

THE CONTRIBUTION OF RURAL COMMUNITIES TO  
CONSERVATION OF MANGROVE FORESTS  
A CASE STUDY OF PANGANI DISTRICT,  
TANZANIA

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### DECLARATION.

I, Seif Shaib Issa here by declare that this is entirely my original work and has not been published or submitted to any institute of learning (university) for any award.

Signature.....

Date.....26. 09. 2008

Signed.....

Supervisor

Date.....27. 9. 2008

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## **DEDICATION**

I would like to dedicate this work to my father the late Seif Issa who laid the foundation for my studies and my mother, Bi Fatuma Rashid.

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## **ABSTRACT**

A study paper on contribution of rural communities to conservation of mangrove forests is conducted in Pangani District, North Eastern Coast of Tanzania and covered two divisions namely as Pangani and Mwera.

The objectives of the study is to identify the activities of rural communities in conservation of mangrove forests in Pangani district, to determine the impact of the rural community actions to conservation of mangrove forests and to identify challenges to rural communities in conservation of mangrove forests. The target areas for the study were communities and mangrove forests.

Data was collected using questionnaire, interview, observation, literature review and uses of secondary sources of qualitatively using statistical data such as tables and charts. A total of fifty (50) respondents were random sampled and interviewed through prepared questionnaires and data are collected. Communities' actions for conservation of mangrove forests it include patrol to watch mangrove forests, replacement of mangrove trees and sustainable conservation of mangrove forests.

Results indicated that there is high deforestation of mangrove forests in these areas, from over harvesting of mangrove trees for daily human activities. Also it was found that fuel wood, building poles, timber and beehive are the some of the human practices which causes low sustainable of mangrove forests conservation.

The study also presents challenges facing rural communities in conservation of mangrove forests, such as shortage of extension workers, lack of projects dealing with conservation of mangrove forests, lack of laws and polices for reinforcement conservation of mangrove forests, lack of other alternative for rural communities income generation and low knowledge and skill on mangrove forests conservation.

The problems identified through related and it was realized that rural community contributions to conservations of mangrove forests was poor. Therefore, there is need to

strengthen sectoral (i.e. villages, wards, division and institutions) capacities to provide programmes and project that can provide an integrated planning and management of mangrove forests. This can insure compatibility of the rural community interest with the objectives of conservation of mangrove forests programmes.



## LIST OF ABBREVIATIONS

ENV/OFF	Environmental Officer
WEO	Ward Executive Officer
VEO	Village Executive Officer
AGR/OFF	Agriculture Officer
FORS/OFF	Forestry Officer
DS	Division Secretary
IGA	Income Generation Activities
URT	United Republic of Tanzania
UNDP	United Nations Development Programmers
MMP	Mangrove Management Plan
UNEP	United Nations Environmental Programmers
THA	Tanzania Harbor Authority
IUCN	International Union for Conservation of Nature
NGOs	Non Governmental Organization
WWF	World Wide Fund for Nature

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Definitions;

**Conservation:** The World Conservation Strategy defines conservation as the management of the human use of the biosphere, hydrosphere, lithosphere and atmosphere so that it may yield greatest sustainable benefits for the present generation while maintaining its potential the needs and aspiration of future generation.

**Mangrove forest:** The definition of Mangrove forest has been used to refer either to the plants of tropical intertidal forest communities or to the community itself, mangroves are salt tolerant evergreen forests and are at the transitional zone between dry land and open Ocean.

The trees are only one component of the complex mangrove ecosystem which includes associated bodies of water and substrate as well as a variety of other plants, animals and micro organisms.

Mangroves thus form unique environments and assemblages of flora and fauna. The mangrove forests are lagoons and estuaries which are important habitats for aquatic organisms. The mangrove ecosystem is rich in molluscs several species of which are gathered by local women and form an important source of protein in the diet of the communities along the coastal areas.

**Rural community:** A rural community consists of people living in a periphery area together in a given environment and various ways affect one another.

**Forest:** A forest is a plant community predominantly of trees or other woody vegetation occupying an extensive area of land. In its natural state, a forest remains in a relatively fixed self regulated condition over a long period time.

#### 1.1.1 General information about mangrove forest in Pangani district;

Forest provide a wealth of indirect environment benefits as well as direct use benefits for many of the people surrounding them as mentioned, forest based biodiversity provides

vital ecological services which protect natural and human resources. It acts as a sink for wastes and residues and maintains essential life support function for local and global communities. What is important for the tiny coastal population and economy is that its marine ecology has for thousands of years played an important role in biodiversity and human lives.

The rural coastal people commercially fisheries of crabs and prawns as well as fish are directly dependent on the mangrove ecosystem. In addition, a wide variety of insects and other arthropods inhabit the mangroves, which form an important resting and feeding stop over. There are several species of mammals utilize the mangroves, such as bats, hippopotamus, wild pigs and monkeys.

The mangrove ecosystem ecological stability it depends on that of both upland terrestrial and coastal estuarine ecosystems with which it is intimately and inseparably linked.

A large section of the population is coast depends on a wide range of marine products; such product can be from mangrove forests for both sustenance and socio – economic development. The biodiversity of the marine area is also of such special important to the global family.

In addition people may gather medical plants, fuel wood or derive food from the forests to support their livelihoods and the conservation of biodiversity also has an international dimension many species provision of bloat value and their habitats of importance in the provision of public goods such as carbon sequestration.

According to Hitchcock and Shauri (1989) found that forestry laws and management institutional arrangement do not support co-operative and joint management between the central levels and the local authorities and the local communities necessary for the management and sustainable utilization of the forest resources locally

### **1.1. 2 The status of conservation of mangrove forests:**

The problem under investigation is what the contribution of rural communities is to conservation of mangrove forests is not satisfactory. The most obstacles which has hitherto prevented rational use and conservation of mangrove forests along the coast of Tanzania has been a management policy which consists of controls and cohabitations

without having the means and capability to carry these out. It has not considered the traditional interests of people in their resource or their involvement in its management. This has not only failed to provide for expanded demand for the service but they have also difficulty in conservation of the existing mangrove forests, this is a need for the rural communities to have good management of mangrove forests in order to have good environments.

### **1.1.3 Conservation in coastal lands:**

Environmental problems associated by environment degradation concerns mangrove forests, however are always global in scope but can be effectively tackled at the community level. Efforts must be promoted to make sure that community capacity building is well developed and encouraged so that the entire communities know their roles and the importance of living sustainable.

Mangrove forests are famous for the exceptional contribution to the coast communities. Apart from being exceptional, mangrove forests are comprised of taxonomically diverse, salt-tolerant tree and other plant species which thrive in inter-tidal zones of sheltered tropical shores “over wash” islands, and estuaries. (United Republic of Tanzania, 1998)

Mangrove trees have specially adapted aerial and salt-filtering roots and salt-excreting leaves that enable them to occupy the saline wetlands where other plant life cannot survive.

The future economic development of the mangrove – dependant (communities living surrounding mangrove forests) for sustainable livelihood security will be ensured only when there is a participatory plans for managing the forests.

The mangroves have for centuries contributed towards the social economic development of the coastal areas. However, lack of knowledge about mangroves and the complex interactions within the mangrove ecosystem was major constraint on this resource management. (United Republic of Tanzania, 1998)

#### **1.1.4 Legal frame work for conservation in Tanzania.**

Relevant policies related to the management of Natural Resources include the Plant Protection Ordinance Cap; 133; supp 60, Tanzania Forestry Research Institute Act No.5, 1980, The National Environmental Policy 1997, The National Fisheries Policy and strategy statement 1998, The Fisheries Act No.10 of 1994, The Territorial and Exclusive Economic Zone Act of 1989, The Marine Parks and Reserves Act 29, 1994, and the New Forestry Policy 1998 and Forests Act No.14 of 2002 which provides opportunities for communities adjacent to mangroves forests to use the resources in a sustainable manner; mangrove use is categorized by zonation compartments based on out dated data. Inadequate understanding of the status and condition of mangrove ecosystems is one of the main constraints to conserving and managing mangrove resources sustainably. However there are already considerable skills and opportunities available to use research knowledge more effectively to improve Management. (Ramsar Resolution VII 21 principle 15)

The recent Government policy to reduce the Regional Authorities management power creates opportunities for more effective biodiversity management at lower levels – District and Community levels.

Ideally, Local Authorities have powers to make decisions effecting Local people and their recourses through such Local organs, as the District and Village councils. In practices, this is not taken place because, there are many laws and policies enacted and being enforced at central level interests at District and Community levels but tend to be superior to the Local Authorities and Villogisation Ac

For example, Mafia Island Marine Park Act No.29 of 1994. The original thinking of the donor, the World Wide Fund for Nature (WWF) was to establish a Marine Park primarily managed by the communities. Unfortunately, the Act gives the upper hand in managing the Park to the Fisheries Division, with little involvement of community representatives. Moreover, sectoral biodiversity management and conservation personnel, under the District Authorities, receive technical, professional and sometimes financial support from

their parent departments. Thus, control over them does not create effective avenues of co-operation with local institutions.

#### **1.1.5 Background to the study.**

The mangroves are salt-tolerant trees that grow well in salty, acidic soils with little air (anaerobic). Mangroves grow in muddy estuaries, lagoons, bays, tidal creeks and inlets. In these areas freshwater mixes with sea water, halfway between the land and the sea. Thus mangrove trees grow in an alternating environment of sea water and freshwater runoff from the land.

Different species of mangroves have developed different adaptations to grow at different zonal gradients from land to sea. Consequently, if one moves from the land to the sea one can often see distinct zones of different mangrove species or a combination of species. The mangrove trees grow in an environment where few other plants can survive, Mangroves have special adaptive features. For example, they have specialised roots (e.g. knee, stilt and peg roots) and buttressed trunks that provide support in an unstable, soft mud environment. To cope with high salinity, mangroves trees have specialised root cell membranes that prevent or greatly reduce the entry of excess salt. They also remove excess salt when they shed their leaves, or secrete salt through their leaf pores. To cope with the water logged environment in which they grow, mangroves have developed spreading, breathing roots called pneumatophores which increase breathing capabilities of the plants in such environment.

Global climate changes are expected to have drastic impact on forests and particularly mangrove forests, which played important role in breaking down ocean current. As the population increases the dependant on mangrove forest resources become very high year after year. It is with no doubt that without mangrove forests there will be no ocean, which is a “natural farm” for coastal people. Sustainable livelihood of the coastal communities will be ensured only if there will sustainable supplies of natural resources, which will guarantee eco-system stability, endless provisions of goods and services, employment opportunities and other earnings for the nation development at large (United Republic of Tanzania, 1998)

## 1.2. Statement of the problem

The situation of the mangrove forests in Pangani district is covers areas of 1755.6 hectares. When water in the creaks is included the area increases to 2282.6 ha.

