FOREST INCOME AND RURAL LIVELIHOODS UNDER SULEDO

COMMUNITY BASED FOREST MANAGEMENT IN KITETO DISTRICT

BY

CLEMENCE ANDAGILE MWAKASENDO

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN THE

MANAGEMENT OF NATURAL RESOURCES FOR SUSTAINABLE

AGRICULTURE OF SOKOINE UNIVERSITY OF AGRICULTURE.

MOROGORO, TANZANIA.

2009

ABSTRACT

How forest income in Community Based Forest Management (CBFM), enters into peoples' livelihood diversification strategies, income distributional profile, degree of dependency and variations due to contextual factors is unknown. This study was carried in Sunya, Lengatei and Dongo wards in Kiteto district from September to December 2008 to assess the impact of community based forest management on rural livelihoods. Livelihood framework was the main approach used. Data collection involved Participatory Rural Appraisal, household questionnaire survey, participant observation and focused group discussion. The study population was grouped into; poor, medium and less poor wealth groups. Descriptive and inferential statistics were used for quantitative data using Statistical Package for Social Science (SPSS version 12) and Excel. The inferential statistic analysis was used to determine the influence of household socio-economic characteristics on household income and how environmental incomes influenced by other sources of household income. Forest resource use dominated by fodder and firewood, improved after CBFM. Household income contributions were as follows; Agriculture 96.3%, environmental income 2.8% and non-farm, off-farms and remittances contributed 0.9%. Livestock owning was potentially a variable with respect to household asset. Total household income increased with increase in number of cattle and the relationship was significant (P<0.001). Lower income households registered lower earnings in agriculture than environmental income. Environmental income reduced income inequality, the Gini coefficient without environmental income in respective study villages of Sunya, Asamatwa, Lesoit and Olkitikiti was increased to 0.01, 0.01, 0.03 and 0.00 units respectively. The overall Gini coefficient increased to 0.02 units. Community's perception on CBFM towards livelihood was generally positive. The study recommends; use of forest resources in CBFM to identify actual needs of the local community in regard to existing

income category and social groups' needs, improvement of existing livelihood options and

identification of other alternative livelihood options and income generating activities.

DECLARATION

I, CLEMENCE ANDAGILE MWAKASENDO 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.

---   -------------------------
Clemence Andagile Mwakasendo   Date
(MSc. MNRSA)

The above declaration is confirmed by

---   ---------------------------
Dr J.M. Abdallah   Date
(1st Supervisor)

---   -----------------------------
Dr J.J. Kashaigili   Date
(2nd Supervisor)

COPYRIGHT

No part of this dissertation may be reproduced, stored in any retrieval system or transmitted in any form or by any means without prior permission of the author or the Sokoine University of Agriculture in that behalf.

ACKNOWLDGEMENT

This work would have not been possible without the contributions from a number of individual persons and institutions. It is not possible to name everybody who has contributed to the success of this work, but to them all I owe my gratitude. First and foremost, I would like to thank the almighty God for giving me strength during the whole period of the study. I want to pay particular tribute to the following: I would like to express my heartfelt gratitude and appreciation to my supervisors Dr J.M. Abdallah from the Department of Forest Economics, and Dr J.J. Kashaigili from the Department of Forest Mensuration and Management, Faculty of Forestry and Nature Conservation, Sokoine University of Agriculture who patiently guided all phases of this study. Their encouragement, constructive criticisms and patience are highly appreciated.

I greatly thank the financial support offered to me by NUFU through EKOSIASA Project. I also thank my employer the then Ruangwa District Executive Director (DED) Mr Athuman Akalama for granting me a study leave.

I am also greatly indebted to Mr. Shaaban Luono, the then Kiteto District Forest officer (DFO) for providing me valuable information relevant for this study and assisting me administrative arrangements in the field. Further thanks are extended to Mr. Minja, the District Natural Resources Advisor under Land Management Project (LAMP) and Dr Ulrike Mizlaff the ORGUT Consultant for providing me detailed information about LAMP activities in the study area. I also express my appreciation to Mr. Fidelis Kyoro, the Kiteto District Administrative Secretary (DAS) for granting me permission to conduct research in his area of jurisdiction.

DEDICATION

This work is dedicated to my late parents; Andagile Magomela Mwakasendo and Aida Amulike Mwaipopo who laid the foundation of my education. This work is also dedicated to my wife Laura Lyinga Samwel and my daughter Tusekiile for their endless love, patience, tolerance and encouragement for all the time I was undertaking my studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

CBFM	Community Based Forest Management
DAS	District Administrative Secretary
DED	District Executive Director
DFID	Department for International Development
DFO	District Forest Officer
EI	Environmental Income
EKOSIASA	Ekolojia Siasa
FAO	Food and Agriculture Organization
HASHI	Hifadhi Ardhi Shinyanga
JFM	Joint Forest Management
LAMP	Land Management Project
MNRT	Ministry of Natural Resources and Tourism
NRM	Natural Resources Management
OLS	Ordinary Least Squares
PADEP	Participatory Agricultural Development Programme
PFM	Participatory Forest Management
PRA	Participatory Rural Appraisal
RFI	Relative Forest Income
SUA	Sokoine University of Agriculture
SULEDO	Sunya Lengatei Dongo
TAFORI	Tanzania Forestry Research Institute
URT	United Republic of Tanzania
VLFR	Village Land Forest Reserve
VNRC	Village Natural Resources Committee
WMA	Wildlife Management Area

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Rural households rely heavily on natural resources, often depend directly on non cultivated natural resources (Vedeld *et al.,* 2007; Kamanga *et al.,* 2008). According to World Bank about 1.6 billion people in the world depend on varying degrees on forest for their livelihoods (Vedeld *et al.,* 2007). Forests make a wide range of tangible and intangible benefits, which make major part of peoples livelihood strategies in both rural and urban areas. Majority of the people who earn their livelihoods from forest related activities are the poorest often marginalized, they depend on forest for their survival (Buyinza, 2008). Many of the forest related services are public goods and their contribution to the poor peoples' income and livelihoods are currently undervalued.

Vedeld *et al*. (2007) reported that as much as 20% to 25% of the rural people's income may be derived from environmental resources in developing countries. He further added that the poor engage more on low return forest activities though fail to accumulate capital from them. Forest related environmental income form an important part of rural income in many poor regions. It is estimated that 80% of human population in Tanzania is rural based with heavy dependency on forest resources for their livelihood (Vedeld, 1999; Luoga, 2000).

Despite the heavy dependency on forest resources, past approaches ('the fortress approaches') in forest management denied peoples access to forest resources. Conflicts between the community surrounding the forest and forest managers were often experienced. This situation made the surrounding community poorer and destruction of the

forests continued (Adam *et al*., 1997). Present, forest management in Tanzania through Participatory Forest Management (PFM) is a dominating approach. The approach is people centered where forest benefits are enjoyed by the local community through, right to access, control and use of forest and tree resources.

One of the core aspects of participatory forest management is a realization that PFM could have a livelihood impact at various levels, the individual and community (Schreckenberg *et al.,* 2007). Thus consideration of how this variation may be is important. For example how impacts may vary between households, richer, poorer or different ethnic groups; or with varied livelihood strategies, or between communities at varying distances from the forest. How do household external factors involving economic, legal socio cultural and natural, impact on the household which finally determine the income, welfare and degree of poverty of the household.

1.2 Problem Statement

Poverty has been a major problem in Tanzania rural communities and so a major cause of forest degradation due to heavy dependency on forest incomes from fuelwood, timber, fodder for grazing and other non-timber forest products (World Bank, 1990).

Kiteto district is one among five districts of Manyara region endowed with forest and woodland resources which are potential to provide forest income for livelihood improvement in the rural communities. Unsustainable land management due to various factors including; land use conflicts between crop cultivation and pastoral activities were criteria used to select Kiteto district in which CBFM were piloted in early 1990's in Arusha, Manyara (then part of Arusha) and Singida regions through Land Management Programme under Arusha Regional Forestry Programme supported by SIDA (LAMP

1995). Sustainable land use and forest management were among objectives of the programme in the area. Forest management in Kiteto district involved 9 villages managing and owning 167 400 ha of village land forest reserve in three wards, Sunya, Lengatei and Dongo (Sjohlom and Luono, 2002).

Different social economic groups including, small scale farmers and sedentary pastoralists are managing the forest through CBFM process. How forest income enters into peoples' livelihood diversification strategies, groups' income distributional profile and groups' degree of forest income dependency and other contextual factors beyond household's immediate control such as geographical, market access, distance to the forest resources and how they explain variations in household strategies is not known.

1.3 Justification of the Study

In Tanzania, although a number of studies (Monela *et al*., 2000; Kajembe *et al*., 2002) have been conducted concerning forest incomes and rural livelihoods but their focus has been rural people's livelihood in general and how poverty levels and forest dependence are linked. Realisation of the extent to which forest income enters into peoples livelihood diversification strategies, will help in identifying actual needs of the local communities with regard to environmental resources in Community Based Forest Management projects. Forest incomes are important for vast groups of rural poor and, local heterogeneity in forest resource access and income generation is increasingly becoming important element in studying local communities and income disparities between them (Vedeld *et al*., 2007; Kamanga *et al*., 2008). Therefore; an understanding of these parameters will be important in identifying other alternative means of livelihood as an important element in conserving and managing the forest and promotion of effective legitimate strategies for poverty reduction.

1.4 Objectives

1.4.1 Overall objective

The overall objective of the study was to assess the impact of community based forest management to Suledo community livelihoods in Kiteto district.

1.4.2 Specific objectives

The specific objectives of the study include:

(i)   To assess different forest based livelihood options before and after inception of community based forest management in Suledo community.

Research questions:

• How does the community access resources?

• Which forest based livelihood options are dominant in the area?

• How is use of forest resources managed in the area?

(ii)   To determine contribution of forest based livelihood options on household income.

Research questions:

• What is the contribution of each livelihood option to household income?

• What is the dependence of forest income with respect to income category and household characteristics?

• Are there differences in income inequality among study villages?

• What are the possible reasons for income inequality among study villages?

(iii)   To assess the community's perception, attitude and awareness on CBFM   towards livelihoods.

Research questions:

- What are the indicators for CBFM intervention in relation to livelihoods?

- What is the community's level of awareness on CBFM intervention in the area?

1.5 Conceptual Framework

The conceptual framework underlying this study (Figure 1) is based on the fact that, the community forest reserve and its management regime can have impact on the community and household adaptations towards livelihoods. The entitlement mapping in village general land including; crop cultivation, settlement development, pastoralism, hunting and forest resources collection as livelihood strategies determining household income levels, welfare and degree of poverty.

The CBFM mechanism controls the way livelihood strategies are acting upon forest resources through household external factors including, general condition in the area, CBFM specific polices and practices which include; economic/technical institutional framework, legal institutional frameworks, socio-cultural and political frameworks and natural and demographic conditions. These controls contribute to materialization of other livelihood options as a pathway for the community to increase or supplement household income. These are assessed through state of household livelihood strategies, consumption pattern and whether there is saving, investment or relative income.

**HOUSEHOLD
EXTERNAL
FACTORS**
General condition in
the Area/ CBFM
specific policies and
practices
Economic/technical,
legal, socio-cultural
and political
frameworks
Natural and
demographic
conditions

**ENTITLEMENT
MAPPING IN
VILLAGE
GENERAL LAND**

Crop cultivation
Settlement
  Development
Pastoralism
Population change
Hunting
FR collection
Beekeeping
Hunting

**ENTITLEMENT
IN CBFM
SCENARIO**

Sustainable
utilization of forest
resource base

Community
Based Forest
Reserve

TOTAL INCOME, WELFARE AND DEGREE OF POVERTY
State of livelihood strategies in the locality
Consumption
Savings/ investment
Gini coefficient

Figure 1: The conceptual framework for the study

1.6 Study Limitations

In pastoral villages some respondents could communicate fluently in Maasai and Kamba and less in Swahili. In this case, an interpreter had to be available; thus limiting the researcher to get first hand information. Language barrier was more pronounced in focused group discussions in villages where majority of the group members could not speak Swahili.

Another limitation encountered was, the researcher could not easily gather the past years quantitative data, as respondents could not easily recall past events. The researcher had to probe for more details and make comparison with current household consumption expenditure to arrive at the meaningful figures. This might have also affected the reliability of the information gathered.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Forest Management in Tanzania

The forest sector in Tanzania is centrally managed through Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism (MNRT). However, past experience indicates that the sector has not performed to the expectation; this is manifested by forest degradation through illegal activities and human pressure (URT, 1998). Generally forest resources in Tanzania have faced both ecological and socio-economic threat speeding up resource base degradation. According to Luoga *et al.* (2000), forest cover has continually been declining from more than 50% during independence to 45% in late 1970s. In 1990s, the decline in forest cover was reported to be 41%.

The paradigm shift in natural resources management started way back in 1980s. Learning from past failures in natural resources management, forest in particular. The National Forest Policy of 1998, supports devolution of ownership and management responsibilities to local communities under participatory forest management (PFM) approaches (URT, 1998). This approach expected to enable local people to access forest resources for livelihood enhancement and sustainable forest resources utilization (Hutton and William, 2003). Reasons for the paradigm shift in forest management included, failure of the state to manage protected areas effectively, high transaction costs for effective management of forests, relevancy of local knowledge of ecological dynamics to proper management and increased motivation for community to conserve forests (Kajembe and Kessy, 2000). Despite of this shift in forest management and implementation of CBFM in particular, few precise data are available which capture broad general conditions and relationships both at individual household and community level with respect of forest income and rural

livelihoods (Leach *et al*., 1997). The community may enjoy same rules and regulations in CBFM, however, economic cultural and social heterogeneity may be found between households in their access to endowments such as land, labour, and capital, in their motivations, skills and in income generating activities (Leach *et al*., 1997). These parameters therefore are important when considering paradigm shift in forest management and how has impacted on forest income and rural livelihoods, since impact includes both positive and negative consequences whether foreseen and expected or not (Kijazi, 2007).

2.2 Livelihood

2.2.1 Livelihood concept and forest management

Livelihood covers a wide and diverse range of things people do, comprising of the capabilities, assets and activities required as means of living (DFID, 1999). A livelihood is sustainable if it can cope with stress and shocks, and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (IUCN, 2005). To maintain this is only possible if conservation measures should proactively look for opportunities to address livelihoods and poverty through, access to natural resources by the rural poor.

