

**SOCIO-ECONOMIC FACTORS INFLUENCING CONSERVATION AND
DEVELOPMENT TRADE-OFFS ON
ULUGURU MOUNTAINS, TANZANIA**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN
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ABSTRACT

Given the reality that trade-offs are rules rather than exceptions there is a need to acknowledge them and assess how different groups of people influence conservation and development choices. This study was conducted on Uluguru Mountains to assess the socio-economic factors influencing conservation and development trade-offs. Specifically the study aimed to identify the major conservation and development trade-offs existing on Uluguru Mountains, assess the socio-economic factors that influence each of the identified conservation and development trade-offs and assess the perceptions of local communities toward conservation and development trade-offs. Data were collected using questionnaire for household survey and checklists for focus group discussions and key informants were also employed. A random sample of 100 households representing 10% of all households in the study area was picked from Nyandira, Tchenzema and Kibuko villages. Data were analyzed using descriptive statistics, and multinomial logistic analysis was also employed for inferential statistics. Results show that, tree planting, terracing, agroforestry, agriculture, schools and dispensaries were the major conservation and development trade-offs existing in the study area. Furthermore the study revealed that, land size and education level significantly influence conservation and development trade-offs on Uluguru Mountains. Also, it was revealed that most of projects in the area were integrating conservation and development. It is, therefore, concluded that, the major socio-economic factors that influence conservation and development trade-offs on Uluguru Mountains are education level and land size. Involvement of people in decision making and proper land use planning are recommended as appropriate ways of addressing conservation and development trade-offs in the area.

DECLARATION

I, MKAMI AMOS, do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own original work and has never been submitted for any degree award at any other university.

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(MSc MNRSA)

Date

The above declaration is confirmed by

Prof. Songorwa, A.N.
(Supervisor)

Date

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DEDICATION

This work is dedicated to my parents Mr. Amos Machera and Mrs. Ellen Machera
who laid the foundation for my education.

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LIST OF ABBREVIATIONS AND ACRONYMS

FAO	Food and Agriculture Organization
FGD	Focus Group Discussion

ICDPs	Integrated Conservation and Development Projects
IUCN	International Union for Conservation of Nature
MDGs	Millennium Development Goals
NBS	National Bureau of Statistics
NGOs	Non-governmental Organizations
PHC	Population Housing Census
PRA	Participatory Rural Appraisal
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
UMADEP	Uluguru Mountains Development Project
URT	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Uluguru Mountains are one of the most important areas for conservation in Africa and are among the top 35 areas for conservation globally (Finch *et al.*, 2009). Also, they are a source of water for urban areas, including Dar es Salaam and Morogoro. Conservation on the Uluguru Mountains first started during the German colonial period, when several forest reserves were established for the protection of water supply and to slow down soil erosion (World Bank, 1992). Uluguru Mountains have continued to play an extremely important role at the local, national and global levels as they support livelihoods of millions of people through material supply and indirect benefits such as ecosystem services (Lalika, 2006). Moreover Uluguru Mountains play a key role in agriculture, which is the backbone of the country's economy (URT, 2002).

Due to the Mountains' importance a number of conservation projects have been implemented there by various organizations such as Uluguru Mountains Agricultural Development Project (UMADEP), Uluguru Land Usage Scheme (ULUS), Uluguru Mountains Biodiversity Conservation Project (UMBBCP) and others (Appendix 1). These projects aimed to improve local communities' livelihoods and conserve

biodiversity on the Uluguru Mountains but there is little empirical evidence about their effectiveness (Burgess *et al.*, 2008).

Overexploitation of natural resources on Uluguru Mountains has been reported to increase day after day (Buckley and Bhatia, 1998; Mitinje, 2004; Burgess *et al.*, 2008). Many people located within proximity to these natural resources still live in poor conditions. Fisher and Cristopher (2007) argue that, biodiversity is highest in the poorest regions because they lack developmental investments, thus more development projects should be implemented in areas such as health, education and infrastructure development. Also, there is a need to undertake conservation measures so as to restore the biodiversity and degraded areas (Burgess *et al.*, 2008). Indeed both of these options need to be undertaken on the Uluguru Mountains but there are challenges and opportunities, which should be considered before making decisions and this entails trade-offs.

Various studies have shown that, there are trade-offs existing between conservation and development interests (Brown, 2002; Faith and Walker, 2004; Dahlberg and Burlando, 2009). Trade-offs in this case are management choices that intentionally or otherwise change the diversity, functioning and services provided by ecosystems over space and time (McShane, 2006). In trade-offs thinking something of value is gained while something of value is lost (Hirsch *et al.*, 2010). Considering the complexities present in managing conservation and development trade-offs since it involves a range of stakeholders, it should be addressed at multi levels so as to consider all stakeholders' interests (Sayer *et al.*, 2006).

Efforts to balance conservation and development depend on local communities and their interests in natural resources, and the capability of other stakeholders to implement them. A fundamental issue is that of making local communities aware of the trade-offs, and for them to be convinced of the direct link between conservation and their quest for development. Indeed trade-offs between conservation and development need to be acknowledged and decision makers must explicitly consider the consequences of all options. This recognition leads to the need to assess socio-economic factors that influence trade-offs between conservation and development.

1.2 Problem Statement and Justification

Choices between conservation and development always entail trading of one land use option over the other and choices among different interests have to be faced continuously (Dahlberg and Burlando, 2009). Choices between conservation and development are hard to make since each has different outcomes to human well-being and ecosystem as well (McShane, 2006).

On Uluguru Mountains especially in Tchenzema ward there are existing conflicts between local communities and village leaders on the achievements of conservation and development projects in Tchenzema ward and this has created mistrust. A study conducted by UMADEP (2001) revealed that the villagers complained about their leaders not being fully responsible in the development and conservation projects implemented in the area (UMADEP REPORT, 2001). But the reason for the

complaints was not clearly stated. Burgess *et al.*, (2008) observed that there are differences in stakeholders' interests on Uluguru Mountains and this has led to contradictions in terms of achievements of conservation and development goals.

The imbalance in terms of achievement of conservation and development projects in Uluguru Mountains calls for conservation and development initiatives to think on the effective measures which can limit biodiversity loss in Uluguru Mountains and also improve livelihood to the local communities. The conformity between conservation and development options cannot be reached if benefits, costs and hard choices between conservation and development are not explored and negotiated honestly (Hirsch *et al.*, 2010).

Various socio-economic factors such as power relation, politics, Education level, people's perception toward conservation and development have been pointed out to affect conservation and development projects on Uluguru Mountains (Mitinje, 2004; Batulaine, 2007) but how each of these socio-economic factors influence the choices of individual between conservation and development is not well documented. Therefore, there is a need to identify trade-offs existing between conservation and development on Uluguru Mountains and assess how socio-economic factors influence the existing trade-offs. Assessment of the influence of socio-economic factors on conservation and development will enable development and conservation initiatives and decision makers to understand the problems, issues and trade-offs existing and weigh outcomes to a chosen set of objectives and make appropriate decisions that will maximize equity, productivity and environmental sustainability.

1.3 Objectives

1.3.1 Overall objective

The general objective of this research was to assess socio-economic factors that influence conservation and development trade-offs on Uluguru Mountains.

1.3.2 Specific objectives

- i. Identify conservation and development trade-offs existing on Uluguru Mountains;
- ii. Assess the local community's perceptions toward conservation and development trade-offs

1.4 Research Questions

Following were the main research questions:

- i. What are the conservation and development trade-offs in the study area?
- ii. What are the socio-economic factors influence conservation and development trade-offs?
- iii. How do these socio-economic factors influence conservation and development trade-offs?

- iv. What is the perception of local communities' towards conservation and development trade- offs?

1.5 arch Hypothesis

$H_0: \beta = 0$ implying that socio-economic factors have no significant influence on conservation and development trade-offs.

1.6 Study Limitation

Inaccessibility: During data collection there were heavy rains in the study area, which destroyed roads and some houses. This delayed the research and caused the exercise to be rescheduled.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Conservation in Africa

Prior to colonialism traditional land use in most of African countries was in harmony with the environment because over the centuries societies had developed their own social customs and regulations, which ensured sustainable use of land-based natural resources from one generation to the next. Individual land use practices were governed by customs and regulation in such a way that they were considered socially acceptable (Kowero, 1990). Local communities relied on natural resources around them and, therefore they exploited them with restraints.

During the colonial period natural resource conservation policies were introduced in African countries, which meant taking large tracts of land away from rural people for the establishment of protected areas and removing their jurisdiction over the land (Murphree, 2000). Thus protected areas were established at the expense of local people and often deprived them of their traditional economic livelihoods. As a result local people considered protected areas as constraints to their livelihoods. Since it was not possible to create rigid separation between land use by local people to obtain natural resource products and those designated by governments as protected areas encroachment, poaching and degradation were inevitable (Primack, 2002).

After political independence most governments in Africa embraced and continued colonial biodiversity protection policies. Due to poor outcomes associated with government-centred policies many conservation policies in Africa failed because traditional authorities that once controlled these resources had been disenfranchised (Agrawal and Clark 2001). Local people's cultural and socio-economic values regarding the natural resources around them were ignored in most state-centred management activities. Henceforth, effective decentralization and devolution of power and control over resources from the centralized state to local communities has become a pressing policy issue throughout in recent days (Brown, 1999).