The total area of the reserves including bare saline areas, clear-cut areas and salt a pan amounts to 3046.4 hectares.

The continuous and indiscriminate cutting down of Mangrove trees in Pangani and Mwera division has exposed the land to severe soil erosion, and as a result the subsistence productivity which rural communities depend on has reduced considerably.

The people of in Pangani district use the mangroves forestry for cultivation, fuel wood, fishing and for economic gains. The important species which are disappearing are *Xylocarpus granatum*, *Avicennia marina*, *Bruguiera gymnorrhiza* and *Rhizophara mucronate*.

The concern of this study is conserving of mangrove forests from severe deforestation of mangrove for fuel wood and soil erosion within rural communities in Pangani and Mwera divisions.

Mangroves regeneration in Pangani is good in large areas of the forests. People rehabilitate the mangrove trees to restore areas deforested for fuel wood, to prevent seashore and estuarine bank erosion to restore fishery productivity and to repair areas damaged by conversion of mangroves.

The aim of the study is to assess efforts by rural communities to reduce degradation of mangrove forests (conservation of mangrove forest)

Many of the early study probably focused on the benefits offered by these extraordinary trees. Observation by early studies not only focuses on the Mangrove trees themselves, but also the associated species of wildlife that habit these productive ecosystems. All mangrove tree species trap, hold and stabilize extreme storms and hurricane, with mangrove forests large coastal areas can be protected wind ward by mitigating damage from waves, current and winds. (UNDP 2005)

With these facts in mind mangrove is a land stabilizer “due to easier seedling transport, quick aerial root production, underground root system increase sediment holding capabilities, higher tolerance to cold temperature, better ability to inhabit “artificial” sites.

### **1.3. Objective of the study.**

- a) To identify the activities of rural communities in conservation of Mangrove forests in Pangani district.
- b) To determine the impact of the rural community actions to conservation of Mangrove forests.
- c) To identify challenges to rural communities in conservation of Mangrove forests.

### **1.4. Research questions.**

In order for the researcher to achieve the objectives of the study above, the following questions were asked to get answers:

- i. How do the rural communities utilize the mangrove forests?
- ii. Does their use of the mangrove forest affect the forest?
- iii. What are the activities carried out by the rural community in conservation of mangrove forests?
- iv. How have the activities improved on the mangrove forests?
- v. What are challenges met by the people in conserving mangrove forests?
- vi. How are the challenges being addressed?

### **1.5. Scope of study**

#### **Area scope**

The geographical scope of study is confined to Pangani and Mwera Divisions, Pangani District United Republic of Tanzania.

#### **Scope of content**

The study focussed on use of mangrove products, causes of degradation the rural communities' contribution of mangrove forests, and means of conservations. The study



also included the identification of the challenges and possible solutions to address on conserving of mangrove forests.

#### **1.6. Significance of the study.**

The proposed study will be useful in creating awareness on mangrove forests conservation in most rural community areas where there is a wide range of mangrove forest deforestation practices. The proposed study will be an eye opener to the rural communities to know the importance of the conservation of mangrove forest in its operations, in the, efficient implementation of laws and policies to improve conservation of mangrove forest for the presents and future sustainable development. It sets the pace for more studies to be done in this area; the results of this study will help the following;

- a) Give basic knowledge and create awareness among rural communities on how to conserve mangrove forests.
- b) To help the District/Local authorities in improving socio-economic income of the rural community through proper utilization and conservation of mangrove forests
- c) To help researchers develop more advanced studies in mangrove forests conservation issues.
- d) To help rural communities to learn, understand and implement laws and policies of conservation of mangrove forest.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1. Distribution of Mangrove Forest**

The term mangrove does not refer to a specific taxonomic group of species. One description implies all halophytic (salt tolerant) species of tropical trees and shrubs representing approximately 12 families and over 50 species. All are not necessary related, but all are adapted to living in loose wet soil, saline habitat, and periodic tidal submergence.

In addition, all possess differing degrees of vivipary (live birth) with propagates (seedling) formation. In mangroves this is accomplished with seed germination while still attached to the parent tree. Mangroves dominate 75% of the tropical coastlines between latitudes 25 degrees N – 25 degrees S or higher latitudes bathed by equatorial originating water masses.

The total area of mangroves worldwide is estimated at between 160,000 and 170,000 square kilometres

Mangroves are the rainforests by the Sea “The majority of the subtropical and tropical coastline is dominated by mangroves, estimated to cover an area of 22 million hectares. However, over the past several decades, the global area in mangroves has increasingly diminished as a result of variety of human activities, such as over harvesting, freshwater diversion and conversion to other uses (Mangrove Management Plan 1998)

Mangrove tree protruding the surface of the sea, roots anchored in deep, black, foul-smelling mud, verdant crowns arching toward a blazing sun...”Here is where land and sea intertwine, where the line dividing ocean and continent blurs, in this setting the marina biologist and the forest ecologist both must work at the extreme reaches of their discipline mangrove forests are comprised of taxonomically diverse, salt-tolerant tree and other plant species which thrive in inter-tidal zones of sheltered tropical shores “over wash” islands and estuaries.

Shortly one can say “mangroves are salt-tolerant evergreen forests and are at the transitional zone between dry land and open ocean” Mangrove trees have specially adapted aerial and salt-filtering roots and salt-excreting leaves that enable them to occupy the saline wetlands where other plant life cannot survive (Mangrove Management Plan 1998)

Probably no other distinct plant community has attracted as much curiosity and scientific attention for as long as have the mangrove forests

Mangroves have one of the most unique reproductive strategies in the plant world. Like most mammals, mangrove are viviparous (bringing forth live young), rather than producing dormant resting seeds like most flowering plants. Mangroves disperse propagules via water with varying degrees of vivipary or embryonic development while the propagule is attached to the parent tree. Once the propagule drops from the parent tree there is an obligate dispersal period, which each species propagule must remain in the water. During this period embryonic development continues.

#### **2.1.1. Distribution of Mangroves along the coast of Tanzania**

Tanzania is a country of extraordinary natural beauty and diversity. It encompasses both the highest and the lowest points of the Africa continent Mount Kilimanjaro at 5896m above sea level and bottom of Lake Tanganyika at 358m above sea level (Sea map 1)

It is the only country that contains part of five bio geographical units:

- Savannah parks and eastern forests
- The extension wetland of western Tanzania
- The afro-montane habitats of mountains Kilimanjaro and Meru
- The Rift Valley Soda lakes various fresh water fisheries of lakes Victoria and Tanganyika
- The coral reefs and the mangrove forests at the coast (UNEP, 2001)

In Tanzania mangroves occur along the coast from the border with Kenya in the north to that of Mozambique in the south and around many of the island off the coast.

According to the 1998 inventory the mangroves of mainland Tanzania cover a total area of about 115,500 ha. The largest area of mangroves is found in the Rufiji delta. Fairly

large areas are also found in Tanga, Kilwa and at the estuaries of Ruvu, Wami and Pangani where is our focal point of study.

There are eighty common species of mangrove trees in Tanzania though not all are found in every forest. Mangroves are valuable for their wood and non-wood products: timber, building poles, fuel wood, charcoal, fishing stakes, local medicines, and as animal fodder and vegetables (United Republic of Tanzania, 1998)

The status of mangroves was assessed using aerial photographs and intensive field work. The information provided by the map set and the computer system appear to be much more detailed than is available for any other mangrove forests in the world.

### **2.1.2. Mangroves Forest Distribution in Pangani District**

The Pangani estuary with a well-distributed mangrove species is located to the North Eastern Coast part of Tanzania, Northern zone administratively known as Block II. Pangani is one of the preferred areas (block) for scientific studies of mangrove as you can study all eight species, with your foot or even when you are in the car with area coverage not more than 7 km, yearly number of students from SUA, Olmotonyi, Mweka, University of DSM and even outside the country and tourists are paying visits to this area (Sea Map 2)

With a coastline of 70 km, Pangani District is the smallest in Tanga Region, accounting for only for 3.2% of the population and 6.7% of the area. Its location to South of Tanga City and lies between 5°20' - 5°50'S and 38°30'E

Mangrove forests of Pangani District cover an area of 17755.6ha, the smallest area of blocks in Tanzania. When water in the creeks is included the area increases to 2282.6ha. The total area of the reserves including bare saline areas, clear-cut areas and salt pans amounts to 3046.4ha. The main stands are found at; Pangani river mouth 753 ha, near Ushongo Mabaoni 153ha, along Msangazi River 422ha, and near Ras Machunisi 184.4ha.

Most of the researches that have been done are on law to help establish solutions to the rural community in conservation of mangrove forests.

According to Blaikie and Brookfield (1987) degradation of biodiversity could be regarded as a “result of forces or a product of an equation in which both human and natural forces find a place”

## **2.2. The Conservation of Mangrove Forests**

Different Scholars have defined conservation differently. The World Conservation Strategy defines conservation as the management of the human use of the biosphere, hydrosphere, lithosphere and atmosphere so that it may yield greatest sustainable benefits for the present generation while maintaining its potential the needs and aspiration of future generation.

The mangrove forests in Pangani District are vast in areas scattered along the coastline and of very different qualities. Their management purpose has been categorized into four zones which includes total protected forests, productive forests, forests requiring recovery and development areas. The functions and uses permitted in these four zones are wind breaks; prevent erosion supply of Wood products, Aquaculture, Salt production, Recreation etc.

According to Biodiversity Action Network (1999), addressed that poverty and other forms of social exclusion were identified as an underlying cause, but were in general not given the high profile which they have received in the past. The case study of Michoacán in Mexico and Nepal cited local unemployment and the need for fire wood as underlying causes of deforestation in these regions. These were identified, however as a consequence of a number of National and International Policies, which create and increase social exclusion, in turn resulting in unsustainable use of forests. Regarding population growth only two workshops highlighted it as an underlying cause.

## **2.3. Objectives of Conservation of mangrove Forests**

The rural communities use mangroves on small scale to supply local needs for fuel wood, fences, boat building, house construction for fish traps and medicine. In the past the rural communities, mangrove bark was important as a source of tannin. Also mangroves are used as the domestic fuel wood market and there is a demand for commercial fuel wood for the production of Salt, Lime and processing of Fish and coconut oil. Mangroves are

the source of raw material for artisans and boat builders. Fisherman use mangroves to make traps and floats for fish nets. Some species are used for animal fodder, other for local medicine. Only rarely, are bees kept in the mangrove forest.

According to Spooner and his Colleagues (1994) the main governmental, social and political considerations relevant to biodiversity management can be examined from the following objectives;

- To address biodiversity issues and strengthen biodiversity institutions for conservation.
- To empower local community to contribute to formulation of policies and programmes that articulates their socio- economic interest relevant to the conservation of biodiversity.
- The roles of such institutions as the judiciary, the policy and NGO's in supporting publicly accepted activities of conservation
- The roles of multilateral and bilateral donors, their policies and approaches to project conception and implementation.

