POWER RELATIONS BETWEEN UPSTREAM AND DOWNSTREAM COMMON POOL RESOURCE USERS: WINNERS AND LOSERS IN THE ULUGURU MOUNTAINS, MOROGORO, TANZANIA

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE DEGREE OF MASTERS OF SCIENCE IN FORESTRY OF THE SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2011

ABSTRACT

Forests and water are important Common Pool Resources (CPRs) in the Uluguru Mountains (UMs). Water connects socio-economic groups of different altitudinal zonation namely upstream and downstream with multiple uses and conflicting interests. Researches have been done on ecosystem value, CPRs depletions and the role of socio-economic incentives in biodiversity conservation but little is known about power relations underlying upstream and downstream CPRs users. This study therefore, was conducted with the objective of assessing power relations between upstream and downstream CPR users and mapping winners and losers under prevailing management regimes. The study was carried out in four villages, two in upstream (Ruvuma and Peko Misegese) and the other two in the downstream (Mafisa and Mlali). Qualitative and quantitative data were collected. Qualitative data were analyzed by means of content analysis technique. Descriptive and inferential statistical analyses were employed to analyze quantitative data. Social Network Analysis was used to analyse interactions of stakeholders. Forty four stakeholders were identified that are involved in the management and utilization of forest and water. The identified stakeholders fall into three categories namely regulators, facilitators and users. The study further identified three types of power: strategic, institutional and structural embedded in peoples' livelihood in both upstream and downstream. Strategic power was found to be dominant in the upstream while institutional power was dominant in the downstream. The study revealed conflictive power relation which created winners and losers, whereby upstream dwellers were the winners. Also the study revealed the existence of resource use conflicts that centred on power relations between upstream and downstream. Furthermore, the study identified existing formal and informal conflict resolution mechanisms. The study concludes that resource use conflicts in the Uluguru Mountains are consequence of power

imbalance between upstream and downstream communities. The study recommends the need of forming stakeholders' platforms and improving institutional arrangements.

DECLARATION

I, Numan Said Amanzi do hereby declare to the Senate of the Sokoine University of Agriculture that the work presented here is my own original work, and has neither been submitted nor being concurrently submitted for a higher degree at any other institution.

_____ _____

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The above declaration is confirmed

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ACKNOWLEDGEMENT

I am deeply indebted to Prof. G.C. Kajembe, my major professor and mentor, who has been a great source of inspiration and guided me through every stage of this work-from the formation of an idea to its fruition. Besides being an extraordinary academician, he is among the most wonderful human beings I've known and it has been marvellous experience learning from him. I am extremely grateful to Dr. G.E Mbeyale, my co supervisor who was always full of enthusiasm and interest in my work. Without his valuable advice, patient and painstaking efforts and his encouragement at every stage of this work, I would not have been able to achieve my objective.

I would like also to thank Prof. S.S. Madoffe, Prof. S. Iddi and all other lecturers in the Faculty of Forestry and Nature Conservation at Sokoine University of Agriculture (SUA) who were source of positive energy and encouragement during the writing process. I remain deeply indebted to the Valuing the Arc Project for financial support without which my studies at Sokoine University of Agriculture could have been impossible. I would like also to thank communities of Ruvuma, Mafisa, Mlali and Peko Misegese for their willingness to be interviewed and made the data collection possible.

My sincere gratitude goes to my parents: my father Mr. S.S. Amanzi and mother M. A. Mpimbita for their tireless encouragement throughout my studies. My beloved wife Mwamvita Y. Kisamile, my sisters, brothers and friends; your encouragement, prayers and moral support are appreciated. Thank you for your company.

DEDICATION

This work is dedicated to my parents, brother and sisters: My father Said Salum Amanzi, my mother Mayasa Abdallah Mpimbita, my brother Abdallah Said Amanzi and my sisters Saida and Sawabu Amanzi for laying a strong foundation on my education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND SYMBOLS

BI	Birdlife International
CBNRM	Community Based Natural Resources Management
CEPF	Critical Ecosystems Partnership Fund
CI	Conservation International
CMM	Chama cha Mazingira na Maendeleo
CMS	Community in Mafisa Street
CMV	Community in Mlali Village
CPRs	Common Pool Resources
CPV	Community in Peko Misegese village
CRS	Community in Ruvuma Street
DAIPESA	Development Alternative Inc.-Private Enterprise Support Activities
DED	District Executive Director
DLNREO	District Land, Natural Resources and Environmental Officer
DOF	Danish Ornithological Foundation
EAMCEF	Eastern Arc Mountains Conservation Endowment Fund
EPU	Extension and Publicity Unity
FAO	Food and Agriculture Organization of the United Nations
FBD	Forestry and Beekeeping Division
FGD	Focus Group Discussion
GEF	Global environment Facility
GN	Government Notice
IEA	International Energy Agency
IFAD	International Fund for Agriculture Development
IMF	International Monetary Fund
INGOs	International Non Government Organizations
IUCN	World Conservation Union
JEMA	Joint Environmental Management Action

LNGOs	Local Non Government Organizations
MDC	Mvomero District Council
MKIRS	Mlali Kipera Rice Irrigation scheme
MM	Morogoro Municipality
MNRT	Ministry of Natural Resources and Tourism
MOECO	Morogoro Environmental Conservation
MORUWASA	Morogoro Urban Water and Sewerage Authority
MoU	Memorandum of Understanding
MRCFP	Morogoro Region Catchment Forest Project
MRDCFP	Morogoro Rural District Catchment Forest Project
MRNRO	Morogoro Region Natural Resource Office
MWB	Mlali Water Board
MWCA	Morogoro Women Conservation Association
NGOs	Non Government Organizations
NORAD	Norwegian Agency for Development Cooperation
NSFT	Network of Small Farmers in Tanzania
NTFPs	Non Timber Forest Products
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Paper
SASUG	Southern Africa Sustainable Use Specialist Group
SNA	Social Network Analysis
SNAL	Sokoine National Agriculture Library
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
TAFORI	Tanzania Forestry Research Institute
TANU	Tanganyika African National Union
TCFN	Tanzanian Community Forestry Network

TFCG	Tanzania Forestry Conservation Group
TTSA	Tanzania Tree Seed Agency
TZS	Tanzania Shilling
UDSM	University of Dar es Salaam
UFR	Uluguru Forest Reserve
UMADEP	Uluguru Mountain Agriculture Development Project
Ums	Uluguru Mountains
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Foundation
UNR	Uluguru Nature Reserve
URT	United Republic of Tanzania
USAID	United States Agency for International Development
VEC	Village Environmental committee
VEO	Village Executive Officer
VG	Village Government
VNRC	Village Natural Resource Committee
VPO	Vice President Office
VRC	Village Reconciliation Committee
WRBWB	Wami Ruvu Basin Water Board
WRBWO	Wami Ruvu Basin Water Office
WRM	World Rainforest Movement
WUA	Water Users Association
WWF	World Wide Fund for Nature

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

1.1.1 An Overview on Common Pool Resources (CPRs)

The exploitation of Common Pool Resources (CPRs) is essential condition for human existence all over the world (Neiland, 2006). Throughout history, humans have manipulated CPRs to produce materials they needed to sustain growing human populations. CPRs provide food, fuel, fodder, herbs, construction materials and income to rural and urban dwellers across the world (Williams, 1998). In addition, most people across the world are relying on exploitation of CPRs for full time or part time employment (FAO, 2004).

Gopalakrishnan, (2005) defined CPRs as natural or man-made resources that are sufficiently large enough to make them costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from their use. The classic examples of natural CPRs include water, agricultural land, wet lands, grazing land, forests and fisheries. Man-made CPRs include communal irrigation schemes, communal fishing ponds and charco-dams (Msangi *et al.*, 2001). The property right of CPRs are held jointly by a group of individuals who form an identifiable community; the resources are subject to individual use but not to individual possession (Ostrom *et al*., 1994).

The CPRs shares two important characteristics: excludability and subtractability (Gardner *et al.*, 2000). The first attribute - difficulty of exclusion - arises from several factors including the cost of parcelling or fencing the resource and the cost of designing and enforcing property rights to control access to the resource. Under a market structure, the

high exclusion cost characteristic of common-pool resources enable free riders who would tend to benefit from the conservation efforts undertaken by other users without cutting down their own levels of consumption (Gopalakrishnan, 2005).

The second attribute, subtractability, creates rivalry between different users. The resource units (e.g. bundles of firewood or fodder) that one user extracts from a CPRs are not available to others. Each user is thus capable of subtracting from the benefits that others derive from CPRs (Williams, 1998). Subtractability of the resource has two effects; firstly, a user of the CPR subtracts a flow of benefits available to others and secondly, cumulative use of the resource by many users eventually subtracts from the total yield (Shekhar, 1998).

It is widely acknowledged that CPRs directly or indirectly provide livelihood to millions of poor people all over the world. It provides economic goods and services; in the development context they may have a primary function for much of the society. For rural societies, CPRs are considered as the most fundamental resources and are essential to generation of income, accumulate wealth and transfer the same between generations, and enabling them to lift themselves out of poverty (Bogale, 2006). However these functions are threatened by environmental degradation and over-exploitation of the resources.

In developing countries, millions of people depend on CPRs including forests, fisheries, rangelands, water and wetland for food, shelter, medicines and fuel and as means of income generation. For instance, the recent estimate by the International Energy Agency (IEA, 2002) revealed that around 2.4 billion people are still depending on fuel from forests as their main source of energy for domestic use. In addition, CPR is the means of

income generation of many people in developing countries. FAO (2004) reported that the fisheries sector employ more than 36 million people.

In Tanzania, CPRs specifically forest and water provides a vital contribution to the national economy and food security for many vulnerable societies. The CPRs also are considered as a key factor in the socio-economic development and the fight against poverty. The national poverty strategies in Tanzania recognise the heavy dependence of the poor Tanzanians on CPRs for income generation (URT, 1998; 2002a).

1.1.2 CPRs in the Uluguru Mountains

The Uluguru Mountains (UMs) and their forests are recognised as one of the world's biodiversity hotspots. The forests are important for both local communities living in and around them and international communities (Lulandala, 1998). The local people who depend directly on the forest resources are typically those living within 10 Km radius from the forests (Rodgers, 1993). Rural households in UMs frequently make use of forests for firewood, building poles, tool handles, medicine, food and honey from the forest on a more or less daily basis to maintain their livelihoods (Lulandala, 1998).

Apart from the production of wood and non wood forest products, UMs act as water towers and as ultimate source of water for most river systems which flow downstream. Rivers flowing downstream provide essential freshwater for agriculture, industrial use and for a rapidly growing urban population (MNRT, 2006). The rivers are considered as CPRs because of the difficult of exclusion and that consumption is subtractive in the sense that water available to upstream users is not simultaneously available to downstream users. Therefore, water scarcity in downstream, cause resource use conflicts with upstream users.

The need to regulate the use of CPRs in UM is growing because their availability and productivity is declining, while exploitation is becoming more intensive. Major causes are the expansion of banana farming in the mountains, increasing population pressure and increased commoditisation of production. Over use is a real risk and may result in degradation and loss of biodiversity (Nkombe, 2003). Eventually rural livelihoods are compromised, with the poorest suffering most because they tend to rely more on CPRs, having less access to alternatives. Women have to walk further to collect water and fuelwood, maybe even no longer finding clean and safe drinking water or the preferred tree species for firewood.

1.1.3 Institutions underlying the management of CPRs in UMs and power relations

Sustainability of CPRs can best be enhanced by restricting resource use through regulations. However, this requires clarity about decision making capacity over CPRs, as well as the presence of effective and respected institutions which oversee a fair application of rules, monitor results and propose changes. Institutions for CPRs management in UMs underwent dramatic changes during the 20th century, mainly as a result of colonisation of indigenous societies (Barrow *et al.*, 2002). Those changes were influenced by changing of policies and practices of pre and post colonial governments.

Before the arrival of Europeans, CPRs in UMs were traditionally managed using informal institutions. Traditionally, the *Waluguru* (inhabitants of UMs) social structure was organised according to clans and lineage groups that were led by groups of elders who made the decisions for the areas within their territorial jurisdiction, hence the significance of a particular clan's land holdings. During colonial times structures such as headmen (*Akidas*: German period) and chiefs (*Mndewa*: British period) were imposed by the colonial authorities (Hartley and Kaare, 2001). At that period, both customary and formal

institutions displayed power and influenced power relations at various degrees in the management of CPRs. Formal institutions displayed powers by the virtue of the state and formal rule of law, while the informal ones acquired power through customary influences and beliefs (Sokile *et al.*, 2005).

The German colonialists established the Forestry Department in 1909, the main activity of the department had been extraction of commercial timber for export, which was followed by the demarcation of forest reserves (Luoga *et al.*, 2005). The first forestry policy was adopted in 1953 by British administration and the first forestry ordinance was enacted in 1957 with the main thrust being the government's monopoly over forest resources. After independence in 1961, the Tanzanian government continued operating with the colonial forest policy although few amendments were made including abolishment of chiefdom (traditional leadership) in 1963 (Bukurura, 1995).

The abolishment of chiefdom system led to breakdown of customary institutions that were traditionally responsible for local resource management and forestland became state property under Forest Department. In this period, the whole country experienced severe deforestation (FBD, 2005). Government failure to manage forest resources properly was among others due to failure to recognise customary rights to land (MNRT, 2003). To overcome further degradation, the Tanzanian Government introduced co-management approach of CPRs termed as Community Based Natural Resource Management (CBNRM) with main objective of transferring management and decision making powers from state to local communities living adjacent to the resources (Pfliegner and Moshi, 2007). The introduced policies in management of CPRs and practices tend to shape power relations among forest and water resource users.

Rath (1997) defined power relations as what enables who to do what to whom, or more explicitly defined as the matrix of possible actors and their possible interactions. Taylor (1982) pointed out that, this is achieved through altering the incentives of others through rewards or threats of penalties. Power relations are not fixed or static, but rather negotiated over space and time, and depend on various factors in the local context (Cornwall, 2000). In many societies, power relations are embedded in social control, social hierarchy and roles given to some individuals in a given society (USAID, 2002).

Nuijten (2005) stated three categories of power which are embedded in people's livelihoods namely strategic, institutional and structural. In some cases, the three categories of power are closely linked and cannot be strictly speaking separated from each other. For example, technologies of government account for the systematization, stabilization and regulation of power relationships may lead to a state of domination. In the same way, 'individual power' is always part of wider institutions and structural processes. Questions of power in social-ecological governance include who controls the process, who ultimately decides, and who are the winners and losers (Carney, 1995).

These power relations influence the way communities are involved in the management and utilization of CPRs in UMs. This in turn leads to an increase in competition among resource users and contributes to the degradation of the natural resources and resource use conflicts (Beeler, 2005). Resource use conflicts arise mainly due to legal pluralistic situations (transformed customary and manipulated state institutions) and ambiguous access and use rights. The good example is the decline in quantity and quality of water that flow downstream due to excessive subtractions done by upstream communities (MNRT, 2003; Yanda and Munishi, 2007). This is considered as an important factor leading to resource use conflicts in UMs.

1.2 Problem Statement and Study Justification

1.2.1 Problem statement

For many years, Common Pool Resources namely forests and water in Uluguru Mountains (UMs) has become important not only to the people living in the mountains but also to other people outside the mountains. The forests in the mountains are the main water catchment for the people in Morogoro, part of the Pwani and Dar es Salaam regions. At the same time these resources make UMs commercially and nutritionally important for urban and rural communities in Morogoro and Dar es Salaam regions. The mountains supply substantial quantities of vegetables, fruits and spices.

Forest and water connects socio-economic groups of different altitudinal zonations namely upstream and downstream with multiple uses and sometimes conflicting interests. This is because in the upstream there are catchment forests that regulate water flow downstream. An inherent feature of the water system makes it difficult to exclude people who live in the downstream from the benefits of utilizing the resource. However, access and use of these resources among stakeholders in upstream and downstream differ in terms of distance from resource base, wealth and relationship to different institutions which are responsible for the regulation of the use of the resources.

In addition to difficult of exclusion, the consumption of water is subtractable. When upstream communities abstract water from rivers/streams for dry season production of vegetables and horticultural crops mainly for cash income (UMADEP, 2001), downstream users suffer from water shortages for agricultural, domestic and industrial sector development (MNRT, 2003). Dwindling of water resources in downstream creates competition which results into tension, power struggles and conflicts in particular, violent

conflicts between upstream and downstream. This situation has existed in UMs for many years.

Although much has been done in Uluguru Mountains in terms of research on ecosystem values (Burgess, 2001), CPRs depletions (MNRT, 2003) and the role of socio-economic incentives in biodiversity conservation (Lalika, 2007), little is known about power relations, specifically, between upstream and downstream CPR users and how they create winners and losers. Power relations often determine who may have access to forests and their products, who manage the water resources in the community, who decides which crops are planted and where. In addition, the existing mechanisms employed by local communities to resolve resource use conflicts in their respective area are scantly documented. Therefore, this study aimed to fill this knowledge gap.

1.2.2 Justification of the study

This study is important because, firstly, it is carried out at a time when there is increasing resource use conflicts as a result of resource scarcity particularly water resources between upstream and downstream users in UMs or farmers and pastoralist. Insufficient studies have been conducted to assess the influence of power relations in resource use conflicts. Therefore, this study aimed at uncovering underlying power relations between upstream and downstream CPRs users in UMs. This is due to the fact that power relations are important in policy processes by considering their role in mitigating resource use conflicts occurring as a result of power imbalance among resource users.

Secondly, the question of power relations has gained a stronger momentum as experience shows that many benefits of interventions such as Participatory Forest Management (PFM) tend to be accrued by the better-off and more powerful community members

(elite capture), even though they were intended for the larger community. Platteau and Gaspart (2005) observed that elite capture deflects a great proportion of community-based development. Therefore, the study aimed to uncover power relations among resources users in upstream and downstream of UMs in order to map winners and losers under current CPRs management regimes.

1.3 Objectives and Conceptual Framework

1.3.1 Overall objective

The overall objective of this study was to assess power relations between upstream and downstream CPR users specifically forest and water users and to establish mechanism for conflicts resolution.

1.3.2 Specific objectives:

(i) Identify key stakeholders in the management and utilization of forest and water resource, their interests and interactions.

(ii) Assess power relations between upstream and downstream resource users, factors influencing dominant power and how they create winners and losers.

(iii) Assess factors influencing resource use conflicts as the result of existing power imbalance.

(iv) Identify existing and potential mechanisms for conflicts resolution.

1.3.3 Research questions

(i) Who are the upstream and downstream stakeholders in forest and water resources utilization and management?

(ii) What are the roles of different stakeholders and their sources of power?

(iii) What are the existing power relations between upstream and downstream resource users?

(iv) Who are the winners and losers as result of existing power imbalance?

(v) What are the resource use conflicts arising as an outcome of power struggles?

(vi) What are the existing mechanisms for conflict resolution?

1.3.4 Conceptual framework

Fig. 1 shows the conceptual framework underlying power relations between upstream and downstream CPR users. The study considered CPRs namely forest and water as livelihood assets for people in both upstream and downstream of UMs. People living adjacent to forest resources (upstream dwellers) benefit from both forest and water resources for domestic and agricultural purposes. The water flowing in rivers or streams from upstream is used by downstream dwellers for domestic, industrial and agricultural purposes.

Due to inherent nature of CPRs that is subtractability, makes quantity of water that flows downstream to decline as water consumption increase in upstream. Different stakeholders being either regulators or facilitators are working hard to ensure sustainable flow of water throughout the year by investing in the conservation of forest resources in the upstream and water in the riparian zone.

Access and use of forest and water are determined by power held by resource users. Three categories of powers namely strategic, structural and institutional were assumed to play role on decision making in access and use resources for people in both upstream and downstream of UMs.

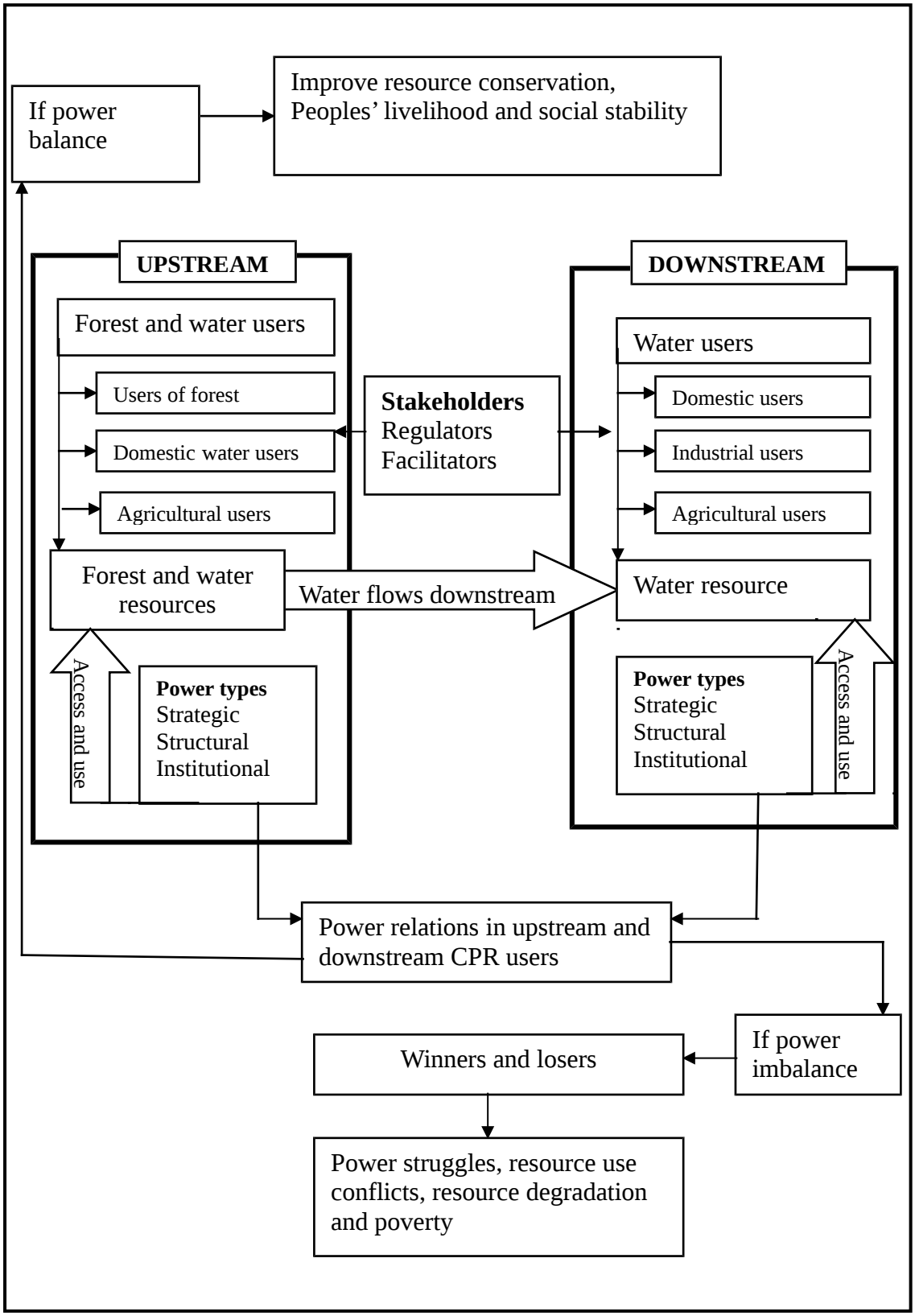

Figure 1: Conceptual framework of the study.

However, the difference in power type dominating upstream and downstream users may create individual or group of users who benefit more from the resources than others (winners and losers), this is because of extractability characteristic of the CPRs. Power imbalance between upstream and downstream resource users may result to resource use conflicts between upstream and downstream.

1.4 Limitations of the Study

1.4.1 Data recalling

During the study, a problem of data recalling was experienced, i.e. data collection depended on respondents' memory. As a result, there were notable difficulties for respondents to give correct account of some categories of data such as households' income. Manyika (2000) stressed that, information based on memory cannot be reliable but if no records exist, it may be the only way to get at least an idea of change. To overcome the limitation the same questions were asked during PRA and focused group discussions in order to triangulate information given by respondents.

1.4.2 Reluctance in disclosing information

Most heads of households especially in upstream villages/streets which were adjacent to forest reserves were reluctant to disclose their undertakings and income. The plausible reason for this could be the fear of bearing responsibilities if activities undertaken are illegal. This is supported by the fact that, respondents felt unease at the initial stages of the study by perceiving that the researcher was on investigation rather than research mission. After several visits and talk, respondents understood the motive and were willing to participate to the research.

1.4.3 Accessibility

Another limitation underlined the study was inaccessibility to the villages and sampled households due to mountainous nature of the area. This is mostly happened in Peko Misegese village in Mvomero district and Ruvuma Street in Morogoro Municipality. To overcome the limitation, few households were visited per day and therefore many days were spent to cover the study villages.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Common Pool Resources (CPRs)

Formally, the expression CPRs refer to a class of goods defined by two characteristics: difficulty excludability of potential beneficiaries and a high degree of subtractability (i.e. rivalry of consumption) (Ostrom *et al.*, 1994). CPRs differ from three other types of goods: (a) public goods, such as air, which share with CPRs the feature of difficulty excludability but also have low subtractability; (b) toll (or club) goods, such as toll roads, which have both low subtractability and excludability; and (c) private goods, such as most consumer products, which have high subtractability and easy excludability (Carpenter, 1998) (Table 1). This makes the management of CPRs characteristically complex.

Table 1: Types of goods

		Subtractability	
		Low	High
Exclusion	Difficulty	public goods e.g. air	common-pool resources e.g. forests, water, irrigation systems etc.
	Easy	toll or club goods e.g. toll roads	private goods e.g. doughnuts personal computers

Source: Ostrom and Hess (2001)

The CPRs including fish grounds, groundwater basins, public parks, forests are the resources from which access is not easily restricted compared to private and toll goods (Carpenter, 1998). Access to private goods and toll or club goods are easily controlled.

Private goods are controlled by the well-known institutions of private property. Access to toll or club goods is limited by the levying of tolls or the existence of membership restrictions. On the other hand, access to public goods sometimes called "free goods," such as air and water, or public information systems, including emergency radio broadcasts cannot easily be denied (Williams, 1998).

The boundary between public goods and CPRs is rather porous. This is due to subtractability characteristic. Public goods are considered low in subtractability. One person's use will not appreciably limit use by another. A CPR, on the other hand, is by definition high in subtractability, one person's use limits another's (Vinod *et al*., 2003). On common land, the grass eaten by animals of herder A is unavailable for animals of herder B.

The commons are strictly speaking public goods. It is when the commons are appropriated by many users that they become unequivocally CPRs. Difficulty of exclusion, combined with high subtractability, can lead to the CPR dilemma which Hardin calls the "tragedy of the commons" (Hardin, 1977). The tragedy of the commons has direct implications for any commonly-held resource being utilized by the motive of personal gain. For example, the collapse (or near collapse) of once-great fishery and whale populations was due to direct consequence of over-exploitation brought about by the world's maritime nations treating the ocean as a common (Hardin, 1977) and the rainforest in South America are threatened because they, too, are treated as commons. CPRs are therefore, potentially subject to congestion, depletion, or degradation, i.e. pushed beyond the limits of sustainable yields. The CPRs are threatened to tragedy due to the fact that the resources are potential livelihood assets for the majority of people across the world (Williams, 1998).

2.2 Global Concern on the Uses of CPRs

According to the Southern Africa Sustainable Use Specialist Group (SASUSG) (1998) "Use is the derivation of benefit (tangible or intangible) in one or more of the following aspects of economic or financial; social or cultural; political; ecological (productivity, stability and biodiversity)". This definition essentially equates use with value and avoids the implication that so-called "non-use" does not carry costs. The common pool resource has both environmental service functions, subsistence and exchange values (Murphree and Mazambani, 2002). The resources provide food, fuel, fodder, herbs, construction materials and income to rural populations all over the world.

Almost all rural populations worldwide and many urban people are CPR users in one way or another (IFAD, 1995). The extent of use varies depending on the type of CPRs. FAO (1997) reported that about 40% of people worldwide rely on forests for fuel as their main or sole source of domestic energy for cooking and heating. The use of 3 million cubic metres of wood for fuel in Bangkok, Thailand were reported (FAO, 1997). In the Sahel, a sparsely populated region, areas surrounding small and medium centres of population, reported the requirements of 130 000 tons of wood annually; this led the extension of deforestation as far away as 100 km.

Furthermore, global freshwater consumption estimated to be 69% for agriculture, 23% for industry and 8% for domestic use. Current global freshwater withdrawals for irrigation are estimated to be between 2000 and 2555 m^3/year. Water withdrawals for industry vary with the level of development. Generally speaking, global withdrawals for industries accounts for 22% of total water use. Most water is used in the developed countries compared to developing countries. For example, high income countries withdrawals 59% of total water use compared to 8% in low income countries (UN, 1997).

2.2.1 CPR use in Africa

For rural poor communities in Africa, subsistence uses of the CPRs are widely seen as critical to poverty alleviation and for their survival. CPRs including rangeland, forests, inland waterways, seasonal ponds and low-lying wetlands are useful to a diverse set of users. They provide food, fuel, fodder, herbs, construction materials and income to rural and urban dwellers across the region. The collection of leaves, fruits and twigs from forests has long been a method of assuring household subsistence during droughts and in resolving imbalances in the diets of rural households (Murphree and Mazambani, 2002).

2.2.2 CPR use in Tanzania

Tanzania is rich in common pool resources ranging from forest and aquatic resources, all of which are important to local people, conservationists and the national economy at large. For the case of forest resources, the country boasts a vast array of forests, with much of it being endemic and is home to numerous species (Wong *et al*., 2005). In addition, Africa's richest and most diverse flora is found in Tanzania in the Zambezian regional centre of endemism (Tanzania Vice President's Office, 2001). Furthermore, wetland resources cover about 10% of the country's total surface and are home to a multitude of aquatic flora and fauna (Tanzania Vice President's Office, 2001).

The forest resources of Tanzania are of great importance to Tanzanian people in many aspects. The use of fuel wood is estimated to cover more than 90% of the total energy consumption in a country. Other products obtained from the forests include timber for furniture and poles as building materials, NTFPs such as edible plants, animals, honey, fungi and herbs and bark with medicinal properties. In addition, the forests provide the nourishment for most livestock; cows and goats are herded into forest areas to graze and

browse. Furthermore, forests play great role in protection of areas for water catchment and soil protection purposes and are the major source of rivers (URT, 1998).

Tanzania has nine river basins or hydrological zones: Pangani, Wami/Ruvu, Rufiji, Ruvuma and Southern Coast, all of which drain into the Indian Ocean, and Lake Nyasa, Lake Rukwa, Lake Tanganyika, Lake Victoria, and the internal drainage basins of Lake Eyasi, Manyara and Bubu depression (URT, 2002a). Tanzania's freshwater systems in the form of lakes cover approximately 60 000 square kilometres (URT, 2002b) and include about 50 lakes. The national annual renewable water resources are 89 km^3 or 2700 m^3/person/year.