Forest resources can contribute directly to livelihoods and complement other key components of poverty reduction (eg. food production, education, primary health care). This is only possible if sustainable supply of forest income and resources is maintained. PFM is one way sustainable supply of forest resources can be achieved (MNRT, 2002). According to Kajembe *et al*. (2003), magnitudes of factors from forest resources which allow families to sustain themselves are regulated by CBFM, most destructive uses that lead to the removal of considerable amount of wood biomass from the forest such as timber, charcoal and building poles extraction require a license. Such arrangements help to

ensure more and constant income, reduce vulnerability and insure more use of forest resources.

It is widely agreed that PFM benefits the local communities by arresting forest degradation and supporting development and empowering rural communities' livelihoods through improvement of financial, natural, physical, human and social capital (Wily 2000).

2.2.2 Rural livelihood strategies

Rural livelihood strategies can be seen as dynamic adaptation process created through pressures and opportunities by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their living (Ellis, 2000). Forest income consideration is important in rural diversification, as; forest resources serve as input into household production and consumption activities. About four rural livelihood strategies distinctions can be explained with respect to PFM and forest resource use in rural communities (Farrington *et al.*, 2002);

- Introduction of PFM in a rural community may imply restricted access to resources and more often loss of land due to forest expansion. The rural communities can adapt to such risks of consumption failures by associated PFM activities during project implementation through introduction of new activities such as; forest boundary clearing, tree nursery preparation and tree boundary planting (Kigula, 2007).

- Coping strategies involve absorbing the impact of an adverse shock by drawing down assets and reducing consumption, this can involve for example engaging in casual labour as a piecework, or temporary migration. Linking with PFM, forest resource use regulations and rules which may include temporal use of forest resources such as fodder and collection of firewood as dead wood might be a community coping strategy with respect to forest resources use.

- Survival strategies are activities opted often by individuals, when household consumption has drastically been reduced and household assets are extensively eroded. However, such possibilities might be reduced in CBFM where sustainability concept reduces the chances for drastic reduction of household consumption and asset eroding by ensuring sustainable forest incomes.

- Accumulative strategies in CBFM may involve community activities which end up in more income and improved infrastructures at community level, timber harvesting, and tourist activities are activities likely to provide substantial changes to the rural community. The resulting outcome may be more income, improved nutrition and increased security.

According to Scones (1998), rural livelihood strategies are divided into three broad types, following the nature of the activities involved as elaborated in section 2.2.2.1, 2.2.2.2 and 2.2.2.3.

2.2.2.1 Rural livelihood diversification

Rural livelihood diversification is a process by which households are involved in a wide range of activities and social capabilities for survival and in order to improve their standard of living (Ellis, 2000). Since farming cannot provide on its own sufficient means of survival, most rural households in developing countries manage a broad range of livelihood activities. The extent of diversification differs between income groups for example, CARE (1995), reported that in Shinyanga, Mwanza and Arusha regions in Tanzania, The poor derive their income from the sale of wild foods (0 to 10%) and firewood (5 to 15%), construction activities e.g. pole and brick production and house building (25 to 35%), migration (0 to 5%), and agricultural labour (5 to 15%), with crop and animal product sales (e.g. chickens and eggs) contributing 25 to 35% and 5 to 10% respectively. It is important that such forest resources be sustained in order to ensure poor

peoples' survival that is conservation initiatives insure that poor people are not made worse off. This is only possible through PFM which may ensure, sustainability of forest resources, increased alternative means of livelihood and forest incomes.

2.2.2.2 Agricultural intensification or extensification

Studies by CARE (1995) in Shinyanga region indicate that farming systems are increasingly characterised by a mixture of agriculture and livestock keeping for increased household earnings. Unlike crop cultivation which leave the land bare, livestock production in woodlands is compatible with woodland management, both from economic and ecological perspectives (Campbell *et al.*2000; Gambiza *et al.*, 2000). It implies therefore that, PFM projects in pastoral lands are more likely to meet both forest management goals and community livelihood improvement.

2.2.2.3 Migration

This can take the form of voluntary or involuntary migration. Mainly as a strategy to secure off- farm employment, stimulate economic and social link between areas of origin and destination (Farrington *et al.,* 2002). According to URT (1997), migration from Lake Zone to other places in Tanzania is a significant activity and major reasons include, searching for farmland, better pasture and water for livestock and employment opportunities. This often creates land degradation related problems, especially where ownership of resources are not clear. Ownership of resources create a sense of responsibility, leading to effective policing especially against 'outsiders' who seem to have no long term interest in the local resources (Luoga *et al.*, 2000). One way of achieving this is through participatory forest management.

2.3 Overview of Participatory Forest Management and Livelihoods

National Forest Policy of 1998 and the Forest Act 2002, provides the basis for communities in Tanzania to own, manage or co-manage forests (Blomley and Ramadhani, 2007). Two types of PFM recognized by law; community based forest management (CBFM) and joint forest management (JFM). The CBFM allows local communities to declare and gazette, village, group or private forest reserves and take full responsibilities of setting and enforcing rules and regulations over forest management and use. In JFM local communities are allowed to enter into agreements with government

Table 1: Current coverage of CBFM and JFM across mainland Tanzania

Joint Forest management		Community Based Forest Management	
Area of forest under JFM	1.61 million (ha)	Area of forest under CBFM	2.06 million (ha)
Number of forest reserves under JFM	209	Number of declared or gazetted village land forest reserves	382
Number of villages engaged in JFM	719	Number of villages engaged in CBFM	1102
Number of districts engaged in JFM	54	Number of districts engaged in CBFM	51
Most common forest type under this management regime	Montane forests and mangroves	Most forest type under this management regime	Miombo Acacia and Coastal woodlands
% of forest reserved by central or local government under JFM	11.6%	% of public land forests now under CBFM	10.2%

Source: Adopted from Blomley and Ramadhani (2007)

and other forest owners for sharing the costs and benefits of the forest management. This takes place in forest catchments.

According to Blomley and Ramadhani (2007), about 1.61 million hectares of forest are under joint forest management arrangement while as 2.06 million hectares are under community based forest management arrangement, see Table 1.

According to Schreckenberg *et al*. (2007), one of the PFM objectives and motivation is to improve livelihoods, although Lokina *et al*. (2008), points out that there is presently lack of an appropriate analytical framework for addressing and measuring the impact of PFM on both forest base and rural livelihoods. Schreckenberg *et al*. (2007) pointed out that PFM can contribute to improving livelihoods by considering various types of capital assets:

- PFM can impact people financial wellbeing by income generation which may include subsistence activities such as fuel wood, commercial activities involving beekeeping and a number of non-forestry income generating activities under PFM in the area.

- By considering natural assets, provision of more sustainable flow of benefits such as fuel wood, timber, water or ecotourism and researcher can be realized through increased biodiversity.

- Improvement of infrastructure at both household and community level include; building individual houses and community projects such as schools, hospitals and village offices can be realized during PFM implementation. This helps to improve physical assets in the community.

- Human capital can also be improved through trainings under PFM activities for example skills on alternative non forest income generating activities to reduce forest dependency and the income raised from PFM may also be used by households to invest in education and health in the communities.

- The process of being involved in PFM often has a positive impact on the capacity of individuals or communities to observe their rights and engage with other development actors to improve their livelihoods, thus improving social and political capital of the community.

However, while it can generally be said that PFM brings about livelihood improvement to the local community basing on above capital assets. The notion of access is important when accessing forest management in relation to rural livelihoods and poverty. Ability of a person to gain access to the resource include mechanisms, structures and processes including, social identity, social relation, coercion, material and physical circumstances(Ribot and Peluso, 2003). These factors have profound impacts on rural peoples' livelihoods for example; decentralized management through CBFM might improve bargaining power of resource user groups such as charcoal markers, beekeepers but entry costs associated with license system may exclude the poorest from producing.

2.4 Forest Related Environmental Income and Poverty

According to Velded *et al.* (2004), environmental income is a value added or captured through consumption or sale of natural capital from the point where natural capital is extracted. An assessment of actual levels of poverty must capture important sources of the poor environmental income such as, wild food, fuel wood, fodder, timber, thatching materials and wild medicine. For instance, fodder contributes domestic livestock production which in turn influences milk and meat output. This is particularly important

during dry season when availability of grasses is markedly reduced. In these periods, livestock grazing is sometimes done inside the forest when resources within public grazing lands are depleted (Mapolu, 2002).

Forest related income forms an important part of the rural income in many regions, interventions that include privatization of communal land, protection of forest for conservation purposes may deny access to a considerable economic importance (Cavendish, 2000). Alternatively, over use and degradation will hurt the poor more than any other groups (Campbell and Luckert, 2002). At the same time strict rules that aimed at conserving forests might have negative impact to the poor (Angelsen and Wunder, 2003).

Under CBFM, restrictions that are associated with forest conservation are not much felt by the community as most of them are set, agreeable and reflect upon the basic livelihood needs of the community surrounding the forest. More importantly, the role that legitimate forest users play in CBFM contributes to a sustainable use of the resource (Abdallah, 2006). It is therefore expected that CBFM management arrangement focuses on environmental income that addresses people's livelihood needs while meeting sustainable forest management goals. LAMP (1995), identified fodder and water sources as important environmental incomes that were considered most during CBFM implementation in Kiteto and Babati districts. These were important for livelihood improvement and poverty reduction to pastoral communities in these districts.

2.5 Community and Environmental Services

Community based forest management can bring a success to rural poor livelihood if it works to ensure that the whole community livelihood is made better off and no section of the community is affected (World Bank, 2001). CBFM projects are able to earn extra

income from external sources of the local area in terms of payment for environmental services. Conserved forests are important sources for water and climatic amelioration to other areas outside the local area; this can assist improving livelihoods at community level. Local community involvement in protecting the forest means losing other economic benefits that could have been gained by forest clearance. Thus earning from environmental services, as biodiversity, water and carbon sequestration may cover the lose felt by the community (Schreckeberg *at el.*, 2007). Kigula (2007) further argues that healthy forests can protect the quantity and quality of water supplies, and maintain or enhance agricultural production by restoring soil fertility in agro forestry systems. The direct use of environmental services is related to poverty avoidance/ mitigation.

2.6 Alternative Livelihood and Reduction to Forest Dependency

Shylajan and Mythili (2003) found that income from non forestry activities can significantly reduce forest dependence. A study done by Kijazi (2007), on the impact of JFM on forest resource base and livelihoods in communities surrounding Amani Nature Reserve in Muheza District, found that, a number of non- forestry income generating project was initiated in line with the project including; fish farming, butterfly farming, growing spices and tree nursery preparation. Significant incomes were realized from these projects. Kigula (2007) found that boundary clearing, tree planting and tour guide services were alternative employment opportunities resulting from PFM in the East Usambara Mountain Forests. He also noted that fruit selling, beekeeping, fish farming and horticulture were other activities resulting from PFM in Usambara forests. More still need to be done on creating non forestry income sources in order to cover the foregone livelihood means as a result of CBFM and JFM interventions.

2.7 Costs and Benefits Involved in Community Based Forest Management

There is evidence that CBFM can create incentives that foster good ecosystem management and contribute to conservation goals as well as economic development. Experiences in Africa, India and Nepal demonstrate that community forest management can result in healthier forestry and improved tree cover (World Bank, 2001). In Tanzania, a notable example is HASHI Program where traditional enclosures registered about 350 000 ha land. Economic benefits distributed to villagers in the form of fodder, fuel wood, medicinal plants and water availability made HASHI program a popular success. Major costs of many community schemes include short term loss of the use of a resource to allow it to recover or to keep its use within sustainable levels (Shyamsunder *et al.*, 2004).

2.8 Household Internal Factors and Forest Dependency

The household diversifies assets into particular set of activities which defines its livelihood portfolio. According to Ellis (2000) land, labour and capital are internal household factors that influence collection of forest resources. Less priority is given to environmental resources for households with a higher incomes, as mostly can access more profitable livelihood activities. In many cases environmental income is considered as the last resort due to lower return to labour and more laborious (Angelsen and Wunder, 2003). Expected relationship between key household factors and willingness and ability of the household to engage in forest income generation can be regulated by the existing rules and regulations in CBFM (Ribot and Peluso, 2003).

2.8.1 Education level and forest income

Education is an important component for development. Education of household head plays a significant role in improving the livelihood of the household in accessing different sources of production. In general, education is expected to open up a diverse portfolio of

employment opportunities. People with better education have more access to a wider range of income opportunities and hence lower forest incomes (Fisher, 2004; Buyinza, 2008). Mbwambo (2000) argues that, education has direct influence on people's participation in natural resources management and promotes sustainable utilization of natural resources. Like wise people with better education are likely to be in a much better position of engaging in projects that come up with CBFM and thus being in a better position of increasing alternative means of income generating activities.

2.8.2 Age of household head and livelihoods

Age and experience of an individual may play an important role in indigenous knowledge and practices in use of forest environmental resources (Paulo, 2007). Households with large household size are capable of being involved in productive activities to improve their livelihoods, as they would be able to get more resources from the forest than older households (Buyinza, 2008). Collection of forest environmental resources by a young household head can be a wealth accumulation strategy. Where as older households may have less time and needed physical strength to gather resources from the forest. On the other hand some young people may consider forest products as old fashioned. They may also lack the necessary skills and experience as compared to old people, though they can easily adopt new ideas of forest management that come in the community such as PFM concepts (Ribot and Peluso, 2003).

2.8.3 Sex of household head

Men and women have different roles in the use of forest environmental resources. It is assumed that products which contribute through direct consumption are under the control of women while men collect products that generate income. Following this female headed households often have less access to labour and lower forest incomes (Vedeld *et al.*, 2007).

Many female headed households are divorced, widowed and some their husbands work far, the adult force is usually small for such households. A report by FAO (1991), from Rufiji district indicates that women were more involved in low income generating activities such as mat and basket weaving, and where both men and women were involved, men had a tendency to produce for market and women for consumption, thus earning low income. However, existence of resource user groups in CBFM can have an impact on roles of gender in the use of forest environmental resources.