-The nature and level of people's participation in conservation Biodiversity Action Network (1999) described that economic and other incentives were widely cited as underlying causes as in the case of deforestation in the palva country of Estonia where as part of the transition to a market economy, subsidies were removed for non-wood resources of fuel, leading to increases in legal and illegal logging. The same case also illustrates the issues of in adequate enforcement of existing laws and lacks in institutional capacity to adequately managed forests

#### **2.4. Economic Roles of mangrove forests**

Mangrove forests products have been used by man for centuries. The earliest historical records available indicate that as early as 200 BC, mangrove poles were an important item of commerce between East Africa Coast, the Gulf States and Asia.

Commercially, Mangroves are an important item of trade and a source of employment and income for the coast rural communities. Mangrove poles are cut for both the export and local market.

According to Technical support Documents International Training Workshop Principles of Environment Enforcement (1999) state that the timber harvesting is another leading

cause of deforestation of the approximately 185 – 190 countries currently recognised as independent, at least 145 are wood producers (the former USSR, now 12 entities is canted as 1)

## **2.5. Planning Process in Mangrove Conservation;**

The implementation of a mangrove conservation project in a pilot area which are Pangani division and Mweru division and later in all coastal area of Pangani District can not take place immediately. The following activities shall take place during the project term; the activities included the medium term interventions and the immediate interventions.

According to Technical Support Document International Training Workshop Principles of Environment, 1999, identified about 60 percents of the clearing of tropical moist forests is for agriculture, Settlement which logging and other reasons such as roads, construction, urbanisation process and different infrastructure construction such as Schools, Hospital, Communication improvement and electricity streams. As an example of the scope of the clearing without timber utilization 6000 separates fires were building on a single day in, 1788, in the Amazon forest as a result of slash and burn deforestation, other including Ghana and Ivory Coast where Ghana with 80 percent deforestation, the forest department estimated only 18 percent of the timber was harvested before land clearance. In the Ivory Coast estimated loss from unutilized timber was perhaps US Dollars 5 billions.

## **2.6 Benefits of conservation of mangrove forests**

The important of mangroves is well established, as sediment traps to clear coastal water of suspended sediment and promote vertical accretion and seaward progradation of the mangrove margin. In addition these provide a natural breakwater to protect coastline from erosion during storms; a natural resource base for silviculture and a large range of economic productions; habitats for rare fauna, and nurseries for commercially valuable fish and crustacean species. These described in detail by Chapman (1976), Christensen (1983), Salm and Clark (1984), Hamilton and Sneaker (1984) and Tomlinson (1986).

The mangrove ecosystem of Tanzania is under heavy pressure from over utilization and in places this resource is being depleted at an alarming rate. It is therefore necessary to estimate the value of what is lost due to degradation and deforestation.

The values derived from mangroves have been divided into three categories which are local values, nation values and Global values.

The Local values of the Mangrove forest in Pangani District are values which directly benefit the local communities such as mangrove woods that is harvesting on a sustainable basis by cutting poles and fuel wood. Mangroves offer breeding and feeding grounds for many species of fish and prawns. If the quality of the mangrove environment is degraded or the trees are significantly reduced, this will have a negative impact on the reproduction of fish and prawns and a resulting drop in the catch. It is believed that the value of the fish and prawns caught far exceeds that of the wood products from the mangroves.

The national values are included government royalties, income by private business men and parastatals

The Global values, if a certain piece of land covered by mangrove vegetation is cut and the wood burnt, there will be a net emission of carbon dioxide (CO<sub>2</sub>) to the atmosphere which will contribute to the global warming and associated rise in temperature (green house effect).

The considerable local, International and Global values of the mangrove indicate that the Government of Tanzania should have a great interest in the protection and sustained management of this resource and must seriously reconsider its present management and conservation policy towards this most valuable resource.

## **2.7 Impacts of destruction of mangrove forests in coastal plain;**

The main impacts of climate change that can be expected to affect mangrove ecosystems and species are sea level rise, temperature rise, changes in precipitation, and changes in frequency or intensity of hurricanes, as well as changes in productivity caused by higher levels of atmospheric carbon dioxide. To date, there has been very little research that directly addresses these issues. These changes will occur in combination with each other as well as with stresses on mangrove communities' consequent from sharing the tropical coastal zone with the majority of the world's human population. As stated by IUCN



(1989) mangroves are today one of the most threatened of the world's natural communities, as they share lowland coastal areas with large, high density human populations.

Some of the activities that people carryout in mangrove forests threaten this important ecosystem. The over exploitation of mangrove trees for housing, fuel wood, boat building(making) and export for the construction industry, has in many areas adversely affected this resource.

The mangrove forests lost when large tracts are cut down to make room for industrial sites, residential houses, hotels, aquaculture, oil and sewage also has a negative impact on mangroves.

The mangrove forests are likewise under threat from activities that affect the environment in which they grow, for instance, changes in the tidal flow and the salt and sediment levels of their surrounding water.

They have a coastal mapping survey to quantify the mangrove forests and to document uses and threats and the status of adjacent communities and whether they would be capable of doing participatory forest management.

## **2.8. Poor Mangroves Conservation Technology;**

The Pangani District extends along the coast as a flat coastal plain with clays and sands on coral limestone, rising inland to undulating slopes. In the river valleys alluvial soils with brackish waters prevail. Vast areas in the South and off the narrow coastal strip along Pangani – Mkwaja Road are with wood land and bushes.

The main threats to the mangrove ecosystem are increased cutting for local domestic uses; the main threat to the mangrove ecosystem today is the uncontrolled commercial use of the resource in a non – sustainable manner which in most cases results in export of the products away from the coastal rural communities.

The commercial activities which affect the mangroves most are large scale cutting of mangrove poles and fuel wood used in fish frying and coconut oil production.

According to Technical support Document International Training Workshop Principles of Environment (1999), the air pollution is associated with degradation of some Europe and

North America Forest. The syndrome is called "Woldsterben" of forest death, for example in 1982, 8 percent of all West German trees exhibited damage rising to about 52 percent nitrogen compounds and sulphates (acid components from fossil fuel burning) acidify the forest soil, forcing toxic aluminium to enter the tree roots instead of calcium magnesium deficiency stunts growth. Thus, the trees succumb to pests and adverse weather, condition which would not otherwise kill the tree.

## **2.9 Good/Appropriate mangrove forests conservation technology.**

The mangrove forests ecosystems are rich in biodiversity and play a key ecological role in the coastal environment by providing feeding areas for large fish, such as snappers, which visit mangroves to feed on smaller fish and other organisms; shelter for coastal and marine creatures such as fishes, oysters, crabs, prawns, hippos, crocodiles and monkeys; safe sites for the young of some species, for example, shrimps, to grow before moving into deeper waters, and good roosting sites for migratory and resident birds.

Mangrove forests act as wave breaks, protecting shorelines from erosion by the action of currents and torrential storms. They stabilise shorelines and promote coastal accretion.

Scientific studies have also confirmed that mangroves contribute towards improving the quality of water by filtration, as their roots are capable of trapping sediments, debris and toxins found in water.

Also mangroves have served human beings for millennia and continue to be an important natural resource. For example, mangroves support rich fishes which provide a valuable protein source and/ or generate income for coastal communities; are used to make construction poles, dyes, tannin and medicine and also provide timber for boat construction and fuel wood; mangrove forests and the varied wildlife that inhabits them offer a high potential for eco-tourism.

If the mangrove ecosystem were destroyed all these functions would vanish, thus affecting the life cycle of some important species, including humans.

## 2.10 Community efforts in conservation of mangrove forests.

The mangroves rehabilitation is carried out to restore areas deforested by over exploitation of mangrove trees for fuel wood, building poles and boat building, to prevent seashore and estuarine bank erosion, to restore fishery productivity and to repair areas damaged by conversion of mangrove areas for solar salt pans.

Site assessments or survey of the areas to rehabilitate involve looking at the remaining plants, density and distribution of naturally regenerating seedlings including mother trees and empty species. It is essential to have good knowledge of local mangroves for species distribution, abundance of seedlings, the nature of the substations, the geomorphology and basic knowledge on the phonology of the mangrove species.

Species for planting are selected according to the mangroves zonation and succession which is related to salinity and substratum of sites. Planting is done at low tide following natural seedlings are planted in rows or plots. Some areas are rehabilitated by filling gaps or enrichment planting. Communities have planted mangroves in degraded areas (this is just the plan area) in 2003, 230000 seedlings were planted rehabilitating a total of 115 hectares and there was 15.7 hectares of natural regeneration.

A lot of degraded mangrove sites replanted (202.46 hectares in 1998-2003 replanting data) Mangrove Management Plan (1999)

The mangroves rehabilitation in Pangani district has led to; increased public awareness on importance of mangroves; increase in the biomass along the estuaries resulting in additional organic matter which influences the biological productivity not forgetting fisheries; control of the erosion of coastal line intertidal mud banks and their stabilization; new avenues for forestry and social forestry activities; marine and terrestrial fauna as well as natural breeding niches increased also their forestry products increased.

Mangrove regeneration is good in large areas of the forests. In this areas reserve, *Heritiera littoralis*, *Lumnitzera racemosa*, *Sonneratia alba* and *Bruguiera gymnorrhiza*, cove relatively small areas while *Xylocarpus granatum*, *Avicennia marina*, *Ceriops tagal* and *Rhizophora mucronate* are the most numerous.

The mangrove regeneration and tending are Silviculture system to used for raising and tending of a given species or group of species depends on the use with which the desirable species can regenerated or the degree to which they tend themselves to artificial regeneration methods The system which is used harvesting mangroves is the selective system where only few required trees are harvested periodically depending on the need.

Therefore with periodic closure the area are capable of regenerating themselves. Artificial planting is only required to restock banks and site with insufficient natural regeneration. For the species which produce viviparous seed like *Rhizophora*, *Ceriops* and *Bruguiera* the rip seed drop off from the parent, normally fall perpendicular like arrow to the soft mud and develop roots in a very short time if not disturbed. This and other darts which found on the ground or floating in the water are the planting materials which are collected and planted. The area where planting has taking place is in degraded areas where natural regeneration was not enough even after the closure of the forest. Planting also took place in the new site where after assessment it was found environmental condition indicate that mangrove tree will survive.

As all mangrove forest is natural forest, there is no tending operation carried for the purpose of improving tree quantity. However tending operation carried out in the new planted area which involves removal of weed and debris brought by sea waves. In the areas with high influence of fresh water especially where river discharges fresh water, creeper and climber cutting operations in carried out to encourage natural regeneration of mangroves.