Young (2005) pointed out five types of water-related economic values that include commodity benefits, aesthetic and recreational benefits, waste assimilation benefits and dis-benefits. Currently, many people in Tanzania especially those living around river valleys are benefiting from irrigated and non-irrigated agriculture land for food and cash crops, livestock production and water for domestic consumption (URT, 2002b). Irrigation potential in the country is estimated to be one million hectares of which only about 150 000 hectares are under irrigation. Eighty percent of the irrigated area is under traditional irrigation schemes with low level water use efficiencies. The remaining 20% are large scale irrigation schemes owned by public and private institutions and individuals (URT, 2002b; Kangalawe and Liwenga, 2004). In the Pangani basin, for example, irrigated food crops include bananas, beans and maize, and irrigated cash crops are flowers, rice and coffee. Irrigation is a highly consumptive water user and makes greatest impact on net water resources in Tanzania (URT, 2002b).

2.3 Governance of CPRs

CPRs are natural or man-made resources characterized by non-trivial exclusion and subtractable yield. Individuals dealing with such resources are presumably trapped into social dilemmas that lead to tragedies (Hardin, 1977). Ever since the proposed ideas on “Commons” and their governance complexities resulting into “tragedies” (Hardin, 1977) were put forth, the issue of governing such resources to avoid tragedies has become an arena of international concern. The latter years have witnessed a debating and discussion groups of academicians addressing the epistemological dilemma shared along with “tragedies” metaphor and “human mediators”.

Hardin’s pessimistic notion of “Commons” was scrutinized under the conceptual difference between resource types and property rights governing their use. The “tragedy” parable uses the term “Commons” to mean everybody’s and therefore, nobody’s property. But, in fact, resources managed as common properties are not necessarily open access resources but are “property in common”, in which property rights are assigned to a community or a social group where the rules of appropriation of resources are assumed to be safeguarded by the entitled community. In addition, social cohesion and feeling of community comprise strong ties of ethical principles, social duties and responsibilities (McCay and Jentoft, 1998) that bring forth collective action and avoid tragedies.

Grafton (2000) illustrated three property regimes for CPRs, these include private rights-based, community rights-based and state rights based property regimes. Private rights-based property regimes use market prices for access and harvesting rights over the flow or yield from CPRs to provide signals and incentives to resource users that reflect the scarcity values of resources. Community rights-based property regimes affect behaviour by using social norms and reciprocity to help ensure that individuals behave in the

interests of the identified community. State rights based property regimes use a rules-based approach to affect individual behaviour. A review of the merits of these three broad classifications of property rights for CPRs is important to understanding what role the state should play in governing the commons.

2.4 The Property Pights Over CPRs

2.4.1 Conceptualizing property rights in CPRs

USAID (2009) pointed out that the terms “tenure” and “property” are often used interchangeably while rights are generally associated with responsibilities. Understood broadly, “tenure rights” over natural resources are synonymous with “property rights.” In its most basic form, the definition of a “property right” is visualized as “a defensible claim to a particular place or thing.” To know who has tenure over a natural resource is to identify who owns the resource, who can use or extract it, who can exclude others from having access to it, and who benefits from exploiting it.

Legally, tenure is a bundle of both rights and obligations; the rights to own, hold, manage, transfer, or exploit resources, but also the obligation not to use these in a way that harms others. In other words, tenure defines property and what a person or group can do with it - their property rights (Ribot, 2002). However, tenure is not only a legal concept but a complex social institution, often involving traditional practices and customary authorities’ as much as formal laws. It governs ownership and access to CPRs, which are the gateways to use and benefit from these resources. These definitions illustrate that there are two basic components to tenure security, the particular “bundle of rights” and the matter of whether those rights are transferable, defensible or secure (Ribot, 2004).

The property rights include both formal (*de jure)* and informal (*de facto*) arrangements. *De jure* rights are those rights explicitly recognized and enforced by governments formally or legally recognized. Holders of *de jure* rights can presume that if their rights are challenged in an administrative or judicial setting, they would probably be sustained. *De facto* rights occur in situations where resource users cooperate to define and enforce rights among themselves. They are *de facto* so long as they are not recognized by government authorities but legitimized by the users themselves. Users who have developed *de facto* rights often act as if they had developed *de jure* rights among themselves. Depending on jurisdiction, d*e facto* rights may be recognized in courts of law but are less secure than *de jure* rights (USAID, 2009).

A number of elements that encompasses property rights in natural resources have been identified by different scholars (USAID, 2009). These include:

- *Use right:* The right to derive benefit from the asset. It including *access* (to enter the resource domain, e.g. the right to cross a piece of land, go into a forest or canal) and *withdrawal* (to remove something, e.g. to take a pot of water, some kindling, fodder, or fish);
- *Management right:* The right to decide who shall be permitted to use the asset and under which conditions;
- *Income right:* The right to derive income from the use of the resource;
- *Capital right:* The right to consume destroy and transform the asset;
- *Transfer right:* the right to sell give away or bequeath the asset and
- *Control right:* including *management* (to modify or transform the resource, e.g. by planting trees or shrubs, enlarging a canal, or restricting what can be

harvested), *exclusion* (to determine who else may use the resource), and *alienation* (to transfer rights to others, either by inheritance, sale, or gift).

2.4.2 Importance of property rights in natural resource management

The property rights systems provide important analytical leverage for understanding the complexity and flexibility to manoeuvre in the use of natural resources which is essential to understanding or comparison of likely outcomes of alternative arrangements in natural resource management. Most scholars (Baden and Stroup, 2007) identify four types of property rights regimes:

- State property regimes where a state has use and control of resources, commonly referred to as public;
- Common property regimes where a group of people or users has use and control of resources;
- Private (individual or corporate individuals or companies) property regimes where individuals have use and control of resources (and their entitlements are protected by the state) and
- Open access regimes where no person or entity has use and control (which might be the consequence of a negligence of state or the prohibitively high costs of establishing one of the three regimes above).

2.4.3 Analysis of property regimes of forest and water resources in Tanzania

2.4.3.1 Forest resources

Forest resources in Tanzania mainland comprise forests, woodlands or woody savannah. In order to fully understand the property rights of forest resources in Tanzania, it is important to understand the basic land tenure systems. The legal basis for land tenure in Tanzania is derived from two basic laws that were passed in 1999. The Land Act No.4

and the Village Land Act No.5 of 1999 stated that all land in Tanzania is public land, which the President holds in trust for all the citizens (URT, 1999).

These two laws have the overall objective of formalizing and legalizing traditional and customary land tenure arrangements. Tanzania recognizes three categories of land: (a) Reserved land - land set aside by central government for purposes of nature conservation under wildlife or forestry laws; (b) Village land - includes land within the boundaries of registered villages and (c) General land - land that is neither reserved nor village land. General land is managed by the commissioner of lands, on behalf of the central government (URT, 1999). For the land set aside for conservation purposes under forestry laws; the Forest Act of 2002 recognizes four categories of forests in Tanzania (URT, 2002a):

- National forest reserves which consist of Forest Reserves, Nature Reserves and Forests on general land;
- Local authority forest reserves consist of Local authority Forest Reserves and Forests on general land;
- Village forests which consist of Village land forest reserves, Community forest reserves created out of village forests and Forests which are not reserved which are on village land and of which the management is vested in the village and
- Private forests are Forests on village land held by one or more individuals under a customary right of occupancy and forests on general or village land of which the rights of occupancy or a lease has been granted to a person or persons or a partnership or a corporate body or a Non-Governmental Organisation or any other body or organisation for the purpose of managing the forest which is required to be carried out in accordance with Forest Act Number 14 of 2002.

2.4.3.2 Water resources

Since the UN Water Conference held in Mar del Plata, Argentina in 1977, various international meetings on water resources and the environment have developed common understanding on how water resources should be managed. The international understandings of broad policy principles arising out of recent international conferences; including the Dublin Statement on water and sustainable development in 1992 and United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 (Agenda 21, Chapter 18) are as follows (URT, 2002b):

- Fresh water is a finite and vulnerable resource, which is essential to sustain life, development and the environment;
- Water management and development should be based on a participatory approach, involving users, planners, and policy makers;
- Women play central role in the use, management and protection of water resources and thus should be involved fully in the decision making process and
- Water has a value in all its competing uses.

Based on the international principles, water in Tanzania is considered as CPR and the policy objective is to have in place fair and equal procedures in access to and allocation of water resources. This is because water is a basic natural resource. Many social and economic activities rely heavily on availability of adequate supply of fresh water. As a source of natural capital, water in adequate quantity and quality is a primary input for a whole array of productive activities (URT, 2002b). Tanzania put in place laws and regulations to ensure that every citizen has an equal right to access and use of the nation's

natural water resources for his/her benefits and for the national benefit in general (URT, 2002b).

2.4.4 Evolution of property regimes of forest and water resources in Tanzania

2.4.4.1 Forest resources

Before CBNRM surfaced in formal nature conservation discussions, the concept and its practices existed in Africa informally through various traditional systems (Fabricius, 2004). Traditionally, people relied heavily on natural resources. As a result, they established their own customary governance and regulatory systems based on their traditional knowledge and belief systems. These customary regulations were integrated with various coping strategies such as establishment of sacred groves and prohibited from use of forests and wildlife species which were under common property regimes to prevent over-usage of resources associated with population density (Fabricius, 2004).

Starting from the early 1920s, many of the policy makers of the colonial administration began to realize that natural resources are being exploited at an alarming rate. So a new strategy of setting aside vast tracts of land and putting them under state property regime for protection as parks or forest/game reserves was introduced with dual purposes of preserving wild places and animals and controlling the movements of people (King, 2007). In Tanzania, the conservation efforts started during the German periods whereby several game and forest reserves were declared.

At the time of independence the legal status of land resources were categorized as follows: (a) Forest Reserves, (b) Native Authority Forests, (c) Game Reserves, (d) National Parks and (e) Public Lands. Today forest resources are under the following categories; (a) National forests reserves (forest reserves; nature forests reserves; and

forests on general land), (b) Local authority forests reserve (local authority forest reserves; forests on general land), (c) Village forests (village land forest reserves, community forest reserves and forests which are not reserved and (d) private forests (forests on village land and forests on general or village land) (URT, 2002a).

The Catchment Forest Reserves on UMs are under control of the Forest and Beekeeping Division (FBD), while other patches of Forest Reserves are under Local Authorities of Morogoro rural and Mvomero Districts (MNRT, 2003). This two tier control of the forests has resulted into a two tier conservation efforts, with the District Forest Officer having reduced capabilities that have further decreased over time, while the Catchment Forest Reserves are better managed due to their link to the Forest and Beekeeping Division (Hartley and Kaare, 2001). The ineffectiveness of market and administrative structures in managing large forest reserves has led to an interest in the role of local communities in the management of natural resources.

Since the 1990s, there has been a slow shift towards the concept of Participatory Forest Management (PFM) in Tanzania to overcome the free rider problem (Blomley and Ramadhan, 2007). The PFM in UMs is an endeavour to conserve the forest resources through joint efforts of local fringe villages and the Forestry and Beekeeping Division and Local Government Authorities. The Joint Forest Management (JFM) initiatives have already started in some villages of Uluguru North forest reserves in collaboration with the forest departments, international agencies and Uluguru Biodiversity Conservation Project under Wildlife Conservation Society of Tanzania (WCST) (Pfliegner and Moshi, 2007).

2.4.4.2 Water resources

UMs are rich in freshwater which are a basic natural resource that sustains life and provides for various social and economic needs (URT, 2002b). The social and economic circumstances prevailing today have made particular demands upon the available water and the environment, and its sustainability is threatened by human induced activities. Over the past 15 years these demands have intensified with the increase in population and concurrent growth of economic activities requiring water as an input in irrigated agriculture, industries, tourism, mining, livestock keeping, domestic, fisheries, wildlife and forestry activities etc (URT, 2002b; Fisher *et al*., 2010).

Water scarcity is perceived by both upstream and downstream dwellers of UMs due to unreliable rainfall, multiplicity of competing uses, degradation of sources and catchments. Water scarcity threatens food security, energy production and environmental integrity and consequently there are water use conflicts between users (URT, 2002b). There are also increasing challenges of managing water resources especially multiple trans-boundary water courses. Inadequate regulations to monitor water resources management has led to underutilization of the resources and in some places over exploitation and interference in the existing water sources (URT, 2002b).

The management of water resources in UMs is under Wami/Ruvu River Basin Water Office (WRBWO) (URT, 2002b). This is after Tanzania adopting a River Basin Management Approach for water resource management in 1980s when the country was divided into 9 basins through Act No.10 of 1981, which was an amendment of the Principal Act No. 42 of 1974 (Kulindwa, 2005). The WRBWO was established in 2002 under Water Utilization (Control and Regulation) Act No. 42 of 1974 and the water office is supervised by the Wami/Ruvu Basin Water Board (WRBWB). However, the Water

Utilization Act and other sub-sector water related laws are inadequate to meet the growing water resources management challenges facing the country today.

In addressing water resource management challenges, the new National Water Policy (2002) and the new Water Resources Management Act No. 11 of 2009 recommended for the continuation of Water Users Associations (WUAs) as formal institutions at local level (URT, 2002b; 2009a). The WUAs formed by the agreement of the majority of a group of water users for one or a combination of the following purposes: (a) manage, distribute and conserve water from a source used jointly by the members of the WUAs; (b) acquire and operate any water use permit; (c) resolve conflicts between members of the association related to the joint use of a water resource; (d) collect water user fees on behalf of the Basin Water Board; and (e) represent the special interests and values arising from water used for a public purpose, such as in an environmental or conservation area, or for the purpose of managing a Groundwater Controlled Area (URT, 2009a).

Furthermore, national water policy (2002) emphasized on the need of integrated water resources management in order to ensure that water does not become a constraint to national development. The existing approach is sector oriented and does not fully recognize the multi-sectoral linkages in planning the use of water resources (URT, 2002b). This is based on a regional development and does not focus on institutional capacity to manage water resources. It is oriented more towards the development of the water resources and not on the protection or management of the water sources, and is based on regulation as a primary instrument for implementing the water policy (Kangalawe and Liwenga, 2004).

The integrated approach addresses participatory, multi-sectoral, multidisciplinary river basin management, which, recognizes that water is a scarce resource and integrates the linkage between land use and water use and recognizes the important role of water ecosystems that play in the national economy. Basically, the new approach reflects three major shifts (URT, 2002b):

(i) Comprehensiveness: A holistic basin approach for integrating multi-sector and multi-objective planning and management that minimizes the effects of externalities, and ensures sustainability and protection of the resource;

(ii) Subsidiarity: decentralizing decision making and devolving to the lowest practicable level, with stakeholders participating in the planning, design, implementation of the management actions and decision making and

(iii) Economic: decision making in the public sector, private sector and in civil society on the use of water should reflect the scarcity, value of water, water pricing, cost sharing, and other incentives for promoting the rational use of water.

2.5 CPR Stakeholders

2.5.1 Conceptualizing stakeholders in CPRs

Stakeholders are defined as those social sectors who have direct, significant and specific stake in a given territory or set of natural resources. They can be groups of people, organisations, institutions and sometimes even individuals. The “stake” or interests involved may derived from a variety of sources; livelihood dependence, cultural and historical association, economic interest, institutional mandate, value commitment and political interest are among the most important factors (Murphree and Mazambani, 2002). Other terms sometimes used in a similar way to refer stakeholders are “actors” and “interest groups” (Krishnarayan, 1998).

The word “actors” stresses that stakeholders are active and interact with each other. The use of the words “interest groups” indicates that people can be grouped according to a common interest (Krishnarayan, 1998). Stakeholders include all those who affect and are affected by policies, decisions or actions within a particular system. Stakeholders are sub-divided into primary stakeholders, those who directly benefit or sustain a loss as a result of an intervention, and secondary stakeholders, those who indirectly benefit or loose (Hartley and Kaare, 2001; Murphree and Mazambani, 2002).

Stakeholders can be at any level or position in society that includes international actors (including foreign governments; bilateral and multilateral aid agencies or agencies of international conventions and protocols); international and national academic, research and consultancy “community” and government ministry or department. Others are national NGOs; national and international private sector enterprises; District Councils; Wards and Village Assemblies; Traditional Authority Structures; Local Self-interest Organisations (including co-operatives and religious groupings and categories of local socio-economic status comprised of households or individuals differentiated by gender, economic status, education and age (Murphree and Mazambani, 2002).

None of these categories of stakeholders operate in isolation; indeed they interact. In the past, many conservation initiatives fail because they paid inadequate attention to the interests and characteristics of stakeholders (Grimble and Wellard, 1997). As a consequence, stakeholder analysis has gained increasing attention and is now integral to many participatory natural resource management initiatives (Mushove and Vogel, 2005). However, there are a number of important limitations to current methods for stakeholder

analysis. For example, stakeholders are usually identified and categorized through a subjective assessment of their relative power, influence and legitimacy (Frooman, 1999).

Although a wide variety of categorization schemes have emerged from the literature (such as primary and secondary (Clarkson, 1995) actors and those acted upon, strategic and moral and generic and specific methods have often overlooked the role of communication networks can play in categorizing and understanding stakeholder relationships. Social Network Analysis (SNA) offers one solution to these limitations. Natural resource applications of SNA are just beginning to emerge, and so far have focused on understanding characteristics of social networks that increase the likelihood of collective action and successful natural resource management (Bodin *et al*., 2006).

2.5.2 Social network analysis

Social networks are comprised of actors (also referred to as ‘nodes’) who are tied to one another through socially meaningful relations. These relations can then be analysed for structural patterns that emerge among these actors. Thus, an analyst of social networks looks beyond attributes of individuals to also examine the relations among actors, how actors are positioned within a network, and how relations are structured into overall network patterns (Wellman and Gulia, 1999; Wellman and Frank, 2001).

Both the social network and resource management literature discuss ways in which networks influence individual actors and groups. For example, research on the strength of ties between actors shows how strong versus weak ties relate to different kinds of outcomes. Strong ties are ones where actors share an emotionally intense relationship with one another and/or communicate frequently with one another. Actors sharing a strong tie tend to: (i) influence one another more than those sharing a weak tie; (ii) share

similar views; (iii) offer one another emotional support and help in times of emergency; (iv) communicate effectively regarding complex information and tasks; and (v) be more likely to trust one another (Schneider *et al*., 2003; Bodin and Crona, 2006).

The advantages of strong ties for resource management are obvious: stakeholders with strong ties are more likely to influence one another, and thus, creating strong ties among diverse stakeholders can, enhance mutual learning and the sharing of resources and advice (Bodin and Crona, 2006; Newman and Dale, 2007). Benefits of strong ties may be countered, however, by the redundancy of information that typically runs through such ties as stakeholders who have shared a strong tie for a long period of time tend to have the same information and knowledge regarding resource management.

Bodin and Crona (2006) argued that for better understanding of how social networks affect natural resource governance processes, one needs to start by acknowledging some key characteristics which differentiate social networks. First, the pattern of relations will differ depending on which network is in focus, i.e. depending on the type of relations involved. These different patterns of relational ties referred as structural characteristics of networks, and the effect they have on social processes include knowledge transfer, information sharing, consensus building and power relations.

2.6 Power Relations in the Management of CPRs

2.6.1 Power relations embedded in CPRs management

Rath (1997) defined power relations as what enables who to do what to whom. In the analysis of political processes the concept of “power” has always played a great role (Schiffer, 2007). Power is one characteristic structuring the interactions of groups of people. It is a social construct that only materializes in the interaction of people. Thus, power is relative; it characterizes relationships between individuals or groups. It is not a

fixed characteristic of a person (or organization) thus it cannot be said that one individual has a certain absolute “amount” of power. The power of one actor is assessed by finding out how strong or weak this actor is in relation to others within a certain social setting and concerning the achievement of a certain set of goals (Schiffer, 2007).

To cater for this fluent nature of power, some scholars have developed concepts of domains of empowerment or spheres of power. This takes into account that one person or organization can be very powerful in a certain sphere and not so in another. For example a male office clerk might be rather powerless in his work environment (as compared to his colleagues and superiors) but exercise a great deal of power back home in the family setting when it comes to decisions on household spending (Schiffer, 2007).

Power is not measurable in absolute terms and might differ in different spheres, furthermore it evades *direct* measurement. The different approaches to “measuring” power empirically rely on indicators that reflect the power of actors. The probably most common single indicator for power relations between actors are the distributions of material resources (Platteau and Gaspart, 2005). For example an indicator for the power of different government departments could be the size of their budget in relation to the whole budget. Indicators for bargaining power within a developing country household could be the observable results: the things different household members have bargained for successfully (Agarwal, 1997).

Existing power relations are often mentioned as a hindrance to effective, sustainable and equitable natural resource management or, on the other hand, as something to be taken into account, changed or encouraged (Nuijten, 2005). The aim to change existing power configurations becomes particularly clear in the notion of ‘empowerment’, in which

power is perceived as a ‘property’ that persons or groups can ‘possess’ and consequently ‘enlarge’ (Nuijten, 2005). This notion of power is also reflected in the many stakeholder approaches that (implicitly) assume that people or groups can be attributed more or less fixed interests and levels of power. Yet, this ‘property-notion’ of power ignores the fundamental fact that power is always ‘relational’ and the result of the working of multiple, intertwined institutions (Nuijten, 2005).

With reference to the analysis of power relations by Lemke (2003), three categories of power relations embedded in people’s livelihood are available including strategic power, structural power and institutional power as discussed here under.

2.6.2 Strategic power

This refers to a ubiquitous feature of human interaction, insofar as it signifies structuring possible fields of action of others. This can take many forms, e.g. ideological manipulation or rational argumentation, moral advice or economic exploitation. Strategic power can be perceived in many daily interactions between people and groups.

There is a general agreement among scholars of common property regime that socio economic heterogeneity increases power imbalance and decreases cooperation in CPR management at a local community level (Kopelman *et al*., 2002). In such a situation, strategic power is observed where power is derived from ones’ endowments and entitlements. Parallel to this, Mbeyale (2009) found that the relative wealth and formal education are the main sources of strategic power in mountains and lowlands of Pangani River Basin. Furthermore, Mbeyale (2009) found the use of strategic power in land acquisitions.

2.6.3 Structural or domination power

This is refers to a particular type of power relationship that is stable, hierarchical, fixed and difficult to reverse. Domination refers to those asymmetrical relationships of power in which the subordinated persons have little room for manoeuvring because their margin of liberty is extremely limited. Mbeyale (2009) found that social position of the household head; age and gender are the main sources of structural power. Trends of household labour, land ownership, access to water and forest resources and distribution of resources in mountains and lowland of Pangani river basin are mobilized trough structural power relations.

2.6.4 Institutional or government power

Refers to regulated and more or less systematized mode of power, this is the exercising of power through discursive rituals and administrative practices or regulation of conduct by rational application of appropriate procedures.

2.7 Institutions in Managing CPRs

An institution can be defined as a set of formal and informal rules, including their enforcement arrangements. The purpose of an institution is to steer individual behaviour in a particular direction. Insofar as it is successful in realizing this objective, an institution provides structure to everyday activity and thus reduces uncertainty. Ostrom (1990) defines an institution as a set of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules are used, what procedure must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals depending on their actions. All rules contain prescriptions that forbid, permit, or require some actions or

outcomes. Working rules are those actually used, monitored, and enforced when individuals make choices about the actions they will take.

Since CPR have long been subjected to overexploitation and misuse by individuals acting in their own best interests as described in three dominant models - the tragedy of the commons (Hardin, 1977), the prisoners' dilemma (Dawes,1975), and the logic of collective action (Olson, 1965), conventional solutions typically involve either centralized governmental regulation or privatization of the resource. But, according to (1990) there is a third approach to resolving the problem of the commons: the design of durable cooperative institutions that are organized and governed by the resource users themselves. These institutions in CPR management can either be formal or informal.

There are clear distinctions between informal and formal institutions. Kasper and Streit (1998) classify institutions as internal and external institutions. Internal institutions are rules evolved within in the light of experience and external institutions are rules designed externally and imposed on society from above by political action. They distinguish four categories of internal institutions including conventions, internalized rules, customs and manners and formalized internal rules; and describe further the different ways on how these compositions constrain people to comply with the rules. Furthermore, they denote internal institutions derived within peoples' experience and practice gradually which later become culture for every member of a society.

2.7.1 Culture of the Luguru and acquisition of property rights

Traditionally the *Waluguru* are a matrilineal society meaning that kinship, inheritance and decision-making are all defined through a female (or mother) line (van Donge, 1993). An important aspect of matrilineality is that women have a higher status when compared

with women from patrilineal groups, although their influence is typically expressed through their male relatives (father, uncles, brothers and sons) rather than directly. In many Uluguru villages it has also been common for matrilocality to be practised in conjunction with the matrilineal kinship system: matrilocality involves the husband moving to live with his wife and in-laws on land owned by the wife's clan (van Donge, 1993).

Matrilocality is relatively unusual occurring only when women's labour is central to the economy. It strengthens the position of women within the village while placing men under pressure because they are living among in-laws; it can result in men being placed in an insecure position within the village. There is evidence now that matrilineality is breaking down in some Uluguru villages and there are increasing reports of patrilineal land inheritance or of both matrilineal and patrilineal inheritance being practised side by side (van Donge, 1993). In general, three factors appear to pushing *Waluguru* inheritance patterns towards inheritance through the father's line. This includes:

- The role of the village government in allocating land in post-colonial Tanzania following *Ujama;*
- Islamic religious influence and
- The extent to which a settlement has become cosmopolitan and influenced by economic factors and the extent to which individuals use the courts, which have tended to be arbitrary in their rulings, to settle land disputes.

2.7.2 Institutional arrangement and power structures in management of CPRs in UMs

Institutional arrangements and governance structures are mechanisms to co-ordinate economic and social activities. Important contributions in the recent literature on

questions about institutional arrangements focus on hierarchies, which are based on authority. Hierarchy involves the capacity to supervise and control, including the right to make decisions (Slangen, 2001). Community organizations cannot operate exclusively through command: they also require cooperation by their members. Such co-operation involves their commitment to specific goals, their willingness to endorse or transform existing routines, and their responsiveness to incentives deliberately designed to maintain or improve their participation.

Important basic elements of these relationships are motivation, trust and commitment among the community members who work towards a common goal. With repeated interaction they promote solidarity, consensus, trust, and common values and norms in a group (Haller, 2002). These norms can be considered as implicit social contracts to cooperate, are self enforcing and embedded in customs and rituals, and result from repeated interactions. If households are not extremely constrained by resource scarcity and their survival is not threatened, they tend to abide by these norms. This, of course, diminishes the incidence of opportunistic behavior between the members of the community.

Social structures in Uluguru Mountains before arrival of Germany in Tanganyika was organised according to clans and lineage groups that were led by groups of elders who made the decisions for the areas within their territorial jurisdiction, hence the significance of a particular clan's land holdings (van Donge, 1993). Essentially, the *Luguru* society has many loci of power and while an individual can become eminent in his own locality he is unlikely to be recognised elsewhere in the Ulugurus. The position of the Kingalu is a good example for Kingalu is recognised in the villages around North Uluguru and his home settlement of Kinole, but not recognised in the villagers around the South Uluguru

(Hartley and Kaare, 2001). During colonial times, local traditional institutions were getting weaker as the colonial government introduced indirect rule in Tanganyika.

After introduction of indirect rule, traditional institutions were still in place but abolished by the independent government during the introduction of *Ujamaa* policy (lit. “Pulling together”) in 1963 (Bukurura, 1995). Abolishment of chiefdom systems and introduction of *Ujamaa* villages affected political systems of the *lugurus* and management of the CPRs drastically (Luoga *et al*., 2005). Local ethno-professional groups stopped to exist in the same way as before because the government declared all Tanzanians and the ethnical boundaries dismantled and consolidated into state villages. The traditional rules and regulations were restructured and replaced by state institutions supported by formal government laws (Bukurura, 1995).

The management of common pool resources, which were linked to local culture and beliefs were gradually eroded and disappeared in some areas. The dismantling of these institutions and their replacement with state institutions took place in 1963 (Bukurura, 1995). Mwl. J. K. Nyerere, the former President of the Republic of Tanzania introduced *Ujamaa* as a means of development and unity in Tanzania. The implementation of *Ujamaa* policies weakened the traditional institutions in the following ways: The traditional leadership was abolished and new village governments were introduced and all the scattered hamlets were consolidated to *Ujamaa* villages. Despite ethnic differences, people were mixed together (Bukurura, 1995).

The powers of the local leaders were reduced and their positions in administration were scrapped and taken by the village government representatives at the local level. The tasks and duties of the former leaders were declared illegal and traditional courts at the local

level were closed (Bukukura, 1995). The “Ujamaa” policies gave the President the power to control land and all the CPRs in the entire country. The customary ownership of land was transferred to the office of the President, who became the trustee of land in the whole country. The traditional boundaries were no longer reorganised and all Tanzanians were allowed to move to any part of the country as they wished, irrespective of their locality (Abrahams and Bukurura, 1993).

The dismantling of the traditional institutions paved way to open access in common pool resources in the UMs as well as in other parts of the country (Katila, 2008). The change of political regimes in Tanzania affected the social-political structure of the *lugurus*. The new regimes changed the informal customary laws and regulations (institutions) and replaced them with constitutional laws. The village government supported the new political structure (Hyden, 2006). But these did not have the same powers as the traditional leaders had before for managing forest and water resources because sanctioning mechanisms were lacking.

Not only have the political changes affected the social life of the *lugurus* but also the new economic policies introduced in the 1980s transformed the rural economy forcing many people to change their main livelihood strategies. The Structural Adjustment Programme introduced in the 1980s by International Monetary Fund (IMF) to consolidate state expenditure and meet the debt of the state led to major economic changes not only in UMs (Luoga *et al.,* 2005). The government was forced to start privatisation programme to reduce the state expenditure whereby working staff were massively reduced but with the same workload. Therefore, the state could no longer manage the resources effectively but the notion that resources are free for all Tanzanians remained. Access to CPR under

state control was also getting easy, as state officials in charge of controlling these resources were poorly paid and therefore susceptible to corruption.

2.7.3 Modern institutions in CPRs management in UMs

During colonial and post-independence times, the control over and the responsibility for resource management were increasingly taken out of the hands of local user groups by the state. In most cases the state is now defining the rules of access to the CPRs. It decides whom, when, and how access to resources is given by distributing licences and permits to those who are able to pay the highest price. Monetisation and commercialisation of resources, as well as institutional rules changed by the state or influenced by powerful local and national actors with capital, have led to monopoly constellations and overuse of former CPRs, which were under the management of traditional institutions in the 1950s (Thomas, 1996).