2.8.4 Household size

According to Gunatilake (1998), families with more labour tend to extract more forest environmental resources. In addition, families with more labour can mobilize part of it to forest product collection and the rest to farm and other income generating activities. Large households may gather forest resources in the sense that, either they have more labour to allocate to this or they could be forced by larger dependence and consumer load (Paulo, 2007). Existing management arrangement in CBFM may regulate the extent to which large families may extract more environmental incomes due to restrictions.

2.8.5 Amount of land owned

A household with less land is likely to engage more in collection of forest resources, since agricultural income is low and options to supplement with off-farm income are less. Where as those that own more land, derive most of the household income from agricultural related income and hence less dependence on forest environmental income (Buyinza, 1998). While farm expansion may be restricted house holds may enjoy the existing income generating activities which are often introduced with CBFM project.

2.8.6 Amount of cattle owned

Livestock generate higher incomes and more stable livelihood to the household. However, there is increasingly dependence for fodder; increased dependency for fodder from the forest is an abstruse phenomenon and more challenging. Since better off households may likewise depend highly on fodder as a forest environmental income. In community based forest where fodder is freely allowed in specific period of the year households owning cattle becomes stable and more assured of their livelihoods (Paulo, 2007).

2.9 Household External Factors and Forest Dependency

Household external factors are those that are beyond direct household control and they may also influence choice of livelihood activities. They may include; land, labour, capital availability, market and production condition, legal access and control, rights of access on environmental resources or socio cultural arrangements. For instance, in Maasai tribe, women are the ones involved in house construction. Other factors include political and administrative framework, ecological condition and demographic conditions, pressures for in–out migration (Vedeld *et al.*, 2007). The operationalization of these factors need one to consider, how to distinguish them between community forest reserved area, or any natural resource management project and general local conditions. This involves making a distinction between before and after establishment of a CBFM or a natural resources management project in which the two scenarios have different rules.

2.10 Measures of Income Inequality

Income inequality refers to disparities in distribution of economic assets and income among individuals, groups within the society or even across nations (Vedeld *et al.*, 2007). Techniques used to measure income inequality of income within an economy are generally categorize as absolute or relative. Absolute measures includes poverty line and poverty

index while relative measures includes, Lorenz curve, Gini coefficient, Gini index, relative poverty line and relative income criteria. Relative income measures are more applicable when comparing the income of one individual (group) with another. The Gini coefficient has been more applicable in the field of resource economics when comparing inequalities with and without forest environmental resources. (Vedeld *et al.*, 2004; Peter, 2006). Kamanga *et al.* (2008) used the Gini coefficient to compare income inequalities between villages with access and without access to the forest resources in Chiradzulu district in Malawi. The Gini coefficient can equally be used to compare inequalities of village communities with access to the same community forest such as in CBFM mainly to reveal other income sources which might make the differences between villages on the same community forest like in Suledo villages.

CHAPTER THREE

3.0 MATERIAL AND METHODS

3.1 Description of the Study Area

3.1.1 Location and size

This study was carried out in Kiteto district in the wards of Sunya, Lengatei and Dongo from which the acronym SULEDO came. The area covers approximately 268 000 ha out of which 167 416 ha is a Village Land Forest Reserve (VLFR) shared by nine villages namely: Sunya, Asamatwa, Olgira, Lengatei, Lesoit, Olkitikiti, Engong'ongale (Mturu) and Laiseri (Fig. 2, Fig. 3) and Appendix 5. Kiteto District lies between Latitude 4° to $6^{\circ}6'$ South of the Equator and between Longitude 36 $^{\circ}15'$ E to 39 $^{\circ}$ E. It boarders with six districts namely, Simanjiro in the North; Handeni in the East; Mpwapwa, Kilosa and Dodoma Rural in the South, and Kondoa District in the West (Fig. 2). The district has an approximate area of 17 000 km^2 (PADEP, 1998).

Low profile conflicts between residential population, small scale farmers and sedentary pastoralists in Kiteto district led to positive response of the people when the government looked into different ways of managing the forest areas together with the local government through CBFM. It is from these reasons that SULEDO was selected as a case study to explore how forest incomes featured in different resource user groups in CBFM.
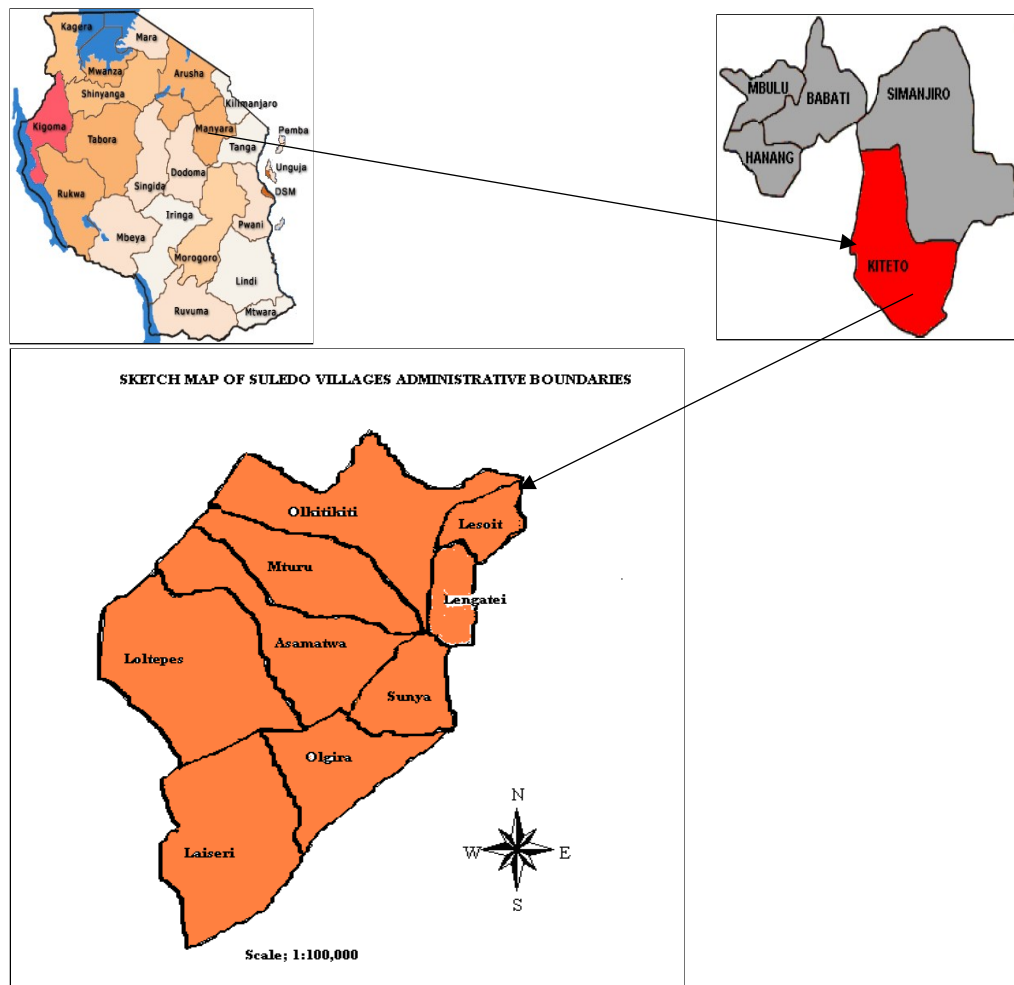
Source: Adopted with modification (LAMP, 2005)

Figure 2: Map of Suledo villages with respect to Kiteto district and Tanzania

3.1.2 Climate, topography and soils condition

The district annual rain fall ranges between 450 mm and 650 mm per year (URT, 2001) and occurs within the months of (November/December- April/May). The average annual rainfall is 550 mm across the area, particularly on the South eastern part of the district where Suledo Community Based Forest Reserve exists. The mean annual range of temperature is between $15^0\,$C to $22^0\,$C. The community forest is situated at the high altitude of Manyara region; it lies at an altitude between 1 000 and 1 500 metres above sea level.

The soils in the area are generally volcanic in origin and range from moderate to fertile soils. They are generally deficient in Nitrogen and Phosphorus.

3.1.3 Population and ethnicity

According to 2002 National Census, the overall district population was 155 727. The District ethnic composition is Maasai 32%; Gogo 27%, Rangi 18% and the remaining 23% is a mixture of smaller groups including the Kamba, Nguu, Bena, Kaguru, Hehe, Sandawi, Burunge, and Wa-Arusha (PADEP, 1998). Likewise, people of different ethnic groups inhibit the study area, the villages are composed of different ethnic groups, but each group tends to live in its own, ethnic uniform sub-villages. Nguu farmers moved into the area from the eastern neighboring district during colonial times; Kaguru farmers came later from the South, and Kamba people from Kenya hunted elephants in the area before the turn of the century and became resident in the area (Lissu and Mitzlaff, 2007).

3.1.4 Vegetation and Land use

The study area has a vast rich miombo forest dominated by species such as Mpingo (*Dalbergia Melaloxylon*), Mninga (*Pterocarpus angolensis*) and Mkalakala (*Brachystegia spp*) (Blomley and Ramadhani, 2007). Table 2.
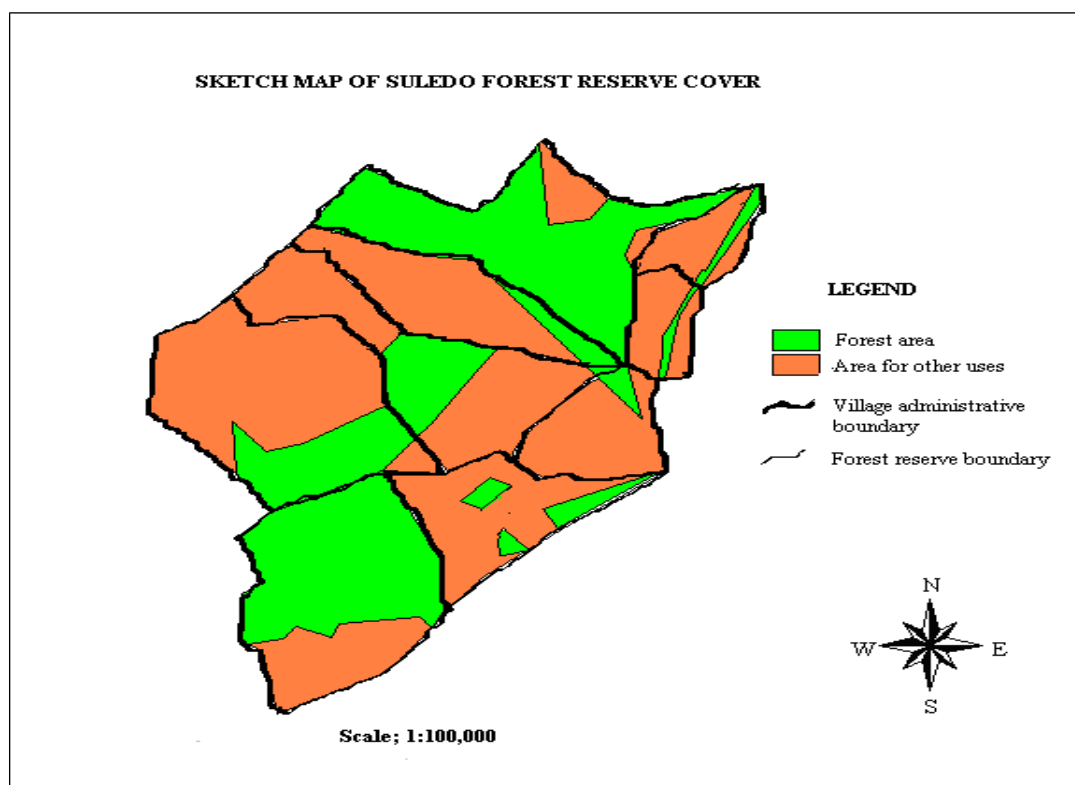
Source: (LAMP, 2005)

Figure 3: Map of Suledo community forest reserve

Table 2: Description of Suledo forest types

Site	Area in hectares			
	Miombo Woodlands	*Combretum/Acacia*	**Thickets**	**Total**
Olkitikiti	5 700	2 700	19 437.5	30 812
Loltopes	1 840	6 644	16 528.5	26 741
Sunya	9 000	-	-	10 000
Asamatwa	2 000	-	16 000	19 375
Lengatei	4 000	-	-	4 408
Olgira	-	-	-	18 020
Laiseri	-	-	-	32 699
Engong'ongale	-	-	-	19 952
Total	**22 940**	**9 344**	**51 966**	**167 416**

Source: Malimbwi (2000)

The most dominant species by number of stems are *Combretum Molle, Delbergia melanoxylon, Julbernadia globiflora and Brachystegia microphylla.* The disturbances in these forests for the past ten years involved cutting poles and trees of diameter classes 5 to

10 cm, 10 to 15 cm and 20 to 25 cm accounting for 0.6% reduction per year. The cause for harvesting is for house construction, firewood and for making kraals for the case of Maasai. According to Malimbwi (2000), critically low state of regeneration of seedlings in Suledo forest was reported as a result of browsing, fraying and grazing. Isango (2007) found that, the forest has mortality per year (1.5%) as slightly higher than recruitment per year (1.3%). When cutting (0.6%) is added to mortality, the recruitment is offset by removals thus indicating that there is considerable degradation of the forest.

Land use in the area include; grazing, agriculture, settlements and forest conservation. Beekeeping, timber harvesting, firewood and honey gathering are carried in the forests. The total district land area covers about 16 645 km^2. The arable land is about 380 000 ha where a total of 75 080 ha is under cultivation which is about 19.8% of the total arable land. The dominant land use is grazing; other land uses such as agriculture have recently been introduced following in-migration of people from neighboring districts (LAMP, 2005).

3.1.5 Accessibility

The study area is accessed by road and is about 126 km South East of Kibaya town, the headquarters of Kiteto District. Kijungu village located 80 km East on the Kibaya- Handeni highway is an important stop over station before going to the South about 46 km where Suledo forest is located. Another route to Suledo is South West via Chakwale settlement on the Morogoro- Dodoma highway in Kilosa district located about 60 km from Sunya ward headquarters in the study area. However, this route is only accessible in dry seasons.

