FOREST ECOSYSTEM SERVICES AND LIVELIHOOD OF COMMUNITIES AROUND SHUME-MAGAMBA FOREST RESERVE, LUSHOTO, TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN MANAGEMENT OF NATURAL RESOURCES FOR SUSTAINABLE AGRICULTURE OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

This study was conducted to assess the potential of forest ecosystem services to the livelihood of communities around Shume-Magamba Forest Reserve in Lushoto District, Tanzania. Data collection involved use of questionnaire survey, focus group discussion and researcher's observation to acquire primary information. Data were analysed both qualitatively and quantitatively using the Statistical Package for Social Science (SPSS) computer software tool. Results revealed that, provisioning services (i.e. water, firewood, medicinal plants, food and building materials) were mostly recognised by local communities as the service provided by forest ecosystem followed by cultural services (i.e. tourism and spiritual areas). Provisioning services played greater role in people's livelihoods by generating subsistence income for sustaining rural communities. The income generated (66%) by both men and women from provisioning services were highly used to cater for food, health and education. There was no significant difference at probability level 5% between gender and income generated from provisioning services to household livelihood in the study area. Findings showed that, task of conserving forest ecosystem to derive services involved both men and women. Men were mainly involved in forest protection and tree planting conservation aspects while women involved in law enforcement thus attaining sustainable forest ecosystem utilization. Fire incidences, planting crops near to water sources and illegal timber harvesting were observed to be the main constraints towards sustainable use of forest ecosystem services. It is concluded that, communities in the study area were highly uncertain on the potentials of forest ecosystem services to the livelihood, but in actual fact ecosystem services provide both direct and indirect benefits for household livelihoods though the income

generated is low. The study recommends that, further research is needed to quantify what is in the field regarding forest ecosystem services and having formal market to ensure its sustainability.

DECLARATION

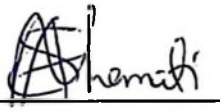
I, JOSHUA MAGUZU, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

12/10/2012

Joshua Maguzu **Date**

(MSc. MNRSA)

The above declaration is confirmed by



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Dr. Suzana Augustino **Date**

(Supervisor)

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DEDICATION

This work is dedicated to my parents: Maguzu Stanley Lupondije and Gaudensia Sosthenes Nzumbi who due to their love shaped me into whom I am; to my beloved wife Nancy Eliad Pima, and my children Gaudensia and Geofrey, the fruit of which is this work so dearly completed.

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LIST OF ABBREVIATIONS AND ACRONYMS

CDRI	=	Cambodia Development Research Institute
DEFRA	=	Department for Environment Food and Rural Affairs
DFID	=	Department For International Development
FAO	=	Food and Agriculture Organisation
IEA	=	International Energy Agency
IUCN	=	International Union for Conservation of Nature
LDCs	=	Least Developing Countries
MA	=	Millenium Assessment
MDGs	=	Millenium Development Goals
NEMC	=	National Environmental Management Council
NGOs	=	Non Governmental Organizations
PCSD	=	President's Council on Sustainable Development
SNAL	=	Sokoine National Agriculture Library
SPSS	=	Statistical Package for Social Science
SUA	=	Sokoine University of Agriculture
SWH	=	Swedish Water House
TSHS	=	Tanzania Shilings
UNEP-SEI	=	United Nations Environmental Programme -Stockholm Environment Institute
URT	=	United Republic of Tanzania

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Forest ecosystem services are defined as services provided by the natural environment that benefit people. Forest ecosystems provide a wide range of services from which people benefit and upon which all life depends. Ecosystem services are classified into four categories (provisioning, regulating, supporting and cultural). Provisioning services are products obtained from ecosystems including food, fuel, building materials and fresh water; regulatory services are benefits obtained through regulation of ecosystem processes such as climate regulation, flood control and pollination; supporting services are services necessary for production of all other ecosystem services as nutrient cyclic, soil formation and waste management; and cultural services are non material benefits obtained from ecosystem like spiritual area, aesthetic and tourism destination (Bond *et al.,* 2009; MA, 2005). All of these benefits depend on the flow of ecosystem services and are non-existent if these services cease to flow. They provide significant economic benefits to surrounding communities and contribute to spiritual, mental and physical well-being, help to fulfill an ethical responsibility to respect nature and provide opportunities to learn about nature and the biodiversity (IUCN, 2000). For the sake of this study, only forest ecosystem services related to provisioning and cultural aspects were dealt with regarding their direct contribution to communities' livelihoods.