Today, most of the local people who have no money to buy food are forced to switch over to more marginal resources, which are then overexploited in order to make a living. Under these circumstances, the anger among local CPR users rises. They become willing to use violence against the newcomers and against one another in the fight over resources, which are becoming increasingly scarcer (Thomas, 1996). Tension is also rising within local communities because the adoption of new technologies and the possibilities of new market options have led to the erosion of the traditional monitoring structures and organisations, which once ruled the use of the CPRs.

The administration through modern institutions (the village government) is not effective because the consolidation of the different households into *ujamaa* villages made the entire administration complicated and difficult (Meroka, 2006). The newly formed state

institutions were not capable of delivering services to the local communities and that has led to mistrust at the local level. Formerly, the local leaders controlled, regulated and managed all the resources on behalf of the lineage or clan members (Meroka, 2006). Currently, the village chairmen protect the needs and interests of the state. Therefore, in spite of having all Tanzanians profit from the state, parts of the local communities cannot participate in decision-making. The political change in UMs and other parts of Tanzania has contributed to mismanagement of the CPRs and hence resource use conflicts (Meroka, 2006).

2.8 Resource Use Conflicts

Ali (2004) defined the word conflict as a disagreement and differences within, between and among individuals, groups and structures. These disagreements and differences become conflicts when they have devastating effects on the individuals. Conflicts emanate from poorly managed changes which are inevitable elements of individual or societal life. The change can be in form of competition over certain benefits which each individual or institution feel it deserves in an environment where there is no acceptable modality of moderating or rationalizing needs or interests, changes in policy, legal and institutional context and changes in power centers and power distribution in the society (Anderson *et al.*, 1996).

Conflict over CPRs such as land, water, and forests is ubiquitous (Anderson *et al.*, 1996). People everywhere have competed for the CPRs they need or want to ensure or enhance their livelihoods. However, the dimensions, level, and intensity of conflict vary greatly. Conflicts over CPRs may have class dimensions, pitting those who own the resource against those who own nothing but whose work makes the resource productive. Political dimensions may dominate where the state has a keen interest in a public good such as

conservation or in maintaining the political alliances it needs to remain in power. Differences in gender, age, and ethnicity may inform the use of natural resources, bringing to the fore cultural and social dimensions of conflict (Anderson *et al.*, 1996).

Conflicts over natural resources can take place at a various levels, from within the household to local, regional, societal, and global scales. Furthermore, conflict may cut across these levels through multiple points of contact. Conflicts occurring mainly in local contexts may extend to national and global levels because of their special legal relevance or as a result of efforts by local actors to influence broader decision-making processes (Anderson *et al.*, 1996).

The intensity of conflict may also vary enormously - from confusion and frustration among members of a community over poorly communicated development policies to violent clashes between groups over resource ownership rights and responsibilities (Suliman, 1999). With reduced government power in many regions, CPRs management decisions are increasingly influenced by the resource users, who include small-scale farmers and indigenous people as well as large-scale landowners, and private corporations in industries such as forestry, mining, hydropower, and agribusiness. Resources may be used by some people in ways that undermine the livelihoods of others.

2.8.1 Reasons underlying resource use conflicts

Power differences between groups can be enormous and the stakes a matter of survival. The resulting conflicts often lead to chaotic and wasteful deployment of human capacities and the depletion of the very CPRs on which livelihoods, economies, and societies are based. They may also lead to bloodshed. There are several reasons that make CPRs susceptible to conflict. Some of these reasons are evident in the study area.

First, natural resources are embedded in an environment or interconnected space where actions by one individual or group may generate effects far off-site. For example, the use of water for irrigation in the upper part of the river pitted upstream landowners and communities against downstream communities in need of water for domestic and other uses. The nature of the problem may not be apparent because ecological relationships are often poorly understood.

Second, natural resources are also embedded in a shared social space where complex and unequal relations are established among a wide range of social actors - agro-export producers, small-scale farmers, ethnic minorities, government agencies, etc. As in other fields with political dimensions, those actors with the greatest access to power are also able to control and influence natural resource decisions in their favour (Peet and Watts, 1996).

Third, natural resources are subject to increasing scarcity due to rapid environmental change, increasing demand, and their unequal distribution (Homer-Dixon and Blitt, 1998). Environmental change may involve land and water degradation, overexploitation of wildlife and aquatic resources, extensive land clearing or drainage, or climate change. Increasing demands have multiple social and economic dimensions, including population growth, changing consumption patterns, trade liberalization, rural enterprise development, and changes in technology and land use. Natural resource scarcity may also result from the unequal distribution of resources among individuals and social groups or ambiguities in the definition of rights to CPRs.

Fourth, natural resources are used by people in ways that are defined symbolically. Land, forests, and waterways are not just material resources people compete over, but are also

part of a particular way of life (farmer, rancher, fisher, and logger), an ethnic identity, and a set of gender and age roles. These symbolic dimensions of natural resources lend themselves to ideological, social, and political struggles that have enormous practical significance for the management of natural resources and the process of conflict management (Chevalier and Buckles, 1995). Ideological, social, and political practices are contested in most settings, making it difficult to bring to bear on natural resource problems the diverse knowledge and perspectives of resource users.

In addition, power imbalance, institutional failure, unequal power relations among social actors in utilization and management of CPRs are some of the factors influencing resource use conflicts (Mbeyale, 2009). Individuals with power are better placed to influence CPRs decision making in their favour. Warner (2000) categorize different types of conflicts that are manifested in different resource use situations and outlines them depending on the type of stakeholders involved and the levels at which conflicts are manifested. This can be among community groups (resources users), or between community groups and outside government officials (regulators), private or civil society organisation/NGO (facilitators).

WRM (2002) reported power struggles in UMs between village governments which would like to allocate forest land for farming (converting forest to banana plantations) and newly created forest committees who would like to establish conservation management systems for those forests. Also, there is conflict between Catchment Forest Department which forbid any agriculture activity in a distance of 20 m from the boundaries of forest reserves and some local communities because they feel that agriculture land is being taken away from them without any compensation (Holck, 2006).

Bogale (2006) in the study of resource scarcity induced conflict and its management pointed out that understanding conflict is a prerequisite in developing approaches to resolving it through cooperative means, whether via community-based natural resource management or otherwise. This requires both a material analysis of the basis for resource use and a social analysis of the stakeholders involved. The implication here is those conflicts and their resolution need to be examined in their ecological, socio-cultural, economic, political, and policy contexts.

2.8.3 Conflict resolution mechanisms

Conflicts are only fully resolved when the underlying sources of tension between parties are removed, a state of affairs that may be antithetical to social life, hence most authors refer to conflict management rather than conflict resolution (Chevalier and Buckles, 1995). For those who view conflict as a normal and potentially positive feature of human societies, conflict should not be altogether eliminated through “resolution” but rather “managed” so that it does not lead to violence but can achieve change. Rahim (2002) goes so far as to suggest that “conflict management can require intervention to reduce conflict if there is too much, or intervention to promote conflict if there is too little.

The field of conflict management draws many of its principles from North American experiences with Alternative Dispute Resolution (ADR) (Brown *et al.*, 1998). In contrast to litigation and other confrontational modes of conflict resolution, ADR refers to a variety of collaborative approaches including conciliation, negotiation, and mediation (Moore, 1996). Conciliation consists of an attempt by a neutral third party to communicate separately with disputing parties to reduce tensions and reach agreement on a process for addressing a dispute. Negotiation is a voluntary process in which parties meet “face to face” to reach a mutually acceptable resolution of the issues in a conflict.

Mediation involves the assistance of a neutral third party, a mediator, who helps the parties in conflict jointly reach agreement in a negotiation process but has no power to direct the parties or enforce a solution to the dispute. Other conflict management strategies include; avoidance, coercion and adjudication (Mvena *et al.*, 2002).

Through ADR, multiparty “win–win” options are sought by focusing on the problem (not the person) and by creating awareness of interdependence among stakeholders. Techniques of ADR depend on both cultural and legal conditions, such as a willingness to publicly acknowledge a conflict, and administrative and financial support for negotiated solutions (Shaftoe, 1993). They also depend on the voluntary participation of all relevant stakeholders. These conditions are not present in many contexts in both the North and the South. Enlightened self-interest among stakeholders may not be apparent or sufficiently urgent in situations involving the interests of national elites or others with coercive measures at their disposal.

ADR may even be counterproductive if the process only manages to get certain groups together to mediate their differences when the causes of conflict and obstacles to resolution are beyond their control (Moore, 1996). Meanwhile, conflict management training based on ADR principles is promoted around the world, giving rise to a new class of development consultant - the mediator. ADR emphasis on the role of mediators in resolving problems can lead to dependence on “experts” and the neglect of processes that lead to enhanced local capacity to manage recurring conflicts. Given this trend, there is an urgent need to critically assess the approaches with a view to determining the conditions under which they lead to more stable, transparent, and inclusive decisions (Shaftoe, 1993).

It is also critical to recognize that although negotiation, mediation, and conciliation are being promoted as “alternatives” in Western societies, they are not completely new. Castro and Ettenger (1996) argue that “all legal orders,” whether based on customary or state institutions, “rely, to varying extents, on the same basic procedural modes to handle disputes .....avoidance, coercion, negotiation, mediation, arbitration, and adjudication.” In addition, people in diverse societies use other “mechanisms to handle disputes at a local level, including peer pressure, gossip, ostracism, violence, public humiliation, witchcraft, and spiritual healing” (Castro and Ettenger, 1996).

Sokile *et al.* (2005) has found that formal and informal institutions interact appreciably in conflict resolution at the local level. Most disputes on water are resolved informally at the lower levels before they erupt into serious conflicts. This conflict resolution dynamic is not normally outspoken. Six tiers are identified in Mkoji sub catchment where informal-formal conflict resolution takes place (Sokile and van Koppen, 2003):

- One to one level between the victims: both parties speak out and agree on resolving the conflict;
- Local elder’s level: normally those who are well known to both parties and who can appreciable solicit trust among the parties;
- Canal committee level: this is a semi-formal level since the committee members are in some places elected among water users and in other areas they assume responsibilities *de facto;*
- Customary village leaders level: there is a village reconciliatory committee (*baraza la usuluishi*), which is made up of elected/appointed elders and resides over local conflicts, especially on resources, marriages and related cases;

- Ward level: the Ward tribune, while established formally through election, it operates according to customary principles, focusing on reconciliatory rather than punitive rulings and
- Basin and/or catchment level: the Rufiji Basin Water Office and the sub-offices mitigate conflicts when local solutions have failed and where the claimants do not wish to go to courts of law.

Experience by various scientists in rural Tanzania suggests that local communities use mostly negotiation approach, and only in some rare cases adjudication for resolving conflicts (Kajembe and Mwihomeke, 2001).

These local mechanisms of conflict management are not always equitable and effective, especially in conflicts involving multiple dimensions and increasing intensity. Some may hinder equitable and sustainable development and can be legitimately challenged. Nevertheless, Western traditions of conflict management need to be balanced with the systematic study of local practices, insights, and resources used to manage conflict (Chevalier and Buckles, 1995). Cultural, symbolic, and psychological factors that emerge from this analysis can be used to strengthen the integrity of local strategies and redress inequities in local forms of conflict management. Moreover, attention to local strategies is important because the diversity they embody is needed to keep methodological debates open to alternative voices and experiences. In a homogenizing world, diverse local insights and methods are critical sources of innovation.

Multi stakeholder analysis of problem areas and conflicts is a key step in catalyzing recognition of the need for change. This is due to fact that natural resource management decisions are made through complex interactions between actors and the natural resource

base at various levels, from the farm and watershed to national institutions and beyond. Problems and conflicts that arise as a result of these decisions are never entirely caused by one individual or group. Understanding and real solutions usually cannot emerge if all stakeholders do not see their own role in creating and perpetuating the conflict (Chevalier and Buckles, 1995).

2.9 Winners and Losers

Win-lose situations normally occur in natural resource management and utilization as a result of institutional change (Cullis and Watson, 2005). There are many vivid examples of win-lose scenarios in the management and utilization of common pool resources.

Sokile *et al.* (2005) reported that institutional changes from informal under chiefdom system to formal institution under state affect power relations resulting to winners and losers in CPR. Powers of safwa's traditional leaders (*mamwenes*) of Mkoji sub catchment in management of water resources collapsed following abolishment of chiefdom officially in 1963 (Bukurura, 1995). Local communities who abide to formal institutions and hold formal water rights and pay for water fees were at an advantage (winners) of accessing water resources while others are at disadvantage (losers).

Hermans *et al.* (2006) that reported increased water scarcity, resource use conflicts and occurrence of a group of winners and losers due to adopted mechanism of conflict resolutions. The increase water scarcity resulted by increase of rice productions in Mkoji sub-catchment aggravated the conflicts over water. So far, the quest for solutions to the conflicts of the paddy farmers has focused on water: improving water use efficiency or changing de-facto water allocations by enforcing rotations. Even though there is ample room for water savings and re-allocation of this saved water, past experiences show that this is difficult and partially likely to increase tensions because water savings may only benefit upstream farmers, while re-allocations will result in “winners” and “losers”.

In Botswana, poor rural households have mainly been the losers in privatization the commons. Many have lost access to land, access to the benefits of the government’s support to the livestock sector and loss of their livestock. In addition, wildlife sector has also been the loser. Coupled with the erection of veterinary fences, the creation of cattle ranches and the promotion of beef production with the consequent growth in the national herd have resulted in a massive and continuing decline of wildlife populations, with serious implications for the national tourism industry (Cullis and Watson, 2005).

CHAPTER THREE

3.0 STUDY AREA

3.1 Overview

This chapter presents the methodology used in this study. It covers the description of the study area, research design, sampling procedure, data collection methods, and data analysis techniques.

3.2 Justification for the Study Area

The study was conducted in Uluguru Mountains (UMs), Morogoro, Tanzania (Fig. 2). The UMs represent part of the Eastern Arc chain of Mountains, which are widely considered to be rich in biodiversity and to display high levels of endemism. The forests are classified as a biodiversity hot spot of global significance. The decision of selecting UMs was taken because its forests perform a vital water catchment function for many rivers and streams that supply water for both upstream and downstream users. In the course of using these CPRs creates resource use conflicts among users as the result of power imbalance. Identifying existing power relations between upstream and downstream CPR users in UMs is prerequisite in mitigating those resource use conflicts. The results of this study can be used in other parts of Eastern Arc Mountains and in other river basin with upstream and downstream relation.

3.3 Description of the Study Area

3.3.1 Location

The UMs are part of a chain of isolated Mountains running from the Taita Hills in South-East Kenya to the Udzungwa Mountains in South-central Tanzania. The chain is termed as Eastern Arc Mountains (Burgess *et al*., 2007).

The Uluguru Mountains are found within Morogoro District (largely), Mvomero District and Morogoro Municipality all within Morogoro region. The mountains are at 07°00' and 10° 00′South and between 37° 40′ and 38° 22′ East (Lovett *et al.,* 1995).

3.2.2 Size of study area

The mountains are a 45.5Km long chain that rises steeply from the Mgeta and Mvuha floodplains that is at 150 m a.s.l. rising to 2 638 m a.s.l. (Lovett *et al.,* 1995). For this study, upstream comprised villages within a 10 km radius from catchment forests due to two main reasons; first villagers within 10 km radius depend directly on the forest for more or less daily basis to maintain their livelihoods (Lulandala 1998) and secondly their activities within or around catchment forest have negative impact to water quality and quantity flowing downstream. The downstream comprised villages/streets that are beyond 10 km radius from the forests along the stream or river systems originating from catchment forests of UMs. These are mainly water users and their activities have no negative impact to catchment forests in the upstream.

3.2.3 Climate

The climate of the Ulugurus is very much determined by the Indian Ocean from where wind laden with moisture arrives on the Eastern slopes. In general these slopes receive 2 000-4 000 mm per year. There is a decrease in rainfall from East to West this is due to

the fact that Western side of the mountains is in the rain shadow and so receives less rains; it receives 890 mm – 2 392 mm/year. The amount of rainfall increases and becomes more predictable with altitude (Lovett *et al.*, 1995).

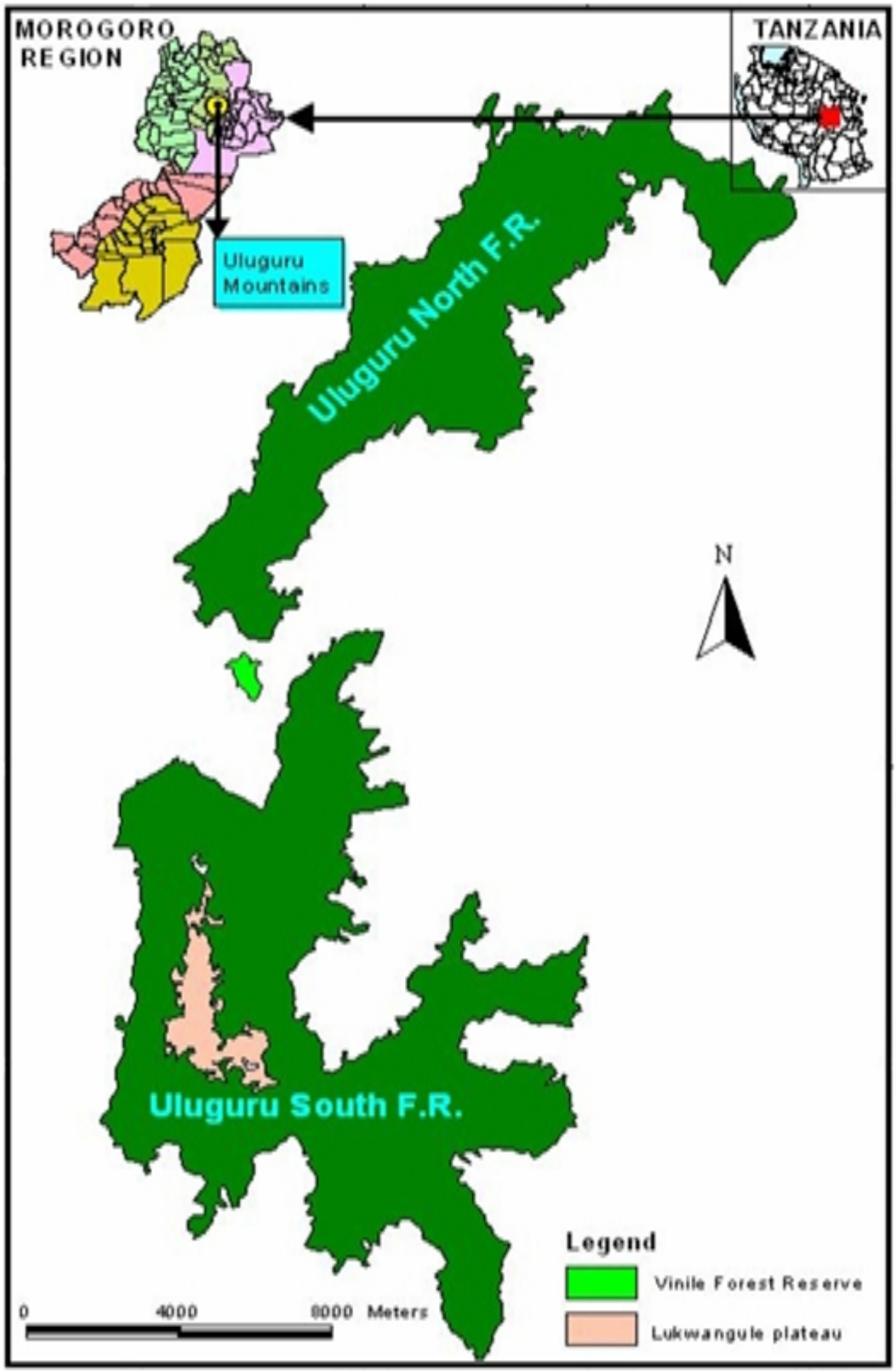

Figure 2: A map of Uluguru North and Uluguru South forest reserves.

Rainfall in general, is bimodal with a dry season between May to late October, a short rainy season between October to the end of December and a long rainy season between March and May (Lovett *et al.,* 1995). Temperature also changes with altitude, with temperatures ranging from below zero at the higher altitudes to above 26°C lower down. It also changes during the year, at Morogoro the average air temperature is 24.3°C with the coolest month being July with a temperature of 21.1°C and the warmest being December with 26.5°C (Lovett *et al.,* 1995).

3.2.4 Forests

UMs are known worldwide for their diversity of flora and fauna, and as an important catchment area. The high rainfall and age, together with the isolated and fragmented nature of the UMs has resulted in high endemism and diversity of biological resources (Madoffe *et al*., 2006; Kalumanga, 2007).

3.2.5 Hydrology

The UMs are probably one of the most important mountain regions in Tanzania, both politically and economically (Svendsen *et al*., 1995). It is from here that Dar es Salaam gets nearly all its water for use in its industries and for the people. The headwater of the Ruvu River that supplies the water to Dar es Salaam occurs in these mountains (MNRT, 2003). Other rivers that have their headwaters in the Ulugurus also have an importance on a more local scale with the Ngerengere River being the major source of water for the sisal estates in Morogoro Rural District; the Morogoro River supplies the water to Morogoro Municipal.

Important rivers flowing from the forest-capped peaks of the Ulugurus include Mgeta, Mzinga and Mbakana in the Mgeta sub catchment on the South Eastern side of the

Ulugurus, Mbezi, Mvuha, Mmanga and Mvizigo in the main Ruvu sub catchment on the Eastern side of the Ulugurus and Mzinga, Morogoro and main Ngerengere in the Ngerengere sub catchment on the Western side of the UMs (Fig. 3). All rivers end up in the Ruvu River after a long way around Ulugurus. Good climate, availability of water and good soils make the Ulugurus being an important agricultural area.

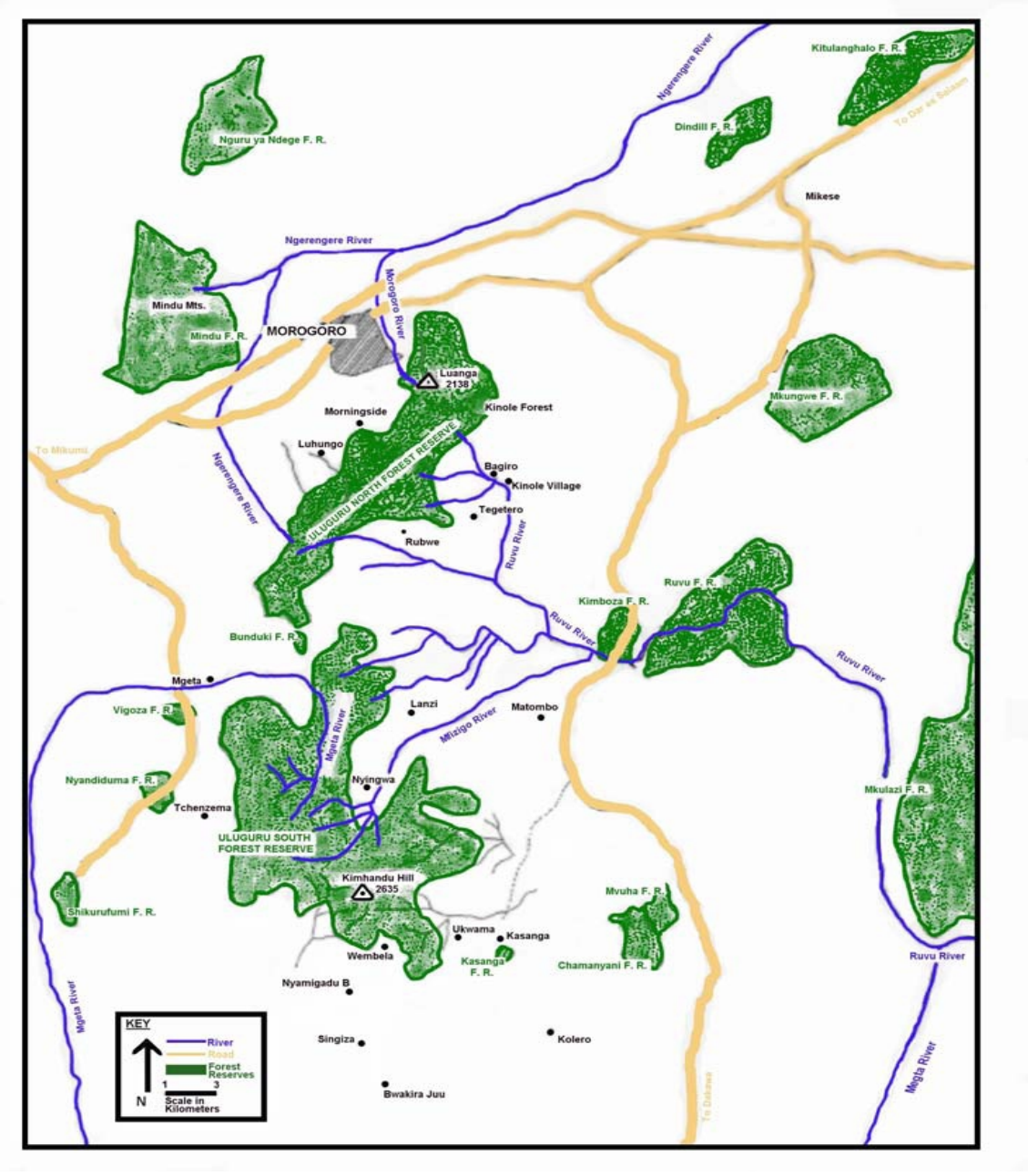

Figure 3: Rivers in Ums.

3.2.6 Population characteristics

The population on the UMs has been increasing since the Luguru people arrived in the area about 200 years ago (Lovett *et al.,* 1995). The population in districts that form UMs varies significantly. In 1994, the population density on the slopes of the UMs was as high as 150 persons/km^2 however, in some areas especially in the upstream of UMs, human population growth rate was close to 6.5% (Lulandala, 1998). The population census of 2002 estimated the population growth to be 2.6% (URT, 2003). The high density is mostly a result of the favourable microclimate of the mountains, which favours agriculture and low rates of malaria (Ponte, 2001). The population in the study villages is as shown in Table 2.

Table 2: Population profile of the study villages, Uluguru Mountains, Tanzania

Streets/Village	Population	Number of households	Average size of households
Mafisa Street	3396	750	4.61
Ruvuma Street	370	89	4.16
Mlali village	5123	995	5.15
Peko Misegese village	2193	530	4.14
Total	**11822**	**2612**	**4.53**
Mean	**2856**	**653**	**4.46**

Source: Svendsen *et al*. (1995)

The dominant ethnic group is *luguru* which account for (85.8%) of the total population in Uluguru Mountains. Other ethnic groups that form (14.2%) include Ndamba, Sukuma, Bena, Hehe, Pogolo, Nyakusya, Yao, Zigua, Kinga, Zaramo, Chaga, Pare, and Kwele. All the study villages are more or less homogeneous in terms of ethnicity.

3.2.7 Economic activities

Crop production is the main economic activity and source of livelihood in the study area. Apart from crop production, other economic activities practised in the study area include livestock keeping, petty trade, and handcraft, casual labour and employment. Traditional staple food grown in the study area include rice, maize, taro, sweet potatoes, cassava, vegetables and plantains, while cash crops include, cabbages, vegetables and fruits. The crops are sold to the burgeoning populations of Morogoro town and Dar es Salaam city (Lalika, 2007).

The subsistence agriculture is carried out right up to lower forest edges. In the study villages, livestock keeping is combined with crop production. Diversification of economic activities is also common to other activities such as petty trade, casual labour and employment in rural areas. Most of the people are engaged in keeping of chicken, cattle, goats and sheep.

3.3 Methodology

The primary data for this study consisted of socio-economic data. Socio-economic data were collected through PRA approach and questionnaire surveys and through reviewing various literatures.

3.2.1 Description of socio-economic research design

A cross-sectional research design was adopted during data collection. Data were collected at a single point in time from selected sample of respondents to represent some large population as suggested by Kajembe (1994). This design was adopted for the study because it is economical in terms of time and money.

Furthermore, a combination of methods was used in the collection of both quantitative and qualitative data, that is, triangulation. The results from each of the research methods were integrated in the overall results. The data collected by different methods provided a reliability check, while at the same time provided additional insights into particular issues and relationships. This approach allowed multiple measurements of the same variables. Qualitative methods provided an insight into reasons for some issues arising from the quantitative methods. They particularly, answered the questions of why and how.

3.3.2 Sampling design and sample size

Both probability and non-probability sampling methods were used in the selection of study units. A purposive procedure was employed to select the forest block, divisions and wards that have high population and high prevalence of resource - use conflicts. Although the procedure of purposive sampling did not provide an entirely random sample it was considered to be the most efficient procedure for obtaining a sample which was representative of the population in terms of the variables considered important for the study. A sampling unit for this study was household. The World Bank (1995) defined household as a unit consisting of one or more persons related or unrelated who live together in one part or of more than housing/dwelling and have common catering arrangement.

Multi-stage sampling procedure was used to select sample villages. One physical division namely Uluguru North was purposively selected. Using simple random sampling, four villages were selected. The first two villages were from upstream of Uluguru North namely Ruvuma (Mlimani ward) and Peko Misegese (Mlali ward) and the other two villages were from downstream namely Mlali (Mlali ward) and Mafisa (Mwembesongo ward) (Fig. 4). A sampling frame for this study was the names of all household heads

from the village registers, obtained from the village government offices; these were used in selecting the households for the interviews. In villages with no register books, the names of people were recorded with the assistance of village leaders from each hamlet and random selection using random numbers was employed so as to avoid/reduce bias.