3.2 Data Collection

3.2.1 Research design and sampling procedures

A purposeful sampling procedure was used to select villages for household interview. In this case, the sampling frames for this study were the village registers. According to

Kothari (2008), purposeful or deliberate sampling is used when population elements are selected for inclusion in the sample on ease access. Four villages were purposely selected from the two wards of Sunya and Lengatei; two selected villages were pastoralist dominated villages while the other two were mixed (pastoralists and crop cultivators). Lesoit and Olkitikiti villages were pastoralist dominated while Asamatwa and Sunya were mixed villages (pastoralists and crop cultivators). Dongo ward was not considered during village selection because it has one village in CBFM (Laiseri village) and was geographically inaccessible, i.e. far located, about 40 km away from the other two wards.

The sampling unit for this study was a household. URT (1993) defined a household as a single person or group of people who live and eat together and share a common living arrangement. Kaewsonthi *et al.* (1992) recommended a sample size ranging from 5% to 12%. In this study, 6% sample size was used. Using village registers as sampling frames, in each of the four villages a 6% sample size was computed to get the number of households to be interviewed see Table 3. Selection of households for interview was through a random sampling, where households were randomly selected from each of the respective village registers.

Table 3: Household sampling

Village	Total number of households	No of sampled households
Asamatwa	373	22
Lesoit	278	15
Olkitikiti	230	13
Sunya	1 041	62

Total	1 922	114

3.2.2 Methods used for data collection

3.2.2.1   Reconnaissance and focused group discussion

The purpose of reconnaissance survey was to familiarize the researcher with the study area and to enable the selection of villages for study. According to Mettrick (1993), questionnaire pre-testing is an essential step before beginning any survey. Questionnaire pre testing was done during this phase; this was an important step in order to check and identify weaknesses and ambiguities before embarking on a detailed interview.

Focused group discussions were also held with selected key resource user groups. A checklist (Appendix 2) of open ended questions was used to guide the discussion. Discussions were made with resource user groups in the four villages under study, Asamatwa, Sunya, Lesoit and Olkitikiti. The groups include herbalists (n=4), charcoal makers (n=5), beekeepers (n=6), pastoralists (n=8) and people involved in building houses (n=6) and crop cultivators (6). Qualitative information on how resource user groups were organized in terms of; type, extent, and time of harvesting environmental resources were obtained.

Focus group discussion were also held with key informants, refer Appendix 1, they included, village natural resources committee members, district forest officer, zonal environmental committee members and the post–LAMP project officers. Information obtained through focused group discussions with key informants included; establishment of CBFM process, existing CBFM organization arrangement, and existing rules and regulations over resource use in the area.

3.2.2.2   Participant observation, Questionnaire Survey and Secondary data

According to (Kimberlay, 2002), observation and interaction within the society enables a researcher to discover discrepancies between what participants say and often believe should happen (the formal system) and what actually does happen, or between different aspects of the formal system. This method enabled the researcher to gain more understanding on the existing livelihoods and how CBFM is perceived towards enhancing livelihoods of different resource use groups in the area of study. Table 3 shows sampled households in study villages. Both structured and semi structured questionnaires were used for household interviews, refer Appendix 3. About 114 households were interviewed. Information on socio-economic characteristic of the household were obtained through household interviews such as; resource ownership, age, education levels and household income levels.

Secondary data were collected by reviewing both published and unpublished reports about the study area. The reports reviewed include, Monitoring sample plots established in Suledo miombo forests in Kiteto district (Isango, 2007), Timber utilization in Suledo village land forest reserve (Mellenthien, 2005) and Moving towards sustainable harvesting of village forests (Lissu and Mitzlaff, 2007). These documents were useful in providing relevant information about the study area.

3.3 Data Analysis

3.3.1 Qualitative data analysis

Qualitative information was analysed using content analysis. Using this method information collected through verbal discussions with key informants and focused group discussions was analyzed. According to Kimberley (2002), this method enables the researcher to include large amount of textual information and systematically identify its properties, for instance frequencies of most used words "key words in context". Textual information was categorized to provide meaningful reading of content under scrutiny. The

basic idea was to reduce the total content of communication to a set of categories that represent some characteristics of research interest (Singleton *et al*., 1993).

3.3.2 Analysis of Quantitative data

Both descriptive and inferential statistics were used during data analysis. Questionnaires were, coded, cleaned and data from open ended questionnaire were categorized for further analysis. Descriptive analysis led to obtaining central tendency, dispersion and frequencies. Tables and pie charts were used to summarize the outputs. This was carried for the purpose of understanding the distribution of response, especially on the perception of respondents on CBFM towards livelihoods in the study area and on responses of forest based livelihoods.

3.3.2.1 Wealth group ranking

All reported incomes were sums of annual cash and subsistence activities, income from forest is the value of forest products. The study population was grouped into three wealth group categories as follows; poor, medium and less poor, using net income per capital per day of less than 2025/=, between 2025- 4050/= and above 4050/= respectively. A t- test was used to compare whether there was significant differences with respect to various parameters between wealth groups in the study area. The comparisons were made on various household socio-economic characteristics, annual income sources, environmental income sources and between study villages.

3.3.2.2 Gini coefficient

A Gini coefficient as measure of inequality of income distribution was used to examine forest income and income inequalities across households in the study villages. The Gini coefficient was calculated from household income with and without forest income, in order

to examine to what extent forest income reduced or increased income inequalities between households in study villages.

3.3.2.3 Relative forest income

In order to determine the household forest income dependence, the relative forest income was used to measure the degree of household dependence on forest income; the test was made whether there were differences in relative forest income and total household income.

3.3.2.4 Multiple regression analysis

Multiple regression analysis (Ordinary Least Square Analysis) was carried out in which, sex of household head, education level of household head, household size, amount of land owned by the household in hectares, amount of cattle owned by the household were among social economic variables. These were considered to influence the total, forest and relative forest income of the household. For more analysis forest environmental income were ran against other sources of income.

The following regression model as suggested by (Kothari, 2004) was used:

$$Y_i = \beta_O + \beta_1 X_{1i} + \beta_2 X_{2i} + + \beta_K X_{Ki} + \varepsilon i$$

Where: $Y_i =$ i^{th} observation value (score) of the linear combination of independent variables influencing household income in the study area.

X_1 to $X_{k=}$ are the independent variables or explanatory variables (sex of household head, education level, household size, amount of land owned in acres, amount of cattle owned).

$\beta_O =$ Constant term of the model without the independent variables.

$\beta_1 - \beta_k =$ are independent variable coefficients (β)   showing the marginal effects(negative or positive) of the unit change in the independent variables on the dependent variable.

$\epsilon i =$ Random error term

$I =$ 1, 2, 3…N (Total number of respondents) = Sample size.

$k =$ Total number of independent variables.

Independent variables included in the model were:

$X_1 =$ Sex of household head, female headed households has often less access to labour and lower forest income, many female headed households are divorced, widowed or their husband work far the adult labour force is expected lower for such households. Male headed households may be expected to be likely to earn more forest income. The expected sign is negative for women.

$X_2 =$ Education level of household head. Better educated households have more access to a wider range of income opportunities; lower forest income. The expected sign is negative

$X_3 =$ Household size. Household size in the study area ranged from 2- 16 people and the average size was 5.9. Families with more labour tend to extract more forest resources; in addition families with more labour can mobilize part of it to forest product collection and the rest to farming and other income generating activities. The expected sign is positive.

$X_4 =$ Amount of land owned in hectres. Amount of land owned in the study area ranged from 0- 16 hectares and the average land owned in acres was 3.5 hectares. Households with less land use forest more, while as families who own more land are likely to earn more income and therefore depend less on forest resources. Thus land is expected to have a negative contribution.

X$_5$ =   Amount of cattle owned. The amount of cattle owned in the study   area ranged from

0-39 heads of cattle and the average heads of cattle per household were 6.7.

Household with more number of cattle are expected to earn more forest resources

in terms of fodder. On the other hand households with accumulated number

of livestock generate higher incomes and more stable livelihoods from cattle

products. The expected sign is positive.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter presents the research findings and implications. It is divided into three sections: Section 4.1 presents forest based livelihood options before and after the inception of community based forest management in Suledo. Section 4.2 discusses contribution of forest based livelihood options to household income. Section 4.3 discusses perceptions, attitudes and awareness of the community towards livelihoods.

4.1 Forest Based Livelihood Options

4.1.1 Access to assets

The sampled households were engaged in a wide range of livelihood options for survival. Table 4 indicates that agriculture (crop cultivation and pastoralism) was a dominant livelihood means, about 68% of the households interviewed were involved solely in crop cultivation. About 7% of the households engaged in off farm activities. The off-farm activities include; casual labour in farms and grazing cattle. Four percent engaged in collecting firewood, medicinal products, selling snacks, hand craft activities and carpentry works as their regular household activities.

Table 4: Main and supplementary activities in the study area

	Frequency	%
Crop cultivation	74	68
Pastoralism	15	14
Pastoralism and crop cultivation	8	7
Off farm activities(Hired labour)	8	7
Others(involving in EI, Non-farm activities)	4	4
Total	**109**	**100**

The main means of land acquisition noted include; village government allocation (39%), buying (1.8%), allocation from parents (17%), hiring (2.4%), clearing forests (38%), and inheritance (1.8%), (Fig. 4). On average, majority of households owned about 3.5 ha.
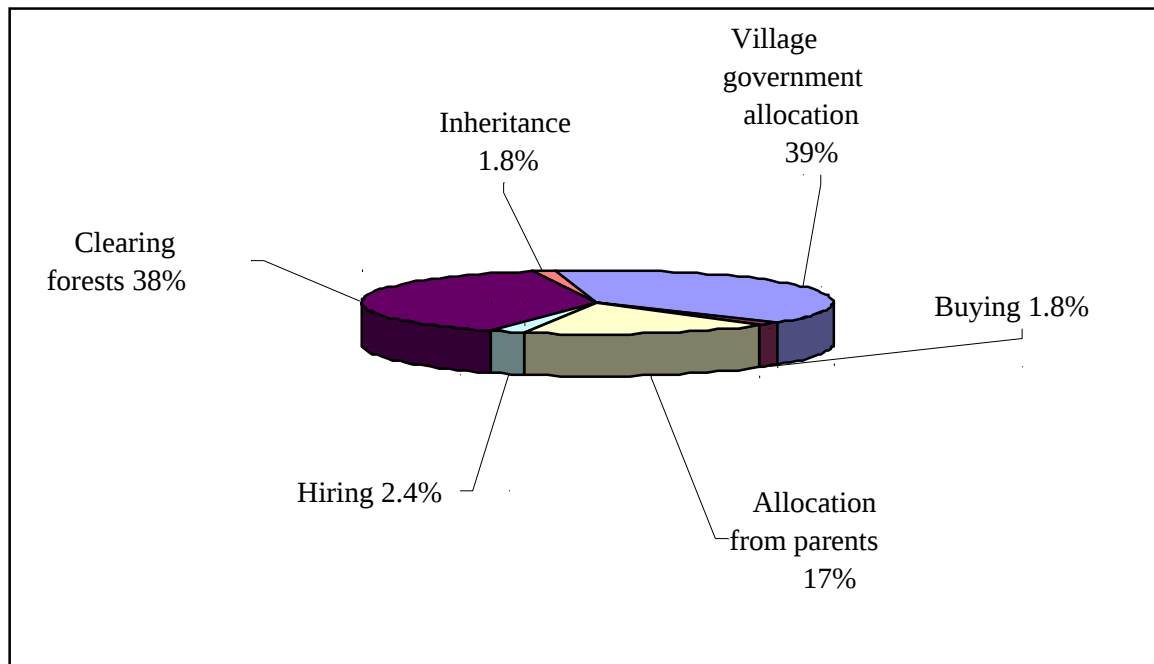
Figure 4: Means of land acquisition

Results show that 59.3% of the respondents owned land for over 10 years, the rest owned less than 10 years. About 30.7% of the respondents who owned land were in-migrants from, Kilosa, Kilindi and other distant areas such as Iringa, Kongwa and Kondoa. Searching areas for pasture (18%), fertile land (53.9%), marriage (7.6%) and to follow relatives (20.5%) were the main reasons for in-migration.

The dominant crops grown in the area include maize *(Zea mays)* and beans, for both food and cash crops. Maize is the main crop cultivated. On average a household cultivates about 3.5 ha/year to earn about 19.7 bags of 100 kgs. Animals reared in the area include cattle, goat and sheep. The average animal head owned per household is 6.7 ± 10.127(SE) for cattle and 0.50 ± 1.058(SE) for goat. During focused group discussions in pastoral

villages, it was revealed that, animals are allowed to graze in the forest during dry seasons when fodder is scarce in designated grazing land.

The practical implications of these results are; a notable percentage of access to land is out of village government allocation, this is a challenge to implementation of land use plan if it continues. Fertile is the main reason for access to land and there is a notable percentage of in-migrants from neighbouring districts all these have some repercussions on forest management if left unchecked.