2.2 Conservation in Tanzania

In Tanzania, conservation can be recalled back during pre-colonial period when emphasis was on preservation and for aesthetic value (Lalika, 2006). Before colonial rule societies protected biological resources according to their locations by putting in place some rules based on their cultures (IIED, 1994). In 19th Century, there was balanced co-existence between human population and natural resources and this was possible because, at that time, the human population was small (Mwalyosi, 1993). When the colonial governments came they shattered away the co-existence by introducing privatization of land and introduced land demarcations for areas of conservation (Mwalyosi, 1993). After independence in 1961 the government of Tanzania continued to gazette protected areas such as Lake Manyara National Park (1960), Arusha National Park (1962), Ruaha National Park (1964) and many others.

It can, therefore, be argued that, the current Tanzanian system of managing and protecting biological diversity was adopted from colonial rules and laws.

Recently, Tanzania has experienced a number of policy reforms, and most of these reforms are geared toward devolving natural resources management from the state to lower levels (Alden and Mbaya, 2001). Together with devolving power to lower levels conservation and development initiatives in Tanzania, like in other African countries, adopted a new conservation approach of integrating conservation and development projects (ICDPs) to ensure sustainable biodiversity conservation and also to improve well-being of individuals (Brown, 2002).

2.3 Concept of Integrated Conservation and Development Projects (ICDPs)

Recognition of problems associated with the top-down approach made way to a more participatory and people-centred approach known as ICDPs (McShane & Wells 2004). The ICDPs approach which has been implemented around existing protected areas since the early 1980s was designed to reduce poverty by improving social services such as health services and education to local communities as well as conserving biodiversity (Brown, 2000). ICDPs have, therefore, become the standard approach in attempting to combine biodiversity conservation and community development (Wells, 2004). However, some reviews have shown that ICDPs have failed to reconcile conservation and development objectives (Hausser *et al.*, 2009; Brown, 2002). There are varying criticisms between conservationists and scientists regarding the performance of ICDPs. While conservationists have complained that

community-based approaches do not provide enough protection for endangered species and the environment and that it fails achieve conservation objectives (Oates, 1999), social scientists have argued that ICDPs function in the same moulds as conventional development projects and result in highly inequitable outcomes that severely limit local people's rights (Schmidts-Soultau 2004). Brown (2002) reports that, the difficulties that hindered the implementation of these ICDPs resulted from oversimplification of key issues and, therefore, ICDPs were unable to meet their conservation and development goals. The key issues as explained by Brown (2002) include involvement of communities as partners or participants, empowerment, and assumption about sustainability of ICDPs.

Community: There are difficulties in how ICDPs conceptualize people as communities. The simplistic understanding of communities in ICDPs whereby communities are seen as small and homogenous and without internal conflicts hence fails to recognize the differences present in the community. The design and implementation of ICDPs should, therefore, consider the complexities and differences present in the communities rather than assuming a cosy and benign community (Brown, 2002).

Participation: Participation, meaning the involvement of relevant stakeholders, is a crucial feature of ICDPs (Brown, 2002). Pimbert and Pretty (1997) show types of participation employed in conservation projects and strategies that failed to actively engage stakeholders. Such types of participation do not address power imbalances and conflicts but create difficulties in managing ICDPs.

Empowerment: Empowerment as defined by Chambers (1993:11) “is the process whereby people especially poor people are enabled to take more control over their own lives and secure a better livelihood with ownership of assets as one key element”. The simplicity assumption about community and participation in conservation and development overlooks complex issues of power and empowerment or make assumptions about who can empower whom (Brown, 2002).

2.4 Conservation and Development Trade-offs

These arise because of differences in interests and views on conservation and development among stakeholders. It is argued that possibilities of rural development are caught in a dilemma of trade-offs between development and conservation as well as other difficulties caused by various stakeholders in decision making, which lead to unexpected outcomes (Brown 2002; Bohne, 2007). Also, Brown (2002) has shown how internal and external stakeholders influence the use of natural resources and draws a conclusion that there is a need to perform a stakeholder analysis so as to understand the key actors in conservation and development interventions. Many authors have shown that trade-offs between conservation and development are rules rather than exceptions (Faith and Walker, 2004; Dahlberg and Burlando, 2009). Others believe in win-win scenarios (IUCN, 2002; Roe and Elliott, 2006).

Win-win approaches that describe the simultaneous achievement of both conservation and development have failed and appear to be exceptions rather than

rules (Songorwa, 1999; McShane and Wells, 2004). Local communities may accept restrictions on resource use as a result of realistic and fairly negotiated trade-offs but, if perceived as unjust, mistrust and resistance will increase. In addition to that, the true costs of conservation have to be recognized and budgeted for at both national and international levels, if efforts to integrate conservation and development are to succeed. In analyzing trade-offs between conservation and development, ecological, political, social and economic impacts to all parties involved should be clearly addressed (Brown, 2002).

2.5 Socio-Economic Factors Influencing Conservation and Development Trade-Offs

Various socio-economic factors such as perception toward conservation and development, education level, income, awareness, power relations, cultural aspects, land tenure system and politics have been reported to influence choices of individual (Mitinje, 2004; Batulaine, 2007; Mbeyale, 2009).

2.5.1 Perception towards biodiversity and development trade-offs

Trade-off choices are complex and are perceived differently depending on the vantage point (Sunderland *et al.*, 2008). Traditionally conservation of biodiversity relied heavily on strict protection. Local people perceived wild animals as enemies and they received very little legal benefit from natural resources. This negative attitude towards the resources made local communities to have less interest in protected areas (Randall, 1993). In Ghana, for example, local communities preferred

forest management over wild animals because wild animals were perceived as more protected (Ntiamoa-Baidu, 1995 cited by Lalika, 2006). Development initiatives have often perceived conservation as a threat to human welfare whereas conservationists generally regard development as the major cause of biodiversity loss. This difference affects decision making and influences someone's choices.

2.5.2 Education Level

Education level is perceived to be among the factors that influence individual uptake of innovation and informs and creates a desire for an individual to learn more and seek resources and any other information regarding his or her improvement (Mitinje, 2004). Education motivates someone to think critically and analyze matters so as to reach a certain conclusion (Campbell, 2006).

2.5.3 Income

An individual's income level has great influence on his or her choices. Duraiappah (1998) argues that people with wealth, greed and power influence decision making. They can deliberately exploit natural resources so as to maintain their socio-economic status. On the other hand Jambiya and Sosovele (1998) show that poor people do exploit the resources for their wellbeing as their alternative in meeting their socio-economic needs. The difference between wealthy individuals and the poor as far as trade-offs are concerned is that wealthy people can choose certain management interventions by knowing that they will benefit from them and ignore the risks they may cause to the poor majority.

2.5.4 Awareness

Decision on whether to undertake conservation or development activities is influenced by the extent at which people are aware of the intervention. Lack of or inadequate awareness of options or alternate land-uses or other development activities can cause decision makers to make improper choices. Awareness is important in choosing a management intervention to be taken in an area. Studies have shown that failure of conservation and development projects has often been caused by lack of awareness among local communities (Wells *et al.*, 2004).

2.5.5 Power Relations

Rath (1997:2) defines power relation as “what enables who to do and what to whom”. In many societies, power relations are embedded in social control, social hierarchy and the roles given to some individuals in the society. Power relation can raise people with more bargaining power than others. Mbeyale (2009) reports that power has influence on choices of individuals. This is so because some people may use their powers to make decisions, which affect other people. Therefore, conservation and development choices can be motivated by powerful individuals who like to maximize their personal gains by manipulating the ideology of others.

2.5.6 Cultural Aspects

Culture of a certain area has been reported to influence conservation efforts (Newmark, 2002). In Africa, for example, conservation projects have been reported to fail because cultures of local communities are neglected (Newmark, 2002). Batulaine (2007) argues that introduced conservation or development initiatives should concur with the existing culture of that area or else the local community will not agree to it. On Uluguru Mountains culture still plays an important role even in conservation. Batulaine (2007) observes that the soil conservation project, which was introduced by British colonial rule in 1947 failed because the Luguru people did not want to adopt terraces.

2.5.7 Land Tenure System

Land tenure system on Uluguru Mountains has been reported to be a combination of inheritance, purchase, rent and borrowing (Batulaine, 2007). Bhatia and Ringia (1996) note that females have more access to land than males (Matrilineal system); those who have no capacity to own land should borrow or rent it. This system has caused a problem of land scarcity on the Uluguru Mountains, which in return has led to poor conservation (Mitinje, 2004).

2.5.8 Politics

Politics has been reported out to influence decisions over natural resource management and development (Benjaminsen and Lund, 2001). The political atmosphere in most African societies is characterized by multiplicity of institutions hence power over decision making is often fragmented and at risk (Benjaminsen and

Lund, 2001). It has been stated that weak governance marked by corruption and political collusion diminish development and conservation goals (Campbell *et al.*, 2010). Politics may bring unexpected outcomes due to the choices that have been made. Mbeyale (2009) argues that people make choices without considering the costs and benefits that their decisions and choices create over others.

2.6 Community Participation in Conservation and Development Projects

Participation is the process whereby local people have been empowered to make their own decision, direct the process and grow in confidence and take their own judgment. The concept of community participation is now widely acknowledged and well researched but less is known in terms of achievement (Mialla, 2002). Participation will not be sustained unless the technical solutions are effective and met the needs of the particular society.

Chapter 26 of Agenda 21 of Rio de Janeiro's Earth Summit in 1992 takes full responsibility of the pivotal importance of forming partnership between government and local people. Over many generations local people have evolved holistic traditional knowledge in the management of their natural resources. However, local communities still have little opportunity to participate in natural resource management and development projects (Mialla, 2002).