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

#### **3.1 The study area;**

The study was conducted in Pangani district, Tanga Region North Eastern Coast of Tanzania. Pangani District has four divisions; Pangani, Madanga, Mwera, and Mkwaja. The study will be done in two divisions that are Pangani and Mwera.

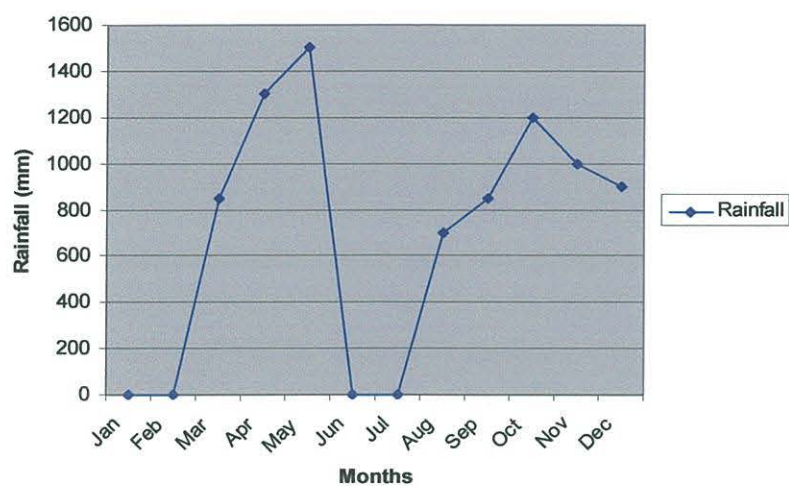
##### **3.1.1 Location;**

Pangani District it is located to the South of Tanga City and lies between  $5^{\circ} 20' - 5^{\circ} 50' S$  and  $38^{\circ} 30' - 39^{\circ} 00' E$ . Pangani district lies along the coastal region of Tanzania on the Indian Ocean. It borders Bagamoyo district to the South, Tanga district to the Northern, Muheza district to the North-West and Handeni to the West.

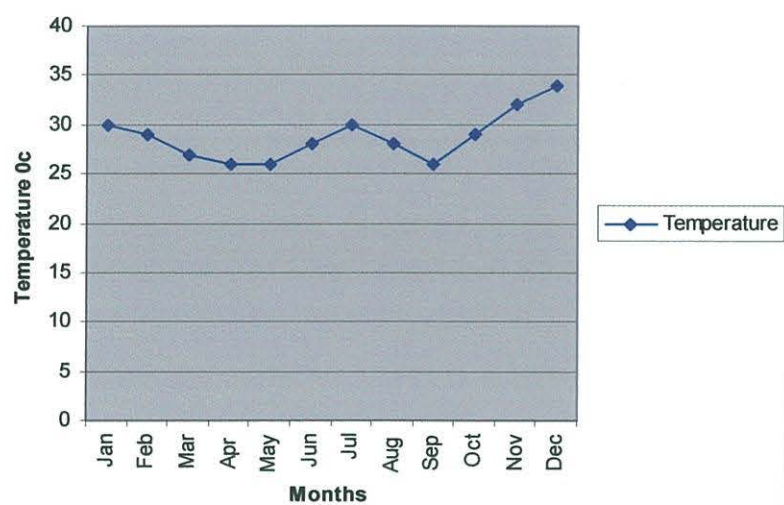
##### **3.1.2 Climate;**

Being on the wind ward side of the Indian Ocean, the climate is hot and humid with moderate to high rainfall. Pangani District receives an average rainfall ranging from 850-1500 mm per annum with temperature varying from  $26^{\circ}C$ - $36^{\circ}C$ . The area receive three main periods of rain annually; long rains between March and May; scattered showers in August, September and short rains between October and December. Pangani District has a moderate climate condition suitable for agricultural activities. Below is an illustration of the annual rainfall and temperature distribution patterns of Pangani District

**Annual rainfall distribution patterns of Pangani District**



**Annual temperature distribution in Pangani District**



### **3.1.3 Topography;**

The District extends along the coast as a flat coastal plain, valleys and streams and rivers, rising inland to undulating slopes. The altitude in Pangani District ranges from 0 to 95 meters above sea level.

### **3.1.4 Soils;**

The soils types in Pangani District are clay soil and sands on coral limestone rising inland to undulating slopes. The total area of the District is 183,080 hectares, out of which 157,819 hectares or 86% is arable land. In the river valleys alluvial soils with brackish water prevail. Most of these soils favour growth of a wide range of crops like maize, rice, cassava, coconut, and cashew nut. Mangrove soils differ from inland soils in that they are subjected to the twin effects of salinity and water logging, both of which are detrimental to the normal functioning of plant life.

### **3.1.5 Vegetation;**

Mangrove forests in Pangani District cover an area of 1,755.6 hectares, the smallest area of all the mangrove forests of Northern East Coast of Tanzania. When water in the creeks is included the area increases to 2282.6 hectare. The total area of the reserves including bare saline areas, clear cut areas and salt pans amounts to 3046.4 hectare.

The main tree species in the Mangrove forests of Pangani include *Rhizophora mucronate*, *Avicennia marina*, *Xylocarpus granatum*, *Heritiera littoralis*, *Lumnitzera racemosa*, *Sonneratia Alba*, *Bruguiera gymnorhiza* and *Ceriops tagal* (Mangrove Management Plan 1998).

### **3.1.6 Population of the study area;**

According to the Pangani District Development Plan for 2002/2007 the population of Pangani District was estimated to be 49,800 people in the year 2007 and this population is expected to grow by 1.8% per year, also the total population of Pangani and Mwera divisions are 30,074 people. The people of Pangani are farmers, fishermen, District Government officials and Non Government Organisations (NGOs)

### **3.1.7 Socio-economic aspect of the people in Pangani District;**

The people of Pangani District practice agricultural activities and fisheries. The main crops grown include; sisal, coconut and cashew nut which are major cash crops and maize, cassava, rice, sweet potatoes and cow peas are food crops. Farming and fishing are the primary means of the subsistence livelihood in Pangani.

About half the men in the coastal villages in Pangani District are fishermen who use traditional sailing boats in relatively shallow water. Fishing supplies the basic dietary protein requirements and earns some cash. However, more income is derived from trade with Zanzibar and Mombasa than from selling fish.

Aside from agriculture and fishing villagers engage in part-time skilled trade such as carpentry, iron working, masonry and boat building. They also process coconut products small scale industries are only found in Pangani town. A large section of population in Pangani depends on a wide range of marine products; such product can be from mangrove forests for both sustenance and socio – economic development. The biodiversity of the marine area is also of such special important to the global family.

Mangrove forests and the varied wildlife that inhabits them, offer a high potential (for eco-tourism 9 for example, there is a proposal for an eco-tourism enterprise at Tauten I). A few small areas of mangrove are protected as “traditional sanctuaries” and are used for spiritual worship.

Infrastructures in Pangani District, there are 427.3 km of road networks in the district most of them are seasonal passable during dry season only. Also there is an initiating water transport from Pangani to other coastal towns such as Zanzibar. Pangani town has an authorized harbour under Tanzania Harbour Authority (THA).

### **3.2 Research Design;**

The researcher employed both descriptive and survey design while conducting the research within Pangani and Mwera divisions in trying to understand the implication of contribution of rural communities to conservation of mangrove forest.



### **3.2.1 Sample size;**

Samples were taken from two divisions of study areas at Pangani District. The sample size contains 50 respondents from those two divisions that are, 25 respondents from Pangani division and 25 respondents from Mwera division. These include 2 Division secretaries, 5 Councillors, 5 Ward Executive Officers, 8 Village Executive Officers, 3 Foresters, 2 Division Environmental Officers, 5 Fisheries Officers, 2 Agriculture Extension workers, 8 Fishermen, 6 Crop farmers, and 4 Livestock keepers.

### **3.2.2 Sampling Design;**

Random sampling, with purposive sampling of people was used.

Where the frame of the 500 people was partitioned into 500/50 to give 10 groups. A random number was then selected from the first 10 individuals and every tenth individual after the first selection was included in the sample.

### **3.2.3 Sample technique;**

A sample size of 50 respondents was selected from a population of approximately 500 people in the two divisions were over twenty one years old. Systematic sampling was used and selected numbers of people are chosen.

## **3. 3. Data Collection;**

The following data collection methods were used, that is Questionnaires, interviews, observation and literature review. Both primary and secondary data were collected. Primary sources of data also consisted of the researchers on-ground visual observation of the real time situation on how communities contribution on conservation of mangrove forests.

### **3.3.1 Questionnaires;**

Questionnaires were also used to acquire primary data from respondents. Close ended questionnaires are used to collect information also a few open ended questions. The designed questions cover background of the study, education levels, gender, marital status, knowledge and skill about conservation of mangroves forest etc.

### **3.3.2 Interviews;**

Interviews were used to collect information from source such as Foresters, Environmental officers, Fishermen, Agriculture extension workers, Livestock keepers, and Division secretaries.

### **3.3.3 Observation;**

Observation undertaken in the field to make comparison as well as to get first hand information so as to confirm whether the information given by respondents is right or not. Further more observation assisted to see what is happening in the field and relate it to the literature reviewed.

### **3.3.4 Literature review;**

Literature reviews were used during the collection of data from books, journals, magazines, internet, maps etc. Literature review was obtained from different relevant Governmental departments, NGO's and education institution. Literature helped to provide definitions of key words, background information, and Geographical information from the study area.

### **3.4. Data analyses;**

Data analysis was done using both qualitative and quantitative method. Such variables analysed quantitatively included the extent of recovery of degraded mangrove forest cover, the extent of communities efforts on conservation of mangrove forests and mangrove forests degradation. The variables for qualitatively analysed data are for example which (gender influence) are more engaged in degradation activities of mangrove forests. While quantitative data were presented in percentages, tabulation and in pie charts.

