attributed to catchment degradation. Turpie *et al* further argue that protection of forests around catchment areas is a necessity; because the costs of providing alternative sources of water are very high adding that the case of water provision for New York City demonstrates this. New York City obtains much of its water from Catskill/Delaware watersheds. A recent evaluation showed it would cost US\$ 7 billion to build a water treatment plant, against US\$ 1 billion for actively managing the forest catchment area by raising water taxes and in turn paying farmers to use less fertilizer and reduce grazing.

In Quito, Ecuador, water consumers may soon be required to pay a small surcharge on their monthly water bills to maintain the forest cover of the watershed that supplies the city with drinking water (Spergel, 2002) in Turpie *et al* (2003). In Costa Rica, the National Government and Energia Global, a private hydroelectric company compensates landowners when they maintain or increase forest cover in watershed areas (Shilling and Osha, 2002) quoted in Turpie *et al* (2003). These are some of the lessons that the Tanzanian government and other stakeholders can learn and indeed find a way through which such these can be incorporated into water resources management practices in Tanzania.

## **PBWO: CHALLENGES AND PROBLEMS OF WATER RESOURCES MANAGEMENT**

### **3.6.9.8 Natural resources management**

The Pangani Basin Water Office is mandated with management of water resources in the Pangani Basin including allocation of water rights and charging water user fees.

The PBWO faces many challenges ranging from difficulties in monitoring abstractions; inadequate funding; to difficulties in dealing with defaulters (60% of annual right bills fail to be settled). Further compounding the problem of management is the fact that there are as twice as many illegal abstractions (2094) as legal water rights (1028). The current government budget allocation covers staff salaries only., Indeed Pangani Basin Water Office requires Tsh 400 million to meet their needs for recurrent budget per year compared to their current annual income of Tshs 75 million (Turpie et al, 2003 pg. 33).

Kulindwa (2005) show that the Pangani Basin Water Office have been able to identify 3,450 water users in the basin of which only 1028 have water use rights, and of which only 438 paid their bills in 2003/04 representing about 43% of water use right holders and only 13% of total identified water users in the basin. The total number of water users in the basin has not fully been recorded.

In Tanga region alone where Sigi River is located there are about 488 water abstractors without water rights (IUCN, 2003). Basically these are illegal abstractors that use water without any payment to the Pangani Basin Water Office. This is a problem that if addressed will contribute to improving financial capacity for the PBWO.

Sustainable management of the Pangani basin will largely depend on adequate allocation of funds for the Pangani Basin Office. However, it is also important to note that putting in place a mechanism to address the problem of illegal abstraction will to a certain degree help to bridge the existing financial gap for managing the basin and its respective catchments. More importantly is the need for the PBWO to review the amount of fees charged from various water abstractors, which for the time being appear to be reasonably low. For instance that the Tanga Urban Water Supply and Sewerage Authority (TUWSSA) pay just Tshs 11,000,000 annually for abstracting around 9,490,000m<sup>3</sup> per year or 26,000m<sup>3</sup> of water daily. This implies that TUWSSA pay to the PBWO just Tshs 1.16 for every 1m<sup>3</sup> of water and yet collecting billions of shillings every year. It is most likely that the situation is the same in other towns in Tanzania, which consequently exacerbate the problems of the Water and basins catchments management.

### **THE HYPOTHESIS**

The hypothesis put forward was: **The conservation of the East Usambaras and the resulting environmental goods and services especially water are a benefit of conservation for biodiversity and not forest management for production of water.**

Basing on the findings the hypothesis appears to have been proved wrong in that the findings indicate that about Tshs. 84 million is allocated annually for three major activities namely **watershed/forest management, Conservation of nature and biodiversity/genetic resources**

**and Soil conservation.** However, something, which is clear, is that the amount allocated is not enough for sustainable watershed management and what is known is that the international community has been funding forest management.

## 4.0 CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

- The International community has been funding forest management based on the “global values of biodiversity”, and locally the benefits have been consistent flows of water and cheap water.
- From **Objective one**, consideration must be given to rewarding upland communities around the forests to obtain sustainable management of the catchment. It is by so doing that sustainable management of the catchment forests will be realized and hence guaranteeing the continuous flow of the Sigi River.
- From **objective two**, It is crucial that part of the revenues collected from water users should be used to establish and improve various social services such as schools and health centers and boost economic status of the upland communities by making the East Usambara Communities access loans and establishing alternative Income Generating Activities (IGAs)
- From **objective three**: The findings show that, most water users see the idea of watershed management as critical for the continuous flow of water and have shown an interest to contribute to it and hence the possibility of rewarding the upland communities who are the stewards of the Catchment areas.
- From **objective four**, while payment for environmental services-water as a watershed management mechanism is a new concept in Tanzania, there are several cases, whereby watershed management have been sound and successful as a result of linking payment for water services to watershed management. Such cases are in Colombia, Costa Rica and Ecuador. These are the successful cases worth borrowing a leaf.
- While the findings show that payment for environmental services (water) has been possible elsewhere, the modalities of payment have yet to be worked out in Tanzania.

### 4.2 Policy Recommendations

- There should be incentives to the East Usambara communities in terms of schools, medical centers, creating alternative income-generating activities and enhancing the existing environmental friendly income generating activities.
- It is important and necessary to develop a policy mechanism where payments made by water users can be applied directly to projects to protect the water sources and the watersheds.
- There should be a shift in the mindset of consumers to appreciate and recognize that environmental services and water in particular has an economic value and that should not be provided free or at minimum cost.
- Education to the potential consumers and suppliers of ecosystem services is very much needed to expand the willingness of consumers and suppliers to use market-based instruments. As such water users should be educated about the valuable economic services that, healthy, properly managed watersheds provide and realize

that the services will continue to be provided if sustainable land management practices are made at least economically. As such they should be prepared to pay some little extra fee, which will be used, for watershed conservation and management.

- The government through the Ministry of Water and Livestock Development in collaboration with relevant stakeholders has to review the current water use/abstraction fees paid by various users and abstractors to the PBWO and use the obtained revenues as incentives to the stewards of the environment-upland community and for watershed management.
- There should be legal and regulatory system in place to enforce the payments for water services mechanism.
- Water-related ecosystem services are often thought of as public goods flowing from a mixture of private and public lands, which people are understandably reluctant to pay for (Perrot-Maître and Davis 2001). For these reasons governments and Tanzanian government in particular should retain an important or even predominant role in protecting water-related ecosystem services.
- Since the East Usambara Forests contribute to global existence and option values, and global climate control, it is important that the international community put more contribution in terms of funding to be used specifically for watershed management and incentives to the stewards of the forests.
- In-depth and detailed studies should be conducted in the area of water user fees, to come up with more reflective fees that would be justifiable for Catchment management. The current water fees payable to Pangani Basin Office does not reflect the real cost of production of water.

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