Conservation of biological resources especially in-situ conservation calls for knowledge of ecological conditions of the biological resources in question.

Therefore, local participation is important. Harnessing local knowledge and technical expertise of the rural communities is an important national strategy that can enhance development processes in a participatory manner. FAO (1998) insists on the promotion of local people's participation in natural resources management because they always view the value of natural resources from the services accrued from the natural resources. Meeting the local communities' needs and expectations is one of the motivating ways to increase capacity building and trust. People will pay more attention to activities that have some returns and they would like to promote such activities to improve the returns (Mialla, 2002).

2.7 The Linkage between Conservation and Development

2.7.1 Conservation as a tool for poverty reduction

Poverty reduction is one of the international imperatives of the new millennium stressed in the Millennium Development Goals (MDGs) (Roe and Elliot, 2005). Poverty as defined by World Bank (1992) is a condition of life characterized by malnutrition, illiteracy and disease as to be beneath any reasonable definition of human decency. Roe and Elliot (2005) explain that poverty and conservation have direct linkage since conservation provides revenue generating opportunities such as trade and tourism that contribute to economic development to poor people. However, traditionally, conservation-oriented literature view local community welfare and

development as conflicting and development was often seen as a problem (Brown, 2002). Many recent and existing conservation projects have now come up with integrated approaches, integrating conservation with development (Brown, 2002). These integrated approaches are widely promoted as a solution to problems of biodiversity loss (Barret and Arcese, 1998). Biodiversity loss has considerable implication to the success of poverty reduction goals and vice-versa. Adams and Hulme (2001) argue that proponents of community conservation present it as a means of reconciling conservation and development objectives by ensuring that the interests of local people are taken into account when making conservation decisions. Conservation is necessary for development and development is a pre-requisite for better conservation (Stocking and Perkins, 1992).

2.7.2 Types of conservation and development linkages

Roe and Elliot (2005) provide types of conservation and development linkages which are positive and negative. The positive linkages include contribution that conservation activities can make to development either directly or indirectly at a local or national level such as income earning activities (jobs, trade) and ecosystem services (provision of air, water and fertile soil). The positive contributions that development can have to conservation include relieving direct dependence on natural resources and reduction of pressure on rural resources through urbanization.

The negative contributions that conservation can have on development include reduced access to land, opportunity costs of resources use prohibition, cost of relocation from protected areas and loss of cultural and traditional values. The negative contributions that development has to conservation are clearance for agricultural purposes (which cause biodiversity loss), unsustainable logging and deforestation. Considering these linkages Adams *et al.*, (2004) argue that shortcomings arise from failure to recognize the linkages and pointed out four realities that should be observed by most conservation and development projects: i) Poverty and conservation are separate policy realms with little opportunity for integration; ii) conservation will be undermined unless poverty is reduced; iii) there is a moral obligation for conservation not to compromise poverty reduction; and iv) poverty reduction itself depends on the conservation of living resources.

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 Description of the Area

3.1.1 Location

The study was conducted in three villages on Uluguru Mountains, which are part of the Eastern Arc Mountains (Burgess *et al.*, 2008). Specifically the study was conducted in Nyandira, Tchenzema and Kibuko villages all located in Tchenzema ward, Mvomero district, Morogoro region (Figure 1). Tchenzema ward is located on the southwestern slopes of Uluguru Mountains with elevation ranging between 900m and 2700m asl. The area is located between Longitude 37° 0' and 37° 38' East and Latitude 7° 00' and 7° 11' South.

3.1.2 Climate

Estimated annual rainfall is 2000-3100 mm (URT, 2002). Temperature changes with altitude ranging from below 0 °C at higher altitude to above 26 °C at lower altitude. In Morogoro town, average temperature is 24 °C with the coolest month being July with average temperature of 21°C and December being the warmest month with temperature of 26 °C (URT, 2002).

3.1.3 Population

The populations in Nyandira, Tchenzema and Kibuko villages, which are all in Mgeta division, are 3 201, 2 200 and 970 respectively (URT, 2002).

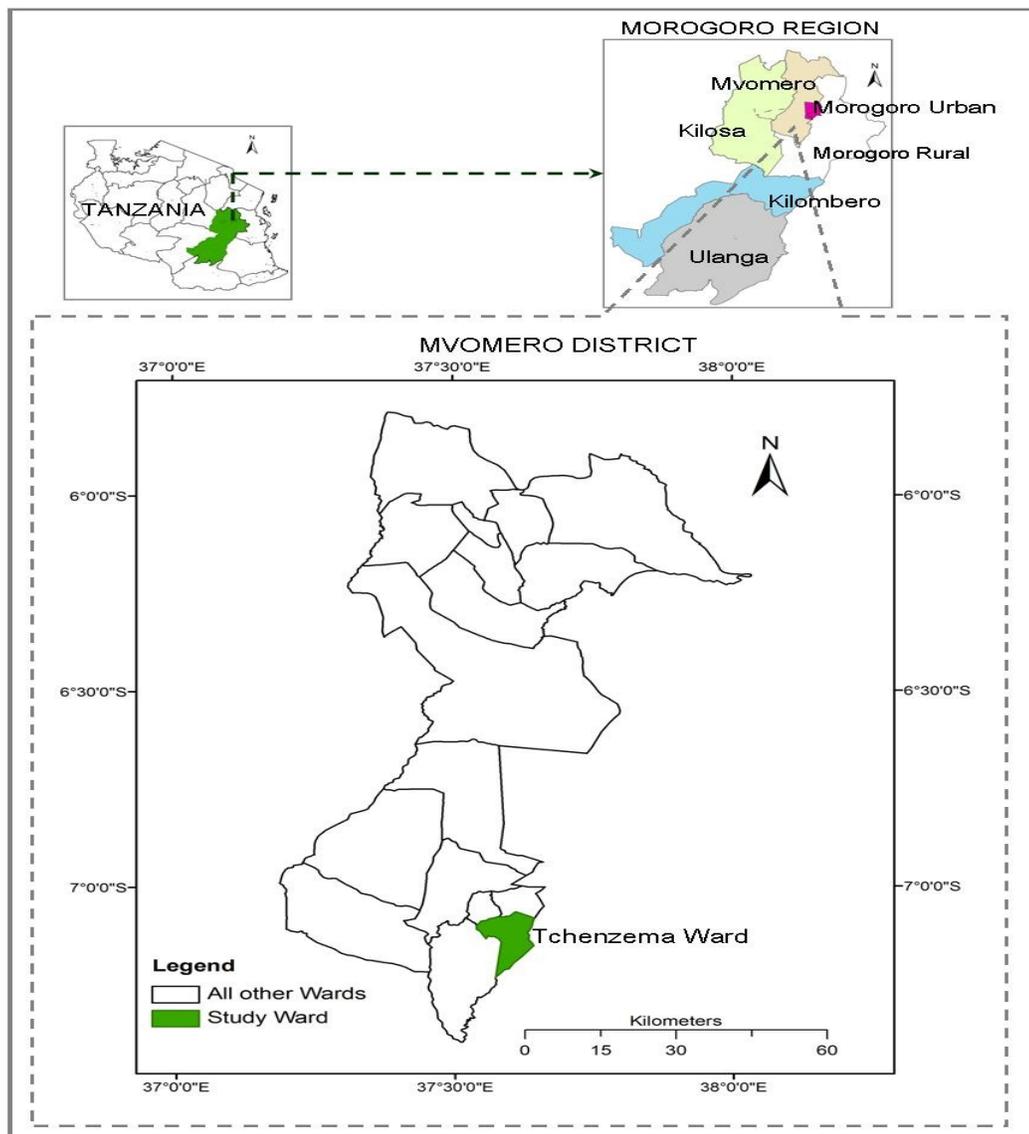


Figure : Location of study area on Uluguru Mountains.

(Source: Mvomero District Council, 2011).

3.2 Research Design

The study used a cross-sectional design whereby data were collected at a single point in time from a selected sample of respondents from a large population at that particular time (Kajembe, 1994). This design was chosen by the researcher because of time and financial constraints.

3.3 Data Collection Methods

3.3.1 Primary data

3.3.1.1 Questionnaire survey

A questionnaire survey tool (Appendix 2) was administered to heads of households. Open-ended and close-ended questions were used to gain in depth information on related socio-economic factors influencing conservation and development trade-offs such as gender, age, income, education level and involvement of local communities in conservation and development projects. The sampling unit was a household. According to Casley and Lury (1987:163), “a household is a group of people generally bound by ties of kinship who live together under a single roof or within a single compound and who share a community life and are answerable to the same head and share a common source of food”. Simple random sampling was employed to obtain a sample population whereby households were selected randomly from the village register. The sampling intensity was 10% of the total number of households in each village. According to Boyd *et al.* (1981), a random sample should constitute at least 5% of the total population to be representative of that population. The total

number of households in the three villages was 1 008 from which 100 households were surveyed (Table 1).