## **CHAPTER FOUR**

### **PRESENTATION AND DISCUSSION OF RESEARCH FINDINGS**

#### **4.0 INTRODUCTION**

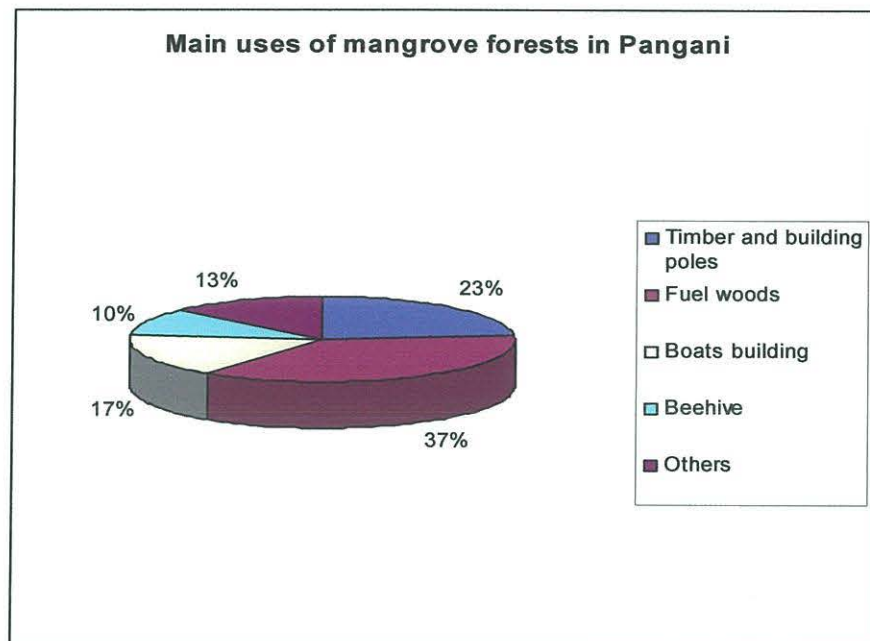
This chapter presents the research findings on the contribution of rural communities to conservation of mangrove forests, and the measures which had been taken to control conservation of Mangrove forests in Pangani District. The presentation of these findings is guided by the systematic order of study objectives.

#### **4.1 Community utilization of mangrove forests in Pangani District.**

The mangrove forests users have exclusive rights to the products from harvesting and silvi-culture and from development activities. They have a responsibility to take part in conservation and protection activities as specified and may be engaged in income generating activities for example, eco-tourism, seaweed farming, beekeeping and aquaculture. Mangrove forests reserves remain the property of the central Government. Staff from the District and / or Central Government is permitted to investigate the activities of forests users or committee in order to determine whether the management plan is being implemented satisfactorily.

The main uses of the Mangroves trees in Pangani District are, (23.33%) timber and poles, (36.67%) fuel wood, (16.67%) boats building, (10%) beehive and (13.33%) other uses. Some activities which affect the mangroves forests in Pangani district mostly are large – scale cutting of mangrove poles and fuel wood used for fish or processing during drying and coconut oil production.

**Figure 1**



#### **4.1.1 The uses of the forests and its products affect the mangrove forests.**

The extent of degradation is the most serious environmental problems in mangrove forests covers. . A decade ago, the area was fully covered with different species of natural marine wood. But the relentless pressure put on forests by population explosion is threatening the existence of these marine woods. Indiscriminate tree felling is fast driving the landscape into bare land. Extensive areas of marine wood, including mangrove forest, have been deforested.

The rate and extent of degradation in the district are yet to be determined. However, from available records and field visits, it is evident that degradation is very widespread and is proceeding at an alarming rate. The process involves the shrinking of marine woods through selective cutting of tree species to complete clear-felling, leaving only stumps.

The mangrove ecosystem of Pangani is under heavy pressure from over utilization and in places this resources is being depleted at an alarming rate. It is therefore necessary to estimate the values of what is lost due to degradation and deforestation. The areas which

have been mostly affected by deforestation are Kokoni (Pangani west), Ushongo and Kipumbwi villages.

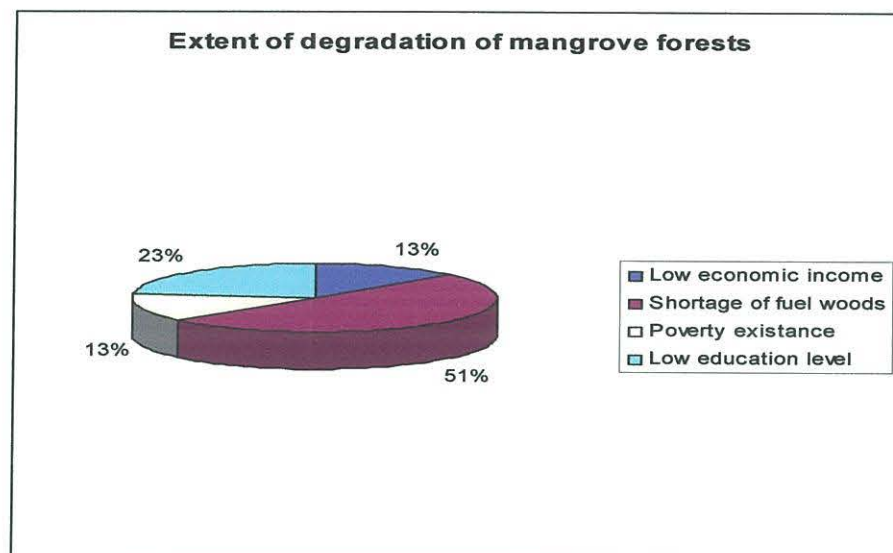
The extent of Mangrove forests degradation in Pangani are associated with several conservation problems, these include low economic income, shortage of fuel wood, poverty and low education level of the people. Observation undertaken during field visits in Kokoni (Pangani west), Ushongo, Bweni and Kipumbwi villages was shown that, (50%) of respondents said that shortage of fuel wood is a major problem to conservation of Mangrove forests in Pangani District followed by low education level in rural community (23.33%) of respondents, low economic income (13.33%) of respondents and (13.33%) of respondents said that poverty existence in their villages and surrounding areas.

Table.1. The problems of degradation of Mangroves forests

Problems of deforestation	Respondents	Percent
Low economic income	4	13.33
Shortage of fuel wood	15	50
Poverty existence	4	13.33
Low education level	7	23.33
Total	30	99.99

These four problems mentioned above lead to degradation of mangrove forests due to challenges faced by rural communities in conservation of mangrove forests, such as shortage of extension workers, lack of projects dealing with conservation of mangrove forests, lack of laws and policies for reinforcement conservation of mangrove forests, lack of other alternative for rural communities income generation and low knowledge and skill on mangrove forests conservation

Figure 2



#### 4.1.2 The causes of deforestation of mangrove forests by agricultural activities.

Mangrove cutting for agriculture is reported to be a major threat in mangrove area receiving fresh water from big rivers. Farming in the mangrove is a very serious problem in Pangani river basin. Farming in the mangrove is practiced along the Pangani River in the area flooded with fresh water during high tides. However interview with farmer in Pangani revealed that mangrove soil is not good for long term agriculture due to salinity and sulphate condition.

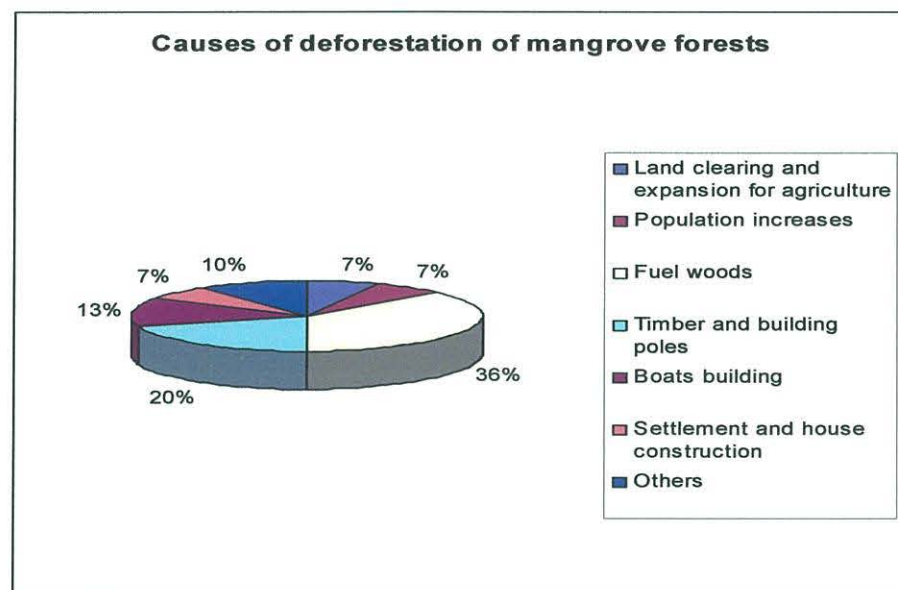
The factor that responsible for the massive deforestation of mangroves in the currently being experienced in Pangani District is the clearing and expansion of mangrove forest for agriculture activities.

From the household interviews, it was evident that fuel wood and timber mangrove building poles were the leading causes of deforestation in Kokoni (Pangani west), Ushongo, and Kipumbwi villages. Almost 36.67% of the respondents identified them as causes of deforestation are fuel wood, followed by timber and building poles (20%), boats building (13.33), land clearing and expansion for agriculture (6.66%), population increases (6.66), settlement and house construction (6.66%) and others factors are (10%).

Table. 2. Causes of Deforestation of Mangrove forests in Pangani

Reason	Respondents	Percent
Land clearing and expansion for agriculture	2	6.67
Population increases	2	6.67
Fuel woods	11	36.66
Timber and building poles	6	20
Settlement and house construction	2	6.67
Boats building	4	13.33
Others	3	10
Total	30	99.98

Figure 3



#### **4.1.2.1 The effect of tourism activities on mangrove forests deforestation;**

Tourism in the Pangani mangroves forests area is only possible through waterways by boats. However, tourists may have to remain on the boats at all time. Furthermore, the Pangani town is small, the forests are low at place very thin, and so the natural vegetation cannot provide adequate shelter and cover to the wildlife population which is already under environmental stress. Major infrastructure for tourism such as roads, accommodation, and other services may degrade the very resource being promoted. Access by boat is the most environmentally friendly mode of transport. However, there is tremendous pressure from a section of the affluent middle class residing in the Pangani town and in its hinterland, for allowing tourism inside the forests at least on weekends.

The tourism sector of the Pangani local council and central Government has provided water crafts to take tourists to the mangrove forests, on very short trips. Proposals are underway to provide accommodation at villages which are connected by bus services in the fringe area of forests and reclaimed land. The tourist's lodges or guest houses in Ushongo and Kipumbwi villages are constructed for such purposes.

#### **4.1.2.2 The uses of the mangrove forests as sewage and waste dumping;**

Extensive amounts of sewage in Pangani district are currently being released into peri-urban mangrove forests, but there is hardly any understanding of the consequences. There is evidence to suggest that mangroves filter discharged waste water and prevent coastal pollution, but this ecosystem service has been conveyed to coastal mangroves, 'nor' has the filtration capacity been exploited. The mangrove is one of the world most endangered habitats; more than a third is already lost and the remaining is disappearing at rate of 2-5% per year with little public notice.

The peri-urban mangroves in Pangani district are particularly hard hit. Therefore the ecological and economical service that peri-urban mangrove provide by mitigating coastal pollution through sewage-filtration and to offer innovative solutions for the exploitation and management of this quality. The two innovative ways in which mangroves filtration can be utilized to preclude coastal sewage pollution (1) facilitating sewage filtration by conserving filtering mangroves and replanting mangroves in



deforested areas exposed to sewage (strategic reforestation and conservation) (2) using constructed mangrove wetlands for sewage treatment. More than 25% of the population of the East African region lives within the coastal areas (UNEP 1998).