4.1.2 Access to forest environmental resources

The main sources of forest resources were forest under community based forest management and general land forests. Forest environmental resources were available and mostly used in the area include; firewood, poles, medicinal products, charcoal, beekeeping, fodder and thatching materials. Fig. 5 shows the use of forest environmental resources in the area. According to the forest management plan, timber, charcoal making and water sources access are protected and not allowed in Suledo community forest. However, timber harvesting from Suledo forest is allowed in special occasions when needed for construction of public facilities such as schools and dispensaries. Fodder, firewood (collected as dead wood), thatching materials, beekeeping, medicinal products and poles are freely accessed from Suledo community forest. The control mechanisms include for resource utilization include; registering of resource user groups for beekeeping, harvesting of poles and thatching material is allowed when an individual is in a process of constructing his/her own house and time of the year to graze in the forest is decided at village level and communicated to all. Charcoal is only allowed in the general land forest after payment of a fee. Registering resource user groups is strength for controlling forest resource utilization.
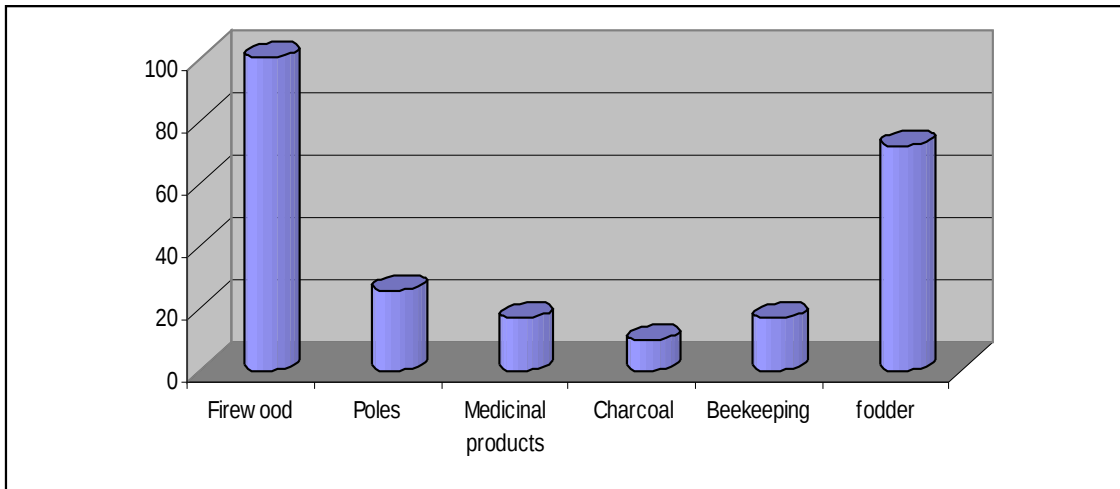
Figure 5: Use of forest environmental resources

4.1.2.1 Firewood

All respondents (100%) interviewed, reported to use firewood for either subsistence or commercial means. The main use of, firewood is for cooking, brick making local brew making and heating. The firewood is collected mainly as dead wood from the community forest, (Plate 1). On average, head load was reported to be 1.28 per week per household, mostly used for domestic consumption. Very few (3.5%) households collected firewood for commercial purposes. The market for firewood is based in Sunya and Lengatei ward centres. Patrol men and VNRC members ensure that only dead wood are used and not cutting a standing tree, however this control mechanism is threatened by lack of manpower and equipments. Presently few collections through fines are not enough for allowances for patrolmen, equipment purchase and other costs involved in managing the forest. This will probably be taken care when pilot harvesting is due.

Plate 1: Thatching material and firewood collected at one of household's compound at Asamatwa village

Firewood collection before CBFM involved cutting of standing trees and regardless of species. People from neighboring villages, outside Suledo were also involved.

4.1.2.2 Building Poles

Building poles harvest was mainly for subsistence. About 25.6% of the respondents interviewed use poles for different household activities including house construction and fencing against livestock. A focused group discussion with women engaged in building traditional houses revealed that about 11 wood species are commonly used for house construction in the area. One has to apply for a permit to harvest the material for house construction from the village natural resources committee (VNRC) of the respective village. Building materials were also collected from other land uses such as, grazing and crop farms. Material requirements for one traditional house unit was known to be, Two beam poles, 40 withies, 27 wall erecting poles and 16 inner wall erecting poles were regarded as enough to construct a house of 2.5 metres by 5 metres. These results do not differ much from Luoga (2000), who found that the material requirements for typical

house in Kitulanghalo area in Morogoro rural were 1 beam poles, 17 inner erecting poles, 25 wall erecting poles and 34 withies. The longevity of houses ranged from 6 -11 years depending on the durability of the poles and resistance to termites. The longevity of houses in other areas in Tanzania is between 3- 15 years (Luoga, 2000).

Plate 2: Livestock grazing in Olkitikiti village

4.1.2.3 Medicinal Products

About 16.6% of the respondents used medicinal product from the forest as their priority. A focused group discussion with herbalists identified 12 tree species with medicinal values. The most common medical species include, *Ximea Caffra, Dombeya.Rotundifolia, Boscia Salicifolia, Grewia boicolor Jussa, Rothmania fischeria and Acacia Nillotica.* Medicinal tree species are more known by knowledgeable individuals, middle aged to elders who seem to have acquired knowledge from their fore fathers. Medicinal products in the sampled villages were mainly used for subsistence means. Commercial actors of medicinal products in the study area, were divided into two levels; those who offer services to their fellow villagers mainly subsistence in nature with a small fee as token for the service. The fee ranged from 2 000/= to 5 000/= per visitor. The second level involves those who are

registered to the authority and operate as traditional herbalist; these had more knowledge on medicinal products than the first group.

Availability of medical tree species in the study area has been more improved because of reserving Suledo community forest, as quoted by one herbalist.

"Medicinal tree species are more available after reserving Suledo forest, in the past fire used to destroy most of the species, we went for 5 hours only to find 1 or 2 species, but now things are better, you just walk a shorter distance and get more than 5 different species in a day".[1]

No limits are set to access medicinal products except that it does not involve cutting standing trees. This is a limitation to those who want medicines in large quantities as they can not get much from dead woods, although much is also found in other land uses.

The use of medicinal tree species for physical and psychological ailments and spiritual rituals and observances is common, through self collection and use as well as via healers. See for example (Brigham, 1994; Cunningham, 1996; Luoga *et al.*, 2002).

4.1.2.4 Beekeeping

About 16.6% of the respondents interviewed engage in beekeeping as supplementary livelihood activities. Most of beekeeping activities were carried out in groups. Before CBFM a beehive could be harvested twice per year yielding 10 to 15 litres of honey. At present the harvests are at 20 to 25 litres per beehive and the harvests can be done thrice per year.

---

[1] Kaleya P. Personal communication, October 2008

One beekeeper at Lesoit village had this comment:

"Now there is a lot of honey, one can set in the forest five beehives and all become full of bees and yields honey three times per year. In the past it was not easy, with two beehives one could get just one tin (about 18 litres) harvesting just once or luckily twice per year."[2]

Setting beehives in Suledo community forest requires beekeepers to work in groups and be registered to the village authority, specific areas within the forest are set to respective groups. Both traditional and modern beehives are used; For example one group identified as Kinyemi with 30 members at Sunya village had four modern beehives and 12 local ones.

This improved yield is attributed to improved skills through training provided and the forest reserve vegetation restoration which favors honey production.

4.1.2.5 Charcoal Making

Household questionnaire interviews revealed that about 9.6 % of the respondents engaged in charcoal making. Potential species for charcoal making identified in the area were; *Brachystegia micropylla, Brachystegia speciformis, Accacia tortilis and Accacia combretum.*

Charcoal production is mainly carried in area designated for crop cultivation after payment to the village government a two weeks license fee amounting to 5000/=. TATEDO an NGO involved in energy and environmental issues conducted a training program on sustainable charcoal production. The training involved 20 village members from each of the nine village of Suledo community forest. It was a training of trainers programme on

---

[2] Mapukoli. M. Personal communication October 2008

sustainable charcoal production. Twenty trained village members from each village were expected to train others in their respective villages. It was part of the preparation for pilot timber harvesting in Sunya and Olgira villages. It was known that timber remains will be used to for charcoal production when pilot harvesting starts. The market price for one bag of charcoal was known to be 5 000/=.

4.2 Contribution of Forest Based Livelihood Options to Household Income

4.2.1 Household income sources and characteristics

Household socio-economic characteristics determine the way households can strive to improve their household income levels (Kamanga *et al.*, 2008). Table 4 shows the socio-economic asset/ characteristics of households in Suledo. Results revealed that married households owning cattle were statistically significant across the three wealth groups. This implies that married households were more likely to utilize the available income sources to improve their asset base than unmarried ones. Households having a bigger number of cattle/ livestock were likely to earn higher income than households with no or fewer number of cattle. In other words, cattle owning is a potential variable with respect to household assets.

Livestock income forms an integral part of agriculture income. Table 5, indicates that the sample mean for cattle ownership in the study area was 6.7 heads of cattle per household. The less poor group had a higher number of cattle ownership with 12.8 heads of cattle per household, unlike the medium wealth group which had 1.2 heads of cattle. No household was reported to own cattle in the poor wealth group. It was observed that a wide range of livestock products, including, hides, milk, cheese and selling of livestock receive good market demand.

Table 5: Socio-economic assets/ characteristics of households in Suledo community

Household socio-economic factors	Poor (N= 28)	Medium (N=29)	Less poor (N=57)	Sample mean
Married (%)*	20.2	19.3	44.7	84.2
Female h-hold (%)	4.3	6.1	5.2	15.8
Education(yr)	3.5	4.3	2.9	3.4
Age of h-head (yr)	42.5	41.2	41.2	41.5
Household size	6.4	6.0	5.7	5.9
Amount of land owned (ha)	3.5	8.8	9.1	8.9
Cattle ownership*	0	1.2	12.8	6.7
Amount of land hired (ha)	2.8	3	3.8	4
Total h-hold income (Tshs)	**170 200**	**636 151.7**	**2 718 640.8**	**1 562 952**

N=114, *P< 0.05, (*) indicates means are significantly different across the wealth group

Results in Table 6 shows that cattle ownership contributes significantly to the total household.

Table 6: OLS regression of total household income against socio-economic characteristics

Variable	Coefficient estimate	Std Error	T- ratio	Prob>│t│
Intercept	1 262 903.8	661 364.5	1.910	0.059
Sex of respondent	-333 063.8	310 949.0	-1.071	0.287
Age of respondent	-10 503.8	10 741.9	-0.978	0.330
Education of respondent	-42 479.4	31 325.4	-1.356	0.178
Family size of respondent	42 386.8	38 757.6	1.094	0.277
Amount of land owned	18 108.7	15 202.3	1.191	0.236
Number of cattle owned*	127 572.9	10 685.1	11.939	0.000

N= 114, R square = 0.598, R square adjust = 0.576, Df= 113, F = 26.555, P< 0.001

From the above it implies that households with bigger number of livestock were likely to have higher total household income.

An OLS between total environmental income and socio- economic characteristics of the households in Table 7 revealed that female headed households and those owning less number of livestock had significant (p< 0.001) relationship with environmental incomes. The probable reason could be, women were more engaged in collection of environmental income such as firewood and households with less number of livestock might engage more in collection of environmental income to supplement earnings.

Table 7: OLS regression of total environmental income and socio-economic characteristics in Suledo community

Variable	Coefficient	SE	t- ratio	Prob>| t|
Intercept	0.939	0.141	6.635	0
Sex of household head*	-0.133	0.067	-2.007	0.047
-0.0020.007-				
0.3540.724Age(yr)	-0.002	0.002	-0.954	0.342
Family sizeEducation(yr)	-0.003	0.008	-0.325	0.746
Amount of land				
owned(acres)	0.004	0.003	1.174	0.243
Number of cattle owned*	-0.004	0.002	-1.745	0.084

N= 114, R square= 0.075, R adjust= 0.024, Df = 113, F= 1.454, P<0.201

4.2.2 Household income, variation and diversification by source and wealth groups

Results in Table 9 revealed a diverse source of income. In general agriculture was the main source of income contributing to about 96.3% of the total household incomes. About 59.8% of the household income accrued from livestock and livestock products such as hides, cheese and milk. Forest environmental income contributed 2.8%, remittances, off-farm and non-farm income earned about 0.9% of the total household income.

An OLS was used to analyse the relationship between total forest environmental income and other sources of income, Table 8. Results revealed that, agricultural income decrease with increase in environmental incomes.

Table 8: OLS regression of forest environmental income and other sources of income

Variable	Coefficient estimate	Std Error	T- ratio	Prob>|t|
Intercept	-0.075	0.588	-0.127	0.899
Incomes from remittances	0.546	0.542	1.007	0.316
Incomes from non farm activities	0.475	0.19	2.505	0.014
Off farms incomes	-0.143	0.14	-1.018	0.311
Agriculture incomes*	-0.179	0.069	-2.599	0.011

N= 113, R square = 0.331, R square adjust = 0.109, F = 3.348, P<0.013

4.2.2.1 Income sources and wealth group diversification

All wealth categories reported higher income from agriculture as appear in Table 9. Income from agriculture and forest environmental income were statistically significant between different wealth groups. Environmental income contributed relatively higher percentage to the total household income in the poor wealth group category than to other wealth groups. Non farm income, remittances and off- farm income contributed very little to the total household income.

Table 9: Annual income sources by wealth groups

Income source	Poor (N=28)		Medium (N=29)		Less poor (N=57)		Total (N=114)	
	Income (Tshs)	%	Income (Tshs)	%	Income (Tshs)	%	Income (Tsh)	%
Income from agriculture*	143 785	83.5	584 482	91.8	2 667 473	98.1	3 395 742	96.3
Environmental incomes*	22 128	12.8	39 048	6.2	36 149	1.3	97 326	2.8
Non farm incomes	2 000	1.2	8 620	1.4	11 403	0.4	22 024	0.6
Remittances	1 607	0.9	689	0	2 631	0.1	4 928	0.1
Off farm incomes	2 678	1.6	4 000	0.6	982	0.1	7 661	0.2
Total	**172 200**	**100**	**636 841**	**100**	**2 718 641**	**100**	**3 527 682**	**100**

N= 114, *P < 0.05, (*) indicates means significantly different between wealth groups

Most of the reported environmental income i.e. 29.2% and 48% came from firewood, though insignificant. However, a higher percentage of the poor wealth group forest environmental income came from firewood income sources (Table 10).

Poles contributed between 10.6% and 43.8% of the household environmental income. The medium wealth group had higher percentage of earning from poles (43.8%) than any wealth group and other environmental income source.

About 4.8% and 21.2% of the reported household environmental income came from charcoal. Less poor group had higher percentage of the forest environmental income from charcoal making.

Table 10: Sources of environmental income and wealth groups in Suledo

Income source	Poor (N=28)		Medium (N=29)		Less Poor (N=57)	
	Income (Tshs)	Percent total	Income (Tshs)	Percent total	Income (Tshs)	Percent total
Firewood	297 600	48	331 000	29.2	628 800	30.5
Poles	65 500	10.6	496 900	43.8	430 220	20.9
Medicinal products	23 500	3.8	29 500	2.6	525 00	2.5
Charcoal	30 000	4.8	70 000	6.3	434 000	21.2
Beekeeping	203 000	32.8	205 000	18.1	515 000	24.9
Total	**619 000**	**100**	**1 132 400**	**100**	**2 060 520**	**100**

N = 114, There is no significant differences between income groups.