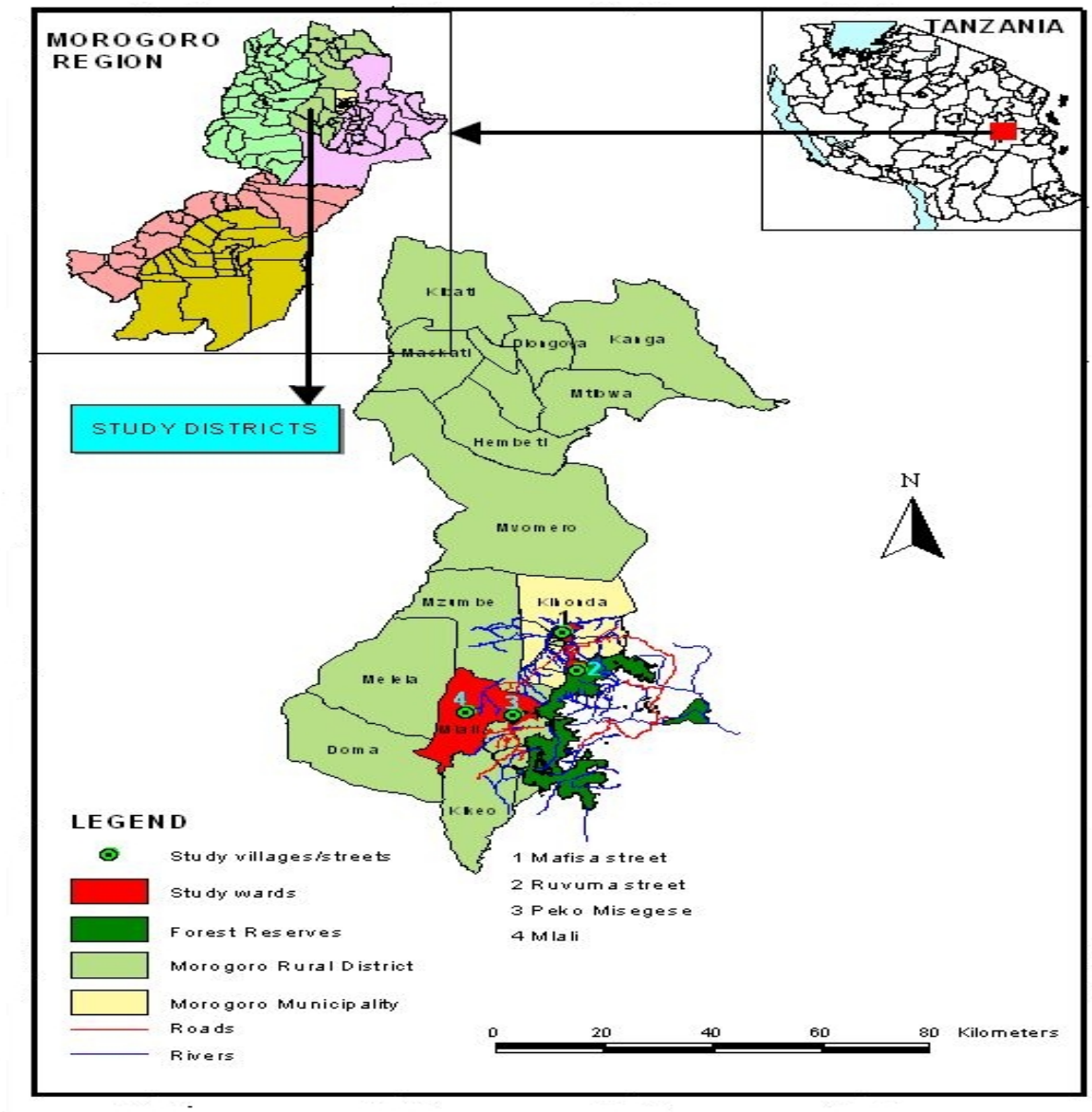

Figure 4: A map of UMs showing study villages.

The sampling intensity for this study was 5% of households in each village. According to Stevens *et al.* (2002) a random sample should at least constitute 5% of the total population to be a representative of that population. In villages where 5% of households showed a sample size less than 30 households, a sample size of 30 households was randomly selected for detailed study irrespective of the population size (Bryman, 2008). The households interviewed were selected by a random sampling procedure, using a table of random numbers. The number of households in the study villages ranged from 89 to 995. A total of 120 respondents from four villages were interviewed in this study (Table 3).

Table 3: Distribution of households in the survey villages in UMs, Tanzania

Street/Village	Location	District	No. of households	No. of sampled households
Ruvuma	Upstream	Morogoro Municipality	89	30
Peko Misegese	Upstream	Mvomero	530	30
Mlali	Downstream	Mvomero	995	30
Mafisa	Downstream	Morogoro Municipality	750	30
Total			**2364**	**120**

Source: URT (2003)

3.3.3 Data collection

The study was carried out in two phases. The first phase involved carrying out reconnaissance survey and PRA while the second phase involved mainly questionnaire surveys. Reconnaissance survey was conducted to get a general picture of the study area. During this survey, pre-testing of questionnaires was done to check for clarity, comprehensiveness, redundancy, and meaningfulness, of the items, to ensure the amount of time required was not excessive and to assess the reaction of respondents. During the reconnaissance survey, key issues including stakeholders, socio-economic activities,

farming systems, power relations and forest and water use were given special attention. There after necessary modifications were done to suit the local conditions.

3.3.3.1 Primary data collection

Both qualitative and quantitative data were collected using a combination of methods: Participatory Rural Appraisal (PRA) methods, participant observation, Focus Group Discussions (FGDs) structured questionnaires, semi structured and unstructured interview (Appendix 1). The combination of techniques helped to compliment limitations by one technique to allow cross checking and verification (triangulation) (Olsen, 2004).

(i) Participatory Rural Appraisal (PRA)

Participatory Rural Appraisal (PRA) is an exploratory approach that aims at identifying relevant variables, their cause-effect relationships and the weight of each variable through participatory communication and analytical techniques. Such variables include stakeholders in utilization and management of forest and water resources, their interests and power relations, resource use conflicts and conflict management strategies. A village chairperson or the Village Executive Officer (VEO) or their representative assisted in notifying 15-20 participants and arranging possible venue. The PRA tools used were Focus Group Discussions (FGD) (Appendix 2) and pair wise ranking.

Focus group discussion

FGD was conducted with users of both forest and water resources. This technique was also used to supplement the structured questionnaire surveys and other instruments to fill the perceived gaps. The types of information that was obtained include; different resource user groups, power relations, resource use conflicts and conflict management strategies.

Pair wise ranking

Pair wise ranking is a structured method for ranking a small list of items in priority order. This technique was employed to rank power relations which were dominating in upstream and downstream separately. The ranking involved three categories of power relations namely strategic, institutional and structural power relations as shown in Appendix 3 and 4.

(ii) Participant observations

When carrying out participant observations the observer becomes part of the situation being studied. This method helped the researcher to gain understanding on the socio economic activities, power relations and farming practices that involve the use of forest and water resources.

(iii) Structured questionnaire administration

Structured questionnaires (Appendix 5) were administered to a sample of households for the purpose of collecting both quantitative and qualitative data. The data collected included economic activities, stakeholders' interactions, factors determining dominant power relations, respondents' perceptions on winner and losers, resource use conflicts, factors underlying winners and losers and resource use conflicts and finally existing and potential conflict management options.

iv) Semi structured and unstructured interviews

Semi structured and unstructured interviews (Appendix 6) were used to supplement the information collected through PRA approaches, participant observations and structured questionnaire surveys. This kind of interview was conducted with key informants. According to Mettrick (1993) key informants are people who are accessible, willing to

talk and having great knowledge regarding the issues under discussion. Key informants approached were commercial producers (large scale farmers), regulators (Forest and Beekeeping Officials, Wami/Ruvu River Basin Officials, Ward Executive Officer, Village Executive officers and Village Natural Resources Committees) and facilitators (WCST, WRBO, CARE). Questions asked include issues relating to their interests in managing forest and water resources, power relations, resources use conflicts and conflict management.

For the Social Network Analysis (SNA) purposes data collected by other methods such as PRA semi structured and unstructured interviews was triangulated and complemented with information gathered through in-depth interviews (Appendix 7)**.** An in-depth interview was conducted with key individuals in each stakeholder group to understand the larger context of the forest related projects and sectors in the management of Uluguru Mountains (UMs). The interviews sought to understand each stakeholder's group perspective on how the project/sector has changed and what impact has been achieved over the last year.

3.3.3.2 Secondary data

Literature survey on stakeholders, power relations, winners and losers, resource use conflicts and conflicts management strategies were collected. Reports on related studies were gathered and relevant information summarized in order to supplement primary data. Sokoine National Agricultural Library (SNAL), Uluguru Mountains Biodiversity Conservation Project, Eastern Arc Management Endowment Fund (EAMEF), Tanzania Forestry Research Institute (TAFORI) and Internet were the major sources of information.

3.2.2 Data analysis

Both quantitative and qualitative methods of data analysis were employed in order to address the study objectives. A qualitative approach seeks a deep understanding of factors and how individual conceives their context. A qualitative research approach cannot generate statistical evidence based on probability sampling, but is able to provide a deeper insight of the research problem (Lund, 2007). A quantitative approach is suitable for statistical methods that derive results based on numerical and standardized data. Quantitative methods are deductive with annexed norm and values of the natural science (Lund, 2007).

3.2.2.1 Qualitative data analysis

Analysis of qualitative data collected start when a researcher starts the data collection exercise, where ideas about analysis and interpretation emerge. This overlap of data collection and analysis helps to improve both quality of data and the focus of the study objectives.

With the help of group discussions with local people to analyse the information produced during PRA exercises, immediate feedback was produced. Other data generated through participant observation and semi structured and unstructured interviews were subjected to content analysis. Content analysis helped to reduce the volume of recorded information or communication to a set of categories that represent some characteristics of the research. Both conceptual analysis (establishing the occurrence and importance of concepts and phenomenon in a text or communications) and relational analysis (which examines the relations among concepts and situations) were applied in content analysis.

The detailed analyses of some documentary materials were done so as to produce information that can be linked to explain the situation in the field regarding to forests and water exploitation. The documents included research reports, official reports including Policies and Acts such as Forest Policy, Water Policy, Forest Act and Water Act. Stakeholders' analysis was also done in analyzing power relations and conflicts among stakeholders.

3.2.2.2 Social network analysis (SNA)

The data from the collaboration rating with stakeholders was analyzed using Ucinet six (6) computer programme. The analysis focused on the overall structure of the networks both within and across stakeholder groups. The analysis included:

- Strength and type of relationship (formal, informal, financial, contractual, equal, or hierarchical, etc.);
- Degree centrality which assessed organizations which have the most connections to other organizations (Wasserman and Faust, 1994);
- Betweenness centrality looked at where organizations sat on the paths to other organizations (for example if many organizations must go through organization X to get to organization Y, then organizations X has a high degree of betweenness centrality) (Wasserman and Faust ,1994).

3.2.2.3 Quantitative data analysis

Data collected through structured household questionnaires were summarized and coded. Statistical Package for Social Sciences (SPSS) computer programme version 16.0 was employed for data analysis. Descriptive statistical analysis was used in exploring the data for distribution of responses, central tendencies and dispersion. Cross tabulation and multiple response analyses was also performed to ascertain responses and percentages.

Cross tabulation is a powerful way of communicating information and the commonest data presentation mode (World Bank, 2002).

a) Analysis of factors influencing dominant power in the upstream and downstream CPR users

Inferential statistical analysis was carried out to provide an idea about whether the patterns described in the sample are likely to apply to the population from which the sample was taken. Linear multiple regression models were developed to find out the relationship between some factors (independent variables), which influence the dominant power in upstream and downstream (dependent variables). In this study, residence duration, education level of respondents, wealth category, family size, farm size, distance to resource base, presence of infrastructures for capturing water and membership to water institutions were considered as independent variables to influence dominant power in the study area.

The following linear multiple regression models were developed.

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

Where;

Y_1 = dominant power in the upstream

Y_2 = dominant power in the downstream

β_0 = a constant showing intercepts for regression equation

β_1- β_n = independent variables coefficients

X_1-X_n = independent variables

E = error term

Whereby, the dominant power in upstream and downstream were determined through carrying out pairwise ranking with the help of PRA groups as shown in Appendix 3 and 4 respectively.

ii) Dependent variables

Y_1 = Dominant power in the upstream

Dominant power was taken to mean influence of individual in access and use of CPRs. In order to get a single numbers (and index of dominance) representing dominant power; respondents were required to respondent to statements that indicate their influence in access and use of CPRs. A 5-point Likert scale ranking the responses was used such that 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree the fact that dominant power used in access and use of forests and water resources. Each value from 1 to 5 in the scale yields a single number representing dominant power index.

Independent variables (explanatory) for dominant power in the upstream

X_1 = Residence duration (years)

It is assumed that the more time a person stays adjacent to resource base has more influence to access and use resources than immigrant. This is due to the fact that an individual who has stayed in a particular place for a long time is assumed to have owned enough land resources at strategic position (place adjacent to water source or forest reserve) which enables he/she to meet his/her livelihoods than an immigrant to the area. The variable was recorded with respect to the number of years that a respondent stayed in a study village and is assumed that number of years individual stayed to have positive regression value ($+\beta$).

X_2 = Education level

Increase of education was assumed to increase individual power in access and use of CPRs. This is due to the fact that increases in education level increase individual's level of investment in human capital and power of defending claims to resources at different levels of conflict resolutions. Thus it was assumed that respondents with high educational level would access more resources than the less educated ones. Education level was recorded with respect to the number of years that a respondent has spent in schooling. The expected sign of the regression coefficient of educational level was positive (+β).

X_3 = Wealth category

The state of being rich by having abundance of valuable possessions or money or being poor significantly affect individual power on access and use forest and water resource in the upstream. Increase of relative wealth increase individual power in access and use forest and water resources. Wealth category had either positive or negative sign of estimate β ($\pm$ β) and was coded with value 1 if respondent is assumed to be rich and 0 if otherwise.

X_4 = Household size

It was assumed that increase in household size had positive effect on existing power. This is because household with many members grants household head with strategic power on access and use forest and water resources. This is due to fact that increases of household size also increase labour force hence makes stable household economy since they can produce more compared to households with few members. The variable was recorded with respect to the number of people having the common catering arrangement and expected sign of the regression coefficient was positive (+).

X_5 = Farm size

Farm size in hectares was assumed to have positive sign to estimate β. This is because households with large land size produce more both food and cash crops than households with small land size. Cash crops and surplus food crops produced are sold and increase households' financial power which used to invest in accessing forest and water resources. The variable was recorded with respect to the number of farm size in hectare.

X_6 = Distance to resource base

Distance in kilometre from a resource base to where individual stay could significantly affect individual power on access and use of forest and water resources. It was assumed that individual living closest to resource base can access and use more resources than a distant individual, therefore individual closest to resource base was said to have strategic power. Distance to resource base was recorded with respect to the number of kilometres from where respondent was staying to the forest reserve or water source. The expected sign for Beta value was either positive or negative β ($\pm$ β).

Y_2 = Dominant power in the downstream

Dominant power in the downstream as dependent variable is an index variable measured by using 5 point Likert scale method. Factors that determine dominant power include residence duration, education level, membership in water institution and presence of water infrastructure. It was measured indirectly by asking respondents on the uses of dominant power to influence decision making on access and use of water resources. Respondents were required to respond to statement in terms of whether he/she strongly disagree=1, disagree=2, undecided=3, agree=4 and strongly agree=5 the fact that dominant power is used in access and use of CPRs. Selected value representing dominant power index.

Independent variables (explanatory) for dominant power in the downstream

X_1 = Residence duration

Number of years that individual stayed in village had positive effect to existing dominant power. This because residence duration has influence in holding position in water based institutions. This is due to fact that most water institutions such as Mlali Water Board (MWB) and Mlali-Kipera Rice Irrigation Scheme (MKRIS) their leaders are obtained through election which involve all members of the institution. In this system, it was assumed that an individual who residing in a village for a long period had more power that may influence his/her position in the MWB or MKRIS and access to resources. Residence duration was recorded with respect to the number of years that a respondent stayed in the study village and is assumed to have positive (+β).

X_2 = Education level

It was assumed that increase in education level had positive effect on individual power in access and use of water resources in downstream. This was due to fact that individual with higher education level may have institutional power. This is because an individual with higher education level can easily hold a position in water institutions such as MORUWASA, MWB and MKRIS or government through employment or election and use his/her institutional power to access water resources. Education level was recorded with respect to the number of years that a respondent had spent in schooling and has positive sign of estimate β.

X_3 =Presence of infrastructures for capturing water resource

In principle, an individual connected to water distribution system under a certain water institution is a member of that particular institution. This is because to become a member of particular water institution an individual should accept the existing rules and

regulations. With this regard, it was assumed that being connected to water system granted an individual with institutional power; therefore tend to access more water resources than individual who is not connected to water system. Dummy variable with value 1 was assigned for connected to water system or 0 if otherwise and the variable was assumed to have positive sign of estimate β.

X_4 = Membership to water institutions

Being a member of well-organized formal or informal institutions such as water user association or water authority guarantee members of institutions to access and use resource. This is because, an individual who pay for water bill or water fee have institutional power to claim for water service he/she has paid for. In this situation, members of water institutions access more water resource than non-members. Dummy variable with value '1' was assigned for individual who is member of water institution or '0' if otherwise. It was assumed membership to water institution have positive sign of estimate β.

b) Logistic regression analysis

i) Analysis for prediction of occurrence of resource-use conflicts between upstream and downstream CPR users

A logistic regression analysis was adopted to analyse the likelihood of occurrence of resource-use conflicts between upstream and downstream CPR users. The dependent variable – occurrence of resource-use conflicts – was conceived as a dichotomous dummy variable with the responses: "Yes" for high conflict magnitude with value '1' or "No" for none to low conflict magnitudes with value '0'. The logistic model predicts the likelihood of occurrence of the event (Menard, 1995), which is predicted by odds (Y = 1). That is the ratio of the probability that Y = 0 to the probability that Y = 1.

This was given by equation:

$$\text{Odd } Y = P(Y = 1)/(1 - P(Y = 1)) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The logit (Y) was given by the natural log of Odds; that is

$$\ln \frac{p(Y_i = 1)}{1 - p(Y_i = 1)} = \log \text{Odds} = \text{logit}(Y) \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where:

Y_i = i^{th} observed value of resource use conflict

The logistic regression model II specification was in a form:

$$\text{Ln} \frac{p(Y_i = 1)}{1 - p(Y_i = 1)} = \beta o + \sum \beta_1 X_1 + \ldots\ldots + \sum \beta_k X_k \quad \ldots\ldots\ldots\ldots\ldots(4)$$

Where:

Yi = dependent variable, resource-use conflict

X_i-X_k = explanatory variables

β_0 = constant term of the model without the independent variables.

β_1 = independent variable coefficients.

Independent variables (explanatory) for factors influencing resource-use conflicts between upstream and downstream CPR users

X_1 = Education level

Education level of respondent plays important role in socio economic development of a particular society as a tool for transfer knowledge and experience. Education tends to create awareness, self-reliance, stimulate self-confidence, motivation and positive altitude. So it was assumed that people with higher education have more livelihood options compared to less educated people, therefore are less likely to cause resource use conflicts. Education level was recorded with respect to the number of years that a respondent had spent in schooling. The expected sign of the regression was negative (-β).

X_2 = **Wealth category**

Wealth category could increase the likelihood of resource use conflicts because of the differences in bargaining powers and disparities in resource endowments and entitlements. With increasing household wealth differentiation is likely to increase resource-use conflicts because wealthier people have strategic that is used against the poor in resource allocation. Wealth category was coded with value '1' if respondent was assumed to be rich and '0' if otherwise and expected sign of the regression coefficient was positive (+β).

X_3 = Household size

Household size was assumed to have positive sign to estimate β. This is because household with many members are expected to access and use more resources in order to meet their household's needs than household with few members. Therefore, the increase demand of forest and water resources which influenced by household size increase the likelihood of occurrence of resource uses conflicts. The variable household size was recorded with respect to the number of people having the common catering arrangement.

X_4 = Farm size (ha)

Increase of cultivated land size in hectare has implication in water consumption as input to increase productivity. Farm size was assumed to have a positive sign on the parameter estimate β as the higher farm size an individual owns, the higher the water could be demand for irrigation. The smaller the farm size, the lower the resource use conflicts because little water could be demanded for irrigation. This means higher or little water demanded by farmers determined the incidences of resource use conflicts. Farm size was recorded with respqwect to the number of hectares that a respondent owns and use for irrigation farming.

X_5 = Farming practice

Farming practise either dry season irrigation or rain-fed farming have impact on water resource requirement and resource use conflicts. Households who practise dry season irrigation farming demand more water. The increasing number of households practising dry season irrigation farming has positive impact on likelihood of occurrence of resource use conflicts. This is because the high demand for water leads to illegal water abstraction and over-allocation hence causing resource scarcity to other users. Dummy variable with value '1' assigned for individual practice dry season irrigation or 0 if otherwise.

X_6=Seasonal farmers

Availability of seasonal farmers in study villages could increase the likelihood of the occurrence of resource use conflicts. This is due to the tendency of seasonal farmers to violate rules of access to resources because they lack long term interest in the sustainability of resources. The variable was recorded with value '1' was assigned if immigrant or '0' if not and expected sign of the regression was positive (+β).

X_7 = Distance to the market

It was assumed that the distance to the market from resource base increase the likelihood of occurrence of resource use conflicts amongst local communities themselves and between local communities and resource base authorities. This is because presence of market nearby resource base motivates exploitation of resources. Households which are adjacent to market access market information easily, therefore exploit more resources to produce variety of products. This variable was recorded with respect to distance in Km from household to the market and was assumed to have positive sign of estimate β (+β).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter presents research findings based on the objectives. This include key stakeholders in the management and utilization of forest and water, their interests and interactions in the upstream and downstream; power relations underlying resource users in the upstream and downstream, factors influencing dominant power and how winners and losers are created; factors influencing resource use conflicts between upstream and downstream users and existing and potential mechanisms for conflict resolutions.

4.1 Stakeholders in the Management and Utilization of CPRs, their Interests and Interactions

Uluguru Mountains were found to have higher conservation priority in the country by having many stakeholders. The study found 44 different stakeholders that are involved in the management and utilization of forest and water resources in both upstream and downstream areas with different interests. Identified stakeholders include communities, Non-Governmental Organizations (NGOs) and state organizations. Community in this study refers to the people that live in a geographically bounded area that are involved in social interaction and have one or more psychological ties with each other and with the place in which they live.

4.1.1 Stakeholders and their interests in the upstream of UMs

Table 4 presents categories of stakeholders and their interest in the upstream of UMs. The communities identified were from Ruvuma Street in Morogoro Municipality and Peko Misegese village in Mvomero district. The state organizations include village governments, Village Natural Resources Committees (VNRCs), SUA, UDSM, Tanzania

Tree Seed Agency (TTSA) and Tanzania Forestry Research Institute (TAFORI). Other state organizations are Forestry and Beekeeping Division (FBD), Forestry Extension and Publicity Unit-Eastern Zone (EPU), Morogoro Regional Natural Resource Office (MRNRO), Morogoro Regional Catchment Forest Project (MRCFP), Mvomero and Morogoro Rural District Catchment Forest Projects, two district councils of Mvomero and Morogoro, Morogoro Municipality, Uluguru Nature Reserve (UNR) and Wami-Ruvu Basin Water Office (WRBWO).

Table 4 further shows NGOs/projects that are involved in the management of UMs. Two types of NGOs were identified in upstream depending on coverage of their activities; local NGOs (LNGOs) operating in UM landscape only while International NGOs (INGOs) operating in Uluguru and elsewhere in the world. LNGOs include Chilunga Nature Conservators, Chama cha Mazingira na Maendeleo (CMM), Morogoro Women Conservation Association (MWCA), Morogoro Environmental Conservation (MOECO), Uluguru Mountain Agricultural Development Project (UMADEP), Wildlife Conservation Society of Tanzania (WCST), Tanzania Forestry Conservation Group (TFCG), Network of Small Farmers in Tanzania (NSFT), Tanzanian Community Forestry Network (TCFN) and Joint Environmental Management Action (JEMA).

Table 4: Stakeholders and their interests in the upstream of Ums

Categories of stakeholders	Stakeholders' interests
Regulators	
Morogoro Region Natural Resource Office	Coordinating local and central government
Forestry and Beekeeping Division (FBD)	Management of the central government FRs
Forestry Extension and Publicity Unit	(Conservation/protection of biodiversity and water
Morogoro Regional Catchment Forest Project (MRCFP)	catchment values)
Mvomero District Catchment Forest Project	
Morogoro Rural District Catchment Forest Project (MRDCFP)	
Uluguru Nature Reserve (UNR)	Management of Uluguru nature reserve (Conservation/protection of biodiversity and water catchment values)
Movomero District Council (MDC)	Improvement of livelihoods, conservation/protection of
Morogoro Rural District Council (MRDC)	local government FRs, improvement of agricultural
Morogoro Municipality	productivity/sustainable agriculture, education, health, water, roads, environmental conservation
Village government	Conservation of natural resources
Village Natural Resource Committee (VNRC)	
Wami Ruvu Basin Water Office (WRBWO)	Hydrological monitoring, water rights
Facilitators	
Local NGOs	
Chilunga Nature Conservators	Cultural tourism/ecotourism
MECA group	Campaigns against fires/fire control, dissemination of energy saving stoves
Chama cha Mazingira na Maendeleo	Environmental conservation and improvement of livelihoods
Morogoro Women Conservation Association	Environmental conservation and improvement of livelihoods
Morogoro Environmental Conservation (MOECO)	Environmental conservation
Uluguru Mountain Agriculture Development Project (UMADEP)	Sustainable land management/agriculture and agroforestry
Wildlife Conservation Society of Tanzania	Biodiversity conservation
Tanzania Forestry Conservation Group (TFCG)	Biodiversity conservation of biodiversity and catchment values, training of farmers
Tanzania Network of Farmer's Group (TNFG)	Improvement of agriculture, marketing of agriculture produce, input support
Tanzanian Community Forestry Network (TCFN)	Natural resource conservation, advocacy for policy change
Joint Environment Management Action	Forest protection
International NGOs	
CARE International	Biodiversity conservation, establishment of village savings and loan schemes
World Wide Fund for Nature (WWF)	Biodiversity conservation, Payment for Ecosystem Services (PES)
CEPF, CI, Birdlife International	Financing biodiversity conservation and research
IUCN	Biodiversity conservation
DAIPESA	Credit and financial management
State organizations	
Sokoine University of Agriculture (SUA)	Research, provision of consultancy services
University of Dar es Salaam (UDSM)	Research, resource assessment, provision of consultancy services/professional advice
Tanzania Forestry Research Institute	Forestry research
Tanzania Tree seed Agency (TTSA)	Provision of tree seed and seedlings
Users	
Communities in Ruvuma and Peko Misegese	Expansion of farms to FR, access to forest and non-wood forest products and services and conservation of natural resources

INGOs include Care Tanzania, World Word Fund for Nature (WWF), Critical Ecosystem Partnership Fund (CEPF), Conservation International (CI), Birdlife International (BI), World Conservation Union (IUCN) and Development Alternative Inc.-Private Enterprise Support Activities (DAIPESA) funded by United States Agency for International Development (USAID). URT (2009b) reported the similar LNGOs and INGOs that are operating in Uluguru landscape. The study further found three categories of stakeholders in upstream of UMs; regulators, facilitators and resources users.

4.1.1.1 Regulators in the upstream of UMs

The regulators found include Forestry and Beekeeping Division (FBD), Morogoro Region Natural Resource Office (MRNRO), Morogoro Region Catchment Forest Project (MRCFP), Mvomero District Catchment Forest Project (MDCFP), Morogoro Rural District Catchment Forest Project (MRDCFP), Mvomero District Council (MDC), Morogoro Rural District Council (MRDC), Morogoro Municipality (MM), Uluguru Nature Reserve (UNR) and Ministry of Water and Irrigation (MWI) through Wami Ruvu Basin Water Office (WRBWO). Fig. 5 presents regulators in the management of UMs and shows that FBD is the highest state organization. FBD vested her management functions to UNR which was established in 7 November, 2008 with Government Notice (GN) 296 after upgrading management status of Uluguru Forest Reserve (UFR). The management objective of UNR is to maintain forest biodiversity, ecological process, cultural and environmental values in undisturbed dynamic and evolutionary ecosystem for present and future generation. To meet targeted objective, UNR is working in collaboration with other stakeholders including MRCFP and her district catchment projects namely MDCFP and MRDCFP. The study revealed that FBD, UNR, MRCFP, MDCFP and MRDCFP all are under central government and are accountable to the Director of FBD.

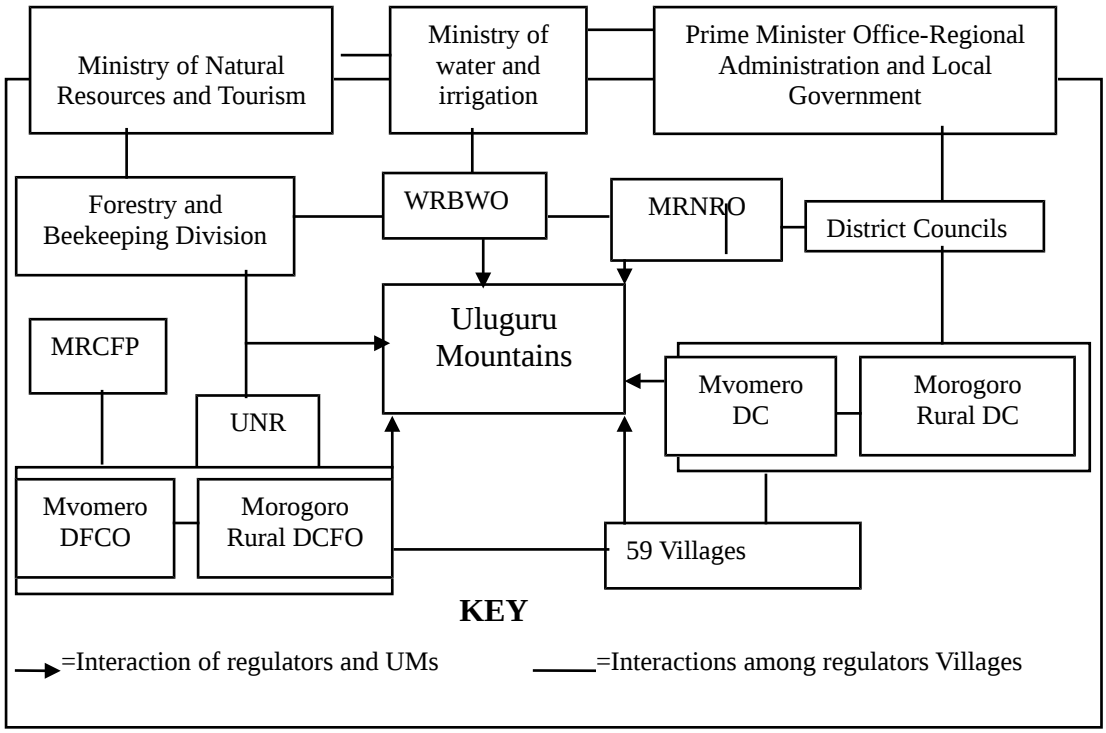

Figure 5: Regulators in management of Ums.

Apart from the regulators which are under central government, the management of UMs is also decentralized to local government. Highest state organization at regional level is Morogoro Region Natural Resources Office (MRNRO) which is under regional secretariat. The Regional Secretariat linking the local governments, regional administration and FBD (MNRT, 2001). In the case of UMs, two district councils and one municipality namely Mvomero and Morogoro rural and Morogoro Municipality are directly involved in its management. District councils and Morogoro Municipality are working in collaboration with village governments. The UMs is surrounded by 59 villages and all the villages have either Village Environmental Committees (VECs) or Village Natural Resource Committees (VNRC) responsible for managing forest (URT, 2009a). Wami-Ruvu Basin water Office (WRBWO) is the core regulator for the management of water in the upstream of UMs.