Table : Distribution of household in surveyed villages

<i>Village</i>	<i>Total number of household</i>	<i>Number sampled households</i>	<i>of Sampling intensity (%)</i>
Nyandira	405	40	10
Tchenzema	303	30	10
Kibuko	300	30	10
Total	1008	100	10

3.3.1.2 Participatory Rural Appraisal

Participatory Rural Appraisal (PRA) was used to collect socio-economic information and to gain knowledge from the local communities on how these socio-economic factors influence conservation and development trade-offs (Kajembe and Kessy, 2000). PRA tools open up discussion and facilitate the collection of key data about local conditions as quickly as possible. PRA techniques used to collect the information were pair-wise ranking, wealth ranking, resource mapping and focus group discussions which included 10-15 people, including both males and females. These methods enabled the community and the researcher to identify the development and conservation options present in the village. Participants in the focus group discussions comprised of village council members, youth, middle aged

and elders in the village. The wealth ranking exercise was used to categorize the surveyed households in wealth groups (Table 7) and the indicators used for wealth ranking are shown in Table 2. A checklist of questions for key informants was employed for conservation and development officers as well (Appendix 3).

Table : Indicators of wealth as applied in wealth ranking

	<i>Indicators</i>	<i>Rich</i>	<i>Medium</i>	<i>Poor</i>
<i>Live stock</i>	Goats	>9	5-9	0-5
	Sheep	>8	4-7	0-4
	Pigs	>1	1	0
	Chickens	>9	5-9	0-4
<i>House and its construction</i>	Roofing materials	Sheets Burnt brick	Sheets Un burnt brick	Grass Poles and mud
	Wall materials	Cement	Bricks soil	mud
	Flooring materials			Soil
<i>Amount of meals taken</i>	One meal	Three meals	Two meals	One meal
	Two meals			
	Three meals			

3.3.2 Secondary data

Secondary data were obtained from findings and experiences from previous research done in the area especially on conservation and development. Reports of related studies were gathered in order to supplement primary data. Sokoine National Agricultural Library (SNAL), Uluguru Mountains Agricultural Development Project (UMADEP) and the Internet were the major sources of secondary data.

3.4 Data Analysis

3.4.1 Qualitative data analysis

Qualitative data were analyzed using content analysis. This method enables the information collected through verbal discussions to be analyzed. According to Kimberley (2002), this method enables the researcher to include large amounts of textual information and systematically identify its properties.

3.4.2 Quantitative analysis

Descriptive and inferential statistics were carried out. Questions were coded and data from open-ended questions were categorized and coded by using Statistical Package for Social Science (SPSS Version 12). Quantitative information was subjected to descriptive statistics, which provide information on measure of central tendencies such as frequencies, percentages, means and averages. Cross-tabulation and multiple responses were carried out to assign frequencies and percentages in each response. Moreover tables and graphs were used to summarize the outputs.

A multinomial logistic analysis, which is one of inferential statistical analysis, was used to analyze the socio-economic factors influencing conservation and development trade-offs. The analysis was chosen because of the type of dependent variables which had more than two variables. The model was based on the options (choices) which were presented to the respondents to choose either conservation, development, both options and none. The socio-economic factors such as education level, residence duration in the village, income level, gender, and land size were independent variables assumed to influence conservation, development or both choices in the study villages. The multinomial logistic equation is given as;

$$\Pr(y_i = k) = \frac{\exp(X_i \cdot \beta_k)}{1 + \sum_{j=1}^J \exp(X_i \cdot \beta_j)} = \log \text{ odds} = \beta_0 + \sum \beta_k \cdot \beta_{i_k} + \dots + e_i = Z_i$$

..... (1)

From equation 1 above the probability of choosing conservation, development or both options is given by:

$$\text{Pr}(\text{event}) = \text{odds}/1+\text{odds} = e^z/1+e^z = 1/1+ e^z$$

And probability of choosing none of the options is given by

$$\text{Pr}(\text{no events}) = 1- \text{prob}(\text{event}) = 1-1/1+ e^z$$

Where;

Pr = Probability

Event = in this study was the conservation and development choices

Y_i = is the dependent variable

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + e_i$$

β_0 = constant term of the model.

e = Natural logarithm equal to 2.718

i = 1, 2, 3 n

β_1 to β_n = Coefficient of variables showing positive or negative effect on the unit change of independent variable on the dependent variable.

X_1 to X_n = independent variables such as education level, income level, land size, residence duration and gender. Explained as follows:

Education level (X_1): Education level was assumed to have positive (+) regression coefficient on parameter estimate β . This is because high level of education can be a catalyst for adoption of new technologies, which require frequent reading of different documents. Thus it was hypothesized that respondents with high level of education would make proper decisions concerning conservation and development choices than the less educated ones.

Income level (X_2): Income level was assumed to have positive (+) regression coefficient implying that people with high income level are expected to choose both conservation and development choices because the increase in level of income motivates people to conserve the natural resources and also improve their livelihoods.

Residence duration (X_3): Duration of residence in the village was also assumed to have positive (+) regression coefficient. It is hypothesized that increase of number of years of stay in the area increase someone's knowledge regarding his or her village. Therefore he or she is expected to make better decisions on conservation and development choices.

Land size (X_4): It was assumed that the larger the size of land owned by an individual the higher the probability of him or her to choose conservation and development choices. This is because people with large pieces of land are likely to choose both conservation and development options. The expected sign of the regression coefficient was positive (+).

Gender (X_5): Gender in Uluguru Mountains play a key role especially in land ownership. Therefore, it was assumed to have positive (+) or negative (-) sign of regression coefficient on parameter estimate β .

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Respondents

Socio-economic characteristics of the respondents included age, household size, education level, sex, land size and ownership, household income and residence duration.

4.1.1 Age, sex, education level and residence duration in the village

Respondents were 18 years and above. The results in Table 3 show that majority (70%) of the respondents were in the age category of 31-60 years followed by those above 60 years (17%). Majority of the age category of 31-60 years implies that respondents were mature enough to make decisions in matters concerning conservation and development trade-offs in their households and villages as well. However, the small proportion of respondents in the age category of 18-30 is attributed to the fact that few of them were household heads upon whom the questionnaire survey tool was administered.

The percentage of female respondents was 53% while that of males was 46% (Table 3). The slight difference in percentage was attributed to by the fact that female respondents were the ones who were at home whereby males were in their businesses away from home.

Generally, most of the respondents had lived in their respective villages for more than 30 years. The results show that 64.3%, 82.1% and 76.7% had lived for more than 30 years in Nyandira, Tchenzema and Kibuko villages respectively. The long period of residence in a certain area implies that people had gained enough experience and accumulated enough knowledge, which can help them when it comes to decision making between conservation and development options. Nduwamungu (2001) reports that people who have resided long in a village can provide reliable information concerning perceived needs in their village.

For the case of education, results in Table 3 show that 81% 88.9% and 86.7% had primary education and 9.4%, 11.1% and 10% had no formal education in Nyandira, Tchenzema and Kibuko respectively. However, about 7.1% and 3.3% had secondary education in Nyandira and Kibuko respectively, none in Tchenzema village and only 2.4% had college education in Nyandira village. The level of education (70%) with primary education was higher than the national average of 56% of Tanzanians who can read and write NBS (2003). Roger (1995) and Makauki (1999) report that ability to read and write enhances adoption of new technologies. Education level is viewed as key for development and conservation (Shalli, 2003). However, other studies have shown that education can also have negative influence on conservation when educated person have an opportunity to look for white color jobs and ignore conservation activities (Bakengesa, 2001).

Table : Distribution of respondents by age, sex residence duration and education level

<i>Variable name</i>	<i>Variable characteristics</i>	<i>Nyandira (n=40)</i>	<i>Tchenzema (n=30)</i>	<i>Kibuko (n=30)</i>	<i>Total (n=100)</i>
Age	18-30	6(15) ¹	4(13.3)	3(10)	13(13)
	31-60	28(70)	20(66.7)	22(73.3)	70(70)
	Above 60	6(15)	6(20)	5(16.7)	17(17)
Sex	Male	18(45)	14(46.7)	15(50)	47(47)
	Female	22(55)	25(53.3)	15(50)	53(53)
Residence duration	5-10	3(7.1)	0(0.0)	2(6.7)	5(5)
	11-20	6(14.3)	3(10.7)	3(10.0)	12(12)
	21-30	6(14.3)	2(7.1)	2(6.7)	10(10)
	Above 30	27(64.3)	23(82.1)	23(76.7)	71(71)
Education level	No formal education	4(9.4)	3(11.1)	3(10.0)	10(10)
	Primary education	34(81.0)	24(88.9)	26(86.7)	84(84)
	Secondary education	3(7.1)	0(0.0)	1(3.3)	4(4)
	College	1(2.8)	0(0.0)	0(0.0)	1(1)

¹ The figures outside and inside the parenthesis indicate frequency and percentages respectively.

4.1.2 Household size and land ownership

The results (Table 4) show that more than half of the households (52.4%, 50.0% and 56.7% in Nyandira, Tchenzema and Kibuko respectively) had 4-6 members. About 21% had above six members and the average household size in the study villages was 6.3, which is bigger than the regional household size which is 5.0 (URT, 2002). Larger sizes of households have been reported by Nduwamungu (2001) and Madulu (1996) to have significant effects on conservation options since large households have more needs of natural resources compared to small ones.