#### **4.1.2.3 Grazing activities in mangrove forests areas;**

The density of the cattle population is one of the highest in the Pangani district. Despite this, little investment has been made in animal husbandry. The shortage of animal and poultry feed, combined with a low level of veterinary skills contribute towards a high mortality rate of animals in the area. The Pangani Development Board has initiated a substantial programme to establish 4,487 poultry units and 384 dairy production units. Availability of natural feed is limited due to an absence of fallow land for pasture, salinity and a lack of irrigation facilities.

Duck and chicken are commonly reared at every household, while a few families have goats. Paddy straw is used as fodder. Hides and skins are collected for use. With the implementation of the development programme, the promotion of animal husbandry and dairy production has been encouraged. There has been some distribution of crossbred bulls for a cross-breeding programme for increased milk production. However foot and mouth and rinderpest diseases are common among the bovine population and there are inadequate treatment facilities.

#### **4.1.3 The contributions of rural communities on conserving mangrove forests;**

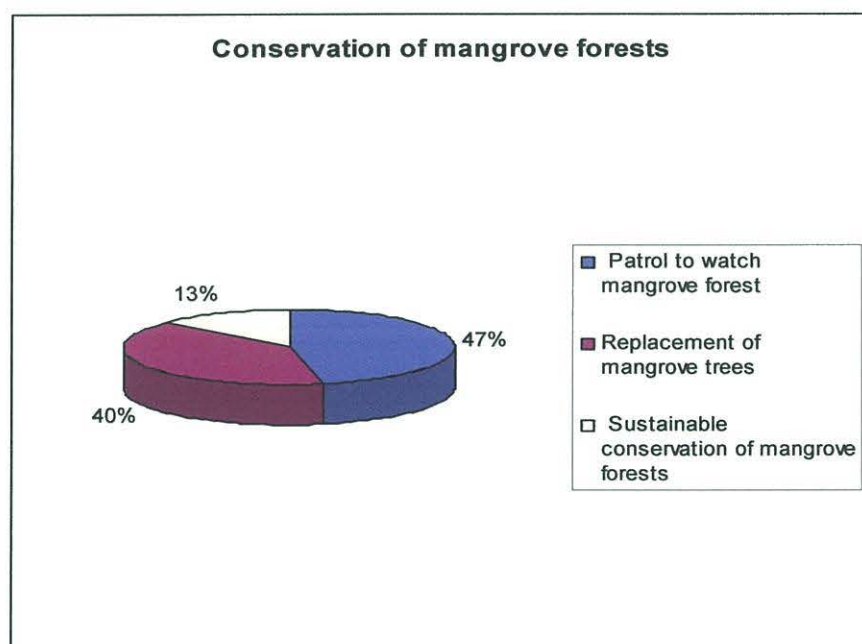
According to the study that was carried out, it was found that the contributions of rural community to conserves mangrove forests in a number of ways; it includes patrol to watch mangrove forests, replacement of mangrove trees and also sustainable conservation of mangrove forests. The study showed that, patrol to watch mangrove forests (46.67%) of respondents, replacement of mangrove trees (40%) of respondents, sustainable conservation of mangroves forests (13.33%) of respondents. Patrol is conducted by villagers voluntary also they engaged in replacement of mangrove trees in degraded areas where natural regeneration was not enough even after the closure of the forest. Therefore, sustainable conservation of mangrove trees are system which

communities uses to harvest mangroves in selective system where only few required trees are harvested periodically depending on the needs.

Table 3. Conservation of Mangrove forests in Pangani

Community actions for conservation of mangrove forest	Respondents	Percentages
Patrol to watch mangrove forests	14	46.67
Replacement of mangrove trees	12	40
Sustainable conservation of mangrove forests	4	13.33
Total	30	100

Figure 4



#### 4.1.3.1 Community's expected benefits from conserving mangroves forests;

The values derived by communities from mangroves have been divided into three categories which are Local values, Nation values and Global values.

The local values of the mangrove forests in Pangani district are values which directly benefit the local communities such as mangrove woods that is harvesting on a sustainable basis by cutting poles and fuel wood. Mangroves offer breeding and feeding grounds for many species of fish and prawns.

If the quality of the mangrove environment is degraded or the trees are significantly reduced, this will have a negative impact on the reproduction of fish and prawns and a resulting drop in the catch. It is believed that the value of the fish and prawns caught far exceeds that of the wood products from the mangroves.

There is National value which including government royalties, income by private businessmen and parastatals.

The Global values of mangrove forests in Pangani. If a certain piece of land covered by mangrove vegetation is cut and the wood burnt, there will be net emission of carbon dioxide (CO<sub>2</sub>) to the atmosphere which will contribute to the Global warming and associated rise in temperature (Green house effect).

The considerable local, National and Global values of the mangrove indicate that the government of Tanzania should have a great interest in the protection and sustained management of this resource, and must seriously reconsider its present management and conservation policy towards this most valuable resource.

The main tree species which are grown in the Pangani Mangrove forests are *Rhizophora mucronate* Lam, *Avicennia marina* (Forsk) Virrh, *Bruguiera gymnorrhiza* (L) Lam, *Sonneratia alba* Sam, *Ceriops tagal* (Perr) C.B. Robinson, and *Xylocarpus granatum* Koenig.

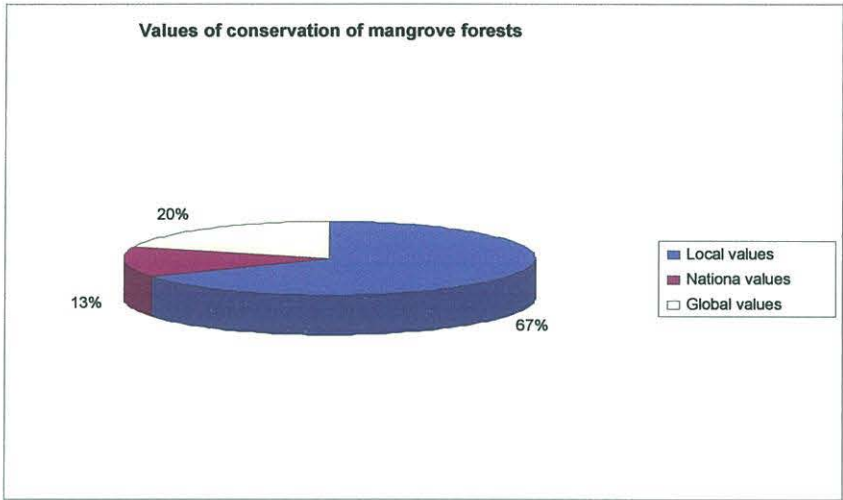
In addition people may gather medical plants, fuel wood or define food from the forests to support their livelihoods and the conservation of biodiversity also has an international dimension many species provision of bloat value and their habitats of importance in the provision of bolas public goods such as carbon sequestration.

From the household interviews it was evident that local values were the leading values as attached to mangrove forests in Pangani District. Through the interviews the researcher found that local values (66.67%) of respondents, global values (20%) of respondents and national values (13.33%) of respondents.

Table.4 Expected benefits from conserving of Mangrove forest.

Values of mangrove forests in Pangani	Respondents	Percentages
Local values	20	66.67
National values	4	13.33
Global values	6	20
Total	30	100

Figure 5



## **4.2 How the conservation strategies have improved the mangrove forests;**

There have several mangroves conservation strategies in Pangani district that includes, Institution strengthening, Zonation of mangrove forests, Involvement of local communities and Inter sectoral co-ordination.

Mangroves rehabilitation is carried out to restore areas deforested for fuel wood to prevent seashore and estuarine bank erosion to restore fishery productivity and to repair areas damaged by conversion of mangrove areas. The mangroves rehabilitate on involves looking at the remaining plants, density and distribution of naturally regenerating seedlings including mother trees and empty spaces. It is essential to have good knowledge of local mangroves for species distribution, abundance of seedlings, the nature of the substratum, the geomorphology and basic knowledge on the phenology of the mangrove species. Species for planting are selected according to the mangrove zonation and succession which is related to salinity and substratum of sites. Planting is done at low tide following natural zonation and the propagules or natural seedlings are planted in rows or plots. Some areas are rehabilitated by filling gaps or enrichment planting.

### **4.2.1 Institutional strengthening of management of mangrove forests;**

Field staff from coastal villages especially from Kokoni, Bweni, and Ushongo and Kipumbwi villages are recruited and provided with appropriate training in matters concerning mangroves forests such as management, extension, harvesting and regeneration. The special training in conservation and management of mangrove forests for senior staff are also being provided and management of mangrove ecosystem requires integrated knowledge and skills.

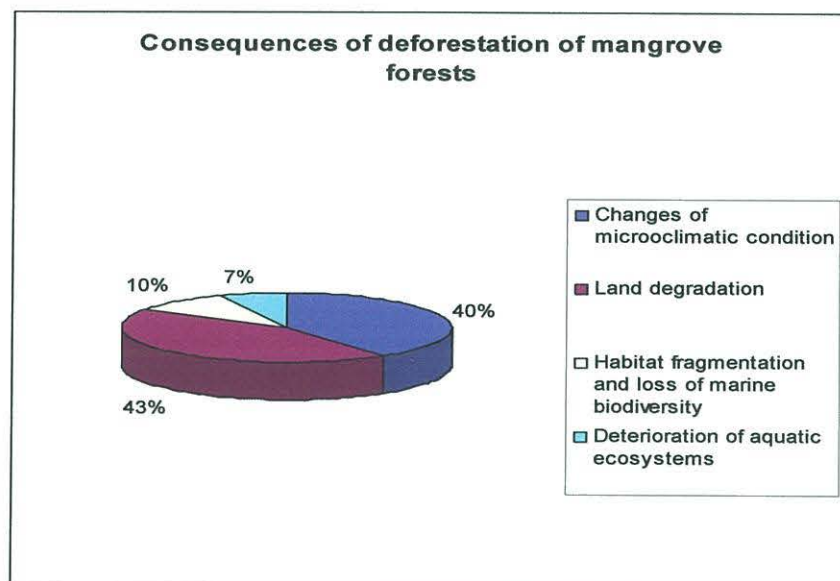
From the household interviews, when they were asked what are the consequences of Mangrove forests deforestation around their areas of Kokoni (Pangani west), Bweni, Ushongo, and Kipumbwi villages, (40%) mentioned changes of microclimatic condition, (43.3%) mentioned land degradation, (10%) mentioned habitat fragmentation and loss of marine biodiversity while (6.7%) mentioned deterioration of aquatic ecosystems and non availability of good quality water

Table.5 Local communities' response to consequences of deforestation of Mangrove forests

Consequences of deforestation of mangroves	Respondents	Percent
Changes of microclimatic condition	12	40
Land degradation,	13	43.3
Habitat fragmentation and loss of marine biodiversity	3	10
Deterioration of aquatic ecosystems and non availability of good quality water	2	6.7
Total	30	100

Therefore, awareness of the implications of mangrove forests degradation is required both among planners and political leaders if the problem is to be solved. Community should be availed with necessary information concerning the wise and the best use of the available sources.