The main interests of regulators are conservation of biodiversity and improving livelihood of adjacent communities. These interests derived from four sources; economic interest, institutional mandate, value commitment and political. The roles of regulators include enforcing forest Act No. 14 of 2002 and other acts relating to natural resources and their regulations in order to ensure that the overall objective of managing UMs is achieved. Law enforcement is done for central, local government and village forest reserves in collaboration with facilitators and users residing around the mountains.

4.1.1.2 Facilitators in the upstream of UMs

State organizations and Non-Government Organizations either local (LNGOs) or international (INGOs) are main facilitators in the management of forest and water in the upstream of UMs. The state organizations include Tanzania Forestry Research Institute (TAFORI), Tanzania Tree Seed Agency (TTSA), Sokoine University of Agriculture (SUA) and University of Dar es Salaam (UDSM). The interests of TTSA, SUA and UDSM in the conservation of UMs include research and provision of professional advice. TTSA facilitates conservation of Uluguru through provision of quality tree seeds for reforestation programs. Other state organizations such as FBD, MRNRO, MRCFP, MDCFP, MRDCFP, MDC, MRDC, MM, and UNR facilitates conservation through awareness creation on environmental education to the communities and provision of funds for the conservation activities.

Local NGOs were found to play an active role in the conservation of UMs. Their key interests include environmental conservation and improvement of livelihoods of adjacent communities. In order to foster environmental conservation and improving peoples' livelihood, LNGOs conducting fire campaigns, provision of training to communities on best farming practices, marketing of agriculture products and dissemination of energy

saving stoves to communities in order to reduce pressure in the forest. INGOs were found implementing conservation activities on the ground in collaboration with other partners such as the Danish Ornithological Foundation (DOF), United Nations Development Programme (UNDP), Global Environment Facility (GEF) and Norwegian Agency for Development Cooperation (NORAD). The INGOs such as Critical Ecosystem Partnership Fund (CEPF), Conservation International (CI) and Birdlife International (BI) provides conservation and research funds.

4.1.1.3 Resource users in the upstream of UMs

Two main categories of resource users were identified in the upstream based on the type of resource they use. The first category is consisting of forest users. These are the ones who are exploiting forest resources such as trees for timber, firewood, and building poles. The study found that all respondents (100%) in upstream are directly connected to the forest through either collection of firewood or construction materials such as timber and poles. Other products collected from the forest include Non Timber Forest Products (NTFPs) such as fruits, mushrooms, honey, small games, herbs and fodder.

The second category consists of user groups that are benefiting from the forest services. This consist of water users and the farmers who are cultivating near forests where conditions of moisture and soil fertility are considered to be more favourable than in farm lands far away from the forest. Informal water user groups consist of domestic water users, small scale farmers employing traditional and semi mechanized irrigation systems and small scale livestock keepers. The study further found that 47% of farmers in upstream practice irrigation farming especially dry season irrigation for vegetable production. MNRT (2003) reported the use of water from rivers and springs in the livestock keeping and production of both food and cash crops in the upstream.

The study revealed that apart from being resource users, communities in upstream are actively participating in the resource conservation. The communities in upstream participate in the management of the forest reserves through Joint Forest Management (JFM) approach and tree planting in their fields. Community involvement in the management of UMs started in 2003/2004 under WCST after signing a Memorandum of Understanding (MoU) with the FBD (MNRT, 2003). Concerning tree planting and enforcement of by-laws, URT (2009b) reported that residents in upstream have planted trees for purposes of meeting different needs and have developed various bylaws intended to enhance the management of these resources.

4.1.2 Stakeholders and their interests in the downstream of UMs

The study found nine stakeholders in the management and utilization of water resources in the downstream (Table 5). The number of stakeholders in the downstream differs significantly from those in the upstream whereby the study found 35 stakeholders; most of them were regulators and facilitators. This is attributed to the fact that the interest of many stakeholders is on management of the forest resources. The plausible reason is that forest carries values for both local and international communities. The stakeholders identified in the downstream include communities of Mafisa Street in Morogoro Municipality and Mlali village in Mvomero District Council, the state organizations and Non-Government Organizations (NGOs).

The state organizations include village governments, Mvomero District Council (MDC), Morogoro Municipality (MM), Wami Ruvu Basin Water Office (WRBWO), Mlali Water Board (MWB), Mlali Kipera Rice Irrigation Scheme (MKRIS) and Morogoro Urban Water and Sewerage Authority (MORUWASA) while Non-Government Organization

(NGO) is Uluguru Mountain Agriculture Development Project (UMADEP). These stakeholders are grouped into three categories; regulators, facilitators and users.

Table 5: Stakeholders and their interests in the downstream of UMs

Categories of stakeholders	Stakeholders' interests
Regulators	
Movomero District Council (MDC)	Improvement of livelihoods, improvement of agricultural productivity/sustainable agriculture, water, environmental conservation
Morogoro Municipality (MM)	
Wami Ruvu Basin Water Office (WRBWO)	Hydrological monitoring, water rights (Sustainable water resource management)
Village governments	Conservation of natural resources
Facilitators	
Morogoro Urban Water and Sewerage Authority (MORUWASA)	Domestic water supply in Mafisa street
Mlali Water Board (MWB)	Domestic water supply in Mlali village
Mlali Kipera Rice Irrigation Scheme	Allocation of water for irrigation in Mlali and Kipera villages
Uluguru Mountain Agriculture Development Project (UMADEP)	Promoting sustainable agriculture in villages around UMs
Users	
Communities of Mafisa and Mlali	Access and use of water for domestic and crop production Conservation of natural resources
Taj Mohamed	Commercial water user for crop and livestock production in Mlali village

4.1.2.1 Regulators in the downstream of UMs

The study revealed three levels of regulators in the water management; village, district and basin level, all are responsible in ensuring proper management of water resource in the downstream. At the village level regulator is Village government (VG) which is responsible for ensuring water resource in the respective area is properly managed through formulation and enforcement of by-laws in collaboration with communities and other stakeholders. At the district level regulators are Office of the District Commissioner

(DC), office of the District Executive Director (DED) that include District Water Officer (DWO), District Land, Natural Resources and Environmental Officer (DLNREO). The roles of regulators at the district level are to approve by-laws submitted by villages and enforcement of water and other natural resources laws and regulations.

At the basin level, Wami-Ruvu Basin Water Office (WRBWO) was found to be the most important regulator in the management of water resources in the UMs. The roles and responsibilities of WRBWO include to issue water use and discharge permits; to control pollution of water resources; to resolve water use conflicts; to collect water user fees; to sensitize on the sustainable use of water resources; to facilitate the formation of Water User Entities; to operate and maintain water resource monitoring stations; to monitor and assess the quantity and quality of water in the Ruvu basin; to plan and coordinate the integrated water resources management plans and to participate in water sources protection programs (WRBWO, 2002; URT, 2009a).

4.1.2.2 Facilitators in the downstream of UMs

In the downstream of UMs, the state organizations and NGO are main facilitators in the management of water. Apart from law enforcement, state organizations such as Mvomero District Council (MDC), Morogoro Municipality (MM) and Wami-Ruvu Basin Water Office (WRBWO) facilitate development activities through provision of technical and financial support to water user groups. The study revealed that MDC employed one irrigation expert who is working with rice farmers in Mlali-Kipera Rice Irrigation Scheme (MKRIS). In addition, the study further found that for the financial year of 2009/2010, Mvomero District Council (MDC) supported rice farmers in Mlali village with one Power tiller worth TZS 9 million.

Morogoro Urban Water and Sewerage Authority (MORUWASA) was found to be the most prominent facilitator in utilization of water resource in Mafisa Street while Mlali Water Board (MWB) and Mlali-Kipera Rice Irrigation scheme (MKRIS) was prominent facilitator in Mlali village. MORUWASA is supplying water for domestic and industrial users, protecting water infrastructures and collecting monthly water bills. MWB is supplying domestic water in Mlali village while MKRIS allocate water to rice farmers in Mlali village. The other roles of MWB and MKRIS are collection of water use fees from users and protecting water infrastructures in collaboration with water users. UMADEP was found to be the only LNGO that facilitates sustainable agriculture by providing technical advice to the farmers around UMs on the best farming methods.

4.1.2.3 Water users in the downstream of UMs

The study found different types of water users in the downstream comprised of farmers, livestock keepers, domestic water users and industrial water users. Farmers are permanent and seasonal (rice growers and vegetable producers), subsistence and commercial. Access to both domestic and industrial water supply is regulated by MORUWASA for Mafisa Street and Mlali Water Board (MWB) for Mlali village. Domestic and industrial water users are required to pay monthly water bills. In Mafisa, the price of water is TZS 440/m^3 while in Mlali water bill per month is TZS 2000 for user who take water from established water points and TZS 5000 for those who have direct connection to their homes.

Furthermore, the study revealed the free access and use of water in the vegetable and rice production done by small farmers in Mafisa. In Mlali village, accessing water for rice production during rainy season is regulated by MKRIS and the user has to pay a fee depending on size of his/her plot in the scheme. Water fee for a plot of 55m x 75m is TZS

2000/season. Apart from paying water use fee, also farmers must volunteer twice per week (Tuesday and Thursday), in cleaning water canals and water intake. The use of water for the production of vegetables and tomatoes during dry season is free. This is due to the fact that MKRIS is regulating the uses of water for the rice production only.

4.1.3 Interactions of stakeholders in the management and utilization of CPRs in the upstream of UMs

Fig. 6 shows the social network comprised of 18 actors (also referred to as ‘nodes’) and links showing interactions or flows between the nodes. Two actors are connected if they have relationship in the management of UMs. Actors such as Morogoro Region Natural Resource Office (MRNRO), Morogoro Region Catchment Forest Project (MRCFP), Morogoro Rural District Catchment Forest Project (MRDCFP) and Uluguru Nature Reserve (UNR) are holding many ties (highly centralized) therefore are located at the centre of the network. The common characteristic of central actors is that all are regulators based in Morogoro region (closest to UMs), therefore are responsible for the management of UMs and oversee interventions of other stakeholders. This implies that they interact with many stakeholders than others, thus are central actors in giving directives and advice to other stakeholders.

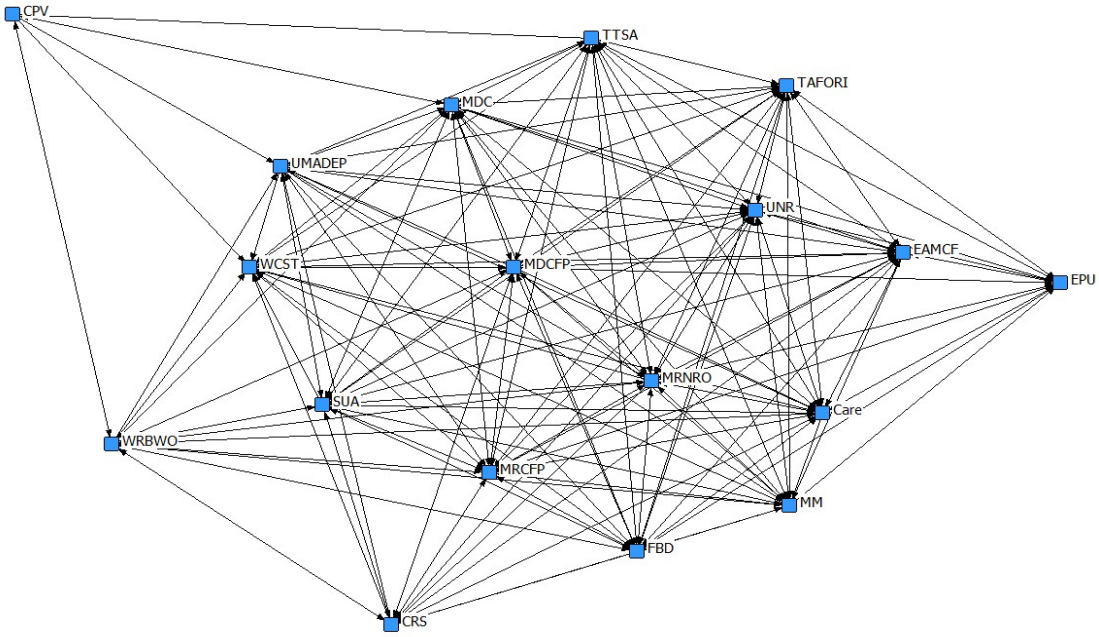

Figure 6: Social network of stakeholders in the upstream.

Fig. 6 further shows that actors such as Extension and Publicity Unit-Eastern Zone (EPU), Tanzania Forestry Research Institute (TAFORI), Tanzania Tree Seed Agency (TTSA), Morogoro Municipality (MM), Forestry and Beekeeping Division (FBD), the community in Ruvuma Street, Wami Ruvu Basin Water Office (WRBWO) and the community in Peko Misegese Village (CPV) received very low centrality scores for this network hence located at the periphery. This implies that those are the marginal actors in the network. Crona and Bodin (2006) and Prell *et al*. (2009) pointed out that peripheral actors connected to networks that are not currently mapped making them very important resources for fresh information not available inside the network. For example, FBD do not appear as very central in the network but has a lot of influence over the ways policies are written and enacted, and thus influence the day to day lives of stakeholders, this is due to its national mandate in the forestry sector.

4.1.3.1 Strength of the relationship of stakeholders in the upstream

The thicknesses of the lines in Fig. 7 depict the varying strengths of the relationship, where thicker lines represent strong relationship among stakeholders. The study revealed strong relationship among state organizations: FBD, MRNRO, MRCFP, EPU, MDCFP, MDC, MM, UNR, TTSA, TAFORI, SUA and WRBWO. This is due to fact that all are state organizations and their relationship is administrative. The study also revealed strong relationship between FBD and other state organizations which influenced by authority of FBD in the management of forest resources in Tanzania. FBD has structural and institutional powers over management of forest resources. The structural power is the result of administrative setup in the forest sector while institutional power is granted by Forest Policy of 1998 and the 2002 Forest Act No.14. Section 4 of the Forest Act grants FBD institutional power to manage national forest reserves and other forest types in Tanzania (URT, 2002a).

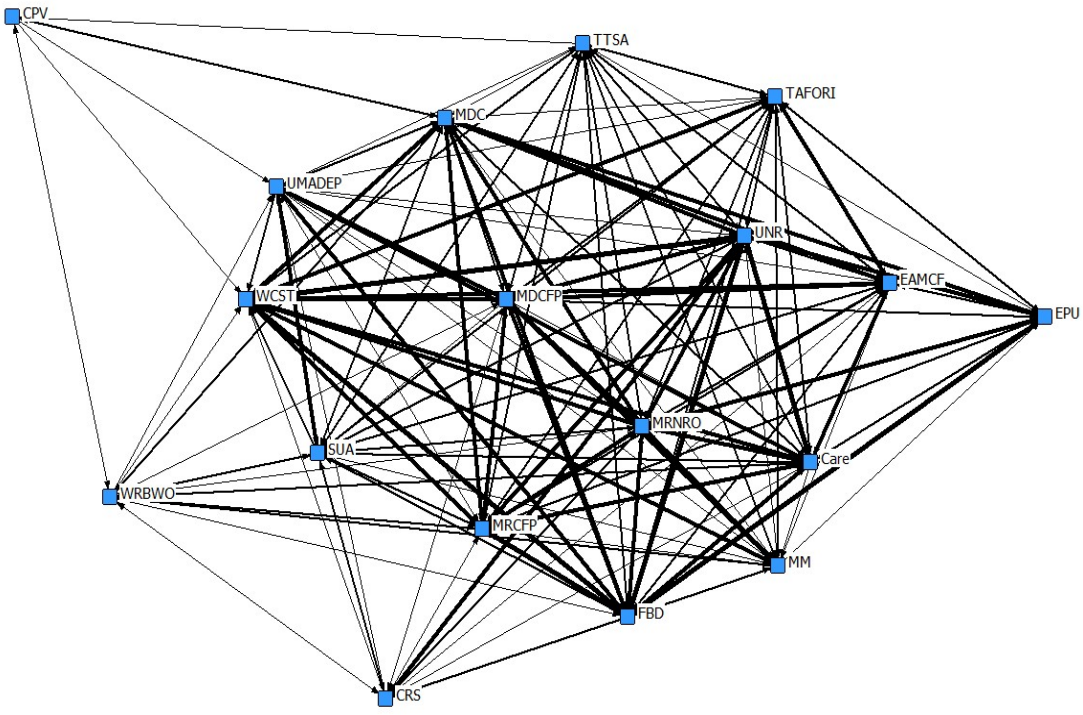

Figure 7: Strength of relationship between stakeholders.

The study further revealed strong relationship between FBD and MRCFP, EPU, MDCFP, UNR, TTSA and TAFORI which influenced by FBD financial power. FBD provide funds for the conservation and research activities in the UMs. For instance, in 2009/2010 FBD funded MRCFP a total of TZS 500 million for the management of catchment forests in Morogoro region. The strength also implies that FBD has formal relationship with other state organizations on specific purposes such as exchange of information, provision of funds and technical advice. Prell *et al.* (2009) argued that the strength of the relationship suggests the most powerful stakeholders in the network.

Fig. 7 depicts strong relationship between state organizations with vested power in the management of UMs and NGOs. The most important state organizations in the management of UMs are Forestry and Beekeeping Division (FBD), Morogoro Region Catchment Forest Project (MRCFP), Uluguru Nature Reserve (UNR), Mvomero District Council (MDC) and Morogoro Rural district council. Their strong relationship with NGOs is because of granted power of issuing permits of enter within the forest reserve or working with communities in the conservation of forest reserve. Activities of NGOs are tree planting in degraded areas of forest reserve, mobilization of sustainable agriculture practices, marketing of agriculture produce, establishment of village savings and loan schemes and dissemination of energy saving stoves to communities living adjacent reserves to reduce their dependency to the forest.

Fig. 7 further depicts weak relationship between communities in upstream and regulators in the management of water and forest resources. For example, the study revealed weak relationship between the community in Ruvuma Street (CRS) and Wami-Ruvu Basin Water Office (WRBWO) in the management of Morogoro River. This is attributed by the fact WRBWO does not work direct with communities in the upstream, most of its

activities are carried out by MORUWASA. Weak relationship between communities and State organizations that are responsible for management of forest resources is attributed by the government notice of reallocating upstream communities (VPO, 2006). This led to conflictive relationship between communities in upstream and regulators because to upstream communities reallocation has social and economic impact.

Furthermore, the study revealed weak relationship between facilitators specifically NGOs and communities in the upstream. For example, there is weak relationship between WCST and community of Ruvuma Street. This is attributed by the phasing out of the project which implies relation cut off. Formerly, WCST was facilitating Participatory Forest Management (PFM) in Uluguru North, therefore had strong relationship with upstream communities because of their financial power. Furthermore, URT (2009b) reported strong relationship between NGOs that implement their activities with communities in the upstream. This is because most of NGOs provide funds in order to encourage community participation in conservation activities. Table 6 presents the effects of strength of relationship on CPR management in UMs.

Table 6: Effects of strength of relationship on CPR management in upstream of UMs

Network concept	Effect on common pool resource management
Strong relation	▪ Good communication and working with complex information and tasks ▪ Hold and maintain trust between actors ▪ Actors more likely to influence one another's thoughts, views, and behaviour. ▪ Can encourage creation and maintenance of norms of trust and reciprocity ▪ Frequently exchange information, work together on projects and have a written contract and/or memorandum of understanding
Weak relation	▪ Tend to bridge across diverse actors and groups ▪ Connects otherwise disconnected segments of the network together ▪ Good for communicating about and working with simple tasks ▪ New information tends to flow through these ties ▪ Not ideal for complex tasks/information ▪ Actors sharing weak ties are less likely to trust one another ▪ Can break more easily ▪ Occasionally exchange information

Source: Prell *et al*. (2009)

4.1.3.2 Position of the stakeholders (Betweeness centrality) and their roles in the network

Fig. 8 presents various sizes of nodes. The size of the nodes corresponds to the relative betweenness centrality of the stakeholders. The study found that stakeholders such as Tanzania Tree Seed Agency (TTSA), Mvomero District Council (MDC), Uluguru Mountain Agriculture Development Project (UMADEP), Wildlife Conservation Society of Tanzania (WCST) and Wami-Ruvu Basin Water Office (WRBWO) hold high betweeness centrality in the network compared to other stakeholders. Borgatti (2005); Wasserman and Faust (1994) defined betweeness centrality as stakeholders located between two important constituencies. With respect to this definition, TTSA, MDC, UMADEP, WCST and WRBWO act as a bridge between stakeholders inside and outside the network.

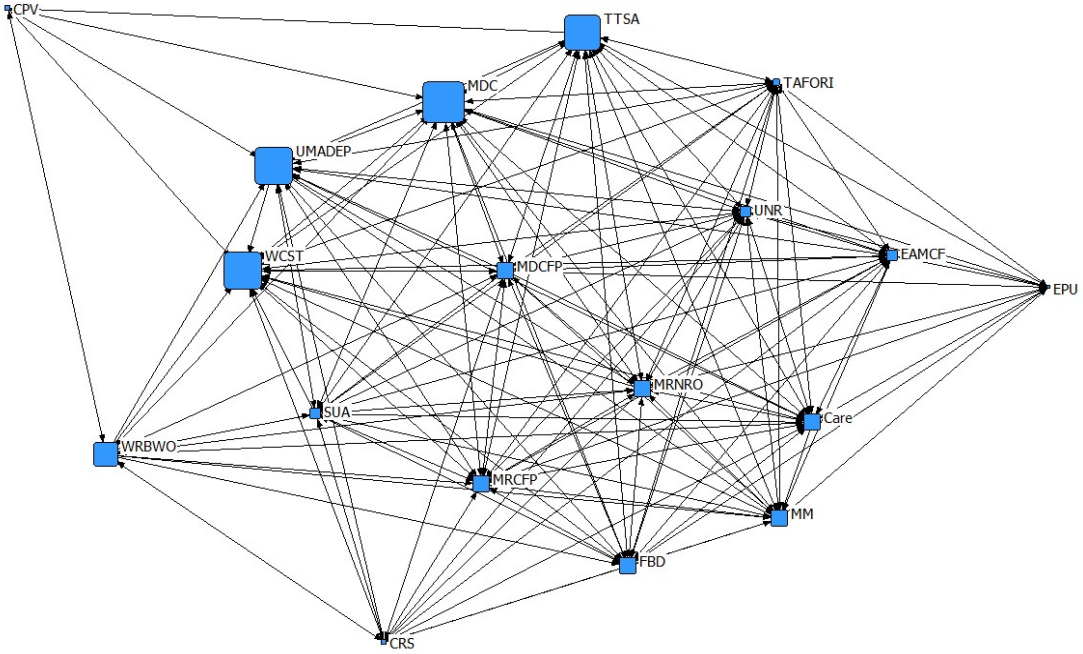

Figure 8: Betweenness centrality.

High betweenness centrality granted TTSA, MDC, UMADEP, WCST and WRBWO the ability to influence the flow of resources among others, and it also provides themselves with diversity of resources provided by the bridging ties. High betweeness centralities perform a broker's role of bringing together disconnected segments of the network, thus bringing diversity and new ideas to the network. The good news about stakeholders holding high centrality; they play a powerful role in the network by having great influence over what flows in and out of the network. The bad news is single point of failure when sending wrong information to other stakeholders inside the network.

4.1.4 Interactions of stakeholders in the management and utilization of water in the downstream

Fig. 9 shows the social network comprised of nine stakeholders that play part in regulating and negotiating access and use of water resources in downstream of UMs. The study found that stakeholders namely Uluguru Mountain Agriculture Development

Project (UMADEP) and Wami-Ruvu Basin Water Office (WRBWO) are highly centralized therefore are located at the centre of the network. This implies that the two have relation with many stakeholders. UMADEP is promoting sustainable agriculture and agroforestry in villages around UMs while WRBWO among other activities issue water use as well as discharge permits and sensitize on sustainable use of water resources.

Fig. 9 further shows that other actors and their centralization in the network. It was revealed that Morogoro Urban Water and Sewerage Authority (MORUWASA, Mvomero District Council (MDC), Community in Mafisa Street (CMS), Mlali Water Board (MWB), Mlali Kipera Rice Irrigation Scheme (MKRIS), Morogoro Municipality (MM) and Community in Mlali Village (CMV) received very low centrality scores for this network, thus are at the periphery. This implies that these actors may be connected to networks that are not currently mapped. For instance, social network of upstream (Fig. 7) revealed that MDC is well connected with many stakeholders such as Uluguru Nature Reserve (UNR), Morogoro Region Catchment Forest Project (MRCFP) and Forestry and Beekeeping Division (FBD). This makes them very important sources of information not available inside the network.

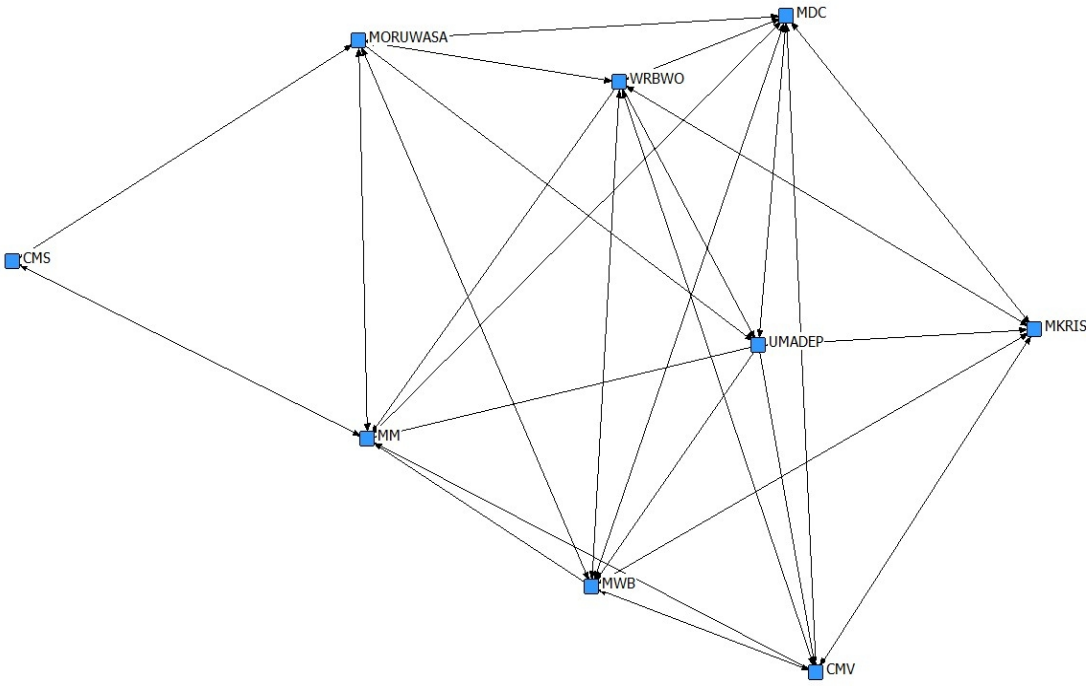

Figure 9: Social network in the downstream.

4.1.4.1 Strength of the relationship of stakeholders in the downstream

The thicknesses of the lines in Fig. 10 depict the varying strengths of relationship, where thicker lines represent strong relationship among stakeholders. The study found strong relationship between WRBWO and water users' institutions (MORUWASA, MWB and MKRIS). WRBWO has institutional power to manage Ruvu basin water resource. The strong relationship is attributed by the fact that WRBWO facilitated the formation of water user institutions and collection of water fees. This makes WRBWO and water users organizations in close contact of sharing information.

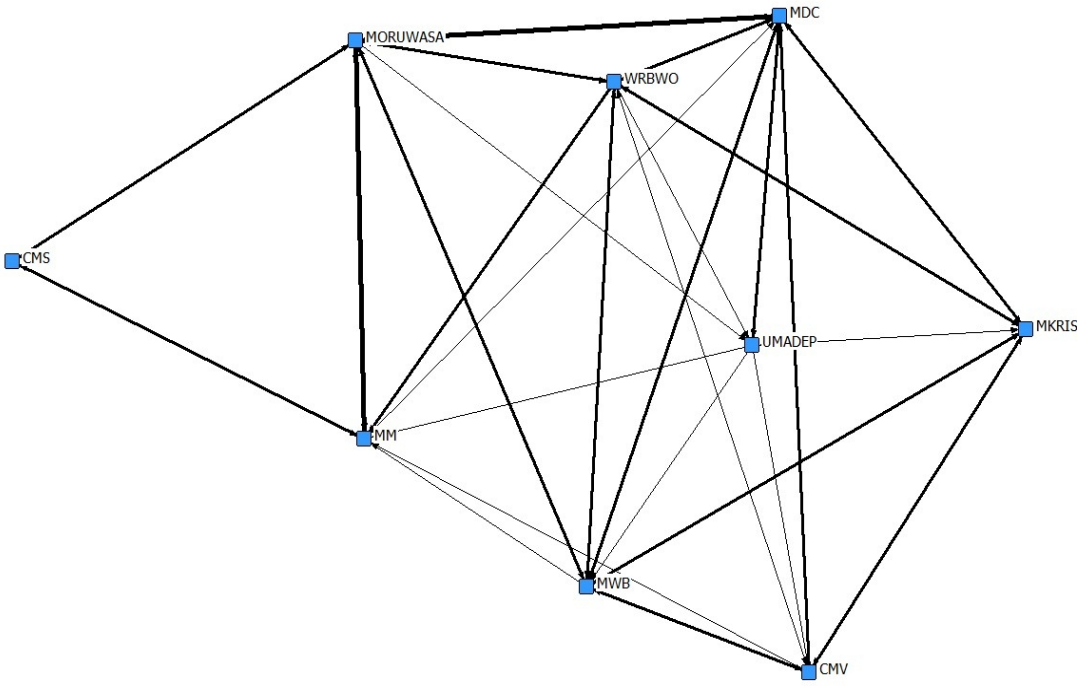

Figure 10: Social network and tie strength among stakeholders in the downstream.

The study further found strong relationship between MORUWASA as key supplier of water in Morogoro Municipality (MM) and Communities in Mafisa Street (CMS), and WRBWO. The strong relationship between MORUWASA and CMS is attributed to economic gain because communities pay monthly water bills to MORUWASA. The strong relationship between MORUWASA with MM and WRBWO is because MORUWASA is accountable to MM and WRBWO. On the other hand, discussion with key informants in Mlali village revealed that WRBWO has no relationship with community in the management of water resources instead has strong relationship with MWB and MKRIS.

4.1.4.2 Position of the stakeholders (Betweeness centrality) and their roles in the network

Fig. 11 presents various sizes of nodes that corresponding to relative betweenness centrality of actors in regulating and negotiating access and use of water resources in the

downstream of UMs. MORUWASA and MM were found to hold high betweeness centrality in the network compared to other actors. This indicates that they are most important source of information to the network. The study revealed that both MORUWASA and MM have potential sources of information outside the network. For example, MORUWASA has many customers include households, private companies, State organizations and NGOs which put it in a pool of new information.