Table 10 show that, there were no significant differences between wealth groups in the use of environmental incomes. Firewood, poles and beekeeping reported higher percentages contribution on environmental income in their respective wealth categories.

4.2.3 Forest environmental resource dependence

4.2.3.1 Relative forest income

Table 9 shows that relative forest income for different wealth groups was 12.8% for the poor, 6.2% medium and much less for less poor. The correlation between relative forest income and total income was significant and the relationship was not very strong. The weak but significant relationship between relative forest income and total household income ($R^2=0.108$, $P<0.001$, N=113) would seem to indicate that forest income constitutes a larger share of total household income in poor compared to other categories.

RFI = 0.1792 -4.0451e − 08T
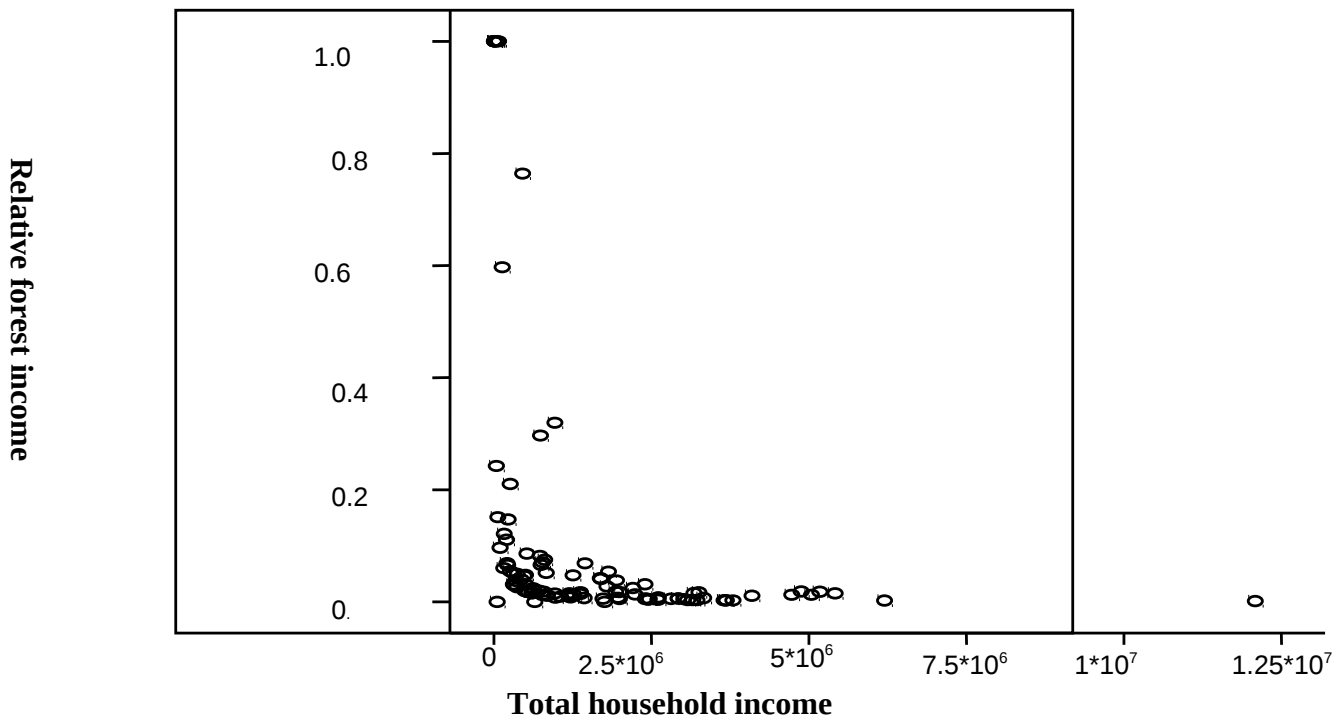
Figure 6: Total income and relative forest income (in TAS)

Forest income comprises of diverse range of total household income in almost all wealth categories, ranging from 0 to 2.5 million shillings annually though, concentrating much on poor wealth group. As total income increases, there is a continuum decline of forest dependence, adjoining towards the lower ranges from (0 to 0.2).

Table 11 shows results of an OLS of relative forest environmental income against socio-economic characteristics of the household it was observed that, households owning less number of cattle depend significantly on forest income.

Table 11: OLS regression of relative forest income against socio-economic

       characteristics

	Coefficient			
Variable	estimate	Std Error	T- ratio	Prob>|t|
Intercept	0.009	0.183	0.052	0.959
Sex of respondent	0.028	0.074	0.382	0.704
Age of respondent	-0.001	0.003	-0.267	0.79
Education of respondent	-0.008	0.007	-1.047	0.298
Family size of respondent	0.004	0.009	0.396	0.693
Marital status of Respondent	0.127	0.103	1.233	0.22
Amount of land owned	0.001	0.004	0.384	0.702
Number of cattle owned*	-0.006	0.002	-2.27	0.025

Rsquare = 0.084, Rsquare adjust = 0.023, F= 1.386, P<0.219

4.2.4 Village locational aspect, access and forest dependence

Village location as a variable may comprise of geographical description, access to resource, ethnic composition, market options, socio conditions involving different socio institutions, values and norms which may together guide resource use patterns.

To determine to what extent composition of socio- economic variables at household level varies between the four villages and whether they explain differences in total and forest income for the four villages, household socio-economic variables were grouped basing on the study villages, as appear in Table 12. It was observed that, mean total household income, mean income from agriculture and off farm income was significantly different among villages. This implies that, villages have different income levels in terms of total household income, income from agriculture and off farms income.

Diversification pattern between villages vary. Agriculture income is substantially higher in Olkitikiti, Lesoit and Asamatwa. Olkitikiti and Lesoit have higher number of livestock and livestock products such as; milk, cheese, hides which access the market to earn higher income in agriculture. Higher income accruing from crop cultivation in Asamatwa village

contributes to increased agricultural earnings. Non-farm income is reported higher in Sunya. Activities involving, selling snacks, foodstuffs, firewood and handcrafts contribute to higher income. Off-farm income is reported high in Asamatwa and involves casual labour in farms mainly done during farm preparation seasons. All villages access the community forest for environmental income and have relatively reported high income.

Table 12: Village location by household income variables in Suledo

Household social economic variables	Villages				Sample mean
	Asamatwa (N=25)	Sunya (N=50)	Lesoit (N=18)	Olkitikiti (N=21)	(N=114)
Total household income*	1 784 158	1 023 861.8	1316016.7	2794818.5	1 562 952
Relative forest income	3%	2.2%	3.6%	0.81%	2.1%
Agriculture income*	1713680	982840	1268027.8	2772071.8	1 517 736.9
Forest income	53998	22421.8	47988.9	22746.7	33443.2
Off farms income*	9880	0	0	0	2166.7
Non farm income	0	18000	0	0	7894.7
Remittance income	6600	600	0	0	1710.5

N= 113, * indicate means significantly different from villages. P<0.01

4.2.5 Wealth distribution and forest income

There is great disparity between different wealth groups in the study area. The poor earns 4.8%, the medium earns 18% and the less poor earns 77% of the total household income. Using Gini coefficient to examine the relationship between forest income and income inequalities across households in villages, a Gini coefficient for household income both

with and without forest income per village and all whole study area was calculated (Table 13).

Table 13: Gini coefficient with and without forest income in Suledo community

Villages	Gini for total income	Gini without forest income	Change(units)
Sunya	0.59	0.60	0.01
Asamatwa,	0.52	0.53	0.01
Lesoit	0.80	0.83	0.03
Olkitikiti	0.31	0.31	0.00
All four villages	**0.54**	**0.56**	**0.02**

Forest income reduces income inequality between households. When forest income is not taken into account on household income there is generally an increase in Gini coefficients (increased income inequality between households) in the villages, Sunya, Asamatwa and Lesoit by, 0.01, 0.01, 0.03 units respectively. Very marginal effect was observed in Olkitikiti village with unit change approximate to zero, the village registered a relatively smaller forest income than 1 percent. For all villages, the Gini coefficient was found to increase moderately when forest income was omitted from the analysis from (0.54 to 0.56) i.e. by 0.02 units. Further support is found in the groups of 28 households with high relative forest income who were among the poorest in the sample. These results reflect slightly similar findings reported by (Velded *et al.*, 2007).

4.3 Perception, Attitude and Awareness of the Community on CBFM Towards Livelihoods

4.3.1Community perception towards CBFM contribution on livelihood means

Table 14 shows that the perception of the respondents in the study area on how community based forest management has had contribution on their daily livelihoods. From table 13, it

was noted that more than 53% of those who responded on how CBFM had contributed to the livelihoods of the people pointed out that the process has contributed through improved pasture and crop yields. After CBFM, each land component had its designated use, and the Village Land Forest Reserve is used for grazing in dry season. About 33.3% of the respondents reported increased benefits realized from the forest these include; availability of fuelwood, increase in honey production and increased availability of medicinal species.

Table 14: Perception of CBFM contribution towards livelihoods in the study area

Perception	Frequency	(%)
	(N=8)	
Improved pasture and crop yields	45	53.6
Increased benefits from forest	28	33.3
No changes	11	13.1
Total	**84**	**100**

4.3.2 Perception on the resulting changes from CBFM

Respondents reported that changes had resulted because of CBFM and their associated activities, as appears in Table 15. About 52% of the respondents perceive that existence of land use plan as an important item in the CBFM lead to reduced land conflicts, 33.7%, of the respondents pointed out that, increased rains, vegetation restoration and emerging water sources were result of CBFM implementation. In a focused group discussion with pastoralists in Lesoit village, it was confirmed that water sources had increased because of the community effort to reserve the forest. Akinyei water source Plate 3 was cited among the water sources emanated due to implementation of CBFM activities.

Plate 3: Water source (Akinyei) emerged due to reserving the forest at Lesoit village

Table 15: Perceptions on resulting changes from CBFM

Changes	Frequency (N=98)	%
Land use plan, and reduced land conflicts	51	52
Reduced land for cultivation,	14	14.3
Increased rains, vegetation restoration and emerging water sources	33	33.7
Total	**98**	**100**

4.3.3 Community attitude and awareness on CBFM

4.3.3.1Community altitudes

Mutual attitudinal change can result in mutual rapport building and trust building resulting in strong bondage of partnership that encourages more participation in CBFM. Community attitude towards CBFM in the study area was observed by using four criteria, involvement in decision making, involvement in implementation of various CBFM activities, benefit and cost sharing. Table 16 indicates that at least 64.3% were above satisfactory level on their response on the attitude towards implementation of various activities involving CBFM. Training particularly capacity building and competence development of villagers creates immediate interest of people to participate in project activities (Ranthore and Jain 2005).

Table 16: Respondents attitude on CBFM

		Villages				
Attitude statement	**Decision criteria**	**Asamatwa**	**Lesoit**	**Olkitikiti**	**Sunya**	**Total**
Decision making	Very satisfactory	6.8(4)	3.4(2)	8.6(5)	1.7(1)	20.7(12)
	Satisfactory	5.1(3)	Nr	Nr	12.1(7)	17.2(10)
	Unsatisfactory	3.4(2)	1.7(1)	1.7(1)	20.7(12)	27.6(16)
	No option	5.1(3)	17.4(15)	Nr	3.4(2)	25.9(20)
Implementation of various activities	Very satisfactory	2.8(2)	2.8(2)	24.3(170	1.4(1)	31.5(22)
	Satisfactory	10(7)	Nr	5.6(4)	11.2(8)	32.8(19)
	Unsatisfactory	2.8(2)	1.7(1)	Nr	2.8(2)	14.3(10)
	No option	2.8(2)	21.4(15)	Nr	2.8(2)	32.8(19)
Involvement in benefit sharing	Very satisfactory	Nr	1.7(1)	5.1(3)	1.7(1)	8.6(5)
	Satisfactory	1.7(1)	Nr	25.9(15)	10.2(6)	37.9(22)
	Unsatisfactory	Nr	1.7(1)	5.1(3)	10.2(6)	17.2(10)
	No option	5.1(3)	27.6(16)	Nr	3.4(2)	36.2(21)
Involvement in cost sharing	Very satisfactory	1.8(1)	1.8(1)	5.4(3)	Nr	9(5)
	Satisfactory	Nr	Nr	12.7(7)	9(5)	21.8(12)
	Unsatisfactory	Nr	1.8(1)	9(9)	7.2(4)	25.4)
	No option	5.4(3)	29(16)	Nr	5.4(3)	43.6(24)

4.3.3.2 Community awareness on CBFM Activities

Table 17 indicated that, about 87% of the respondents admitted that they were aware of the forest resources management and responsibility. Majority (72%) revealed that the management was effective.

Table 17: Respondents awareness on CBFM

	Response	Villages				Total
		Asamatwa	Lesoit	Olkitikiti	Sunya	
Awareness on forest resources management and responsibilities	Yes	18(20)	15(17)	18.9(21)	35.1)	87(97)
	No	2.7(3)	0.9(1)	Nr	9(10)	12.6(14)
Is the forest resources and management effective	Yes	14.4(16)	14.4(16)	15.5(17)	28.2(31)	72.7(80)
	No	6.4(7)	1.8(2)	2.7(3)	16.4(18)	27.3(30)
Do you know the boundaries of the forest	Yes	15.2(16)	9.5(10)	17.1(18)	26.7(28)	68.6(72)
	No	6.7(7)	7.6(8)	0.95(1)	16(17)	31.4(33)
Are the boundaries respected	Yes	15.9(15)	10.6(10)	20.2(19)	23.4(22)	70.2(66)
	No	8.5(8)	7.4(7)	Nr	13.8(13)	29.8(28)
Are there existing rules and bylaws	Yes	17.9(19)	16(17)	17.9(19)	39.6(42)	91.5(97)
	No	3.7(4)	Nr	Nr	4.7(5)	8.5(9)
Are the by laws effective	Yes	18.5(19)	13.6(14)	17.5(18)	21.4(22)	70.8(73)
	No	2.9(3)	1.9(2)	0.9(1)	23.3(24)	29.2(30)

Majority (91.5%) were aware of the rules and by-laws with regard to CBFM. In focused group discussions, it was revealed that the awareness of the community on rules and by-laws and was due to a series of meetings and awareness raising campaign done during

commencement of CBFM in 1990s. Kajembe *et al.* (2004 b) emphasise full participation in CBFM, schemes for all stakeholders at community level.