Table : Distribution of respondent's household size and land size in the study villages

<i>Variable name</i>	<i>Variable characteristics</i>	<i>Nyandira (n=40)</i>	<i>Tchenzema (n=30)</i>	<i>Kibuko (n=30)</i>	<i>Total (n=100)</i>
Household size	1-3	9(21.4)	11(39.3)	6(20.0)	26(26)
	4-6	22(52.4)	14(50.0)	17(56.7)	51(51)
	>6	11(26.2)	3(10.7)	7(23.3)	21(21)
Land size (acres)	1-3	19(45.2)	17(60.7)	17(56.7)	53(53)
	4-6	18(42.9)	6(21.4)	11(36.7)	25(25)
	> 6	4(9.5)	5(17.9)	2(6.7)	11(11)
	No land	1(2.4)	0(0.0)	0(0.0)	1(2.4)

The majority of households (45.2%, 60.7% and 56.7% in Nyandira, Tchenzema and Kibuko respectively) owned 1-3 acres of land. These results are contrary to those obtained by Mitinje (2004) who observed that the majority (84%) of households owned 1-2 acres. Such results on household size versus land ownership suggest that population increase (evidenced by average household size) could have forced people to clear more land for opening or expansion of farms. Large households require large pieces of land and this is evidenced in Table 5 which shows that households (53%) with 4-6 people owned farms of more than 6 acres.

Table : Distribution of household size by land size

Variable	1-3	4-6	Land size	no land	Total
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		>6				
Household size	1-3	20(37)	5(14.7)	0(0)	1(100)	26(26)
	4-6	25(46.3)	21(61.8)	7(63.6)	0(0)	53(53)
	7-10	9(16.7)	6(17.6)	4(36.4)	0(0)	19(19)
	> 10	0(0)	2(5.9)	0(0)	0(0)	2(2)
Total		100.00	100.00	100.00	100.00	100.00

4.1.3 Land acquisition system

Table 6 shows result on land acquisition systems in the study area. A large proportion of respondents (84.8%) mentioned inheritance as the major system of acquiring land, followed by buying (63.6%), clearing of forest (32.3%) and hiring (24.2%). These findings correspond with those of Bhatia and Ringia (1996) and Mitinje (2004) who found that inheritance system was the major source of acquiring land on Uluguru Mountains. This has contributed to land scarcity problem especially to male individuals since females are the ones who have better access to land (Batulaine, 2007; Bhatia and Ringia, 1996). Land scarcity on Uluguru Mountains has caused people to clear forestland so as to increase agricultural land. Moreover, results from focus group discussion confirmed that people are still clearing the forest to increase farmland. Clearing of forest to increase farmland has been reported to decrease the forest cover on Uluguru Mountains (Madoffe and Munishi, 2005). Studies have shown that forest area on the Uluguru Mountains declined from around 300 km² in 1955 to 230 km² in 2001 (Burgess *et al.*, 2002). Forests on Uluguru Mountains harbor a number of endemic plants and animal species meaning that continued clearing will eventually lead to loss of species (Burgess *et al.*, 2002).

Table : Land acquisition system

<i>Variable name</i>	Nyandira	Tchenzema	Kibuko	Total
Inheritance	32(82.1)	24(80)	28(93.3)	84(84)
Buying	27(69.2)	22(73.3)	14(46.7)	63(63)
Hiring	10(25.6)	7(23.3)	7(23.3)	24(24)
Clearing forest	15(38.5)	8(26.7)	9(30.0)	32(32)

Frequency* and percentage are more than 100 because respondents mentioned more than one type of land acquisition systems

4.1.4 Respondents' wealth groups

Generally, majority of the respondents were in the medium category of wealth. The results show that about 60%, 70% and 63.3% in Nyandira, Tchenzema and Kibuko respectively were in the middle group of wealth category (Table 7). These results imply that the majority of respondents were capable of getting their basic needs such as food, clothing and shelter. Also, 20% in Nyandira, 22% in Tchenzema and 30% in Kibuko were grouped as poor and this means that they were not capable of getting their basic needs. About 17.7%, 10% and 6.7% respondents were in the category of rich individuals in Nyandira, Tchenzema and Kibuko respectively. However, the scale for wealth classification is deceptive because the major sources of income are crop production, livestock keeping and selling of forest products that still rely on forest and other natural resources. Thus, whether someone falls in the rich or medium income category, he or she will still encroach on forests for agriculture, livestock grazing and fuel wood. Results from FGD indicate that wealth of an individual was amongst the factors that were perceived to influence decisions on conservation and development options in the study villages. Rich people were regarded as powerful and because of their wealth they were respected in the villages.

People with wealth and power have been pointed out to influence decision making elsewhere (Duraiappah, 1998).

Table : Distribution of households by wealth category

<i>Village</i>	<i>Wealth category</i>	<i>Number of households and percentage (%)</i>
Nyandira	Rich	7(17.5)
	Medium	24(60.0)
	Poor	9(22.5)
Tchenzema	Rich	2(10.0)
	Medium	21(70.0)
	Poor	6(20.0)
Kibuko	Rich	2(6.7)
	Medium	19(63.3)
	Poor	9(30.0)

4.1.5 Income sources of respondents

Table 8 shows various sources of income in the study villages. Among the various sources of income crop production was stated as the major source of Nyandira (95.2%), Tchenzema (100%) and Kibuko (100%) village followed by livestock keeping (Table 8). From these results it is clear that crop production is the major economic activity performed by almost everyone in the study villages. On Uluguru Mountains crop production is considered to be the main source of income and the major economic activity because local communities earn money from selling agricultural crops such as vegetables and fruits in Morogoro and other urban areas in Tanzania (UMADEP Report, 2001). Therefore, agriculture will likely receive priority at the expense of conservation. Small businesses or petty trade was highly visible in

Nyandira village. This was because, in Nyandira, there is a market for agricultural products. Also, the village is regarded as the centre for business in Tchenzema ward. The growth of population in Tchenzema ward and especially in Nyandira village has opened up opportunities for small businesses. Businesses were in form of permanent and temporary shops and carpentry which were mostly done by men. Women were engaged in making local brew and selling food in small restaurants locally known as *mama lishe*.

Table : Distribution of respondents by sources of income

<i>Source of income</i>	<i>Nyandira</i>	<i>Tchenzema</i>	<i>Kibuko</i>
Selling forest product	4(9.6)	3(7.1)	8(19.2)
Remittance	2(2.5)	3(10)	0.0
Formal employment	3(7.1)	0.0	0.0
Small business	14(33.3)	6(21.4)	3(10)
Livestock production	11(26.2)	14(50)	20(66.7)
Crop production	39(95.2)	30(100)	30(100)

Frequency* and percentage are more than 100 because respondents mentioned more than one type of land acquisition system.¹

Other sources of income were formal employment, remittance and selling of forest products (Table 8). The overall results show that the percentage of people with formal employment was very small (7.1%) and mainly in Nyandira. This suggests that most people are relying on the other sources of income. These results correspond with the national census results of 2002, which revealed that only 4.4% had formal employment in Morogoro rural and about 62.2% were actively engaged in agriculture (URT, 2002). About 9.6%, 7.1% and 19.2% in Nyandira, Tchenzema and Kibuko village respectively reported selling forest products as their source of income. The major forest products sold were said to be firewood, charcoal and poles.

At FGD it was reported that almost every household used firewood for cooking, which was sold at TShs 2 500 per bundle. Others collected firewood directly from the forest reserve. These findings correspond with those of Mitinje (2004) who found that 67% of the fuel wood was collected from the forest reserve.

4.2 Conservation and Development Trade-Offs Existing on Uluguru Mountains

4.2.1 Choices between conservation and development options

Table 9 shows results of the choices between conservation and development options. Respondents were asked to choose one of four choices: conservation, development, conservation and development or none. Overall results show that 14% of the respondents chose conservation, 59% chose development, 27% chose both options and no one chose the none option. Findings from personal observation revealed that the choices relied on the performance of and need for conservation and development projects to the local communities and these were the reasons for the small percentage of development option in Kibuko village. This implies the villages had development projects that have either performed poorly or did not meet their direct and sometimes urgent needs. In Table 9 it can be observed that 67.9% of the respondents in Tchenzema chose the development option over conservation (14.3%). This corresponds with findings from focus group discussion in that village where the villagers claimed that they needed a dispensary because the existing one was not in good condition. To them development was of higher priority over conservation. In Kibuko village the choice of both options in was high (36.7%) compared to Nyandira

(26.2%) and Tchenzema (17.9%). This could be because both conservation and development options were highly needed by the residents in Kibuko village.

Table : Choices between conservation and development as per responses

<i>Options</i>	Nyandira (n=40)	Tchenzema (n=30)	Kibuko (n= 30)	Total (n=100)
Conservation	5(11.9)	4(14.3)	5(16.7)	14(14)
Development	26(61.9)	19(67.9)	14(46.7)	59(59)
Both options	11(26.2)	5(17.9)	11(36.7)	27(27)
None	0(0.0)	0(0.0)	0(0.0)	0(0.0)

4.2.1.1 Development option

Results show that, among the development options, agriculture was high in percentage (75%) compared with dispensary (59%) and schools (28%) and statistically significant at ($p \leq 0.05$) (Table 10). Agriculture was of highest priority because it is the major economic activity in the area. This corresponds with findings by Lalika (2006) who found that 83.2% of respondents on Uluguru Mountains were engaged in farming activities. Although crop production is the major source of income for the residents, the quantity of yields has been reported to be low because the land is less productive (UMADEP Report, 2001). This has forced people to clear more land in order to increase crop yield. Poor farming techniques, use of inorganic fertilizers and location of farms were observed to be the causes of land degradation and soil infertility. Findings from personal observation show that most of the farms were located along rivers, near the forest edge and on mountain slopes. Studies have shown that clearing of forest land for agriculture results into global warming, loss of

wildlife habitats, environmental degradation and pollution. All these costs are incurred both locally and globally. Biodiversity conservation is being traded-off for agricultural production because people have no knowledge of other development options, which are both environmentally friendly and can serve their needs as agriculture does. Moreover, how much conserved land should be sacrificed so as to provide sufficient agricultural options is still ubiquitous (Bouma and Huitema, 2010).