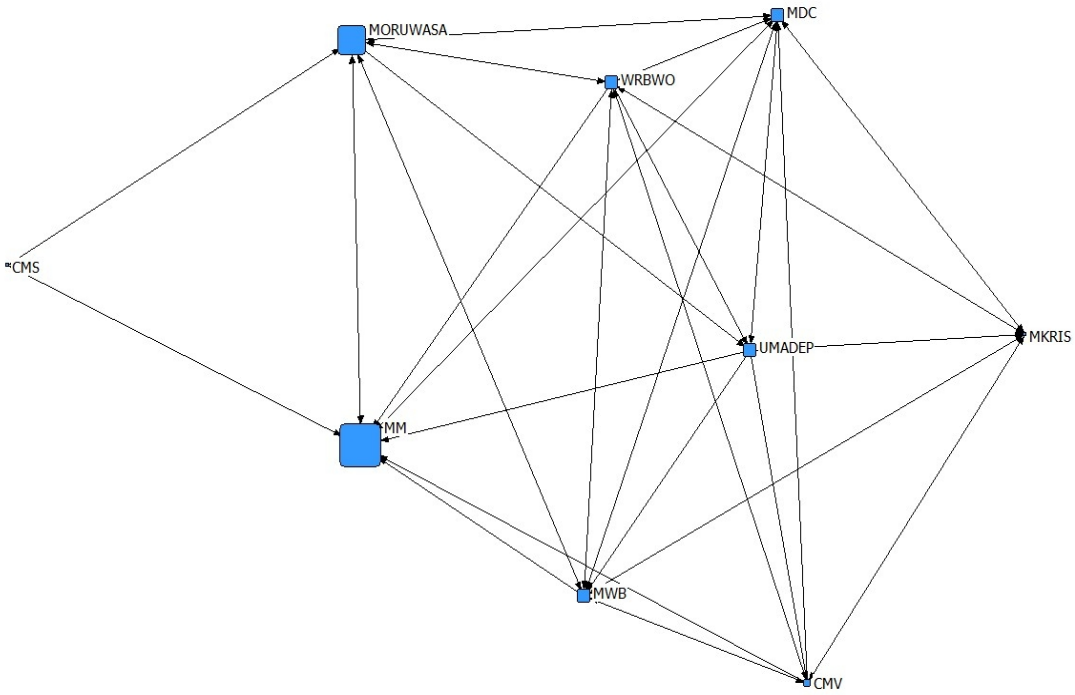

Figure 11: Betweeness centrality of stakeholders in downstream.

4.1.5 Platform of stakeholders in UMs

All (100%) stakeholders in UMs revealed the absence of formal platform/arena that gathers all stakeholders. The platform of stakeholders is very important because it gathers all stakeholders regardless of their interests and categories. Furthermore, the study revealed that stakeholders meet once or twice per year on interest-based seminars or workshops organized by Forestry and Beekeeping Division (FBD). Those seminars or

workshops are attended by few stakeholders and marginalize others which hinder unity among stakeholders. The most marginalized stakeholders were found to be those at village level from both upstream and downstream despite of the significant role in the management of CPRs. This may lead to conflict relation among stakeholders.

4.2 Power Relations between Upstream and Downstream CPR users and how they create Winners and Losers

4.2.1 Power relations underlying CPRs users in the upstream of UMs

The study found that all (100%) of respondents in the upstream use firewood or charcoal as the main source of energy for cooking and heating. The use of building poles for construction was found to account for 47% in Ruvuma Street and 41% in Peko Misegese village while the use of timber accounts for 63% in Ruvuma Street and 33% in Peko Misegese village. Difference across villages is attributed by the distance from forest reserve (FR); people in Ruvuma are adjacent to FR compared to those in Peko Missegese. The collection of forest products is done either outside or inside FR. The exploitation of timber is illegal and mainly done for business whereby people from outside the village in collaboration with village members are found to be key players in the illegal timber business.

The study revealed cordial power relations between timber traders and some village members in the upstream. The timber traders make informal arrangements with young men from the upstream villages for buying timber or financing pit sawing activity. In this case, a strategic power of timber traders revealed whereby they use their financial power to access forest products through illegal harvesting. Discussion with key informants revealed two reasons for involvement of young men in illegal timber trade. Firstly, they are adjacent to forest, therefore, are able to enter in the forest easily and secondly, most

young men are idle during dry season due to lack of capital to engage in the vegetable production, therefore, turning to illegal timber business.

The study further revealed power relation between timber dealers and members of Village Natural Resources Committee (VNRC) and Village Government (VG). The VNRC and VG have institutional power while timber dealers have strategic power as the function of their financial power. In this case, supportive power relation was manifested whereby members of VNRC and VG use their institutional power to support illegal timber trade for personal gain. They support illegal timber trade by not reporting illegal activities to respective institutions for taking legal actions. Mbeyale (2009) reported that village chairmen in villages adjacent to Chome Forest Reserve in Eastern Same tended to act as a power broker as they normally take some money from timber traders and pit sawyers instead of siding with the forest officers.

This mainly is attributed by weak institutions following the intention of the government to relocate upstream residents to the lowland areas. The government intention was to relocate the upstream communities by the end of June 2006 (VPO, 2006) but it is not yet implemented. The study found that VNRC in Ruvuma Street stopped patrolling and taking care of the forest in 2006 and few members of former VNRC are still working but by blessing illegal harvesting. Discussion with key informants from Morogoro Region Catchment Forest Project (MRCFP) confirmed that the government intention on reallocation of upstream dwellers reduce the morale of communities in the upstream to participate actively in JFM consequently increasing illegal activities.

The study further revealed that apart from forest products, upstream communities benefit from water resources. Water is used for both domestic and agricultural purposes. In

agricultural production, water is regarded as natural capital and used by 83% of communities in production of vegetables. Types of vegetables produced and irrigation systems used differ between two sites of upstream, Ruvuma Street and Peko Misegese village. Ruvuma Street is famous for production of vegetables such as radish, cabbage, spinach, beetroot, green bean, salad, coriander, and leeks (Plate 1). The vegetables produced are sold in Morogoro town and Dar es Salaam city.

Plate 1: A plot of leeks grown during dry season in Ruvuma Street

The vegetable production in Ruvuma Street is done along river valley employing traditional and semi mechanized irrigation systems. The traditional irrigation system involves the use of furrows or using water canes and is common for farmers who are adjacent to rivers/streams. Semi mechanized irrigation system involves the use of long water pipes inserted at the water source and fitted with sprinter at the field (Plate 2). In this method water runs through the pipe by gravity and is mainly used by individuals with

relative higher income. The sizes of the water pipes differ from 50 m to 400 m depending on distance from the water source to the field. Water flows in water pipes throughout the day.

Plate 2: Water pipe lay on the ground flowing water from source to the field

In Peko Misegese village, vegetables grown include cabbage, carrots, beans, water melons, spinach and tomatoes. These vegetables are grown along river valleys but unlike Ruvuma Street, most communities in Peko Misegese village use traditional irrigation systems. In this system, water is diverted from river/stream to the field using traditional furrows. Participant observation revealed the use of traditional water pipes (bamboo) channelling water to the field (Plate 3). The size of the plot is about 0.25-0.5 ha and some

produce are sold at local market but large quantities are sold at weekly market (Sunday and Wednesday) at Mlali village. The study found that power relations of most farmers in the upstream are centred on access of water for irrigation.

Plate 3: The use of bamboo to divert water to the field in Peko Misegese village

In the use of water during dry season vegetables production in the upstream, the study revealed that community members differed in strategic power and hence access to water resources, whereby wealthier members had more access to the resources. In this situation skewed power relations manifested whereby wealthy people in the community use their money strategically to paralyze the poor. The rich farmers were found exploiting the poor by using their financial power to buy land in strategic position. In this case, strategic power of rich people revealed whereby power is a function of relative wealth. The study revealed that rich people access more water resource through the use of water pipes or water pumps for vegetable production during dry season. On the other side, the study

revealed that households owning plots in strategic position that is adjacent to forest or water source also access and use more water than distant ones. Mbeyale (2009) reported that the relative wealth is the main source of strategic power in mountains and lowlands of Pangani River Basin.

4.2.1.1 Dominant power among CPRs users in upstream

The study revealed unequal access to CPRs among people living in the upstream; there are group of people who are accessing more CPRs than others. This is probably due to socio-economic differences that exist among people in the upstream. Bardhan and Dayton-Johnson (2002) pointed out that socio-economic heterogeneity increases power imbalance and decreases cooperation in CPRs management at a local level. In line with this, the study showed that individuals in the upstream have different power as a result of differences in wealth, strategic positions to resources and their relationship to different institutions. Three categories of power namely strategic, institutional and structural were revealed underlying access and use of forest and water resources, however, strategic power was found to be dominant in the upstream of UMs (Appendix 3).

PRA results match with results from structured questionnaire survey which employed five points Likert scale. The majority of respondents interviewed, 38.3% strongly agreed and 28.3% agreeing the fact that strategic power influence access, control and use of CPRs in the upstream of UMs. The rest, 8.3% strongly disagreed, 6.7% disagreed and 18.3% undecided. Respondents that agreed to the fact exceed the numbers who disagreed by five times. This implies that strategic power dominate in the upstream of UMs and has higher influence in the access and use of forest and water resources. Different factors were identified that underlying strategic power in the upstream.

4.2.1.2 Factors underlying strategic power in upstream forest and water users

Table 7 shows factors underlying strategic power underlying CPRs users in the upstream of UMs. The coefficient of determination (R^2) of 0.79 (1.59 Std. Error of the estimate) implies that independent variables explained about 79% variation in dependent variable. Table 7 further shows that positive correlation was depicted between strategic power and residence duration of respondent, wealth category of respondent, Farm size, education level of respondent, household size and distance to resource base.

Table 7: Factors underlying strategic power in the upstream

		Coefficients (a)	R^2 = 0.79	
Factors X_i	β	S. E	t	Sig.
Residence duration	.606	.024	8.587	.000*
Wealth category	.135	.366	2.396	.021*
Farm size	.143	.150	2.059	.045*
Education level	.053	.352	1.101	.276NS
Household size	.012	.119	.194	.847NS
Distance to resource base	-.169	.123	-2.728	.009*
(Constant)		1.673	4.640	.000*

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

Residence duration

Table 7 shows that the number of years an individual has stayed in the study area to be highly significantly correlated (p=0.000) with the strategic power and had positive Beta value (Beta= 0.606). This implies that an increase in number of years of residence improve the social capital of the individual, therefore, holding strategic position and become more influential to the community. It has been revealed from the study that people having been born in an area describe themselves as belonging *"mimi ni mzaliwa hapa*". Individuals born in an area exercise a greater level of influence than outsiders who

have moved into the area. This further highlights the importance of territoriality and claims on the resource being a defining characteristic for the *Waluguru*.

Table 8 shows residence duration of respondents in Ruvuma and Peko Misegese villages. Results in Table 8 indicates that (8%) of respondents stayed in the study area for less than 20 years. The majority, (47%) of respondents interviewed born in the study area and stayed in the area for duration of 20 to 40 years while 40% born in the study area and stayed for duration more than 40 years. This implies that in the study area the majority of respondents have stayed in the study villages for relatively long time, therefore, they have built enough social capital which is the main source of power that influence the access and use of the CPRs.

Table 8: Residence duration in the study area

	Name of Street/village		
	Ruvuma Street	**Peko Misegese village**	**Total**
Residence duration	**F (%)**	**F (%)**	**F (%)**
Less than 20 years	3 (10)	5 (17)	8 (13)
21-40 years	17 (57)	11 (37)	28 (47)
More than 40 years	10 (33)	14 (47)	24 (40)
Total	**30 (100)**	**30 (100)**	**60 (100)**

Wealth category

Table 7 shows relative wealth of respondents to be highly significantly correlated ($p = 0.021$) with dominant power (strategic power) in the upstream and had positive Beta weight (Beta=0.876). This implies that increase of relative wealth increase individual power in access and use forest and water resources. Their power is based on their financial or ability to raise capital necessary for harvesting and transporting the products to the market by using the low income groups. This enables them to strategically exploit resources based on their need such as food and other important livelihood items.

The study found individuals who belong to the rich income groups mobilized their resources and invested in dry season vegetable production. In such investment they employ poor to perform all farm operations including tilling land, transplanting, weeding and harvesting. They also bought water pipes, sprinklers, farm inputs such as inorganic fertilizer, and pesticides and quality seeds. People who belong to poor income group depend much on vegetable production during rainy season because water is plenty, the rest of the time; they are engaged in casual labour or illegal activities such as pit sawing. Rain season production of vegetables is not economically profitable because the market value is low due to high supply. The minority of poor who are engaging in dry season vegetable production own small plots and produce less because plants dying due to lack of enough water, pests and diseases.

Table 9 shows wealth ranking for the upstream of UMs. The results revealed that in Ruvuma Street, 33% of households estimated to be poor, 56% of households with middle income and 11% households were rich. On the other hand, 43% of households in Peko Misegese village estimated to be poor, 49% households' middle income and 8% households were rich people. The difference can be attributed to the fact that the production of dry season vegetables in Ruvuma Street makes them better off than in Peko Misegese village. This is because people in Ruvuma Street are adjacent to market of Morogoro town and furthermore produce vegetables which fetch high demand in Dar es Salaam city than those in Peko Misegese village.

Table 9: Relative wealth ranking

Income group	Wealth criteria	Value in percentages	
		Ruvuma	Peko Misegese
Rich	Have land more than 5 acres Have high income of more than 200,000 shillings per month Have a good house made by bricks/blocks and iron sheet Have four cattle, five goats, 2-3 pigs, 15-30 chicken Have kiosk/shop as other source of income Have a car and/motor cycle Have enough food throughout the year (3meals/day)	11	8
Middle	Have land more than 1-2 acres Have income of 150,000-160,000 shillings per month Have a normal house Livestock, have one or no cattle, two goats, 2-3 pigs,8-10 chicken Have kiosk/shop as other source of income Have assets like Radio and bicycle	56	49
Poor	Have no enough food for whole year Have house made by muddy walls and grass Have income of 50,000/=per month Have farm size of less than 2 acres Have no means of transport Have 5-10 chickens	33	43
Total		**100**	**100**

Farm size

Table 7 shows that farm size to be significantly correlated (p=0.045) with the strategic power in upstream and had positive Beta weight (Beta= 0.143). This implies that an increase in farm size increase strategic power of the respondent. A plausible explanation is that farmers with large farm sizes could produce more agricultural products and sell the surpluses which make them financially better off compared to those with small farm sizes. Those respondents who are financially better off can buy farm inputs such as water pipes or water pumping machine to be used in exploitation of water resources to increase productivity or invest in illegal harvest of forest products.

The study revealed that all (100%) of respondents in upstream own farm for crop production. Farm is the most important household resource for both subsistence and cash income. The majority, 57% of respondents in the upstream acquired land through inheritance from their parents (In matrilineal system practiced by *luguru* inheritance is from mother to daughter) while 2% bought land, 18% rented land, 3% allocated by government, 20% bought and inherited (Fig. 12). The study found positive correlation between farm size and annual income of respondent however has no significant (r = 0. 191) and (p=0.152) which is more than the critical value (α=0.01 or 0.05).

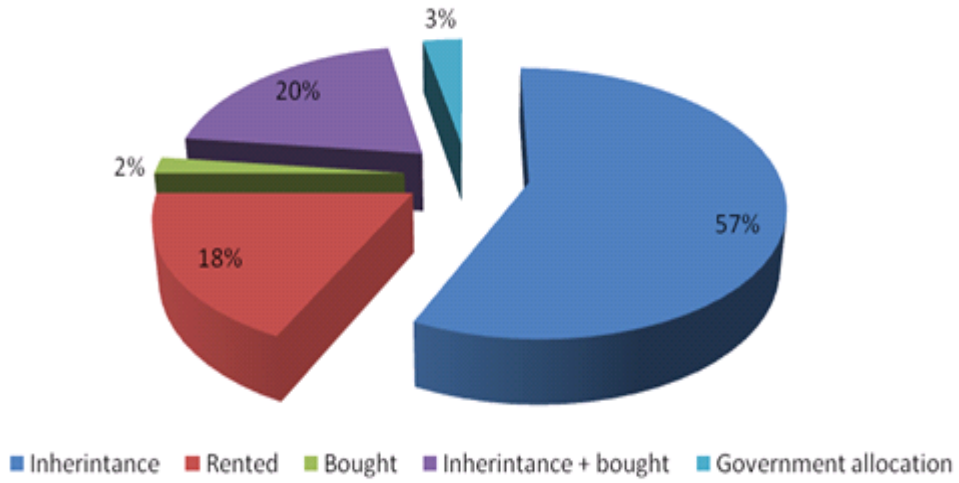

Figure 12: Farm acquisitions in study area.

The study further shows that high population and inadequate arable land causing most households owning 0.25 and 5 ha of farm. The average farm size was 1.6 ha (1.73 standard deviation) while majority has 1.8 ha. Table 10 presents farm sizes owned by respondents in the upstream. The findings revealed that the majority, 48% of respondents had farm size between 1.26 and 2.4 ha, 35% had less than 1.2 ha, 13% of respondents had farm size between 2.46 and 3.6 ha while the rest, 3% had farm more than 3.6 ha.

Table 10: Farm size in study Street/village

Farm size	Ruvuma Street	Peko Misegese village	Total
	F (%)	F (%)	F (%)
Less than 1.2 hectares	14 (47)	7(23)	21(35)
1.21 – 2.4 hectares	16 (53)	13(43)	29 (48)
2.41- 3.6 hectares	0 (0)	8(27)	8 (13)
More than 3.6 hectares	0 (0)	2(7)	2 (3)
Total	**30 (100)**	**30 (100)**	**60 (100)**

Education level of respondents

Table 7 shows that education levels of respondents were positively correlated (Beta= 0.053) to the dominant power (strategic power) in upstream, however, was not statistically significant (p=0.276). The positive value indicates a positive attitude towards the dominant power as education level of respondents' increases. This is due to the fact that increase in education level increase people's level of investment in human capital and power of defending claims to resources at different levels of conflict resolutions. Onu (1991) pointed out that education level of an individual is vital in terms of CPRs conservation and utilization.

Mbeyale (2009) reported that formal education is a source of strategic power acquired through investment in human capital, ability to defend their claims or having great network with other people in urban centres. Table 11 indicates that the majority of the respondents in the study area, 75% had primary education, followed by no formal education 22% and secondary education (3%). The study revealed that Ruvuma Street have at least 3% of the respondents attained secondary education while in Peko Misegese village 90% of respondents have primary education and very few (10%) have no formal education.

Table 11: Distribution of respondents by education levels

Education level	Name of Street/village	Total

	Ruvuma Street	Peko Misegese village	
	F (%)	F (%)	F (%)
No formal education	10 (33)	3 (10)	13 (22)
Primary education	18 (60)	27 (90)	45 (75)
Secondary education	2 (7)	0 (0)	2 (3)
Total	**30 (100)**	**30 (100)**	**60 (100)**

Household size

Table 7 further shows that household size was positively correlated (Beta= 0.023) to strategic power, however, not statistically significant (p=0.847). The positive value indicates a positive contribution of household size in access and use of forest and water resources. Household members (family) are the main source of labour power to the household and are the important parameter in the household economy. Increasing the number of members in the family also increase labour force and land size cultivated. The result show that household size strongly correlated with land size cultivated by household with (r = 0. 632) and (p=0.000) which is also less than the critical value (α=0.01).

State of being many in numbers has significant influence in household's power through wealth and social networking. This makes households with large family size to have stable household economy since they can produce more as compared to households with few household members. Wealth accumulated through cash and food crop production is the main source of household strategic power. Mbeyale (2009) pointed out the importance of human labour in transporting sick people from different locations and transporting goods to the markets, the situation in which large families are in advantage.

The mean family size was 4.47 (2.25 standard deviation) persons per household. The study found that the majority, 42% of household visited in both Ruvuma and Peko Misegese had 3-5 family members, 20% had less than 2 members, 33% had 6-8

household members while 5% had more than 8 members (Table 12). A typical household in the study area consists of four dependent members and more than 53.44% of the sample households had at least 2 dependent members. The implied dependency ratio; ratio of number of household members younger than 14 years and older than 65 years old to number of household members between 15 and 65 years old was 114.75%.

Table 12: Household size in the study area

	Name of Street/Village		
	Ruvuma Street	**Peko Misegese village**	**Total**
Household size	**F (%)**	**F (%)**	**F (%)**
<2	7 (23)	5 (17)	12 (20)
3-5	16(54)	9 (30)	25 (42)
6-8	7(23)	13(43)	20 (33)
>8	0(0.0)	3 (10)	3 (5)
Total	**30(100)**	**30(100)**	**60 (100)**

Distance to resource base

Physical proximity to catchment forests gives upstream dwellers ability to derive benefits from both forest and water resources to support their livelihood. Table 7 shows that distance from residence to resource base (forest and water for upstream) to be statistically significant (p=0.009) with negative Beta value (Beta=-169). The negative correlation indicates that increase in distance from residence to the resource base tend to weaken individual power in access and use of resources. The plausible explanation is that increase of distance to resource base makes exploitation of the resources costly in terms of investment capital and walking time to resource base. Short distance to the resource base makes individual in a strategic position to access resources.

The study revealed that respondents who are residing adjacent to the resource base are at advantage of accessing and using forest and water resources therefore have strategic

power. This is due to their strategic position from the resource base. In this situation, strategic power is normally observed where power is derived from ones' endowments and entitlements (Mbeyale, 2009). In line to this, the study showed that individuals who are closer to forest and water resources had more access to resources. In Ruvuma Street the study found that individuals who are near to forest are main producers of the carrots and cabbages because they have easy access to water.

Table 13 shows distance in kilometres from residence to the resource base in study area. The majority, 53% of respondents in both Ruvuma and Peko Misegese villages were residing less than 1.5 km from resources base while 38% respondents located 2.0 to 3.5 km and 8% of respondent reside more than 4 km from resource base. The study further revealed that 37% of respondents who reside at less than 1.5 km from the resource base practised dry season vegetable production while 17% depend on rainfall only (Fig. 13). Fig. 13 further shows that 27% of residence residing 2–3.5 km practise irrigation while 12% depend on rainfall. The plausible explanation is that people who stay far away from the resource base usually do not practise irrigation because of high cost of constructing irrigation infrastructures.

Table 13: Distance to resource base for study area

Distance to resource base	Name of Street/village		Total
	Ruvuma Street	Peko Misegese village	
	F (%)	F (%)	F (%)
Less than 1.5 km	17 (57)	15 (50)	32 (53)
2.0-3.5	10 (33)	13 (43)	23 (38)
More than 4 km	3 (10)	2 (7)	5 (8)
Total	**30 (100)**	**30 (100)**	**60 (100)**

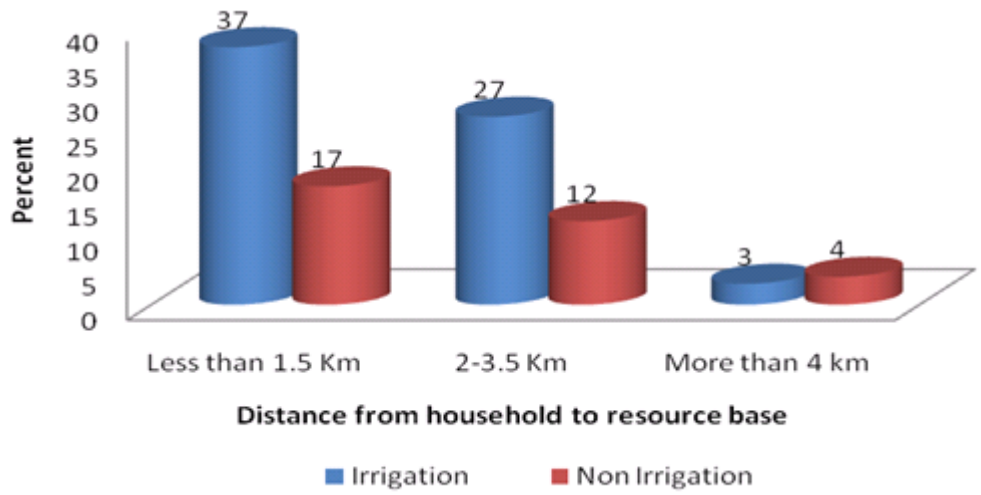

Figure 13: The influence of distance to water resource use.

4.2.2 Power relations underlying water users in the downstream

The study revealed that communities living downstream are highly dependent on water from upstream for domestic, industrial and agricultural sector development. Participant observation revealed the presence of infrastructures along Morogoro River used to capture water for domestic and industrial use. It was further revealed the use of water from Morogoro River for rice, vegetable production and brick making (Plate 4) done by communities in Mafisa Street to sustain their livelihoods. The main vegetables grown include spinach, cabbage, tomatoes, chinese, okra and eggplant and are mainly sold in the local market. Water for vegetable production is pumped from Morogoro River using machines. During severe drought, water wells are dug along the river to facilitate irrigation activities. Brick making is also done along the river valley due to presence of sustainable water and clay soil which is suitable for brick making.

Plate 4: Brick making along Morogoro River valley

In Mlali village, the study found two main sources of water; water source for domestic use and the other for agriculture. Water for domestic use is withdrawn from Mgela River that originates from the Uluguru North Forest Reserve (UNFR) and empts in Mindu dam. Water for agriculture is withdrawn from Mlali River. Several rivers join to form Mlali River but the most important rivers include Obwe from Peko Misegese village and Mbalala from Mbalala village. Rice irrigation scheme has been established along this river. During dry season, water from the river is supplemented by water from wells and used for production of vegetables specifically tomatoes.

The communities from both sites, Mafisa and Mlali their power are centred on the access and use of water for domestic and irrigation purposes. In Mafisa Street, the study found strong relationship between communities and MORUWASA whereby both institutional and strategic powers were portrayed. MORUWASA have water user rights therefore

granted institutional power to supply water to Morogoro Municipality while communities have strategic power because of their financial power. The strategic power enable communities to be connected to the water supply system, hence become a member of MORUWASA. In this case, complimentary power relations manifested since MORUWASA and community join together in delivering water services.

The study further revealed power relations underlying access and use of water for dry season farming. In Mafisa village, irrigation plots were found along Morogoro River. The access and use of water for irrigation is not regulated by any entity, makes the resources under open access. In this case, strategic power was revealed whereby rich people exploit more water by using water pumps than those who are poor. In this case the conflictive power relations revealed between rich and poor farmers in access and use of water for irrigation. To avoid violent resource use conflicts, poor farmers tend to cultivate small plots and irrigate using water cans while the majority cultivate during rainy season only, during dry season they become vegetable vendors.

In Mlali village, strategic and institutional powers were revealed in interaction among communities and communities with water institutions: Mlali Water Board (MWB) and Mlali Kipera Rice Irrigation Scheme (MKRIS). The communities in Mlali have strategic power because of the economic exploitation while MWB and MKRIS have water user rights therefore, granted institutional power. MWB granted institutional power to supply water for domestic use while MKRIS for allocation of water in the rice production. In this case complimentary power relations manifested because community associate with water institutions in supplying and maintaining water infrastructure.

The study further revealed conflictive power relations among community members in the use of water for vegetable production due to differences in power. Water for vegetable production is under open access; therefore, individuals with strong strategic power are in advantage. In this case, strategic power is the function of distance to resource base and relative wealth. Rich people were found buying land along rivers and block river flow while poor seek casual labour to sustain their life. During the peak of dry season, rich people drill water wells to overcome water shortages while poor hire water pump by offering their labour power or by paying in cash.

Combination of strategic, institutional and structural powers is manifested in interaction between communities and MWB whereby conflictive power relations manifested. During interview with community members, it was reported that some members of water board allocate water to vegetable growers at night because vegetable growers corrupt members of water board. Nuijten (2005) pointed out that organization or officials who do not operate according to principles of accountable management are normally labelled corrupt and cannot be trusted by community or village government. In line with this, leadership of MWB was overthrown by the village government. The village government use their structural power to punish leaders of MWB because leaders of MWB are subordinate to the village government.

Interaction between communities in Mlali village and MKRIS revealed both strategic and structural power whereby conflictive power relation manifested. This is due to the miss use of structural power in allocation of irrigation plots to new applicants done by scheme leaders. For example, chairperson of MKRIS allocated a plot to his son under corrupt environment. On the other hand, institutional and strategic powers were revealed where rich people got a piece of land for rice production through corruption. According to the

constitution of MKRIS, individuals applying for land should pay application fee of TZS 20 000 but the study showed that applicants are paying more than TZS 100 000 to cover other costs such as sitting and meal allowances for board members. This creates opportunity for rich people who are able to pay large sums of money to get irrigation plots in the scheme and marginalizing the poor.

4.2.2.1 The dominant power in the downstream

Unlike in upstream where access and use of water resources for domestic and irrigation is free to people living adjacent water sources, in the downstream access and use of water for domestic, industrial and agricultural are regulated by formal institutions. The resource users are abide to the rules and regulations of the respective institutions including paying of monthly bill for domestic and industrial water use and annual water fees for agricultural use. The main institutions identified in the study area include Wami-Ruvu Basin Water Office (WRBWO) which is overseeing water management in Wami and Ruvu River Basins. Other important role of the water basin office is to allocate water to different users.

Despite of the presence of institutions, 62% of respondents blamed lack of equity in access and use of water because their allocations are influenced by individual power while 28% acknowledge the presence of equity. Problems of water allocations were high in Mlali village whereby water is used for domestic and crop production. Three categories of power namely strategic, institutional and structural were observed in access and use of water in the study area. The study revealed that institutional power is dominant in the downstream with the score of four, followed by strategic power with score of two as shown in Appendix 4.

The findings obtained through PRA exercises match with those from respondents obtained through structured questionnaire. Five points Likert scale was used to assess the fact that institutional power influence individual access and use of water resource. The majority of respondents interviewed, 38.3% strongly agreed and 21.7% agreed while 13.3% strongly disagreed, 13.3% disagreed and 13.3% undecided. Combining responses respondents that agreed out numbers those who disagreed by four times. This implies that institutional power dominates, therefore has higher influence in access and use of water. Different factors were identified that underlying institutional power as discussed below.

4.2.2.2 Factors underlying institutional power relations in downstream

Table 14 shows factors underlying institutional power in the downstream of UMs. The coefficient of determination (R^2) of 0.84 (1.37 Std. Error of the estimate) implies that independent variables explained about 84% variation in dependent variable. Table 14 further shows that positive correlation was depicted between institutional power (dominant power in downstream) and education level, membership of institutions, residence duration and presence of infrastructures.