Figure 6



#### **4.2.1.1 Zonation of the mangrove forests for regulated use and disposal;**

The mangroves conservation and management strategic plan in Pangani district has categorised into four zones, that is;

##### **ZONE I**

These mangroves forests which receive total protection thus unsuitable for harvesting trees, in this zone we have; environmentally stressed mangroves, in this category occur in conditions which are marginal for growth. Mangroves that protect the coast from wind and erosion; these grow on exposed sites and are maintained under permanent forest cover to provide the first line of defence against wave erosion and storm surges. Mangroves that maintain genetic resources and protect flora and fauna; this category are regarded as important spawning and nursery site for fish, prawns and other aquatic organisms, such areas may also be important nesting and resting sites for resident and migratory birds.

##### **ZONE II**

These are forests which have been put under production. They are ecologically stable areas with sufficient regeneration potential to permit controlled harvesting. The main objective of establishing this category is to maintain productivity of the area while permitting controlled harvesting for poles timber and fuel wood it can be used for beehive activities.

##### **ZONE III**

These are degraded areas which have been closed for cutting for periods of varying lengths to allow recovery and rehabilitation. The objective of establishing this zone is to permit recovery and regeneration of mangroves by restricting access. The zone is characterised by an open medium density with many trees of small size or poor growth from which makes them unsuitable for poles production.

The trees with good regeneration do recover without planting. In some areas it may be necessary to replant and activities allowed on this zone are beehive, research training and demonstration and for future supply of wood products.

## ZONE IV

These are areas in the mangrove forests set aside for development of different types. They are regarded as suitable for certain defined carefully controlled development activities both at commercial and village level. Emphasis here is on economic activities such as fishing, small scale aquaculture, tourism, beehive and salt production. The objective of this zones are; to study possible effects results of development schemes in mangroves and to provide research, education, demonstration and related uses which minimises adverse impacts on the natural environment.

### **4.2.1.2 Organised participation of local communities in conservation of mangrove forests;**

Community based resource management is widely accepted concept and crucial for success of development and environmental programmes. Mangroves management strategies have recognised that it is essential to enter into a management partnership with local communities aimed at the conservation and sustainable use of the mangroves ecosystem.

Currently Centralised management regimes suffer from lack of adequate resources, personnel and insufficiently training which does not allow effective monitoring and enforcement. There are seldom enough financial resources for, research, public awareness, community consultation and effective management.

Most of Government decision or approaches to the resource management are in a centralised manner which rarely includes consultation with and participation of the resource users and other concerned members of community. This has resulted in the failure to incorporate popular knowledge, skills and energies in management strategies, in the marginalization of traditional users and in the loss of local rights and benefits. Most communities don't see the resources as theirs.

The success in sustainable management strategies of mangrove ecosystem is to give some responsibility and authority to resource users and the community group that are most dependant on continued productivity. This it allow the use of popular ecological knowledge, the use of traditional strategies system of mangroves conservation.



Community are more committed to the decision to solve resource management problems in which they have taken part and accepted during planning and implementation.

#### **4.2.1.3 The intersectoral co-ordination conservation strategies;**

Lack of co-ordination between many different Government Institutions directly or indirectly involved in the issues concerning conservation of mangroves ecosystem has been identified as the major hindrance to the successful management strategies of mangroves forests. For example, land division-issuing lease holds in mangroves forests area without prior consultation, fisheries division- issuing permits to carryout mariculture in mangroves forests, wildlife division, national environmental management council, district executive directors and non governmental organisation.

Several workshop/ seminars have been conducted to raise awareness and bring together all these institutions, for the purpose of sound sustainable management strategies of mangrove ecosystem and also we do the joint resource management strategies.

#### **4.2.2 The extent of improvement of the mangrove forests;**

Various mangrove species have been planted, notably *Avicennia spp*, *Rhizophora spp*, *Bruguiera spp*, and *Xylocarpus spp*. The annual achievement for the establishment of mangrove plantations is increased in Pangani district. The mangrove species are primarily expected to provide a good yield of fuel wood, but also some timber, house poles and other forest and non-timber products.

The degraded land was planted with mangrove trees in Pangani and Mwera divisions, but these areas was damaged beyond repair by fuel woods ,house poles and timber processing products. The plantation areas with mangrove species was continued, but it is under local methods. These degraded areas are no longer inundated by tidal water and the areas from large flattish, shallow and depressions. The absence of regular inundation results in excessive evaporation which in turn leads to the formation of a saline encrustation on the soil surface. The lack of flooding in the forest also reduces the supply of organic matter. The loss of natural flooding may be replaced by digging small channels up to the saline and denuded sites to facilitate the ingress of tidal water.

#### **4.2.2.1 The mangrove forests regeneration of biodiversity composition;**

The increases of species diversity at the community level it add the competitive ability of mangrove forests communities as a whole. Outside the present latitudinal limits for mangroves, comparable sedimentary coastal environments are generally occupied salt mash vegetation. It is likely, given the more herbaceous nature of the vegetating in these communities that mangroves forests are out compete such species in the medium to long term and that a gradual replacement of salt mash vegetation by scrubby mangrove, first of *Avicennia* and later of *Rhizophora* may be expected to occur.

#### **4.3 Challenges faced by rural community in conserving of mangrove forests;**

The principal problem hindering sustainable management of mangrove forests in Pangani is land acquisition by reclamation for settlement and expansion of agriculture resulting from population pressure. Furthermore, there is inadequate scientific knowledge concerning the resilience of the mangrove forests ecosystem to human use. The resultant loss of productivity capacity and related systems cannot be contained therefore.

There are conflicting policies relating to the exploitation, management, or conservation of mangrove forests and the organization of management agencies have been established on the basis of economic sectors and according to natural management units.

Management and planning of mangrove ecosystems requires a thorough knowledge of the needs and functions of the ecosystem and a broad perspective on the economic and social significance of the mangrove ecosystem. Multi-integrated programmes are therefore required to help in the process of formulating sound management guidelines. The concern of foresters in the Pangani district is to manage the mangrove forests for the long term viability of resources. However, the problem is not of encroachment but of overexploitation. The best timber and *Nypa* resources have been exploited a long time ago, when administrators exercised poor control over mangroves exploitation. The foresters have failed to clearly express the social and economic significance of the complex web of resources opportunities offered by mangrove ecosystems. It has been

realized only lately, and management guidelines are now being formulated to incorporate ecological, economic and social parameters.

#### 4.3.1 Lack of knowledge and skill on conserving of mangrove forests in Pangani District.

The main potential threats of mangrove forests in Pangani district are clearance for industrial sites, housing, agriculture, salt pans and aquaculture. Some of the respondents were open enough to say that they are challenges in conservation of Mangrove forests. From the findings (63.33%) of the respondents reported said that “yes” lack of knowledge and skill on conservation of mangrove forests it’s a challenges and (36.67%) said that “no” challenges

Table. 6 Lack of knowledge and skills on conservation of Mangrove forests in Pangani

Lack of knowledge and skill	Respondents	Percentages
Yes	19	63.33
No	11	36.67
Total	30	100

Figure 7



#### **4.3.2 How the challenges of conserving mangrove forests in Pangani are being addressed.**

Mangrove conservation plans are being increasingly seen as a mechanism to address these existing problems in district as far apart as Pangani and Mwera division, however it is clear that although these conservation plans are being developed within the framework of local conditions they are often too sectoral in their approach and almost without exception fail to take account of potential changes to the climate and hydrology of the conservation area which may occur as a consequence of climate change and sea level rise. If mangrove forests are to be managed on a sustainable basis then clearly a multi-disciplinary cross-sectoral approach to conservation must be developed based on a sound inner-disciplinary, scientific understanding of the way in which these ecosystems function.

## **CHAPTER FIVE**

### **5.0 CONCLUSION AND RECOMMENDATIONS**

#### **5.1 CONCLUSIONS**

From the study, impacts of deforestation of mangrove forests in Mwera and Pangani divisions is high and the contribution of rural communities to conserves mangrove forests are poor. These affect land productivity by increasing the rate of soil erosion, and affecting the life cycle of some important species, including humans.

The study revealed that, in this two divisions communities sources of fuel wood were never enough because of the following factor's; inadequate agroforestry practices, lack of financial incentives especially to rural communities, gender related conflicts, and culture / taboos which were detrimental to women's participation in mangroves forests management and conservation practices.

The combination efforts of conserving Mangrove forests and its effects on the community, lives are a great challenge to the rural community and whole area a large. The rural community contribution of mangrove forests in Pangani district is faces a lot of problems which hinders the whole process of sustainable conservation of mangrove forests.

Also it was found that frequencies harvesting of mangrove trees for fuel wood, building poles, timbers and beehive are the some of the human practices which causes low sustainable of mangrove forests conservation in Pangani District.

It would appear obvious from the above discussion that in the case of mangroves the key factors or components of global change will differ according to the nature of the response which is being evaluated. Thus would seem that: the dominant factors determining possible future latitudinal range extension are temperature related, moderated by coastal current regimes; the factors determining changes to ecosystem stability, relate to the sediment budget and hydrology; changes to zonation within individual mangroves communities will be related to relative sea level rise; and hydrological processes will determine both individual species and community responses

## **5.2 RECOMMENDATIONS**

The problems identified through related and it was realized that rural community contributions to conservations of mangrove forests was poor. Therefore, there is need to strengthen sectoral (i.e. villages, wards, division and institutions) capacities to provide programmes and project that can provide an integrated planning and management of mangrove forests. This can insure compatibility of the rural community interest with the objectives of conservation of mangrove forests programmes.

Another way is to involve rural community, to insure that they share in the financial and economic benefits from mangrove forests control management and project. There is need to introduce a system of joint protected conservation areas, in which communities would be involved in conservation and protecting mangrove forests.

These measure and proposals are important moves towards decentralizing government in strengthening mangrove forests conservation.

Government, political leaders, planners, experts and communities generally display a surprisingly poor understanding of the implications of the problem of poor mangrove forests conservation.

It recommended that the mangrove forests should be surveyed and mapped, their uses and threats document, and an assessment made of whether the adjacent local communities would be able to undertake participatory forest management adjacent to mangrove forests were selected for the survey.