Table : Major development projects existing in the study area

Development projects	Nyandira	Tchenzema	Kibuko	Statistical significance
Agriculture	25(62.5)	28(93.3)	22(73.3)	0.045*
Dispensary	16(40)	21(70)	22(73.3)	0.11
Schools	16(40)	6(20)	6(20)	0.397
Others	23(57.5)	5(16.6)	2(6.6)	0.668

*Statistically significant \approx at 5%

Dispensary and schools were the other development options chosen by respondents in Tchenzema and Kibuko. School was the third option chosen by all three villages together. Variation and differences in the development options above could be caused by differences in interests and necessity of a particular option in a particular village. Dispensaries were more important in Kibuko and Tchenzema because the residents were experiencing health service problem. Other development options mentioned were market, road construction, chicken and dairy goat project. These options received higher responses in Nyandira village (Table 10) compared with the other two villages. The reason for this, as reported in the focus group discussion, was

because Tchenzema and Kibuko had poor participation in those development options.

4.2.1.2 Conservation options

4.2.1.2.1 Tree planting

Trade-offs arise even between conservation options. Figure 2 shows that the majority (72%) of respondents chose tree planting over the other conservation options. The results show that 100%, 95.3% and 77.1% chose tree planting in Nyandira, Tchenzema and Kibuko respectively. These results correspond with the results by Batulaine (2007) who found that about 70% of his respondents in Bunduki and Maguruwe villages were aware of tree planting as the major conservation option. Personal observation showed that despite the fact that many respondents chose tree planting, few households had planted trees on their farms. This is in spite of the awareness and knowledge, which have been given by NGOs such as UMADEP, CARE International and government institutions. Findings from focus group discussion revealed that on Uluguru Mountains tree planting has been given more priority by many governmental and non-governmental institutions for biodiversity conservation and for local communities' wellbeing. CARE International and UMADEP were reported to be among the NGOs which have been promoting tree planting in the study villages. However, the local communities have neglected this practice claiming that it has no direct benefit to their lives. This statement was supported by one respondent who said that, *"I could only plant trees if they bring quick benefit, but it is better to plant vegetables which I know take only a few months than fruits or timber which takes years till harvesting period."*

Furthermore the villagers pointed out land scarcity as the reason for them not to plant trees. Therefore, the conservation community should put more effort in conducting awareness creation sessions on the importance of trees and tree planting options through agroforestry to minimize land requirements for planting trees only. Also, the types of trees planted should be able to produce short-term and direct benefits to the local communities. Planted trees can bring many benefits to the local communities such as charcoal, building poles, timber, firewood and medicines and reduce pressure on the forest reserves. But, changing local communities' perceptions and interests requires efforts and agreements (Mitinje 2004).

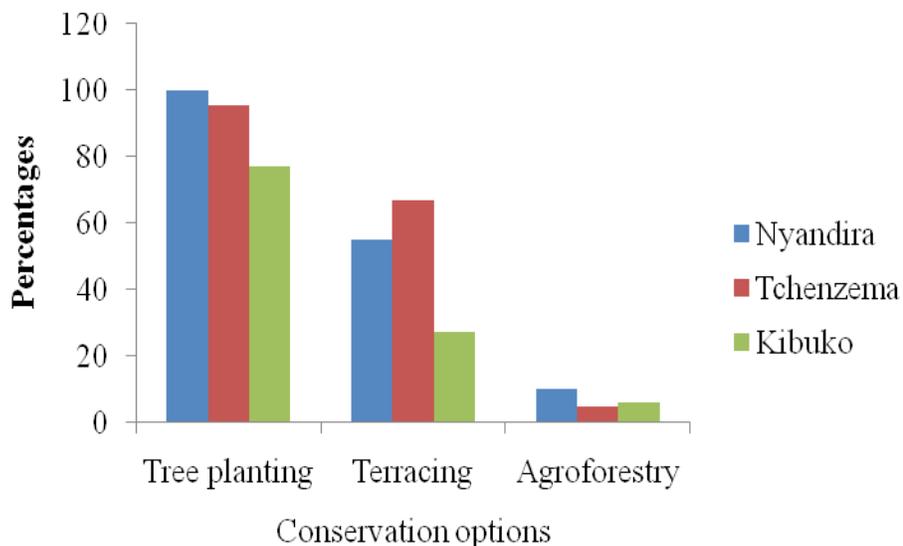


Figure : Conservation options in Nyandira, Tchenzema and Kibuko villages

4.2.1.2.2 Terracing

The results in Figure 2 show that about 55.1%, 66.7% and 27.1% in Nyandira, Tchenzema and Kibuko respectively mentioned terracing as the second conservation choice present in their villages. In Tchenzema village, the response was high (66.7%) compared to the other two villages. The reason for this could be that terracing was much adopted in the village. Terracing is used by farmers on Uluguru Mountains for soil conservation since their farms are located on steep slopes. They do so to prevent soil erosion and conserve soil fertility (Kajembe *et al.*, 2005).

Agroforestry

The results in Figure 2 show also that 10.2%, 4.8% and 5.9% reported agroforestry as the third conservation choice practiced in Nyandira, Tchenzema and Kibuko respectively. This does not imply that agroforestry is not considered as important by the villagers because most of the farmers are practicing it. This was only because of interests and priority from respondents about their choices among given conservation options. Agroforestry is still practiced as the solution for the land problem. As observed agroforestry practices were home gardens, alley cropping and mixing of trees and agricultural crops.

4.2.2 Reasons for choosing conservation, development or both option

About 65.0%, 61.3% and 44.8% of the respondents in Nyandira, Tchenzema and Kibuko villages respectively reported to had chosen development options because they got direct benefits (Table 11). The percentages in Nyandira and Tchenzema were high (65.0% and 61.3%) compared to Kibuko (44.8%). Findings from a focus group

discussion in Kibuko village revealed that conflicts between village leaders and villagers on projects were the major reason causing low percentage (44.8%) in Kibuko. The villagers complained that there was no openness in the way money was spent. This raised conflicts and mistrust and caused the villagers communities to perceive the government as unjust. Dahlberg and Buhlando (2009) observed the same in South Africa. Direct and short-term benefits accruing from development options motivate people to choose development over conservation projects. The reason for choosing conservation option was awareness and environmental protection (Table 11). Findings from focused group discussion show that local communities were aware of conservation benefits such as prevention of soil erosion, improving soil fertility, microclimate amelioration and maintenance of water sources.

Table : Reasons for choosing conservation, development or both options

Options	Reasons	Villages		
		Nyandira	Tchenzema	Kibuko
Conservation	Environmental protection	3(7.5)	4(14.8)	6(20.7)
	Awareness	2(5.0)	1(3.7)	0(0.0)
Development	Direct benefits	26(65.0)	18(61.3)	13(44.8)
	Livelihood improvement	0(0.0)	1(3.7)	0(0.0)
	Experience	2(5.0)	1(3.7)	0(0.0)
Both	Important for development	11(27.5)	4(14.8)	10(34.5)

4.2.3 Awareness of conservation rules

Overall, 92%, 89.3% and 92.0% of the respondents in Nyandira, Tchenzema and Kibuko villages were aware of the existence of formal rules governing the forest reserve. Only 7.1%, 10.7 and 6.7% of the respondents in the three villages respectively were not aware of the rules. This suggests that the level of conservation awareness is high in all villages. The study identified a number of conservation rules which were used in the area (Table 12). Furthermore, the results (Table 12) show that traditional rules are no longer being applied in conserving biodiversity. Findings from focus group discussion revealed the same, that traditional rules are not observed by the residents because of generational changes in beliefs and the fact that older people do not teach the young generations the cultural aspects of conservation. Nyandira, Tchenzema and Kibuko villages are in close proximity to Nyandiduma forest reserve. Though it has limited catchment value the forest reserve is known to serve and protect slopes of the mountains from soil erosion (Lovett *et al.*, 1993). Government forest officers and conservation initiatives are making efforts to make sure that the formal rules regarding the forest are observed by the local communities, but they too face challenges on how to balance development and conservation.

Table : Awareness of conservation and traditional rules

Variable name	Variable characteristics	Nyandira	Tchenzema	Kibuko	Total
Conservation rules	Prohibited to collect firewood	9(23.3)	3(11.1)	3(10)	15(15.6)
	Prohibited to cut trees	31(83.8)	24(88.9)	26(73.3)	81(85.1)
	Prohibited to make charcoal	3(8.1)	2(7.4)	1(3.3)	6(6.4)
	Prohibited to cultivate near the forest edge	5(13.5)	5(18.5)	6(19.6)	16(16.8)

Awareness	Aware	39(92.0)	25(89.3)	28(92)	92(92)
	Not aware	3(7.1)	3(10.7)	2(6.7)	8(8)
Traditional rules	Still applied	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Not applied	40(100)	30(100)	30(100)	100(100)

4.3 Local Communities' Involvement in Conservation and Development Projects

About 77.5% and 66.7% of the respondents in Nyandira and Tchenzema villages respectively stated that they were involved in conservation and development projects (Table, 13). These results were significantly higher compared with 54.3% in Kibuko ($p = 0.014$). Community involvement in conservation and development projects is very crucial. In trade-offs approach, involvement of local communities is important because it allows all parties involved to weigh all costs and benefits of a given option otherwise it creates mistrust and conflicts in the community (Dahlberg and Buhlando, 2009). Involving communities in conservation and development projects increases trust and creates a sense of ownership among community members. Moreover communities' involvement is key in achieving conservation and development goals (Brown, 2002). If communities are denied their rights conflicts and mistrust will occur and conservation and development goals will not be achieved (Hausser *et al.*, 2009). This was revealed in Kibuko village where villagers were not fully involved in conservation and development projects. This created conflicts leading to failure of some of the projects in the village. For example, in focus group discussion, it was revealed that CARE International brought three projects to Kibuko

and Bunduki villages which were beekeeping, tree planting and chicken rearing projects but the projects succeed in Bunduki and failed in Kibuko.