Table 14: Factors underlying institutional power in access and use of CPRs in the downstream

Factors X_i	**Coefficients (a)**	**R^2 = 0.84**		
	β	**S. E**	**t**	**Sig.**
Education level	.349	.276	4.216	.000*
Membership to institutions	.408	.565	4.476	.000*
Residence duration	.094	.019	1.163	.251NS
Presence of infrastructures	.057	.459	.861	.393NS
(Constant)		**1.334**	**7.100**	**.000***

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

Education level of respondents

Table 14 shows that there was positive correlation (Beta=0.349) between institutional power and education level of respondents and highly statistically significant (p = 0.000). Positive correlation implies that people with high education holding position in institution, therefore use institutional power to access water resources. This is due to the fact that an increase in education tends to increase people's chances of being employed in institutions or contest for political positions in the society compared to less educated people.

The study revealed that education is the significant condition for holding position in water institutions in the study area. For example, constitution of MKRIS Article 11 (iii) requires any person who wants to contest for leadership should have at least primary education. This condition automatically ignored illiterate and make them losers. Table 15 presents education level of respondents in the downstream whereby the majority, 78.73% had formal education which makes them in position to compete for the leadership while 21.27% had no formal education.

Table 15: Distribution of respondents by education levels in the downstream

	Name of the Street/village		**Total**
	Mafisa Street	**Mlali village**	
Education level	**F (%)**	**F (%)**	**F (%)**
Non formal education	4 (13.3)	9 (30)	13 (21.27)
Primary education	20 (66.7)	16 (53.3)	36 (60)
Secondary education	4 (13.3)	5 (16.7)	9 (15)
Tertiary education	2 (6.7)	0 (0)	2 (3.33)
Total	**30 (100)**	**30 (100)**	**60 (100)**

Membership to water institutions

Table 14 shows the effect of being a membership of water institution to dominant power in the downstream. The table reveals that membership in water institution significantly correlated with institutional power (p=0.000). Being a member of water institution has positive Beta weight (Beta=0.408) suggesting that respondents' membership in water institution increase his/her institutional power in access and use of water resources. This is because, members of water institutions pay water bills and other charges therefore are institutionally obliged to claim for better water service they paid for.

Residence duration

Table 14 shows that residence duration of the respondent in the study area has positive correlation (Beta=0.094) with institutional power in the downstream however not statistically significant (p= 0.251). This implies that people who stay for many years in the study area are able to become members or hold positions in the institutions, therefore connected to water supplying system. The plausible explanation is that in the past, demand for water was not high because population was very small. This made possible for majority of people to get connected to tape water supplying system at that time. Currently, there is increasing demand of water which does no match with infrastructure available. This hinders the process of supplying water to additional water users.

For instance, MORUWASA through her gravity sources of water in Morogoro River and other small streams of Kigurunyembe, Kibwe, Mgolole and Vituli, together with pumping source of Mindu reservoir its capacity is range from 70% to 75% of Municipal population. People who have direct connection of clean water account for 30% of total population in the municipality. In Mlali village, 25% of population has direct connection of clean water in their houses. The majority are those who reside in the area during

establishment of the water board in 1977. Last connection to new customers in the water system was done in 2002 while there are more than 250 people applied for connection. This implies that individuals who stayed for many years are accessing clean water supplied by existing water institutions in their houses.

The study further revealed the importance of residence duration in access and use of water for rice and vegetable production in Mlali village. It was revealed from the study that people who own plot in the scheme are indigenous of either Mlali or Kipera village. To limit immigrants to acquire plot in the scheme, Article 5b Section (i) of the constitution of Mlali-Kipera Rice Irrigation Scheme (MKRIS) require applicant to be resident of either Mlali or Kipera village. This condition marginalizes non-members of Mlali and Kipera village to access and use water for irrigation in rice irrigation scheme.

Presence of water infrastructure

Table 14 indicates that availability of water infrastructures had a positive correlation (Beta=0.057) but not statistically significant (p=0.393) correlated with institutional power. Positive regression suggests that respondents who connected to water system have institutional power hence access more water as opposed to those who are not connected to water systems. This could be due to principle operating water institutions whereby individual connected to water distribution system under a certain water institution is a member of that particular institution. This granted individuals chance to compete for leadership in the institution than non-members. The study showed that individuals connected to water distribution system access more and store water in water tanks for selling during water shortage.

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

The study revealed conflictive power relations between upstream and downstream CPR users. The conflictive power relations were attributed to differences in the dominant power types that operate under weak common property institutions in sustaining management of the CPRs and distributing its products. In the upstream where CPR is regarded as open access, strategic power is dominant whereby power is the functions of distance to resource base, residence duration and financial capability while in the downstream, institutional power is dominant whereby power is the function of individual relation with water institutions. The study revealed that the differences in power types create winners and losers.

The majority, 72% of interviewed respondents affirmed the presence of winners and losers in access and use CPRs in UMs whereby more than half (60%) reported that winners are upstream communities. Main reason is the presence of weak institutions in regulating and negotiating access and use of forest and water resources. Hardin (1968) argued that tragedy of the commons often results, not from any inherent failure of common property, but from institutional failure to control access to resources, and to make and enforce internal decision for collective use. Adhikari *et al*. (2004) emphasized on the importance of the efficient institutional arrangements in many CPRs management systems to ensure equity and sustainability of resource management at the local level. It serves a number of important socio-economic functions like coordinating the formation of expectation, encouraging cooperation and reducing transactions costs. The study revealed that institutional failure in the management and utilization of CPRs in UMs benefited the upstream users because they are able to access and use them freely.

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

The management of water resource flowing from catchment forests of UMs is under Wami/Ruvu Basin Water Office (WRBWO). The WRBWO was established in July 2002, under Water Utilization (Control and Regulation) Act No. 42 of 1974 and its amendments No. 10 of 1981 and granted institutional power to manage water in Wami and Ruvu Basins. For many years basin water office had no mandate to facilitate establishment of lower level water management organizations in order to bring together users and stakeholders of the same source till 2009 after new water act was enacted. Despite of presence of provision in Water Supply and Sanitation Act No. 12 of 2009 that gives WRBWO authority to establish lower level water management organization such as WUAs, still there is no such organization in the study area. The study found lack of coordination between upstream and downstream users in the management and utilization of water a situation, which benefits more upstream than downstream users.

Presence of weak institutions also affects ability of the forest reserve to store water. This is due to forest degradation done by upstream communities. MNRT (2003) reported variations of water quantity and quality during rain and dry season at Morning side water gauge station in Ruvuma Street which was attributed to human activities. Human

activities affect forest/ vegetation cover. Furthermore, vegetation destruction was found to impair rainfall interception, stem flow, percolation and regulated discharge of water.

The presence of winners and losers in UMs affect justice and equity in access and use of CPRs hence led to resource use conflicts. This happen because resources available for downstream users has negative impact on peoples' livelihood such as crop growing and water availability for both domestic and industrial use. In efforts of ensuring enough resources are made available for downstream users, institutional power was used against upstream resource users. The case of 2006 whereby Morogoro Municipal Council used armed police to stop irrigation activities in Ruvuma Street and charged of a group of water users in Mongwe village are vivid examples of the use of institutional power. Both events end up in creation of resource use conflicts between upstream and downstream common pool resources users in UMs.

4.3 Resource Use Conflicts as the Result of Existing Power Relations

4.3.1 Resource use conflicts between upstream and downstream CPRs users

Table 16 shows occurrence of resource-use conflicts in the study area. The study shows that 63% of respondents acknowledged presence of resource-use conflicts between upstream and downstream against 37% who have different perception. Resource use conflicts in UMs are centred on interactions between upstream and downstream water users, in particular due to difference in power that influence access and use of water. This can be explained by inherent nature of water in rivers or streams where actions by one individual or group in upstream generate effects to downstream.

Table 16: Responses distribution on occurrence of resource use conflicts in UMs

Villages and its location		Response		
Location	**Street/svillages**	**Yes**	**No**	**Total**
Upstream	Ruvuma Street	27 (90)	3 (10)	30 (100)
	Peko Misegese village	26 (87)	4 (13)	30 (100)
Downstream	Mafisa Street	13 (43)	17 (57)	30 (100)
	Mlali village	19 (63)	11 (37)	30 (100)

Responses at village/Street level reported the same results although the magnitudes differ between villages/street. In Ruvuma Street, 90% of respondents reported presence of resource-use conflicts while 10% of respondents reported absence of them. In Mafisa street, street at downstream of Ruvuma, 57% respondents reported absence of resource use conflicts while 43% acknowledge the presence of resource use conflicts. The differences in responses between two streets are attributed to difference on how they responding to the problems of water scarcity. Water users in Mafisa are organized by formal institution (MORUWASA) which is responsible to ensure enough water is supplied, thus their water problems are presented directly to MORUWASA. The interventions of MORUWASA such as stopping water use activities in upstream (Ruvuma Street) created resource use conflicts with upstream users.

In Peko Misegese village, 87% of respondents acknowledged the presence of resource use conflicts and 13% reported absence of it. The results slightly differ with Mlali village where 63% of respondents acknowledge presence of resource use conflicts and 37% said no conflicts. The difference on perception of resource use conflicts between Mafisa and Mlali, both in the downstream was attributed by weak water institutions in Mlali village. Two types of conflicts were revealed in Mlali village; conflict between domestic water users and Mlali Water Board (MWB) and conflict between communities in Mlali and communities in the upstream villages. The conflicts between domestic water users and

MWB led to dissolving of the water board. Communities blamed leadership of MWB for misuse of funds and failed to deliver better services.

4.3.2 Values of water involved in the resource use conflicts

4.3.2.1 The value of water for domestic and industrial use

Water is the most important resources for both domestic and industrial uses. In the domestic, water is used for cooking, washing and drinking. Lack of enough and quality water for domestic may result to eruption of waterborne diseases. In industrial sector, water is used for washing of raw materials and cooling engines, lack of water reduce productivity. Therefore, the underlying value of water is not over water per se, but over securing good health and income. When upstream communities abstract water, they impact on water availability and quality hence threaten people's health, which further shake productivity, disturb revenue, later lead to job loss and finally collapse of economy.

4.3.2.2 The value of water in vegetable and rice production

Water is the most important input in vegetable production for both upstream and downstream and in rice production in downstream. In this case, the value of water in UMs is not over water per se, but over securing a good income: it is not over obtaining cu bic meters of water but over obtaining money. One can easily see the reason to the fight o ver water from looking at vegetable and rice prices during the season. Market prices of vegetable and rice vary considerably during the harvesting season, prices are higher in early and the late harvesting season and lower in the mid of the season. For example, whe n marketing tomatoes at the regular time (August-September) a household with 0.25 ha plot can earn an income of TZS 250 000 for its harvest, whereas it can earn as much as TZS 300 000 if the harvest can be marketed early or late of the harvesting season.

Hermans *et al*. (2007) argued that realizing the importance of the price dynamics in the l ocal markets also means realizing that these price dynamics are related to scarcity of water. Most probably, the scarcity of tomatoes on the local markets is due to the scarcity of water to produce the tomatoes. The result is a cycle in which the scarcity of water driv es up the price of tomato, which in turn reinforces the demand for water as more farmers want to take advantage of high market prices, which then in turn aggravates the conflicts over water.

4.3.3 Type of resource use conflicts

The results indicates that resource-use conflicts occurring in the study area can be delineated into three main types; conflicts among upstream and downstream farmers, farmers and livestock keepers and farmers in upstream and water institutions in downstream. The majority of respondents, 81% and 92% in Ruvuma and Mafisa streets respectively, reported conflicts between water users in upstream and water institution in downstream, for this case MORUWASA. High conflicts between farmers in upstream and downstream were reported in Peko Misegese and Mlali village by 92% and 59% of the respondents respectively (Table 17). The difference in the type of conflicts between Mlali and Mafisa (downstream areas) is attributed by difference socio economic demand of water. Mafisa mainly demand water from upstream for domestic and industrial use while Mlali demand water mainly for agriculture and domestic use.

Table 17: Types of the resource use conflicts

Street/village	User groups: Among farmers	User groups: Farmers and livestock keepers	User groups: Users in upstream and water institutions	Total
Ruvuma	5 (19)	0	22 (81)	27 (100)
Peko misegese	24 (92)	2 (8)	0	26 (100)
Mafisa	0	1 (8)	12 (92)	13 (100)
Mlali	10 (59)	2 (12)	5 (29)	19 (100)

Fig. 14 present periods when respondents experienced first resource use conflicts. The majority of respondents, 58% experienced the first resource use conflicts 5 years ago while 41% experienced 6-10 years ago and one percent experienced less than three years ago. Two reasons account for this, first increase demand of water in upstream and some villages in downstream for production of vegetables during dry season following increase market demand in Dar es Salaam and Morogoro. Secondly, unreliable rainfall due to changes of weather patterns and reduction of catchment value of the forest due to human activities such as illegal logging and expansion of banana farms.

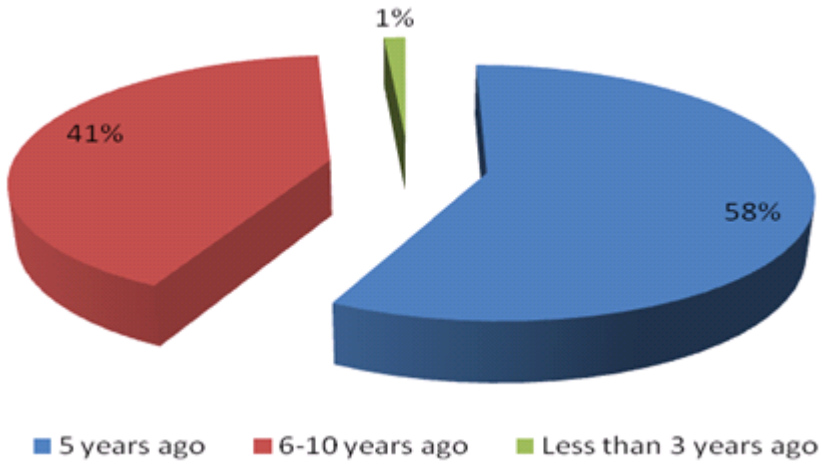

Figure 14: The period experienced first resource use conflicts in village.

4.3.4 Intensity of resource use conflicts

The intensity of conflict in the study area varies from arguments among members of a community to violent clashes between groups over resource access, ownership rights and use. The study found that nature of conflicts in the study area is dominated by arguments, disagreements and animosity among user groups as reported by 40%, 28% and 21% of respondents interviewed respectively. Tensions and violent clashes were reported by 2% and 8% of respondents respectively. The study revealed arguments in Mkuyuni village, a sub village of Mlali where the chairperson and villagers of Mkuyuni had arguments with people of Mbalala village which abstract water in river Mbalala (Plate 5) causing river drying. Violent clashes were reported in Ruvuma Street in 2006 where police was called to stop irrigation activities by confiscating water pipes used for irrigation.

Plate 5: Water abstraction at upstream of river Mbalala in Mbalala village

All respondents (100%) revealed that resource use conflicts intensify during dry season due to several factors. Fig. 15 presents factors driving resource use conflicts in the study area. The main factor underlying upstream and downstream resource use conflicts

identified by 70% of respondents was dwindling of water. This is interpreted as supply induced scarcity caused by degradation and depletion of environmental resources (Homer-Dixion, 1996). Increasing population in both upstream and downstream due to seasonal immigration ranked the second and was identified by 16% of respondents. This referred as demand induced scarcity resulting from the water needs of increasing populations with justified demands for increased welfare (Homer-Dixion, 1996).

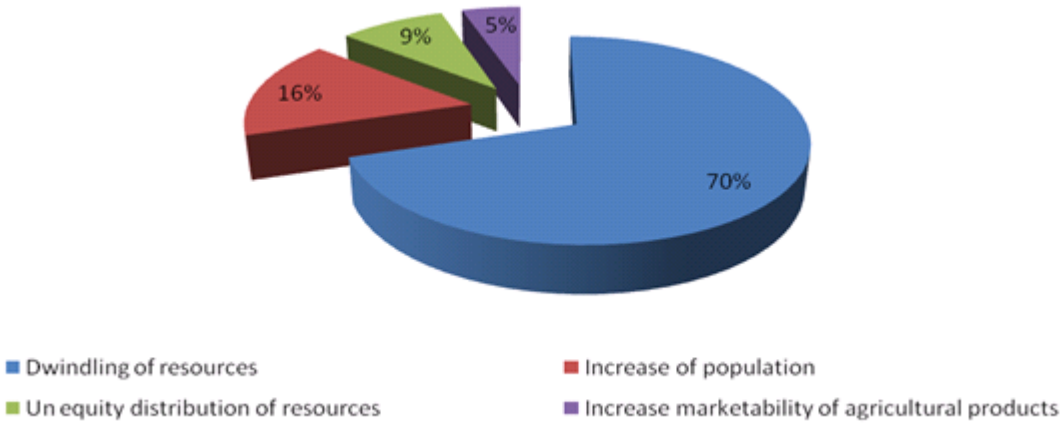

Figure 15: Factors driving resource use conflicts.

Furthermore, inequity distribution of water resources and increase marketability of agricultural products in big cities and indicated by 9% and 5% of respondents interviewed respectively, led to resource use conflicts in the study area. An unequal distribution of water resource was attributed by difference in power that influences access and use of water among users. Peet and Watts (1996) pointed out that CPRs are embedded in a shared social space where complex and unequal relations are established among a wide range of social actors, those actors with the greatest access to power are also be stable to control and influence natural resource decisions in their favour.

4.3.5 Effects of resource use conflicts

Effects of resources use conflicts between upstream and downstream are presented in Fig. 16. The main effect identified by 57% of respondents was pre mature drying of crops in the fields. Drying of crops occur when water available in the river are not sufficient or drying of the rivers. In some areas water users' especially rich people are coping water shortage by drilling water wells and irrigate by using water pumps. People who can not afford to drill wells or buy water pump hire to his or her neighbour or walk a distant to take water from rivers or shallow wells. Hiring water pump and well cost TZS 10 000 per day.

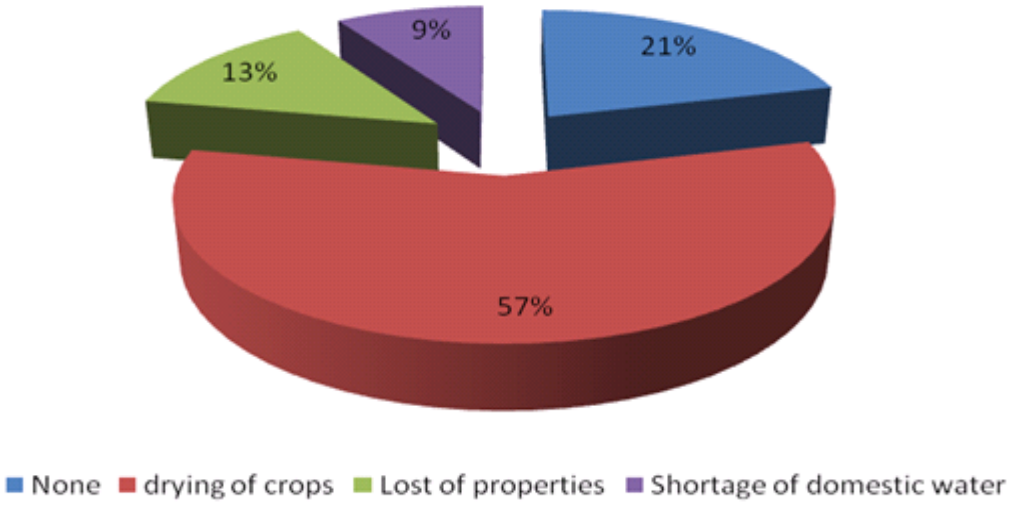

Figure 16: The effects of resource use conflicts experienced.

Another important effect of resource use conflicts mentioned by (13%) of respondents was loss of properties. Citing examples in 2006 where police raid and confiscated water pipes in Ruvuma, some community members lost their water pipes and sprinklers. This had negative impact on people's livelihood and relations with water authority which organized the exercise. The shortage of domestic water was reported by 9% of respondents while 21% reported no effects. Majority of respondents who do not perceive

the effects of resource use conflicts are from Mafisa Street (Morogoro Municipality) whereby MORUWASA supply water for domestic purpose hence they have no direct connection with upstream water users. Shortage of domestic water is very serious problem in Mlali and adjacent villages as compared to Streets in Municipality. Severe water rationing among sub villages of Mlali starts in September, at this period tape water is available only three days per week. Technique used to cope with water shortage is having many buckets (Plate 6) or water tanks for water storage.

Plate 6: Water buckets used for water storage during water shortage

4.3.6 Factors underlying perception on resource use conflicts between upstream and downstream CPR users

A logistic regression model was employed to determine factors influencing resource use conflicts between upstream and downstream. The dependent variable was individual perception on occurrence of resource-use conflicts and independent variables were farm size, distance to the market, type of farming practiced, wealth category, household size, seasonal farmers and education level of respondent (Table 18). The model has predicted

correctly the cases at 86.7% although statistically not significant at p<0.05 with Chi-square value of 88.899. The high -2 Log Likelihood (69.88) indicates a high fit between the model and the data. The Negelkerke R squared = 0.713 implying that 71.3% of observed variation in the resource use conflicts is explained by independent variables in the model.

Table 18: Determinant of resource use conflicts between upstream and downstream

Factor X_i	**β**	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B) Odd ratio**
Farm size	1.201	.324	13.697	1	.000*	3.322
Distance to market	1.391	.455	9.335	1	.002*	4.017
Type of farming practiced	2.806	1.101	6.495	1	.011*	16.547
Wealth category	1.151	.775	2.202	1	.138NS	3.160
Household size	.107	.163	.431	1	.512NS	1.113
Seasonal farmers	.215	.784	.075	1	.784NS	1.240
Education level	-1.514	.605	6.257	1	.012*	.220
Constant	1.185	3.880	.093	1	.760	3.269

Overall percentage of classification 86.7%, Model Chi-square 88.69, Nagelkerke R Square 0.713, -LL Ratio 69.88, p = 0.05; Exp (β) = odds rations (probability of access/probability of failure), SE = standard error of the estimate, p-value of sig =significance, e = 2.718, β = beta weights which stands for the odds ratio of probability of success to the probability of failure, *statistically significant at $p \leq 0.05$ level of significance, NS = statistically non significant at $p \leq 0.05$ and Wald statistics = $\beta/(SE)^{2}$. (Norusis, 1990 and Xie, 2000)

Furthermore, out of seven factors six has positive effects, while one factor had negative influence on the likelihood on perception of occurrence of resource use conflicts between upstream and downstream CPR users. Factors with positive influence include farm size, distance to the market, type of farming practiced, wealth category, household size and seasonal farmers while factor with negative influence is education level.

Farm size

The likelihood of resource use conflict was found to increase significantly (p = 0.000) by a factor of 3.322 with an increase in the farm size. The farm size has regression value of

1.201 and Wald statistic of 13.697 (Table 18). This indicates that individual with large farm size use more water for irrigation than individuals with small farm sizes. As more water used by individual with large farm sizes, less water is available to other individual downstream, hence create conflicts. Discussion with the chairperson of Mlali-Kipera Rice Irrigation Scheme revealed that in avoiding conflicts among community members, allocation of water to Taj Mohamed who has more than 100 ha is done when farmers start harvesting rice and he use water for dry season vegetable production.

Distance to market

Distance from homestead to the market was positively correlated to the resource use conflicts with regression value of 1.391 and is significant (P=0.002) with Wald statistic of about 9.335 (Table 18). This implies that increase of distance from the homestead to the market tend to increase resource use conflicts between upstream and downstream significantly by a factor of 4.017. The plausible explanation is that household which is adjacent to market easily access market which influences him to increase production hence consumption of CPRs. Participant observation revealed that household which is adjacent to urban centre of Morogoro such as Ruvuma and Mafisa because of being close to market engaged in production of vegetables. This is due to fact that, vegetables such as spinach and amaranths are perishing easily therefore can not be produced by distant households.

Table 19 presents estimated distances from resource base to main and intermediately market of agricultural products produced in the study area. The study found two main markets namely Morogoro urban and Dar es Salaam and one intermediately market; weekly market at Mlali village. Households in Ruvuma and Mafisa Streets are adjacent to Morogoro urban market while those of Peko Misegese and Mlali villages are adjacent to

Mlali intermediate market. The study further revealed that household in Peko misegese has longest distance to travel in order to access both markets, this slightly affect their vegetable production. Participant observation in the study area further found several buyers of vegetables from Morogoro town and Dar es Salaam city at Mlali weekly market.

Table 19: Estimated distances from resource base to main market of agricultural products

	Market for selling agricultural produce			Estimated distance to the market		
Study area	Mlali	Morogoro urban	Dar es Salaam	Mlali	Morogoro urban	Dar es Salaam
Ruvuma	-	✓	✓	-	5	205
Mafisa	-	✓	-	-	0	-
Peko Misegese	✓	✓	✓	10	45	245
Mlali	✓	✓	✓	0	40	240

Type of farming practiced

The result in table 18 shows that farming practice especially dry season irrigation has positive regression value of 2.806 and Wald statistic 6.495. This indicates that irrigation farming currently practised in upstream and downstream of Uluguru Mountains increase the likelihood of resource use conflict by a factor of 16.547 for every unit change of this variable. The study found that 60% of respondents in Ruvuma Street, Peko Misegese and Mlali villages practise dry season irrigation. The plausible explanation for this is an increasing market for horticultural crops. This led to shrinking of water in rivers and escalation of resource-use conflicts. The increase of odds of resource use conflicts between upstream and downstream was statistically significant ($p = 0.011$).

Wealth heterogeneity

The wealth heterogeneity of the household was positive but not significant (p=0.138) with Wald statistic 2.202 (Table 18). The results indicated that, the likelihood of resource use conflicts increase by a factor of 3.160 for every unit change in this variable. With increasing household wealth differentiation is likely to increase the likelihood of resource-use conflicts between upstream and downstream resource users of UMs. This is because wealthier people have strategy that is used against the poor in resource allocation.

The study showed that wealthier people in the study area own large parcels of land and using a lot of water through long water pipes or pumps. In Mlali village wealthier people were blamed for abstracting water in rivers which flows downstream for vegetable production. Kisoza (2006) reported resource use conflicts due to appropriation of land by rich pastoralists in Mkata plain which has previously been shared by both pastoralists and farmers as CPRs. Mbeyale (2009) found negative correlation of wealth heterogeneity and resource use conflicts in lowland of Pangani basin because wealthier people were engaged in other types of business including starting shops.

Household size

Household size has positive regression value of 0.107 and Wald statistic 0.431 (Table 18). This result indicates that the likelihood of occurrence of resource use conflicts increases by a factor of 1.113 for every unit change in this variable. This means that household with big family size has more demand for resources, thus scramble for resources than household with few family members. Participant observations in Mlali village and Ruvuma Street revealed that household with family size more than 6 members were found to own many plots and sharing resources like water pipes or pumps to capture

water resources from a distant. The increase of odds of resource use conflicts between upstream and downstream was not statistically significant (p =0.512).

Seasonal farmers

Seasonal farmers has a positive relationship to resource-use conflicts in Uluguru Mountains, with a regression value of β = 0.215 and an odd ratio of 1.24 (Table 18). This suggests that increase in seasonal farmers especially in upstream is likely to increase resource use conflicts. The seasonal farmers are increasingly playing a greater role in influencing resource utilization and thereafter resource use conflicts due to their tendency of violating rules of access to resources because they lack long term interest in the sustainability of resources. The study found that seasonal farmers renting land and charged between TZS 10 000 and 50 000 per season depending on land size and location. In upstream, the study found that access to water is free since there is no legal institution responsible for water allocations to different users. Participant observations revealed that the majority of seasonal farmers were businessmen from Morogoro town and neighbouring villages.

The number of seasonal farmers varies across the study villages depending on several factors include accessibility and availability of land and water. The study found no seasonal farmers in Ruvuma neighbourhood due to poor road reaching the area (Plate 7) and land shortage. Averagely 22 farmers enter in Peko Misegese and Mlali villages for every dry season. The number of seasonal farmers were higher in Mlali village because the area is accessible, have good plain with good soil for tomato production. Seasonal farmers led to increase in water competition among users hence escalate resource use conflicts. The increase of odds of resource use conflicts was not statistically significant (p =0.784).

Plate 7: Women carrying agricultural produce to the market

Education level

Table 18 shows that increase in education level (increasing number of years spent in school) significantly ($p=0.012$) decrease likelihood of occurrences of resource use conflicts with regression value $\beta = -1.514$ and Wald statistic of 6.257. This indicates that the likelihood of resource use conflicts decreases by a factor of 0.22 for every unit change in this variable. The plausible explanation of negative regression value in education might be due to the fact that increase in education level tends to decrease dependence on CPRs. This can be explained by the tendency of most educated household members to look for other options for livelihood. The livelihood diversification strategies include being employed in urban centres, establishing businesses as middlemen and transporting vegetables or banana from villages to the towns.

Kisoza (2006) and Mbeyale (2009) urged that education level has negative influence on resource use conflicts by increasing livelihood strategies. It was revealed during this study that individuals with secondary education in Mafisa Street are getting employment in adjacent factories while several with primary education are working as casual labours in the industries.

4.4 Existing and potential mechanisms for conflict resolution

4.4.1 Existing mechanisms for conflict resolution

Table 20 presents mechanisms used for conflict resolutions in the upstream and downstream of UMs. The study found that both formal and informal institutions are used in conflict resolution. However, formal institutions were found to be the most common mechanisms than informal institutions as mentioned by majority, 69.3% of interviewed respondents. The use of informal institutions was mentioned by 6.7% while 24% mentioned both formal and informal institutions. This is in line with Mbeyale (2009) and Zainabu (2009) who pointed out that both formal and informal institutions are used in conflict resolutions.

Table 20: Current mechanism of resolving the resource use conflicts

Response	Frequency	Percent
Formal institutions	52	69.3
Informal institutions	5	6.7
Both formal and informal institutions	18	24.0
Total	**75**	100.0

The study further found that formal mechanisms of conflict resolutions are most common in downstream rather than upstream. Ninety five percent of interviewed respondents in downstream mentioned formal institutions while 4.3% mentioned both formal and

informal institutions. In upstream, 57.7% mentioned formal institution while 9.6% mentioned informal institutions and 32.7% mentioned both formal and informal institutions. The difference between upstream and downstream can be explained by composition of communities. In downstream there are mixing of people from different cultures of which some of them do not respect traditional institutions while in upstream most are lugurus which still respecting traditional institutions.

4.4.1.1 Informal institutions

The study found that most disputes on resource are resolved informally at the lower levels before they erupt into serious conflicts. The informal institutions that involve in conflict resolutions include family, clan head, elders and informal groups. The study showed that conflict resolutions started between victims; both parties speak out and agree on resolving conflict. If conflict is not resolved at this level, the conflict is taken to the family/clan. This is because in most cases resource use conflicts are associated with land ownership which is customary owned. The elder of clan is normally used when both parties are from the same clan.