Ecosystem services operate in almost every aspect of our lives including forests, farm paddocks, city parks and house gardens. Individuals farms, cities, towns and industry rely on the services that ecosystem provides (MA, 2005). Ecosystem

services contribute to economic welfare in two ways: through the generation of income and wellbeing and prevention of damages that inflict costs on society. With a broader focus on valuing the benefits provided by ecosystems, policy options that enhance the natural environment are also more likely to be considered demonstrating that investing in natural capital can make economic sense (MA, 2005).

Ecosystem services are of enormous value to human society. It was estimated by Costanza *et al.* (1997) that the annual value of these services was $33 trillion, compared to global gross national product total at that time was around $18 trillion per year. Although this figure has proved controversial, there is no doubt that ecosystem services represent a massive contribution to the economic wellbeing of all societies. Furthermore, many of the services are simply irreplaceable. For example, there is no way of providing food to the human population except through the use of natural systems involving soil organisms and crop plants, or of providing drinking water, except through the operation of the water cycle which depends critically on the activities of organisms (Costanza *et al.*, 1997).

Many people in the world depend on forest resources on which their contribution to the people's livelihood can come in various aspects (Dubois, 2003). Benefits from the forest are either direct or indirect; including subsistence goods such as fuel woods, medicines, wood for buildings, ropes, bush meat, fodder, mushrooms, honey, edible leaves, roots and fruits. These can also be considered as goods for sale including art crafts, timber and other wood products. Forests also provide income from employment, both in the formal and informal sectors (FAO and DFID, 2001).

Tanzania is endowed with a number of biological and other natural resources, which among others; include forests, water, minerals, fish, wildlife and soils. Such resources are of paramount importance to the existence of ecosystems that range from wetlands, marine to highlands or mountain ecosystems. These ecosystems support the livelihoods of a majority of Tanzanians and the country's economy in general. They provide goods and services which include food, water, medicine, biological diversity as well as raw materials to industries, very vital for socio-economic development (NEMC, 2006).

The concept of ecosystem services has become important basing on the role of nature for maintaining human livelihoods especially in contributing substantial net gains and economic development. Generally, ecosystem services are little understood and too sophisticated but yet the important roles they play in household livelihood are not being recognized adequately in economic markets and government policies (MA, 2005). Valuing benefits derived from ecosystem services contributes towards better decision-making and highlighting much more clearly the implications for human well-being, while providing policy development with new insights (DEFRA, 2007).

1.2 Problem Statement and Justifications of the Study

The West Usambara Mountains have forests that are important for the existence of ecosystem services. They provide both provisioning and cultural services including timber, food, medicinal plants, tourism destinations and spiritual areas which contribute to substantial net gains in community livelihood. In addition, they have regional importance as catchment forests protecting water supplies for the surrounding lowlands-local communities, and moderating climate (Ramsay and

Kessy, 1996). Shume-Magamba Forest Reserve, which is the biggest in the West Usambara, and is in the process of being upgraded to the status of a nature reserve, provides various forest ecosystem services. Communities around Shume-Magamba Forest continue benefiting more from the forest to improve their livelihoods through various ecosystem services.

Degradation of ecosystem including forests has been observed to be significant barrier in achieving Millennium Development Goals (MDGs), especially for the rural poor (MA, 2005), and hence protection of these services is urgently needed. For example, when population, increases people's options for regulating their use of forest resources at sustainable levels are reduced (MA, 2005).

Forest ecosystems and its beneficial services have been rapidly disappearing and becoming scarce, threatening future economic development and human well-being (Barbier, 2007). According to the Millennium Ecosystem Assessment (MA, 2005) 60% of ecosystem services including forests are being degraded or used unsustainably, often resulting in significant harm to human well-being (Harrison, 2009). A similar situation could be observed in West Usambara Mountain particularly Shume-Magamba Forest. Currently, the potential of forest ecosystem services to improve livelihoods of communities around this forest reserve in West Usambara has not been adequately documented, despite the threats posed by continued degradation. Therefore there is a need to conduct a study to document such useful information. The study contributes useful information on the potentials of forest ecosystem services in Tanzania especially in West Usambara. The information is important to various stakeholders including policy makers in order to design

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strategies to sustain the forest ecosystem services and development opprotunities. According to (UNEP-SEI, 2009), innovative opportunities that enable development and improve livelihood without undermining ecosystem services are urgently needed. For example, since the rural communities are more directly reliant on ecosystem services for a larger share of their livelihood, investment in securing ecosystem services seem to be of greater benefit to them than other sectors (Shackleton *et al.*, 2008).

1.3 Objectives

1.3.1 Overall objective

To assess the contribution of forest ecosystem services to the livelihood of communities around Shume-Magamba Forest Reserve, Lushoto, Tanzania.