Therefore, awareness of the implications of mangrove forests degradation is required both among planners and political leaders if the problem is to be solved. Community should be availed with necessary information concerning the wise and the best use of the available sources. In fact, awareness campaigns regarding the problem of rural community contributions to conservation of mangrove forests, its implications and how can be encroached should be emphasized.

Promotion of agroforestry practice to improves the supply and availability of fuel wood. Trees and shrubs should be grown in cropped areas, particularly in compound farms; this is because trees planted to provide energy could also serve other functions such as soil stabilization, provision of fodder, shade, windbreak and also soil nutrient improvements.

Encourage participation of both rural communities in this area, women participation in mangrove forests conservation practices are negligible; this is because there is a different view with regard to mangrove trees uses between men and women, however, through extension services by Ministry of Natural resources, forests and tourism, non-governmental organizations, and communities can be sensitized through being involved in discussions, open forums, where both men and women contribute their views on mangrove trees utilization.

Financial empowerment of rural communities in this area, communities has little if any income generating activities. Mangrove forests conservation projects have failed due to financial constraints on part of rural communities; therefore the government should come up with programmes for rural micro-financing, conduct trainings in small medium enterprises and revive the collapsed communities groups by training them on leadership skills and office running of community based organizations.

Promotion of energy conservation, although in the past there had been a project aimed at encouraging energy saving, it collapsed. Fuel conservation remains an important strategy of preserving the ever decreasing wood resources. The improved cooking stove should be widely promoted among all households in Mwera and Pangani divisions.

Promotion of alternative sources of energy rather than uses mangrove trees, from the study almost 50% of home in Pangani and Mwera divisions had one cow. Zero grazing was the dominant cattle rearing method in this area. However, no single household tapped the waste from the cattle shed to produce bio-gas. Bio-gas production can be

promoted by government through offering training, awareness, technical know-how and incentives to the communities. Bio-gas uses cheap raw materials which can be found in the villages. Its adoption would greatly reduce the demand of fuel wood from mangrove forests.

Environmental education, in Pangani and Mwera divisions' primary school and secondary school pupil attendance is high. Therefore, Ministry of Education should incorporate environmental education for mangrove forests conservation techniques in the school curriculum so as to equip the pupils with adequate knowledge on mangrove trees planting which they can disseminate to community around schools. Schools can also exploit various opportunities of co-operation between schools and parents like parents-teachers meetings and field days. Schools can also act as demonstration centers where community can learn more on matters to do with the environment.

Future studies, similar studies to address other social-economic factors for, income, gender, markets, culture and political factors that affect the adoption of mangrove forests conservation techniques and general tree planting should be done, and replicated in different ecological and socio-economic regions to ensure the full understanding of the development and adoption processes.

Finally, there should be increased co-operation between governments, communities and non-governmental organizations (NGOs) involved in mangrove trees planting and conserving of mangrove forests as a way of stabilizing the foundations of rural communities' development.

The conservation of mangrove forests promotes stabilisation of shorelines and coastal accretion. Scientific studies have also confirmed that mangroves contribute towards improving the quality of water by filtration, as their roots are capable of trapping sediments, debris and toxins found in water.



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## APPENDIX – I

### TIME SCHEDULE OF ACTIVITIES

MONTH AND YEAR	ACTIVITIES
Sept. 2007 – Dec. 2007	Research proposal writing
Oct.2007 – Nov. 2007	Questionnaire Preparation and Pre - testing
Dec. 2007 – Jan. 2008	Data Collection
Jan. 2008 – Feb. 2008	Data analysis
Feb. 2008 – March. 2008	Write up Dissertation
March. 2008 – April. 2008	Submission of the Dissertation

## APPENDIX – II

### PROPOSED BUDGET

ITEMS	COSTS (TZ. SHs)
Stationeries	120,000.00
Photocopies, typing and printing costs	150,000.00
Allowances for supervisor, respondents driver, accommodation etc	500,000.00
Transport charges	200,000.00
Miscellaneous charges	30,000.00
Grand Total	1,000,000.00

Sources of the funds is from Pangani District Council (Health department)

## QUESTIONNAIRE

QUESTIONNAIRE INTERVIEWER \_\_\_\_\_

DATE \_\_\_\_\_

DIVISION \_\_\_\_\_

VILLAGE/STREET \_\_\_\_\_

PART "A" PERSONAL DATA (Please tick the most appropriate)

1. SEX

Male (    )    Female (    )

2. AGE

Below 20 years (    )

21 – 30 years (    )

31 – 40 years (    )

Above 40 years (    )

3. MARTITAL STATUS

Married (    )

Single (    )

Single Parent (    )

4. EDUCATION LEVELS

None (    )

Primary (    )

Secondary (    )

Other (Specify) -----

5. RELIGION

Moslem (    )

Christian (    )

Others (    )

6. MAIN OCCUPATION

Farming (    )

Fishing (    )

Worker ( )

**PART "B" INFORMATION RELATING THE CONTRIBUTION OF RURAL COMMUNITIES TO CONSERVATION OF MANGROVE FORESTS.**

1. What is your current position in the Community-----

2. Is there any knowledge or skill about conservation of Mangrove forest?

Yes ( ) No ( )

3. If yes, can you explain it?

(i ----- (ii----- (iii-----

4. What are species of mangroves trees which are found in your area?

i Rizophora mucronata Lam

ii Bruguiera gymnorhiza (L) Lam

iii Avicennia marine (Forsks) veirh

V Sonneratia abba sm

VI Xylo carpus granatum Koenig

a= 1 b= 2 c= 3 d= 4 e= 5

5. There are any reasons for rural community to conserves Mangrove forests?

Yes ( ) No ( )

If you know mention it

(i----- (ii----- (iii-----

6. There are any Laws and policies which have been set for conservation of Mangrove Forests?

Yes ( ) No ( )

If yes, which policies or laws?

(i----- (ii----- (iii----- (iv-----

7. What is the main use of the mangrove Forests at your area?

- (i) Fuel wood ( ) (ii) Timber ( ) (iii) Boat building ( ) (iv) Beehive ( )  
(v) Others ( )

a= 1 b= 2 c= 3 d= 4 e= 5

8. Do you have any other forest in your area?

Yes ( ) No ( )

9. There is any Project which dealing with conservation of mangroves forests?

Yes ( ) No ( )

10. There is any Extension Worker in your area dealing with conservation of mangroves forests? Yes ( ) No ( )

11. What problems associated with conservation of mangroves forests do you face?

- (i) Low economic income  
(ii) Poverty existence  
(iii) Low education level  
(iv) Shortage of fuel wood

a= 1 b= 2 c= 3 d= 4

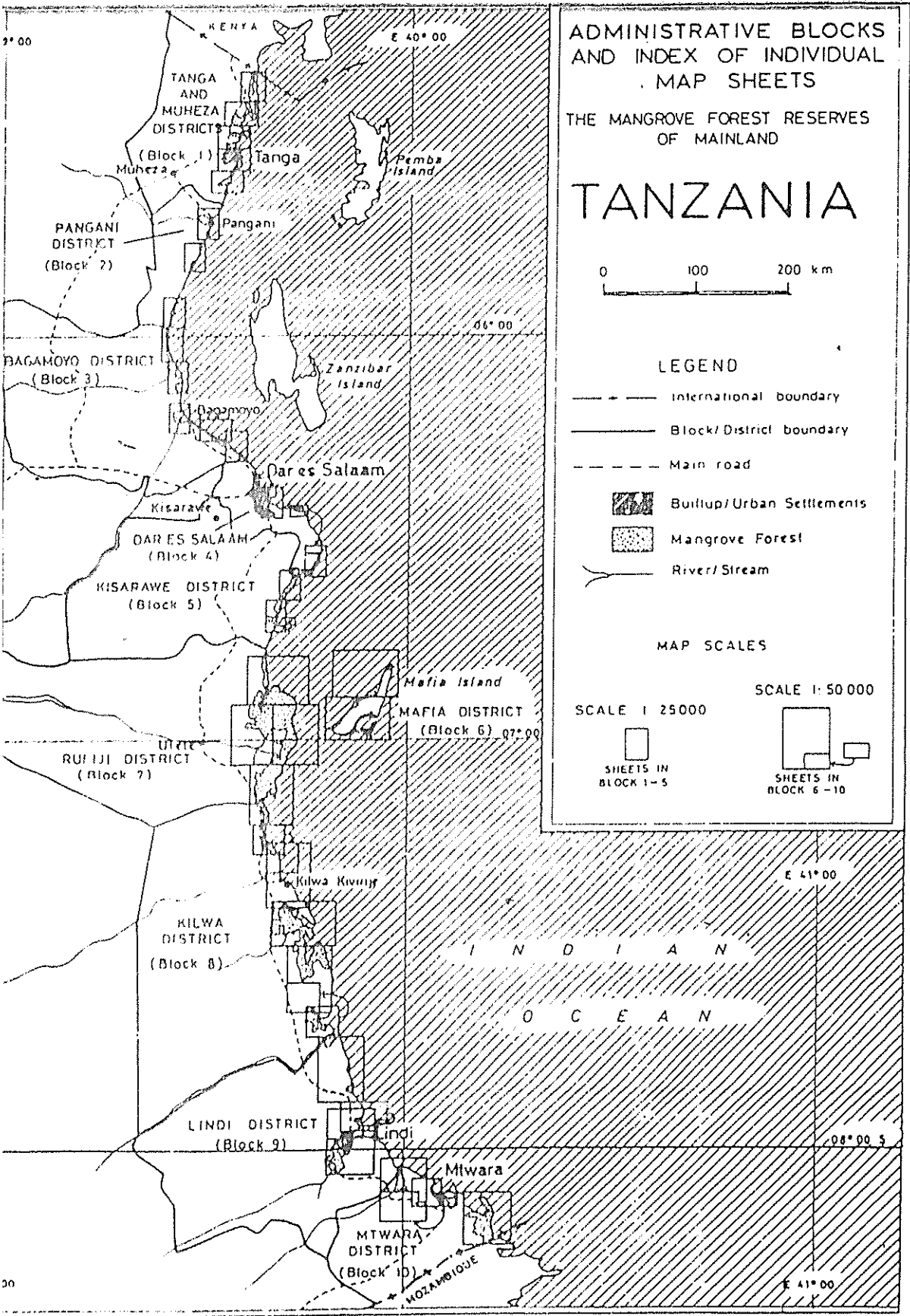
12. What the contributions of rural communities are to conserves mangrove forests?

- (i) Patrol to watch mangrove forests  
(ii) Replacement of mangrove trees  
(iii) Sustainable conservation of mangrove forests

a= 1 b= 2 c= 3

**Thanks for your co-operation**

MAP 1.1: Distribution of mangroves along the coast of Tanzania



Map 2.1: Distribution of mangroves in Pangani District