The use of council of elders in resolving resource conflicts is not given much attention in the study area. During PRA with local community in the study area revealed that councils of elders are currently not used for resolving conflicts. The study further showed the use of informal groups in resolving resource conflicts. This is in line with Sokile *et al.* (2005) who reported that some informal group members elected to form conflict resolution committee. The committee is working to resolve conflicts that arise among group members. The serious conflicts (conflict that led to violent) are taken to formal institutions.

4.4.1.2 Formal institutions

The formal institutions that are involved in conflict resolutions include village government, Primary court, Village Reconciliation Committee (VRC), Ward Development Committee (WDC), formal water institutions and Office of the District Commissioner (DC). The study found that village government is best arena as mentioned by 74.7% of respondents for resolving resource use conflicts; this is in line with Mbeyale (2009) who reported the significant of the formal institutions in resolving resource use conflicts in Pangani basin. Primary court was mentioned by 18.7% and ranked second while WDC was mentioned by 5% of respondents and ranked third. Four important attributes were identified during the interviews which accounted that accounted for people's preference of village government. The attributes identified include availability of the institution in the village, having power to resolve conflicts, provision of fair judgement and cost effectiveness.

Fig. 17 indicates that the majority, 46% of respondents preferred village government because is available in their respective areas while 24% because it has power to resolve conflicts, 8% because it provide fair decision/judgement and 22% because it of cost effectiveness. The study found that in all villages there are buildings which used as the offices of village governments. Access to primary court and WDC by members of community from some villages especially upstream is costly. The study revealed that there is no primary court in Ruvuma and Peko Misegese and WDC is centred in Liti for Ruvuma Street and Mlali for Peko Misegese village. At village level both village chairperson and VEO are available and are used in resolving conflicts.

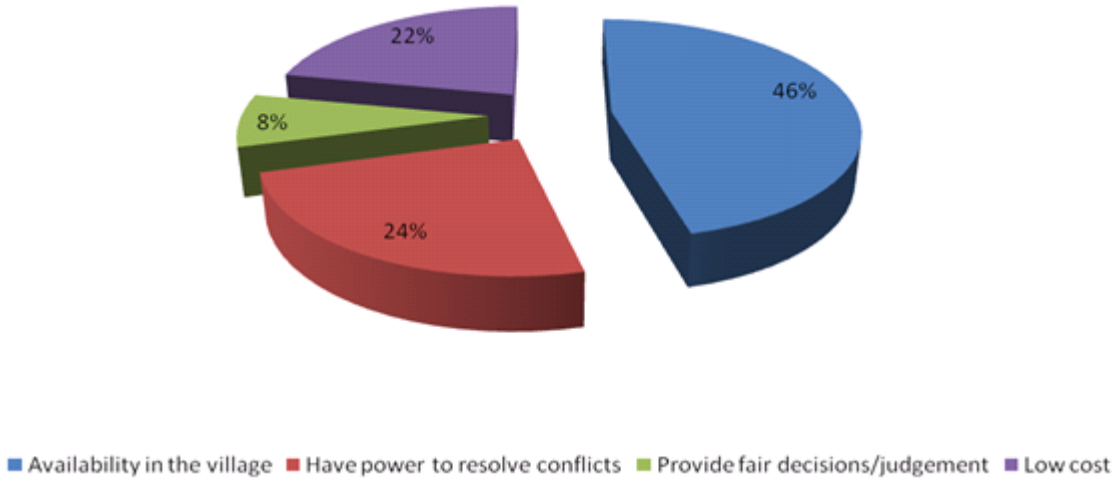

Figure 17: Attributes for community preference on village government in resolving conflicts.

The use of Primary court, Village Reconciliation Committee (VRC), formal water institutions and Office of the District Commissioner (DC) was reported by respondents interviewed in the study area. The use of primary court was reported in Mlali village whereby communities in Mongwe were charged for abstracting water that flow to the intake. Involvement of VRC (in Swahili *Baraza la usuluhishi*) that is made up of elected elders and resides over local conflicts was found in Peko Misegese village; VRC resolving resources, marriages and related conflicts. The use of formal institutions such as MKRIS to manage and resolve conflicts was reported in Mlali village among rice farmers while Office of the DC was used in resolving conflicts between farmers in Ruvuma Street and water authority Morogoro Urban Water and Sewerage Authority (MORUWASA) in 2006. The study further revealed that out of 75 respondents interviewed who acknowledged presence of resource use conflicts, 20% were involved in formal conflict resolutions while the rest, 80% were not involved.

4.4.2 Potential mechanisms for conflict resolution

During focus group discussions and questionnaire survey, the study found different potential conflict resolution mechanisms including informal and formal.

4.4.2.1 Informal conflicts resolution mechanisms

Eighty five percent of respondents interviewed mentioned council of elders and religious leaders as potential mechanisms of conflict resolution in the study area. The study revealed the presence of elders and religious leaders for both Christians and Muslims. Currently, these leaders are involved in resolving non resource use conflicts such as marriages.

4.4.2.2 Formal conflict resolution mechanisms

The potential mechanisms of conflict resolution include empowerment of VNRC and water user institutions. VNRC is sub committee in the village government. The empowerment of VNRC can be done through strengthening JFM by signing Joint Forest Management Agreement (JFMA) between Village governments in upstream and FBD. This means that, forest management in the study area can be bottom up instead of being top-down as is the case at the moment. This is in line with Zainabu (2009) who reported the potential of participatory approach in resolving resource conflict related to forest resources.

Empowerment and institutionalization of existing informal water institutions in upstream was found to be a potential for conflict resolution. In order to empower and institutionalize those institutions, respondents suggested the need of transforming them into formal institutions such as Water Users Associations (WUAs) or Water Users Groups (WUGs). The WUAs and WUGs granted legal responsibilities in managing and resolving

conflicts. This is possible due to presence of the new Waater Management Act No 11 of 2009. Formation of WUAs or WUGs was said to be starting point in formation of a network of water users that can be conflict resolution arena for the conflict that involve upstream and downstream water resource users.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

This chapter presents salient conclusion and recommendations based on the findings.

5.1 Conclusion

The study revealed the presence of many stakeholders that are involved in the management and utilization of CPRs in both upstream and downstream of UMs; however, more than three quarters of stakeholders are concentrated in upstream. This is an indication of high conservation priority of the mountains taking consideration its potential role of supplying water to both rural and urban centres and its biodiversity values. Identified stakeholders fall under three categories; regulators, facilitators and resource users depending on their interests. The study revealed the interactions among stakeholders although the strengths of their relationships are not the same. Furthermore, it was revealed that lack of formal platform that assemble all stakeholders is the reason which hinders their unity.

The study identified three types of power categories namely strategic, institutional and structural power embedded in peoples' livelihood in both upstream and downstream CPR users. Strategic power was found to be dominant in upstream while institutional power was dominant in downstream. Differences in the dominant powers were found to cause conflictive power relations which ended up with group of winners and losers. The study revealed that upstream dwellers are the winners while downstream are the losers. Power differences were attributed to weak common property institutions in sustaining management of the CPRs and distributing its products.

Furthermore, the study found resource use conflicts that centred on power imbalances between upstream and downstream water users. Two values of water were found to be core cause of conflicts, value of water for domestic and industrial uses and value of water for vegetable and rice production. The resource use conflicts were found to intensify during dry season mainly due to water scarcity. The factors underlying resource use conflicts between upstream and downstream CPRs users were quantified through logistic regression model. The identified factors that intensify resource use conflicts include: farm size, distance to the market, type of farming practiced, wealth category, household size and presence of seasonal farmers while education level was found to reduce resource use conflicts between upstream and downstream users.

Moreover, the study identified formal and informal institutions used for conflict resolutions. Informal institutions include family, clan head, elders and informal groups while formal groups include village governments, Primary courts, Village Reconciliation Committees (VRCs), Ward Development Committees (WDCs), formal water institutions and office District Commissioner (DC). The potential conflict resolution mechanism available in the study area include of elders and religion leaders (informal institutions) and Joint Forest Management Agreements (JFMAs) to empower Village Natural Resources Committees (VNRCs) and Water User Associations (formal institutions).

5.2 Recommendations

In order to improve management and utilization of CPRs in UMs, the following are some of the recommendations which should be taken into consideration by the government and other conservation partners.

5.2.1 Establishment of stakeholders' platform

There is need to establish a platform that will involve all stakeholders involved in the management and utilization of CPRs in UMs regardless of their power. The platform may start with users from sub catchments; Mgeta, Ngerengere and Ruvu in Ruvu basin. The platform will be used to discuss issues related to CPR concern such as water allocation and resolving water use conflicts. The stakeholder meeting can be arranged regularly to discuss issues related to the management and sustainable utilization of the resources. This will enable stakeholders to build trust among themselves.

5.2.2 Improving institutional arrangements

The government and other stakeholders should improve institutional arrangements in the management systems of CPRs in UMs to ensure equity and sustainability of the resources. The improvement of institutional arrangement can be done by devolving more power to communities adjacent to forest through JFM Agreements. This will serve a number of important socio-economic functions including encouraging cooperation and reducing transactions costs.

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APPENDICES

Appendix 1: Summary of methods of data acquisition to be used for each objective

No	Specific Objective	Data to be collected	Method of Data collection	Technique of data analysis

1	To identify key stakeholders utilizing forest and water resources in upstream and downstream and their interests.	Different Stakeholders in forest and water resources and their interests.	PRA, participant observation and focus group discussions	Content analysis
2	To assess power relations between upstream and downstream resource users and how they create winners and losers.	Different power relation categories, sources of power and winners and losers	PRA, Participant observation, Focus group discussions, Interview and Questionnaire survey	Content analysis and Inferential statistical analysis by using multiple and logistic regression models
3	To assess resource use conflicts as the result of existing power relations.	Resource use conflicts	PRA, Participant observation, Focus group discussions Questionnaire survey	Content analysis and Inferential Statistical analysis using Logistic regression model
4	To identify existing and potential mechanisms for conflicts management and resolution.	Existing and potential mechanisms of resource use conflicts	PRA, Participant observation, Focus group discussions Questionnaire survey	Descriptive statistical analysis and Content analysis

Appendix 2: Checklist for the PRA

PRA group members (5 members from each group)

1. Members from the village government for the selected villages
2. Members of the Village Natural Resource Committee (VNRC) and Water Users Association (WUA).
3. Prominent people in the village (preferably old people; men and women)
4. Youth (men and women)

Issues to be discussed in PRA

1. Resource mapping
2. Wealth ranking by first establishing criteria for wealth and then use pie chart to quantify wealth groups.
3. Identification of various stakeholders and their interests underlying use and management of forest and water resources.
4. Identification of power relations which is dominant in management and utilization of forest water resources.
5. Identification of various sources of power.
6. Identifying winners and losers as a result of existing power relations.
7. Identifying factors underlying winners and losers.
8. Identify types of resource use conflicts that exist.
9. Identification of factors underlying resource use conflicts.
10. Identification effects of resource use conflicts
11. Identification of different periods were different resource use conflicts erupted (Time line)
12. Identification of conflicts resolution mechanisms current being used
13. Identification of potential mechanisms for resolving resource use conflicts
14. Matrix ranking of power relations which dominating in upstream and downstream resource users separately.

	Strategic power relations (1)	Institutional power relations (2)	Structural power relations (3)
Strategic power relations (1)			
Institutional power relations (2)			
Structural power relations (3)			

Appendix 3: Pair wise ranking in upstream

	S1	**I2**	**S3**	**Scores**
S1		S1	S1	4
I2	S1		S3	0
S3	S1	S3		2

S1=Strategic power; I2=Institutional power and S3=Structural power

Appendix 4: Pair wise ranking in downstream

	S1	**I2**	**S3**	**Scores**
S1		I2	S1	2
I2	I2		I2	4
S3	S1	I2		0

S1=Strategic power; I2=Institutional power and S3=Structural power

Appendix 5: Structured questionnaire

1	**SURVEY IDENTIFICATION**		
1.1	Date and start time		
1.2	Household Identification's No.		
1.3	Name of interviewer		
1.4	Name of interviewee		
1.5	Name of district and division	District:	Division:
1.6	Name of ward and village	Ward:	Village:
1.7	Location of a village	Upstream	Downstream

2. General information of respondent

You are requested to provide information on the following questions. All information will be treated confidentially.

2.1	Sex and age of respondent **(Only recorded, not asked!)**	1. Male 2. Female Age of respondent……
2.2	Marital status	1. Married 2. Single 3. Divorced 4. Widowed 5. Others (specify)……
2.3	Religion	1. Christian 2. Muslim 3. Pagan 4. Others……
2.4	Ethnicity and tribe: Are you native of this area? Residence duration if not native?	1.Yes 2. No Tribe……..... Duration….....years
2.5	Reasons for moving to the village if not native	1. Land for crop production 2. Business 3. Married 4. Others (specify)…….
2.6	Education level	1. None 2. Primary 3. Secondary 4. College 5. Others (Specify)……..
2.7	Political position	1. Political party chairperson 2. Political part secretary 3. None 4. Others (specify)……
2.8	Administrative position	1. WEO/VEO 2. Village chairperson 3. Member of village council 4. Head of government institution 5.None 6.Others (specify)……
2.9	Wealth category of respondent	1. Rich 2. Poor
2.10	Household composition	

Age group	Males	Females	Actual number of household members
Under 18 years			
18-60 years			
Above 60 years			
Total			

2.11	Household head	1. Male

		2. Female

3. Socio-economic information

3.1	What is your main economic activity?		1.Crop productions 2. Livestock keeping 3. Fishing 4. Charcoal making 5. Handcraft (e.g. Carpentry/Manson/) 6. Others (Please specify)……	
3.2	What occupations performed by other members in your family?			
	Family member	Age	Education level	Occupation
	Husband			
	Wife			
	Relatives: Male Female			
3.3	Do you have land for crop production in this village?		1. Yes 2. No	
3.4	If Yes in Qn 3.3 How did you acquire land you own?		1. Bought 2. Rented 3. Inherited 4. Allocated by government 5. Other (Please specify)……	
3.5	Who own land and what is the total land size in acres?		1. Male 2. Female Land size in acres……	
3.6	Where is the location of your farm plot in the landscape?		1. Beside the stream or river 2. Along the valley 3. Around homestead 4. Along the slopes of mountain or hill 5. Other (Please specify)……	
3.7	How far in kilometres your farm located from homestead ……			
3.8	What type of farming method do you practice?		1. Rain fed agriculture 2. Irrigation 3. Both rain fed and irrigation 4. Others (Please specify)……	
3.9	If you practice irrigation, who own and what is the size of your irrigation plot in acre?		1. Male 2. Female Irrigation plot size in acres……	
3.9	What irrigation method do you use?		1. Traditional 2. Modern 3. Both traditional and modern 4. Others (specify)……	
3.10	How do you see farming practice whether can ensure protection of soil erosion or not?		1. Poor 2. Good	
3.11	Is irrigation infrastructures already constructed?		1. Yes 2. No	
3.12	Are there immigrants looking for agricultural land during dry seasonal?		1. Yes 2. No	
3.13	What type of crops do you grow in farmland?		1. What demanding crops 2. Non water demanding	
3.14	If answer in Qn 3.12 above is Yes, do you estimate how many immigrants are moving in this village per season?.....			
3.15	What is average productivity of three main crops (specify rain fed and irrigation)?			
	Rain fed agriculture			Irrigation agriculture
	Main crops grown	Acreage	Average productivity	Main crops grown	Acreage	Average productivity

Crops: 1=Maize, 2=Rice, 3=Banana, 4=Sweet potatoes, 5=Tomatoes, 6=Irish potatoes, 7=Vegetables, 8=Fruits, 9=Sugarcane, 10=Carrot, 11=Beans, 12=Cowpeas, 13=Millets						
3.16	Do you keep livestock?			1. Yes 2. No		
3.17	If Yes in Qn 3.16 above what type of livestock, number, ownership and their mode of grazing?					
	Livestock type	Number	Ownership 1. Male 2. Female	Where do you graze		
				Dry season	Wet season	
1. Cattle 2. Goats 3. Sheep 4. Chicken and ducks 5. Pigs				1. Own land 2. Common grazing land 3. Both		
3.18	What is your main source of labour in a main economic activity?			1. Family members 2. Casual labour 3. Employed labourers 4. Others (Specify)…….		
3.19	Where do you sell your agricultural and other products and how far from your homestead?			1. Village market 2. Market in nearby village 3. Buyers from town comes at home 4. Others (Please specify)…….. What distance from homestead in km….		
3.20	Do you have other products different from agricultural crops that you sell in a market place?			1. Yes 2. No		
3.21	What are three main agricultural/other products you're selling at the market (write in ascending order start with the main product)?					
	Agricultural products			Other products		
	1st ……2nd ……3rd …			1st ……2nd ……3rd		
3.22	What is your average income			1. Per month…….. 2. Total income per annum…….		

4.0 Power relations

4.1	Do you access and/or use forest and water resources?	1. Yes 2. No
4.2	If answer is "Yes" in Qn 4.1 above, do you pay for use of resources?	1. Yes 2. No
4.3	If answer is "Yes" in Qn 4.2 above, which resource are you paying for?	1. Water for domestic use 2. Water for irrigation 3. Forest products
4.4	How much do you pay for using resources?	1. Water for irrigation……. 2. Water of domestic use…… 2. Forest products……
4.5	What regulations provides for access to resources?	1. None 2. Bylaws 3. Forest/water act 4. Others (specify)……
4.6	Do you think there is equity in access and use of forest and water for irrigation to all villagers?	1. Yes 2. No
4.7	If the answer is "No" in Qn 4.6 above what group of people do you think	1. Those living adjacent to resources 2. Those with higher income

	have more access than others?	3. Those with administrative/political power 4. Those with higher education 5. Heads and members of institutions 6. Others (specify)……
4.8	What are the features embed to group of people you mentioned above?	1. Are adjacent to resources 2. Have higher income 3. Have political/administrative power 4. Have higher education 5. Have institutional power 6. Others (specify)……

4.9	Show whether you strongly agree =1, disagree=2, undecided=3, agree=4 or strongly agree=5 the fact that;					
	Statement	1	2	3	4	5
4.9.1	Decision making on access and use of forest and water resources is influenced by individual's closeness to resource base, income, education level and relative wealth (Strategic power)					
4.9.2	Decision making on access and use of forest and water resources is influenced by individual's position in political party, government department/sector and formal institution (Institutional power)					
4.9.3	Decision making on access and use of forest and water resources is influenced by individual's social and cultural position, age and gender (Structural power)					
4.9.4	Decision making on access and use of forest and water resources is influenced by strategic and institutional power					
4.9.5	Decision making on access and use of forest and water resources is influenced by strategic and structural power					
4.9.6	Decision making on access and use of forest and water resources is influenced by institutional and structural power					

5. Resource use conflicts and winners and losers

5.1	Who owns forest resources in this village?	1. Central government 2. District council 3. Village council 3. Others (Specify)……
5.2	Are you involved in resource management?	1. Yes 2. No
5.3	Are any resource use conflicts between upstream and downstream resource users?	1. Yes 2. No
5.4	Around which resources do resource use conflicts revolve?	1. Water 2. Forests
5.5	If the answer is "Yes" in Qn 5.3, who are involved in resource use conflict?	1. Among Farmers 2. Farmers and livestock keepers 3. Others (specify)……
5.6	When did you first experience resource use conflicts in this village?	1. 5 years ago 2. 6-10 years ago 3. More than 10 years ago 4. Others (specify)
5.7	During which season of the year do the resource conflicts intensify?	1. Rain season 2. Dry season 3. Both rain and dry season
5.8	What is the nature of the conflicts?	1. Violent clashes 2. Animosity 3. Disagreements 4. Arguments 5. Tensions

		6. Others (specify)……
5.9	What effect of the resource use conflict have you experienced?	1. None 2. People were killed 3. Crops were slashed 4. Others (Specify)…….
5.10	What are the main factors driving resource use conflicts?	1. Dwindling of resources 2. Increase of population 3. Un equity distribution of resources 4. Increase marketability of agricultural products 5. Others (specify)……
5.11	Do you think there is group of people who win while others lose as a result of existing resource use conflicts?	1. Yes 2. No
5.12	What are the features of winners and losers in resource use conflicts?	
	Features of winners	Features of losers
	1. Are adjacent to resources 2. Have higher income 3. Have political/administrative power 4. Have higher education 5. Have institutional power 6. Others (specify)…….	1. Are far away to resources 2. Have low income 3. Have no political/administrative power 4. Have low education 5. Have no institutional power 6. Others (specify)……

6. Conflicts management and resolution

6.1	Mention any organization/institutions in village which supervises/controls forest and water resource use	
	Forest resource	**Water resource**
	1. Central/district government 2. Village government 3. Village Natural Resource Committee (VNRC) 4. NGOs/CBOs 5. Others (specify)……	1. Central/district government 2. Village government 3. Water Users Associations (WUAs) 4. NGOs/CBOs 5. Others (specify)……
6.2	Which organization/institution you mentioned in 6.2 you feel has more power over resource control? (Please specify institution in forest and water resources).	
	Over forest resource	Over water resource
	1. Central/district government 2. Village government 3. Village Natural Resource Committee (VNRC) 4. NGOs/CBOs 5. Others (specify)……	1. Central/district government 2. Village government 3. Water Users Associations (WUAs) 4. NGOs/CBOs 5. Others (specify)……
6.3	Are you a member of any of above institutions (VNRC or WUA)?	1. Yes 2. No
6.4	Does other member of your family participate in conservation and management of forest and water resources?	1. Yes 2. No
6.5	How are the resource use conflicts currently being resolved?	1. Formal institution 2. Informal institutions 3. Both formal and informal institutions 4. Others (Specify)……
6.6	Mention institutions used to resolve resource use conflicts?	
	Formal institutions	Informal institutions
	1. Primary court 2. Village government 3. Ward Development Committee	1. Chief 2. Elders Baraza 3.Traditional Reconciliation Committee

<table>
<tr><td></td><td colspan="2">(WDC)
4. Others (specify)……</td><td colspan="2">(TRC)
4. Others (specify)……</td></tr>
<tr><td rowspan="3">6.7</td><td colspan="4">Which conflict resolution arena seen to be most popular and why?</td></tr>
<tr><td>Formal Arena</td><td>Reason for selected arena</td><td>Informal Arena</td><td>Reason for selected arena</td></tr>
<tr><td>1. Primary court
2. Village government
3. WDC
4. Others……</td><td>1……
2……
3……
4……</td><td>1. Chief
2. Elders Baraza
3. TRC
4. Others……</td><td>1……
2……
3……
4……</td></tr>
<tr><td>6.8</td><td colspan="2">Have you ever been involved in resolving conflicts at any level?</td><td colspan="2">1. Yes
2. No</td></tr>
<tr><td>6.9</td><td colspan="2">If Yes in Qn 6.8 in which institution of conflict resolution were you involved?</td><td colspan="2">1. Formal institution
2. Informal institution
3. Both formal and institution
4. Others (specify)……</td></tr>
<tr><td>6.10</td><td colspan="2">Do you think between formal and informal institution which is best in resolving resource use conflicts?</td><td colspan="2">1. None
2. Formal institution
3. Informal institution
4. Both formal and institution</td></tr>
<tr><td>6.11</td><td colspan="4">Please give reason (s) for your answer in Qn 6.10 above
1……
2……3……</td></tr>
<tr><td>6.12</td><td colspan="2">How do you rate the capacity of local government in conflict resolution?</td><td colspan="2">1. High
2. Moderate
3. Low</td></tr>
<tr><td>6.13</td><td colspan="4">In your opinions what are the potential resolution mechanisms of the resource use conflicts?
1……
2……
3……
4……</td></tr>
</table>

The end
Thanks for your cooperation

Appendix 6: Checklists for the key informants

Key informants
A. Village leaders
B. Representatives of NGOs and CBOs working in Uluguru Mountains.
C. District forest Officers
D. Wami/Ruvu River Basin Water Officer
E. Morogoro region catchment manager

Issues to be discussed and collected
1. General information
    a. Date……Place of interview…….
    b. Name …….Sex……
    c. Position……
2. Who is the owner of forest reserves and what is the current management regime?
3. What your main interests in Uluguru Mountains?
4. What other stakeholders are having the same interests?
5. What other stakeholders have different interests?
6. What different power relations categories existing between the stakeholders?
7. What are the main sources of power?
8. Who are the winners and losers in existing power relations?
9. Which rules and regulations are governing access and use of forest and water resources in the present?
10. Are there any resource use conflicts?
11. What are the causes of resource use conflicts?
12. Do devolution of power cause resource use conflicts? (Yes/no), if yes reasons give reasons.
13. What are the commonly reported resource use conflicts?
14. What the impacts of the resource use conflicts on the resource management?
15. What are current strategies exist that are used to resolve the conflicts on the resource use?
16. What are the potential mechanisms that can be used to resolve resource use conflicts?

Appendix 7: Social Network Analysis Tool for the Stakeholders Working in Conservation and Management of Uluguru Mountains, Morogoro, Tanzania

2: Mission Statement and Objectives of Organization
Mission: …….
……
Objective: …..……..
……
3. Type of Organization (please tick √)

Local NGO	
National NGO	
International NGO	
International Agency (donor/aid etc.)	
Government Ministry	
Government department	
District council	
Academic	
Private	
Civil Society Organization	
Individual	
Any other (please specify)	

4: What is the approximate total/annual budget of your organization?

Average Annual Budget	

5a: What is the main source of fund for the organization?

Source of funds	

5b: If your organization has more than one source of fund for different or the same activity, please indicates the source, activity and percentage of the contribution

Source of fund	Activity (ies) for fund	Percent

6: What administrative and political scales do your organization works? (Please tick √)

International	
National	
Regional	
District	
Local (villages or specific forest, fields, etc.)	

7. How much staff is currently employed in your organization?

Local Staff		Foreigner Staff	

8: What is the region of influence of your organization? (Please tick√)

National level	
Regional level	
District level	
Village level	

9: How do you rate the objectives/priorities of your organization to ensure environmental sustainability: Please choose as many as relevant by rating between 0-10 (0=No importance, 10= Highest importance).

Forest Protection	
Forest regeneration	
New plantation	
Climate moderation	
Watershed protection	
Integrated NRM	
Restoration of environmental degradation and pollution control	
Biodiversity conservation	
Forest and range management	
Sustainable use of natural resources	
Compensation of environmental losses	
Any other (pl. specify)	

10: Please indicate the important factors for decision making in your organization relating to natural resource management. (0=No importance, 10=highest importance)

Influential conditions	0	1	2	3	4	5	6	7	8	9	10
Environmental problems											
Socio-economic problems											
Socio-cultural problems											
Security Issues											
Political Issues											
Political instability											
Your donor's strategy											
Local customs and traditions											
Politics in your organization/ country											
Sectoral policies E.g. Forest Policy, Water Policy etc											
Agreements/coordination with other organization											
Knowledge produced by research											
Any other											

11: What are the main important sources of information regarding to **environment** that your organization utilizes?

Source 1:	Research reports (international and national)
Source 2:	Country strategy papers
Source 3:	Documents from bilateral and multilateral agencies

12: For each source of information, please indicate to what spatial scale the information refers?

	Local	District	Regional	National	International
Source 1:					
Source 2:					
Source 3:					

Name of organization		13. How strong is your organization's relationship with this organization in conservation of UMs?	14. What type of relationship does your organization have with this organization? (Check all that apply)							15. What things you receive or provide to the organization? (Check all that apply)									
		1= No relationship 2= Occasionally exchange information 3= Frequently exchange information. 4= Work together on projects. 5= Have a written contract and/or memorandum of understanding	We receive training	We provide training	We receive materials Eg planting material	We provide materials Eg planting	We receive publications	We provide publications	Not Applicable	We present our activities/ reports to them	They present their activities /report to us	We receive fund	We provide fund	We offer user permit	We receive user permit	We maintain public order	They maintain public order	We protect catchment forest	They protect catchment forest
1	Forestry and Beekeeping Division (FBD)																		
2	Regional Catchment Office (Morogoro)																		
3	Eastern Arc Mountains Conservation Fund																		
4	Sokoine University of Agriculture (SUA)																		
5	Tanzania Forestry Research Institute (TAFORI)																		
6	Wildlife Conservation Society of Tanzania (WCST)																		
7	Uluguru Mountains Agriculture Project (UMADEP)																		
8	Wami-Ruvu River Basin																		
9	Morogoro Municipal Council																		
10	Mvomero District Council																		
11	Morogoro Regional																		

	Name of organization	13. How strong is your organization's relationship with this organization in conservation of UMs?	14. What type of relationship does your organization have with this organization? (Check all that apply)							15. What things you receive or provide to the organization? (Check all that apply)									
		1= No relationship 2= Occasionally exchange information 3= Frequently exchange information. 4= Work together on projects. 5= Have a written contract and/or memorandum of understanding	We receive training	We provide training	We receive materials Eg planting material	We provide materials Eg planting	We receive publications	We provide publications	Not Applicable	We present our activities/ reports to them	They present their activities /report to us	We receive fund	We provide fund	We offer user permit	We receive user permit	We maintain public order	They maintain public order	We protect catchment forest	They protect catchment forest
	Natural Resources Office																		
12	Communities in Ruvuma neighborhood (Mtaa)																		
13	Communities in Mafisa neighborhood (Mtaa)																		
14	Communities in Mlali village																		
15	Communities in Peko Misegese village																		
16	Morogoro Urban Water Supply and Sewerage Authority (MORUWASA)																		
17	Mlali Water Board																		
18	Mlali Rice Irrigation Scheme																		
19	Ministry of Water and Irrigation																		
20	Care International																		
21	Morogoro Environmental Conservation (MoEC)																		
22	Ministry of Agriculture and Cooperation																		
23	Police																		

Name of organization		13. How strong is your organization's relationship with this organization in conservation of UMs?	14. What type of relationship does your organization have with this organization? (Check all that apply)							15. What things you receive or provide to the organization? (Check all that apply)									
		1= No relationship 2= Occasionally exchange information 3= Frequently exchange information. 4= Work together on projects. 5= Have a written contract and/or memorandum of understanding	We receive training	We provide training	We receive materials Eg planting material	We provide materials Eg planting	We receive publications	We provide publications	Not Applicable	We present our activities/ reports to them	They present their activities /report to us	We receive fund	We provide fund	We offer user permit	We receive user permit	We maintain public order	They maintain public order	We protect catchment forest	They protect catchment forest
24	Courts																		
25	Forestry Extension and Publicity, Eastern Zone																		
26	Uluguru Nature Reserve (UNR)																		
27	Taj Mohmed (Farmer in Mlali village)																		
28	Village government																		
29	Tanzania Tree Seed Agency (TTSA)																		
30	Morogoro District Catchment Office																		

16. Please list any organizations/Institutions/Groups/Individual working in Conservation and Management of UMs

Organizations/Institutions/Groups/Individual	***Contact information***

17. Please describe the process of decision making in your organization? *(Optional)*

_____

Name of the Respondent: …….

Position in the Organization:…….

Address: ……

Phone Number……..

E-mail Address: ……..

Thanks a lot for your co-operation.