<i>Involvement</i>	Villages (All =100)			<i>Significanc</i> <i>e</i>
	<i>Nyandira</i> (n=40)	<i>Tchenzema</i> (n=30)	<i>Kibuko</i> (n=30)	
Involved	31(77.5) ^I	20(66.7)	16(54.3)	0.014*
Not involved	9(22.5)	10(33.3)	14(46.7)	0.423

Table : Communities’ involvement in Conservation and Development projects

*Statistically significant at 0.05%;

4.4 Communities’ Perception Toward Conservation and Development Trade-Offs

4.4.1 Respondents’ perception of projects in their communities

Table 14 shows perceptions of respondents on projects present in their villages. Respondents were asked to state how they viewed most of the projects under implementation in their villages: whether they were purely conservation, purely development or integrated conservation and development. The majority (66%) reported that most of the projects were integrating conservation and development (Table 14). About 69.7%, 80%, and 43.6% in Nyandira, Tchenzema and Kibuko villages respectively stated that projects in their villages integrated conservation and development. However, results from FGD revealed that most of the projects had failed to achieve both conservation and development objectives. It was stated that if projects were developmental, they carried out only some conservation activities and

vice versa. Therefore, relying on either conservation or development activities led the communities to perceive the projects as purely conservation or purely developmental.

Table : Respondents’ perceptions of projects in their communities

<i>Perception</i>	Villages			Total
	Nyandir a	Tchenzema	Kibuko	
Purely conservation	6(15.0)	6(20.0)	7(23.0)	19(19.0)
Purely development	4(10)	1(3.3)	2(6.7)	7(7)
Integrate conservation and development	28(69.7)	24(80.0)	13(43.6)	60(66.0)
Don’t know	2(5.0)	4(13.3)	8 (26.7)	14(14.0)

4.4.2 Effects of ignoring conservation and development trade-offs

Table 15 presents views as given by different age groups of respondents on the effects of ignoring conservation and development trade-offs. The major effect as reported by all age categories was that ignoring conservation and development trade-offs will slow down economic development (51%) (Table15). About 43% of all respondents reported that ignoring conservation and development trade-offs will result into conflicts, injustice and will create mistrust among community members. This suggests that the effect of ignoring conservation and development trade-offs is experienced in development matters by all age groups. Studies have shown that despite relying strongly on agriculture local communities have maintained a high dependence on natural resources for their survival (Hauser *et al.*, 2009). Therefore, conservation and development trade-offs should be acknowledged in order to improve local communities’ well-being. The dependence of local communities on

agriculture as a major source of income has resulted into conflicts with conservation of natural resources such as wildlife management and forestry (Wilfred, 2010). About 4% of the respondents stated that ignoring conservation and development trade-offs can also result in environmental degradation. Ignoring conservation and development trade-offs will not only jeopardize the communities' wellbeing but also goals of conservation will be at stake.

Table : Effects of ignoring conservation and development trade-offs as perceived by respondents by age groups

<i>Reasons</i>	<i>Age category</i>			
	<i>18-30</i>	<i>31-60</i>	<i>> 60</i>	
Conflicts, injustice, mistrust	10(50)	28(43.8)	5(31.2)	43(43)
Slow down economic development	9(45)	31(48.4)	11(68.8)	51(51)
Environmental degradation	1(5.0)	3(4.7)	0(0.0)	4(4.0)
No effects	0(0.0)	2(3.1)	0(0.0)	2(2.0)

4.4.3 Ways of managing conservation and development trade-offs

Table 16 shows that about 78.3%, 68.8% and 56.2% of the 31-60 age group in Nyandira, Tchenzema and Kibuko villages respectively stated that communities should be involved in planning and decision making process as a way of managing conservation and development trade-offs. About 33.3% of the youth in Kibuko village were of the opinion that policies regarding conservation and development trade-offs should be framed so as to address complexities present in managing conservation and development projects. On average the 31-60 age group stated that all three ways are desirable in managing conservation and development trade-offs. **Table : Ways of managing conservation and development trade-offs as perceived by respondents by age groups**

Responses	Nyandira (n=40)			Tchenzema (n=30)			Kibuko (n=30)			Average		
	1	2	3	1	2	3	1	2	3	1	2	3
Involvement in planning and decision making processes	13	78.3	8.7	12.5	68.8	18.8	18.8	56	25	14.5	67.7	14.1
Conservation and development trade-offs should be made clear to community members	14.3	71.4	14.3	25	68.8	6.2	15.4	53.8	30.8	14.9	62.6	13.7
Policies regarding conservation and development should be made clear to involve complexities present in managing conservation and development projects	27.8	55.6	16.7	16.7	66.7	16.7	33.3	58.3	8.3	25.9	60.2	10.5

1= 18-30 years, 2 =31-60 years, 3= Above 60

4.5 Socio-Economic Factors Influencing Conservation and Development Trade-Offs

Socio-economic factors influencing conservation and development trade-offs, which are discussed in this section, include level of income, education level, gender, duration of residence and land size.

4.5.1 Level of income

Level of income (Table 17) does not significantly influence conservation and development trade-offs but has positive correlation with conservation and development choices. The positive and significant relationship of level of income with conservation and development options indicates that level of income plays an important role in ensuring the choice options. Moreover, rich people have influential capacity in decision making and they feel free to express their ideas contrary to poor people who usually have no voice in decision making (Bouma and Huitema, 2010).

4.5.2 Education level

Table 17 shows that education level had positive regression coefficient on both conservation and development choices. Although the level of education indicated non-significance to the conservation choices ($p = 0.999$) it was statistically significant at ($p \leq 0.05$) with development options. The logical explanation is that increases in the level of education increase knowledge and awareness of the people and this in turn affects their choices. Also, education has been argued to contribute to development and conservation of natural resources (Kajembe and Luoga, 1996).

Batulaine (2007), observed that increase in education status of the household head in Uluguru led to an increase of trees on a farm.

4.5.3 Residence duration

Table 17 shows that residence duration of respondents had a positive regression coefficient on conservation and development choices. The positive correlation implies that people who have stayed longer in a village have historical knowledge of the village and know much about matters concerning conservation and development. Therefore, it is expected that when it comes to decision making on choices between conservation and development, they will measure costs and benefits of both choices and come up with best option than those who have spent less time in the village. Furthermore, people who have stayed long in the village would be interested in investing in long-term projects especially conservation projects than those who have spent less time in the villages. Luoga *et al.* (2000) observed the same in Kitulangalo Forest Reserve where they found that short term residents were not committed to conservation options as long-term residents.

4.5.4 Gender

Table 17 shows that gender had a negative regression coefficient in conservation option and a positive one in development option but, it did not show any significance with both conservation and development options. Although gender did not show any significance in both conservation and development options the negative coefficient in

conservation option implies that on the Uluguru gender plays a vital role especially in land ownership. Therefore, the decline of female participation in decisions pertaining to conservation issues may hinder conservation goals. On the other hand the positive coefficient in development options indicates that, the increase of female participation may improve development on Uluguru Mountains because females are highly involved in development activities. Bhatia and Ringia (1996) state that, females on Uluguru Mountains have better access to inherited land hence they are capable of deciding on matters concerning land utilization than males. Batulaine (2007) found the same in Maguruwe village.

4.5.5 Land size

Table 17 shows that land size had positive regression coefficient and also statistically significant in both conservation ($p = 0.05$) and development ($p = 0.027$) choices. This implies that the size of land owned by an individual determines her/his choice between conservation and development. People who have large pieces of land are likely to choose both conservation and development options because they can use one portion for crop production and the remaining portion for tree planting. On the other hand individuals with small pieces of land choose development options especially agriculture, which brings quick benefits for their subsistence and ignore tree planting, which has long-term benefits. These findings correlate with those of Katani (1999) who found that, the number of trees planted increased with increase of land size.

Table : Socio-economic factors influencing conservation and development trade-offs

	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Conservation								
Intercept	-21.406	1.48	209.19	1	0.00*			
Income level	1.755	1.227	2.044	1	0.153	5.782	0.522	64.096
Education level	4.348	2425	0	1	0.999	77.358	0	.b
Residence duration	3.06	2.058	2.21	1	0.137	21.334	0.378	1205
Gender	-0.32	0.763	0.175	1	0.675	0.726	0.163	3.241
Land	2.585	1.346	3.689	1	0.055*	13.262	0.948	185.4
Development								
Intercept	-20.652	0.995	431.19	1	0.00*			
Income level	0.359	0.676	0.282	1	0.595	1.432	0.381	5.391
Education level	20.178	1.142	312.39	1	0.00*	6E+08	6E+07	5E+09
Residence duration	0.352	0.92	0.146	1	0.702	1.422	0.234	8.625
Gender	0.449	0.525	0.731	1	0.393	1.567	0.56	4.385
Land	1.787	0.807	4.908	1	0.027*	5.974	1.229	29.04

Where;

β = Estimated regression coefficient

S.E = Standard error

Wald = Wald statistics

Exp (β) = e^β Where $e = 2.718$ and β regression coefficients (Table 17)

EXP (β) is the odds ratio, which is the ratio of probability of success to the probability of failure

C.I = Confidence interval at 5% level of significance

Sign. = level of significance

* = Statistically significant at 0.05 level of significance

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study found that tree planting, terracing, agroforestry, agriculture, schools and dispensaries were major conservation and development trade-offs existing in the study area. Education level was found to be dominated by primary education and most of the residents have been in their villages for more than 30 years. This implies that they have enough knowledge and experience regarding their villages.