4.3.3.3 Suledo forest management arrangement

Suledo forest was under village management and declared as a village forest reserve in 1997.The management of the forest is based on land and forest zoning which consisted, (i) grazing, (ii) agriculture expansion (iii) total protected forest zone. The grazing zone is further zoned to ensure sustainability and the agricultural expansion zone is demarcated for expansion of agriculture. Land and forest use rules were developed by the environmental committee member in cooperation with the DFO and LAMP advisors and later approved by the Village Assembly. These rules provide the basis for the joint Forest Management Plan for Suledo, through the Zonal Environmental Committee (ZEC) established in 1999 consisting of three members from each of the nine villages located within Suledo forest. The ZEC formulated the management plan for SULEDO forest in 2000 (Mellenthien, 2005).

During focused group discussion with ZEC members it was revealed that, the CBFM process in Suledo has taken quite a long time over ten years. This is a long time for a participatory process as people might be demoralized since more tangible benefit from the forest have not been realized.

Other challenges with respect to management of forest include; forest encroachment due to lack of clear external boundaries with neighbouring districts of Kilindi, Kongwa and Kilosa, the need for strengthening the patrols by improving equipment, transport, boots, weapon etc. Encroachment is related to logging; intruders operate during the night and are mostly armed and hence difficult to be controlled by village patrollers.

4.3.3.4   Suledo forest pilot harvesting and future consideration

The pilot harvesting process is underway for Sunya and Olgira villages. *Brachystegia and Jubernadio Gloliflora* tree species with 40 cm diameter have already been earmarked for harvesting. It was also observed that a number of big health trees are to be kept standing as a gene pool for future generation. Sunya village with 10000 hectares of forest under a 60 years rotational system has 167 ha per coupe. The cubic metres and income resulting from this coupe will then determine whether is economically viable to harvest. According to Isango (2007), early indications show that it may be necessary to demarcate an additional coupe from the adjacent village forest area.

The harvesting process is likely to bring more opportunities for income generating activities through non timber products. If Suledo villages are to produce charcoal from leftover branches after timber has been retrieved (which may take 50% - 60%) of the total harvested volume, this would provide second source of income (Lissu and Mizlaf, 2007). Arrangements could be made to provide this to more vulnerable groups with other sources of income such as youth groups and women groups. The pilot harvest in two villages will provide valuable experience to the communities and help to establish harvesting strategies in future.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study revealed that people were involved in a wide range of activities for livelihood improvement. Agriculture employs a bigger percentage of the sample. Other activities included off farms, non farms and collection of forest resources. Firewood and fodder are the dominant forest environmental resources used in the area. Others include; medicinal products, beekeeping and charcoal. After CBFM intervention, there is an organized way of using environmental resources. This facilitates easy control and monitoring of resources through; formulation of forest resource user groups including charcoal makers and beekeeping groups; specified period to use forest resources such as fodder, firewood are collected as dead wood and there is selectivity of species to harvest for the case of poles and charcoal production. Before CBFM there were no such communal arrangements, harvests were done haphazardly by people outside SULEDO.

Agriculture (crop cultivation and pastoralism) contributes largely in each income category. The wealth differences between groups are statistically significant in terms of married households and those owning cattle (P<0.05). The poor group earned relatively lower income from agriculture, with fewer or no number of cattle. Female headed households are more dependent on environmental income and are contributing higher to the total household income than any wealth group. Total household income, mean income from agriculture and income from off-farms are statistically significant between villages. The Gini coefficient indicates that, when forest resources are not taken into account on household income, it is reduced to 0.02 units. The study revealed positive community

perception on CBFM and its contribution on peoples' livelihoods. The community attitude and awareness towards CBFM activities in the area were generally positive.

5.2 Recommendations

From the results and discussions of this study, the following are recommendations:

- Implementation of CBFM projects should strictly identify actual needs of the local community with regard to the use of environmental resources. This may include finding out potential social economic assets in the locality and how they can be linked with environmental incomes for livelihood improvement and poverty reduction.

- The use of environmental resources in CBFM operating projects should consider existing income category and social groups; this will in turn provide a base on how environmental income should be used for positive livelihood outcomes.

- CBFM implementation should consider how improvement of existing livelihood strategies should be carried to provide the most desired output and equally seek to identify alternative livelihood strategies that are beneficial and practical to the local communities under CBFM.

- A harvesting plan for Suledo forest is due to start with pilot harvesting in two villages of Sunya and Olgira. A recent and modified harvesting plan is focusing the cut mainly on *Brachystegia and Jubernadio Gloliflora*. This opportunity will therefore provide sources of income to the vulnerable groups such as women and youth with income resulting from charcoal production through leftover branches. This will also provide for more income to strengthen activities related to patrol and general forest management.

- The whole process for forest management in Suledo has taken more time to start baring the fruits due to some legal and bureaucratic procedures between different levels. This should probably if possible be avoided in other CBFM projects as may demoralize people's willingness to participate in the project.

REFERENCES

Abdallah, J.M. (2006). Economic and productive efficiency analysis of tobacco and impact on miombo woodlands of Iringa region in Tanzania. Dissertation for award of degree of Doctor of Philosophy at Sokoine University of Agriculture, Morogoro, Tanzania. 222pp.

Adams, W., and Hulme, D. (2001). Conservation and Community: Changing narratives, policies and practices in African conservation. In; D. Hulme and M. Murphree (Eds.), *African wildlife & livelihoods: The promise and performance of community conservation.* James Currey, Oxford, UK.   (pp. 9-23).

Angelsen, A. and Wunder, S. (2003). *Exploring the Forestry –Poverty link: Key concepts, issues and research implications.* CIFOR Occasional paper, No vol. 40. Centre for International Forestry Research, Bogor, Indonesia.58p.

Behera, B. and Engel, S. (2004). *The four levels of institutional analysis of evolution of Joint forest management (JFM) in India:* A paper presented at the annual Meetings of the International Association for the Study of Common Property (IASCP), Oaxaca, Mexico. 26pp.

Blomley and Ramadhani (2007). Participatory forest management in Tanzania – An overview of status, progress and challenges ahead. *Arc Journal no 21*: p(3-5). Dar-es- Salaam. 36pp.

Buyinza, M. (2008). Environmental Incomes Derived from Mountain Forest Ecosystems of Mt. Elgon National Park, Eastern Uganda. *Research Journal of Applied Sciences* 3: pp (225-232).

Campbell, B.M. and Luckert, M.K. (Eds.). (2002). *Uncovering the hidden harvest. Valuation Methods for Woodlands and Forest Resources.* Earth scan, London. 262pp.

Campbell, B.M., Costanza, R. and van den Belt, M. (2000). Introduction, overview and synthesis: Land use options in dry tropical woodland ecosystems in Zimbabwe. *Ecological Economics*. 33: pp (341-351).

CARE (1995), *Rapid Food and Livelihood Security Assessment in Shinyanga, MaraMwanza Regions, Tanzania.* Unpublished Report. CARE International in Tanzania. Dar-es-Salaam, Tanzania.

Carney, D. (1998). Implementing the Sustainable Rural Livelihoods Approach. In: D. Carney (ed.). *Sustainable Rural Livelihoods, What contribution can we make?* Paper presented at the Department for International Development's Natural Resources Advisors' conference, London, July 1998. 15pp.

Cavendish, W. (2000). Empirical regularities in the poverty-environment relationship of rural households: evidence from Zimbabwe. World Development 28 (11), 1979–2003.

Chambers, R. and Conway, G. (1992). Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. IDS discussion paper 296. Brighton, IDS. Pp (12- 24).

Department for International Development (DFID). (1999). Sustainable Livelihood Guidance sheets. Framework [http://www.dfid.gov.uk] site visited on 10/05/2009.

Dercon, S. (2000). Income risk, coping strategies and safety nets. WPS #2000: 26. Oxford, UK: Centre for the Study of African Economies.

Ellis, F. (2000). *Rural Livelihood and Diversity in Developing Countries*. Oxford University Press, Oxford 273pp.

FAO. (1991). Household Food Security and Forestry. An analysis of socio-economic issues. Community Forestry Note No 1. 147pp.

Farrington, J., Ramsul, T. and Walker, J. (2002). Sustainable Livelihood Approaches in Urban Areas: General Lessons, with illustrations from Indian cases. Swedish International Development Cooperation Agency report. Stockholm, Sweden.

Fisher, M. (2004). Household Welfare and Forest Dependence in Southern Malawi. *Environmental and Development Economics*. pp (135-154).

Gambiza, J., Bond, W., Frost, P.G.H. and Higgins, S. (2000). A simulation model of miombo woodland dynamics under different management regimes. Ecological Economics. 33: pp (353-368).

Gunatilake, H.M. (1998). The role of rural development in protecting tropical rainforests: Evidence from Sri Lanka *.J. Environ. Manage.,* 53:p (273-292).

Hassan, R.M., Mbuli, P. and Dlamin, C. (2002). Natural Resources Accounts for the State and Economic Contribution of forestry and Woodland Resources in Swaziland. Mbabane, Swaziland. 34pp.

Hutton, J.N. Leader- Williams. (2003). Sustainable Use and incentive – driven conservation: realigning human and conservation interests. Oryx 37: 225-226.

International Union for Conservation of Nature (IUCN). (2006). Investing in Environmental Wealth for Poverty reduction: Annotated Bibliography. Prepared on behalf of the Poverty- Environment Partinership. IUCN: Gland www.Biodiversity economics.org/MDGs visited on 20th February 2009.

Isango, J.A. (2007). *Monitoring of Permanent Sample Plots (PSPs) established in SULEDO Miombo Forests in Kiteto District, Tanzania.* Unpublished Report. Tanzania Forestry Research Institute, Morogoro, Tanzania.

Kaewsonthi, A. and Harding, S. (1992). *Starting, Managing and Reporting Research.* Chulalongkorn University Press, Bangkok, Thailand. 133pp.

Kajembe, GC., Monela, G.C. and Mvena, Z.S.K. (2003). Making community-based forest management work: A case study from Duru-Haitemba village forest reserve, Babati, Tanzania. In: *Policies and governance structures in woodlands of southern*

Africa, (Edited by Kowero,G., Campbell, B. and Sumaila, U.) Jakarta: Center for International Forestry Research: pp 16–27.

Kamanga, P., Vedeld, P., Sjaastad, E. (2008). Forest incomes and rural livelihoods in Chiradzulu District, Malawi, *Ecological Economics* 68: pp (613-624).

Kigula J.J., (2007). Contribution of Participatory Forest Management to livelihoods and poverty reduction in Tanzania: A case study of East Usambara Mountain forests, Tanga. Dissertation submitted in partial fulfillment for the degree of Masters of Science in Management of Natural Resources and Sustainable Agriculture, Morogoro, Tanzania. 106pp.

Kijazi, M.S. (2007). Impact of Joint Forest Management on forest resources and Livelihoods of communities in Amani Nature Reserve Muheza district-Tanzania. Dissertation Submitted in Partial fulfillment for the degree of Master of Science in Management of Natural Resources and Sustainable Agriculture of the University of Sokoine- Morogoro Tanzania. 108pp.

Kimberly, A. (2002). Content Analysis Guide Book.[http://enwikipedia.org/w/index.php] visited on 25/06/2008.

Kothari, C.R. (Eds.) (2004). *Research Methodology Methods and Techniques.* New Delhi, New Age International Limited Publishers. 398pp.

LAMP. (2005). Building a future with our forests: Experiences of community- based forestry. *LAMP booklet*, SIDA.

Leach, M., Mearns, R., scones, I. (1997). Environmental entitlement: Dynamics and institutions in community based natural resources management. *Word Development* 27(2), 225-247.

Lema, T.A. (2003). The Role of Non-Timber forest products in household food security and women income in Morogoro Rural District, Tanzania. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 109pp.

Lissu, T. and Mizlaff, U. (2007). Moving towards sustainable harvesting of village forests-experience from Kiteto District- SULEDO forest. *Arc Journal 21*: p (7-10) Dar-es- Salaam.36pp.

Lokina, R., Robinson, E. and Stage, J. (2008). Economics of forests products in Tanzania. Research and development for Sustainable management of semi arid miombo woodland in East Africa. Working paper of the Finnish Forest Research Institute 98: pp (87-92).

Luoga, E.J. (2000). The effects of human disturbances on diversity and dynamics of eastern Tanzania miombo arbores cent species. Dissertation submitted in partial fulfillment for the degree of Doctor of Philosophy at the University of Witwatersrand, Johannesburg. 222pp.

Malimbwi, R.E. (2000). Forest inventory report for SULEDO forests. Prepared for ORGUT office, Stockholm.

Mapolu, M.H. (2002). Contribution of Non-wood Forest products to the household food security: A case of Tabora District. Tabora, Tanzania. Dissertation Submitted in Partial fulfillment for the degree of Master of Science in Management of Natural Resources and Sustainable Agriculture of the University of Sokoine-Morogoro Tanzania. 132pp.

Mbwambo, J.S. (2000). The role of local knowledge and organizations in sustainable conservation of biodiversity: A case study of Udzungwa Mountains, Tanzania. Dissertation for Award of Msc. Degree at Sokoine University of Agriculture, Morogoro. 117pp.

Mellenthien, J. (2005). *Timber Utilization in Suledo Village Land- Kiteto District, Tanzania.* Unpublished Consultant Report, ORGUT consulting AB. Dar-es-salaam, Tanzania.

Mettrick, H. (1993). Development oriented research in Agriculture. An ICRAF Text Book. Wageningen. The Netherlands, 287pp.

United Republic of Tanzania (URT). (1998). The National Forest Policy of Tanzania. Government printer, Dar-es-Salaam. Tanzania 59pp.

Monela, G.C, Kajembe, G.C, Kaoneka, A.R.S. and Kowere, G. (2000). Household livelihood strategies in miombo woodlands of Tanzania: Emerging trends. *Tanzania Journal of Forestry and Nature conservation*. 73: pp (17-33).

Monela, G.C. (1995). Rain forest Degradation and land use in Nguru Mountains, Tanzania. Analysis of Socio- Economic and Ecological Aspects. Unpublished Thesis for Award of Dr- Scient. Submitted to Department of Forest Sciences Agricultural University of Norway, Aas Report no 1: pp (20-97).