Among the socio-economic factors, education level and land size owned by household heads have significant influence on conservation and development trade-offs. This means that, education and size of land owned are the key focus areas in the aspect of conservation and development trade-offs on Uluguru Mountains. Additionally, traditional rules are no longer being applied in the study area because of generational changes.

Participation of local communities in planning and decision making process pertaining to conservation and development projects is a major way of managing conservation and development trade-offs in the study area so as to avoid conflicts and mistrust among community members.

5.2 Recommendations

Based on the findings presented here the following recommendations are pertinent and desirable for addressing conservation and development trade-offs in the study area.

- Conservation and development trade-offs are not clear to most of the local communities, therefore, measures should be taken by conservation and development initiatives to address the problem.
- Land seems to influence choices between conservation and development options, therefore, actors and stakeholders in conservation and development should focus on better land use planning measuring costs and benefits when making decisions on conservation and development trade-offs.
- Involvement of local communities in decision making should be given priority especially in conservation and development trade-offs so as to avoid conflicts and mistrust.
- Extension officers, governmental and non-governmental institutions should make sure that farmers cultivating on the slopes of the mountains use proper agricultural techniques so as to reduce environmental degradation.

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APPENDICES

Appendix : Conservation and development Projects on Uluguru Mountains

<i>Period</i>	<i>Organization name</i>	<i>Conservation Projects</i>	<i>Development Projects</i>
1945-1955	British Colonial Government	Uluguru Land Usage Scheme (ULUS)	
1993 to date	Sokoine University of Agriculture		Uluguru Mountains Agricultural Development Project (UMADEP)
1995-1996	Birdlife International	Promoting Community Involvement in Biodiversity Conservation	
1999-2002	Wildlife Conservation Society of Tanzania (WCST)	Uluguru Mountains Biodiversity Conservation Project (UMBBCP)	
2002-2005	ARI, Tanzania		Improving Farmers' Livelihoods: Better crops, System & Pest Management
2003-2005	CARE International	Uluguru Mountains Environmental	

		Management and Conservation Project (UMEMCP)	
2006-2007	CARE International	Assessment of Baseline and Socio-economic Factors for Forest Restoration Planning in Bunduki Gap of Uluguru Mountains Forest of Tanzania	

Source : UMADEP Report, (2001)

Appendix : Household questionnaire

Name of enumerator

Date.....

1. Division.....
2. Ward.....
3. Village.....
4. Sub-village.....
5. Respondent no.

SECTION A: GENERAL INFORMATION

6. Total size of the household

1. Number of children (<18 yrs): Female Male
2. Number of adults (≥18 yrs) : Female Male
3. Dwelling ownership (1 = owned: 2 = rented)
4. Dwelling type [1= concrete/ burnt bricks and iron sheets; 2 = concrete/ burnt bricks and grass/palm leaves; 3 = unburnt bricks and iron sheets; 4 = unburnt

bricks and grass/palm leaves; 5 = mud and iron sheets; 6 = mud and grass/palm leaves, 7= *other (specify)*]

- 5. If rented how much do you pay monthly as rent?
- 6. Wealth category (1 = High; 2 = Medium; 3 = Low) (* as established during focus group discussion).

7. Sources of income (circle the most appropriate answer)

1) Selling forest products, mention them.....

2) Formal employment

3) Small business.....
.....

4) Remittance.....
.....

5) Others (Specify)

8. Residence duration in the village.....
(Years)

9. Ethnic origin.....(Tribe)

10. Age.....(Years)

11. Sex 1. Female 2. Male

12. Marital status 1. Single 2. Married 3. Divorced 4. Widow

13. Education level (circle the most appropriate answer)

1) No education

2) Primary education

3) Secondary education

4) High school

5) University

6) Others (Specify).....
.....

SECTION B: CONSERVATION AND DEVELOPMENT TRADE-OFFS

12. Are there any conservation projects in your area?

1) Yes []

2) No []

13. If yes, list them in the table below

	Conservation projects
1	
2	
3	
4	

14. Upon their establishment did they consider local communities' involvement in those projects?

1) Yes []

2) No []

15. If the answer to Q9 is yes, who were involved

Projects	Participants
1	
2	

3	
4	

16. Are you aware of any conservation benefits?

1) Yes []

2) No []

17. If the answer is yes, mention them 1.....2.....
3.....

18. Are there any development projects in your area?

1) Yes []

2) No []

19. If yes, list them in the table below

	Development projects
1	
2	
3	

20. Given the following options (choices) which one do you choose and why?

1) Conservation options (tree planting, soil conservation, terracing etc)

2) Development options (school building, infrastructure development, market building etc)

3) Both

4) None

21. Give reasons to your choice

Conservation options	Development	Reasons

	options	

22. If your choice is development option, how do you think the forest reserve will look like in ten years time.....

23. What do you think will be the impacts on the well-being of local communities surrounding this area?

24. Can you suggest any management options that can be done by conservation and development officers so that the impacts can be minimized?

SECTION C: SOCIO-ECONOMIC FACTORS INFLUENCING CONSERVATION AND DEVELOPMENT TRADE-OFFS

25. How much land does the household own.....

26. Where is your land located for agriculture? (Tick where appropriate)

Inside the forest	
Near the forest edge	
On the mountain slopes	
In valley bottom within the forest	
In the valley bottom outside the forest	
Along the river	
Others (specify)	

27. Are there any cultural systems of forest resource management?

i) Yes []

ii) No []

28. If yes, what are they? 1.....2.....

29. Are there any formal rule governing the use of forest?

i) Yes []

ii) No []

30. If yes, mention them 1.....2.....

31. How did you acquire land

1.....2.....3.....

32. Is land shortage a problem to your household?

i) Yes []

ii) No []

33. If yes, what are the main causes of this problem?

1.....2.....

34. How do tackle land shortage problem? 1.....2.....

35. Cash crop production for the last season(Provide information in the table below)

Type of crop	Farm size(acres)	Amount harvested(Kgs)	Amount given to family members and	Amount kept for consumption(Kgs)	Amount sold(Kgs)	Earning from the amount sold
--------------	-------------------	-----------------------	------------------------------------	----------------------------------	------------------	------------------------------

			friends			

One tin or bucket = 20kg

38. Do you use any forest related products?

i) Yes []

ii) No []

39. If yes, mention those products 1.....2.....3.....

40. Where do you get those products 1.....2.....

SECTION D: PERCEPTION TOWARD CONSERVATION AND DEVELOPMENT TRADE-OFFS

41. How do you perceive most projects in your area?

- 1) Purely conservation
- 2) Purely development
- 3) Integrate conservation and development
- 4) Do not know

42. Give reasons to your answer in question 41 above.....

43. On your own opinion how do you think trade-offs between conservation and development should be handled?

- 1) We should be involved in planning and decision making process

- 2) Trade-offs between conservation and development should be made clear to community members
- 3) Policies regarding conservation should be framed so as to consider complexities present in managing conservation and development projects
- 4) Others (specify)

44. Comment on the effects of ignoring conservation and development trade-offs 1.....2.....

**Appendix : Checklists for key informants
Project/Program officers**

A. Conservation and development trade-offs

- When did the project started?
- What are the interests of the project?
- Before arriving at this particular project which options did you have?
- Why did you choose to implement this kind of project?
- What are the objectives of the project?
- Did the project achieved to link conservation and development?

B. Socio-economic factors influencing conservation and development trade-offs

- What do you think are the socio-economic factors influencing conservation and development trade-offs?
- How is the project perceived by local communities?
- Do you face any difficulties in implementing you projects objectives? Mention them?
- Comment on how conservation and development can harmonize in order to improve both peoples wellbeing and biodiversity conservation in this area?

**Appendix : Checklist for Focus group discussion (Village committee members,
old people, and youth)**

Village.....

Ward.....

A: IDENTIFICATION OF CONSERVATION AND DEVELOPMENT TRADE-OFFS

- Ethnic group tribe/composition in the village.....
- Are there any conservation or development projects in your village?
- What are they?
- When did they start?
- Were you informed about what they are going to do in the village?
- Did you involved in making decisions?
- What are the conservation and development options present in the village?
- Among these options which one have more priority compared to the other and why?

B: SOCIO-ECONOMIC FACTORS INFLUENCING CONSERVATION AND DEVELOPMENT TRADE-OFFS

- How do you rank people in your village like rich, middle class and poor people?
- Are there any cultural systems which affect conservation activities?
- Are there any rules that govern the forest uses in this are? What are they?
- Are the people fully engaged in conservation or development option provided by the projects? Explain?

- How do people perceive conservation and development trade-offs in the village?
- Are these projects meets their objectives as they stated?
- How the people do responds towards these projects?
- What do you think are the factors which make people not to respond to these projects?