Paulo, T. (2007). Contribution of Non Timber forest products in improving livelihood of rural communities in Kilwa district. Unpublished Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 113pp.

Peter, P. (2006). Rural income and poverty in time of radical change in Malawi. *Journal of Development Studies* 42 (2), 322- 345.

Ribot, J. C. and N. L. Peluso (2003). A Theory of Access. *Rural Sociology* 68:153-181.

Schreckenberg, Cecila, Pelin and Moss. (2007). A way out of poverty? A review of the impacts of PFM on Livelihoods: A role of PFM in poverty reduction. A paper presented at 1st National Participatory Forest Management Conference 6-8 June 2007. KEFRI, Kenya.

Scones, Ian. (1998). Sustainable rural Livelihoods: A framework for analysis, IDS Working Paper No 72. IDS, Brighton.

Shyamsunder, P.E. Araral, and Weerartne, S. (2004). Devolution of Resource Rights, Poverty and Natural Resource Management – A Review. Environment Department Paper No 104. Washington DC. Word Bank. pp124.

Shylajan, C.S, and Mythili, G. (2003). Community dependence on protected forest areas: A study on valuation of non-wood forests in a region of India. Srilankan Journal of Agricultural Economics Vol5, No1 2003. http://www.slageconfer.net/Sjae.51/Sja5 107.pdf. Visited on 03/02/2008.

Sjoholm, H. and Luono, S. (2002). "The green forest pastures of SULEDO- Maasai communities organize to save their forests and secure their livelihoods". *In Forest, Trees and People Newsletter No. 46*. SLU- Kontakt, Swedish University of Agricultural Sciences, Uppsala. pp (13-21).

United Republic of Tanzania (URT). (1993). *The Labour Force Survey 1990/1991. Tanzania Mainland.* Tanzania Bureau of Statistics. Planning Commission, Dar-es-Salaam, Tanzania. 162pp.

United Republic of Tanzania (URT). (1997). *Tanzania Demographic and Health Survey 1996.* Tanzania Bureau of Statistics, Dar-es-Salaam, Tanzania. 312pp.

Vedeld, P., Angelsen, A., BojØ, J., Sjaastad, E., Kobugabe, G.K., (2007). Forest Environmental Incomes and the Rural Poor, *Ecological Economics* 9, pp. 869-879.

Vedeld, P., Angelsen, A., Sjaastad, E. and Berg, G. (2004). Counting on the Environment: Forest Income and the Rural Poor. *Environmental Economics* Series No. 98. Washington, D.C.: World Bank.

Wily, L.A., (2000). Forest law in eastern and southern Africa: moving towards a community-based forest future? *Unasylva Vol. 51 No. 200*. pp. 19-26.

World Bank (2001).Recommended revisions to OP 4.36: Proposals for Discussion. The World Bank: Washington, D.C

APPENDICES

Appendix 1: Check list for key informants

1. Village leaders and Natural Resources Committee (VNRCs)

1. Awareness on the importance of CBFM

2. Existence of CBFM plan and regulations

3. Local communities and access to forest products and services from forest

4. Local leaders' role and mandate in management of forest reserve.

5. Income generating activities introduced in the village due to introduction of CBFM

6. Goods and services obtained from the forest reserve.

7. Condition of he peoples livelihood before and after CBFM

2. District officers

1. Existence of CBFM plan and regulations

2. The contribution of CBFM to the improvement of the rural communities

3. Emerging of other alternative means of livelihood as a result of CBFM intervention.

3. Elders/ Old people

1. History of the area and changing livelihood means

2. Contribution of forest based livelihoods on household incomes before CBFM

3. Resource use and management by indigenous people in the area.

Appendix 2: Checklist for guiding Focus group discussion

1   Sources of livelihood before and after CBFM

2   Contribution of forest product to household incomes before and after CBFM

3   Changes on forest based livelihood options as a result of CBFM intervention

4   Involvement of community in CBFM activities

5   Existing arrangements in the use of forest based resources

6   Resettlement and compensation issues during CBFM inception

Appendix 3: Household Questionnaire

Serial number………………………

Name of Interviewer …………………………………………………………….

Name of respondent …………………………………………………………

Village…………………………………Ward………………………………

Date…………………………………..

Part one: Basic Household Information.

1   Sex of respondent   01 male   02 Female   ……………………….

2   Age in years ………………………………….

3   Place of birth   …………………………………..

         01 in the village   02 not in the village

4   Did you shift from another village to this village …………………………..

         01 Yes   02 No

5   If yes, Years of residence in this village…………………………..

6   Education level ……………………………………………………………

         01 illiterate   02 primary education   03 Ordinary secondary school

          04 Advanced secondary school   05 vocational training   06 College

         07 University   07 others specify…………………………………….

7   Marital status ……………………………………………………………

          01 married   02 not married

8   How many dependants do you have………………………………………..

         01 Total number of children   ……………………………….

         02 Total Number of relatives …………………………………

9   Reasons for shifting to this village …………………………………………..

          01 Looking for fertile land   02 Looking for pasture   03 Looking near   area   for

         timber sawing   04 near area for charcoal harvest   05 Followed   relatives

06 Honey harvest from the reserved forest.

07 Other specify ………………………………………………………………….

9   Where were you living in this village before CBFM was introduced?

01 YES,   02 NO   …………………………..

10.   What changes you consider to have taken place significantly in your village?

……………………………………………………………………………

Part Two: Employment and Incomes

11 What is your main occupation…………………………………………..

  01 crop cultivation 02 pastoralism   03 saw miller 04 Hunter and gathers

05 Charcoal dealer 06 Others specify   …………………………………..

12 Have CBFM intervention changed in any how your main and supporting

economic activities?

01 yes …………………………

02 No

13 If yes how has it changed? ………………………..

14   What other occupations were you engaged into before CBFM

Type of activity	Amount obtained	Estimated Income per month

15   What were your reasons for changing your occupation?

………………………………………………………………………………………

    01 limited land for grazing   02 limited land for cultivation   03 low yields in

    pastoralism   04 Low yield in agriculture   05 Availability of

    resources in the forest 06 restrictions in the forest

16   How far is the forest reserve?..

17 What limitations you have had by having a forest reserve in the village

………………………………………………………………………………….

    01 reduced land for cultivation   02 Reduced land for grazing 03 Lack of   access

    to NTFP   04 Increased wild animals

18 Are you allowed to access/ use forest resources?

01Yes   02 No   …………….…………………………………..

19 Which forest products are you allowed to use and at what time of the year?

Forest Products	Period

20   What other activities you are engaged in to supplement your living………………

01 crop cultivation 02 Pastrolism 03 collection of NTFP's   04 work as   laborer

    05 Beekeeping

21   How much land do you own? ……………………………………

22   How did you obtain the land?..

23   How long have you owned this land?..

24   How many acres do you cultivate each year……………………….

25   How long have you been cultivating the area ……………………

26   Have you lost any land that you owned before as result of CBFM?

Yes/No …………………………….

27   Were you given an alternative land elsewhere?....................................

28 Is your land adequate………………………………..

29   Have CBFM affected in any how the land you own?

   ………………………………………………………………………

30 What can you generally say about your life standard before forest reserve was

established and at present?..

31 How can you compare access of forest product before and after CBFM

intervention……………………………………………………………….

32   What are your comments on these

differences……………………………………………………………………….

Part Three: Household Incomes

Incomes from Animal products

33 Meat production from cattle last 12 months

Season	period	No of cattle slaughtered	%of meat sold	Income for 1 animal	Total incomes
Season 1					
Season 2					

34 Meat production from cattle before CBFM started

Season	period	No of cattle slaughtered	%of meat sold	Income for 1 animal	Total incomes
Season 1					
Season 2					

35 Meat production from goats last 12 months

Season	period	No of cattle slaughtered	%of meat sold	Income for 1 animal	Total incomes
Season 1					
Season 2					

36 Meat production from goats before CBFM started

Season	period	No of cattle slaughtered	%of meat sold	Income for 1 animal	Total incomes
Season 1					
Season 2					

37 Milk production from cows last 12 months

Season	period	No milk cows	Production litre per day	Sold litres or %	Mean price per litre
Season 1					
Season 2					

38 Milk production from cows before CBFM started

Season	period	No milk cows	Production litre per day	Sold litres or %	Mean price per litre
Season 1					
Season 2					

39 Milk production from goat last 12 months

Season	period	No milk cows	Production litre per day	Sold litres or %	Mean price per litre
Season 1					
Season 2					

40 Milk production from goat before CBFM started

Season	period	No milk cows	Production litre per day	Sold litres or %	Mean price per litre
Season 1					
Season 2					

41 Animal hides last 12 months

Animal	Total number produced	No sold	Price (mean) Tshs	Sold total or %	Total amount earned
Cattle					
Goats					
Sheep					
Other					

42 Animal hides before CBFM started

Animal	Total number produced	No sold	Price (mean) Tshs	Sold total or %	Total amount earned
Cattle					
Goats					
Sheep					
Other					

43 Other livestock incomes last 12 months

Type	Total produced	Total sold	Total cash income
Season 1			
Season 2			

44 Other livestock incomes before CBFM started

Type	Total produced	Total sold	Total cash income
Season 1			
Season 2			

Part 4

Incomes from crop production

45 Which crops have you cultivated within the last 12 months?...........................

…………………..…………………….. …………………..

46 Farm production and sales

Crop	Total production		Sales			
	Unit	No	unit	no	price	income

47 Farm production and sales before CBFM started

Crop	Total production		Sales			
	Unit	No	unit	no	price	income

48 Incomes from forests and woodlands last 12 months

Type	Total collected or produced	Amount sold	Total net incomes from sales
Charcoal			
Firewood			
Fodder			
Poles/thatches			
Beekeeping			
Medicinal products			
Mushrooms			

49 Incomes from forests and woodlands before CBFM started

Type	Total collected or produced	Amount sold	Total net incomes from sales
Charcoal			
Firewood			
Fodder			
Poles/thatches			
Beekeeping			
Medicinal			
Mushrooms			

Part 5

Local peoples perceptions, Attitudes and Awareness to Forest Reserve

50   Are you aware of the forest resources management and responsibilities involved?

51   Who owns the forest?
    01 central government   02 local government   03 private institution 04 Village
   05 Individuals

52 Do you think the current forest management is effective   Yes/No

53   Give reason for the above question? …………………………………………..
    …………………………………………………………………………………….
54 Do you know the boundaries for the forest reserve?   01 Yes   02 No

55   If yes are they respected?   01 Yes   02 No

56 What is your altitude on the involvement in managing the forest reserve?

Altitude statements	Attributes			
	Very satisfactory	Satisfactory	Unsatisfactory	No option
1. Decision Making				
2.Implementation of various activities				
Benefit Sharing				
Cost Sharing				

57 Are there any by laws and rules in using the forest products 01 Yes   02 No

58 If yes in 57 above are these bylaws effective?   01 Yes   02 No

 59 What happens if one breaks the rules or agreement...

        01 Verbal warning 02 Fined   03 Sent to court   04 Both of the above   Suspended

60 What are the general problems with regard to forest management and use of its products? ………………………………………………………………………………
    …………………………………………………………………………………….

61 When comparing forest condition before and after CBFM, how do you say about the

contribution of forest based livelihoods on household

incomes? ....

Appendix 4: Tree species found in Suledo Community Based Forest

Local Name	Botanical name
Mlama mweusi	*Combretum molle*
Mpingo	*Dalbergia melanoxylon*
Msane	*Brachystegia microphylla*
Mgunku	*Combretum zyheri*
Komalume	*Canthimum burtti*
	Vitex payos
Mfulu	*Mundelee spp*
Mhangala(mbonta)	*Julbernadia globiflora*
Mkelengembe	*Dischrostachys* cinerea
Mhuga	*Dalbergia nitidula*
Mtalawanda	*Markamia obtusifolia*
Mtovo	*Markamia obtusifolia*
Mtulavula	*Clerodendrum glabrum*
Mtwitwi	*Commifora africana*
Mkilika/mlwati	*Dombea rotundifolia*
Kitovutovu(kilavilavi)	*Rothmania fischeri*
Kisakulankwele	*Margaritaria discoidea*
Msolo	*Pdeudolachnostylis mapronefolia*
Mumbu	*Lannea schimperi*
Mninga	*Pterocapus angolensis*
Mtondolo	*Brachystegia speciformis*
	Darbergia boehmil
Mkungugu	*Acacia tortilis*
Kilemelantembo	*Gardenia ternifolia*
Mtundwi	*Ximenia caffra*
Mkulu ndende	
Mkambu (Mgusa)	*Croton spp*
Kiloriti(Kimwinya)	*Acacia nilotica*
Mgonank'olongo	*Combretum schumanni*
Mnjeja	*Dalbergia nitidula*
Mninga maji	*Xedroderris stuhlmannii*
Mchala	*Albezia petersiana*
Mkuanga	*Zanha africana*
Mtanga mdogo	*Terminalia coriciea*
Mfumbiri	*Lonchrecapus bussei*
Mnungu	*Erythrina spp*
Mtugutu	*Vernonia colorata*
Msinzila	*Brideria cathartica*
Mtogo	*Diplorhynclus conylocarpo*
Mwijiri	*Pappea capensis*
Mbombwe(mpome)	*Commiphora eminnii zimmermannii*
Mgunga	*Acacia plyacantha*
Mgunga mwekundu	*Acacia spp*

Mndizi	*Teclea spp*
Msisimizi	*Albezia harveyi*
Mnindi -pori	*Lannea schmperi*
Dondo	Cussonia arborea
Kivunguti	*Ficcus spp*
Mguluka	*Boscia salicifolia*
Mhogolo	*Albizia harveyi*
Mkambala	*Acacia nigrescens*
Mng'ongo	*Scterocarrya birrea*
Moza	*Sterculia africana*
Msamayu	*Phllanthus engleri*
Msada	*Vangueria infausta*

Appendix 5: Distribution of Suledo community forest coverage by village

Name of village	Area of Forest in hectres
Olkitikiti	30 812
Loltopes	26 741
Sunya	10 000
Asamatwa	19 375
Lengatei	4 408
Olgira	18 020
Laiseri	32 699
Engong'ongale(Mturu)	19 952
Total	**167 416**