1.3.2 Specific objectives

Specifically the study aimed to:

i) Identify different ecosystem services from forest resources in the study area.

ii) Examine the potential of the identified forest ecosystem services to the household livelihood.

iii) Examine the role played by different user groups in conservation of identified forest ecosystem services.

iv) Identify constraints toward sustainable uses of the forest ecosystem services in improving livelihoods.

1.4 Conceptual Framework

Conceptual framework helps to prevent fragmentation of knowledge into diverse segments of unconnected statements. According to Katani (1999) conceptual framework binds facts together and provides guidance towards collection of realistic data and information. Forest ecosystem services will lead to an increase in both direct and indirect benefits to household. Furthermore it will contribute to household livelihood of the study area. Revenue generated from selling forest ecosystem services will be used to cater for food, health, education and other social activities hence contributing to household livelihood. Figure 1 shows the relationship between forest ecosystem services and household's livelihoods.

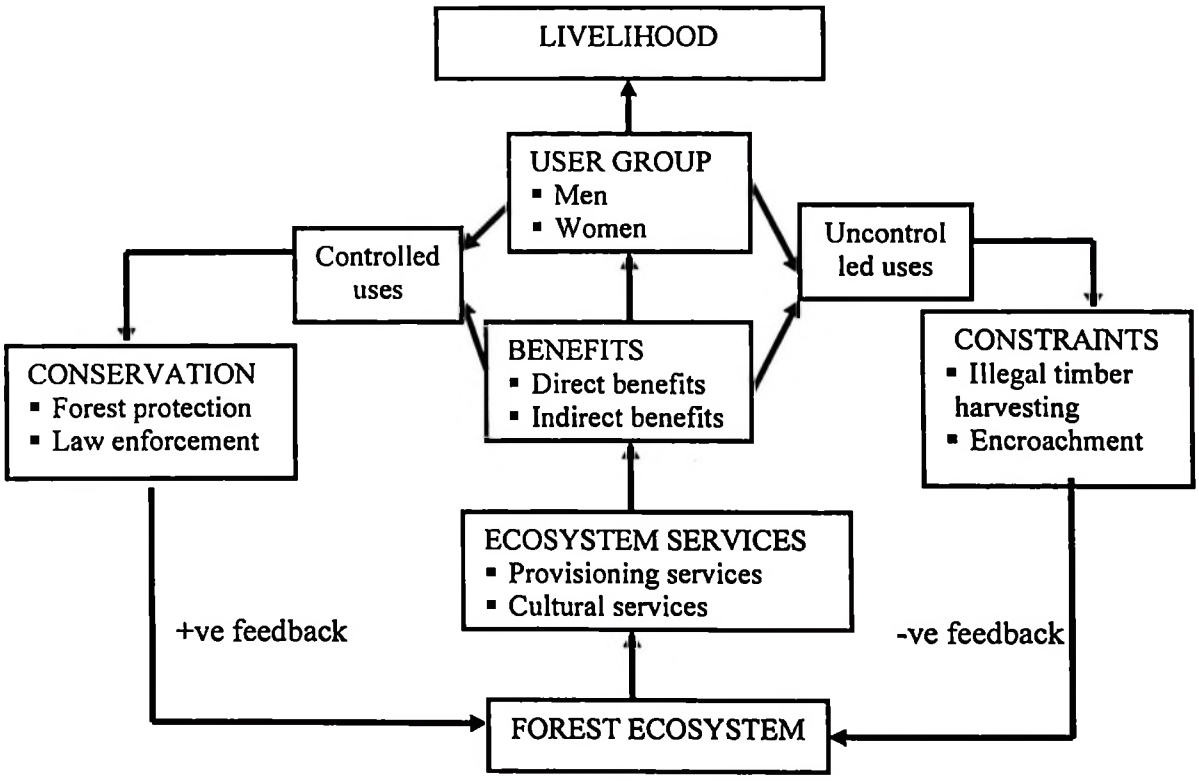

Figure 1: Conceptual framework of the study

1.5 Research Questions

i) Which are the ecosystem services provided by the forest resources in the area?

ii) Which forest ecosystem services are the most important according to the local people's perceptions?

iii) What are the potentials of forest ecosystem services in household livelihood in the area?

iv) What are the roles played by different user groups in conservation of the identified forest ecosystem services?

v) What problems do local communities face in sustainable uses of forest ecosystem services toward improved livelihood?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Global Overview

Ecosystem services are all the fundamental benefits that forest ecosystem provides for our survival e.g. food production, bioenergy, water purification, climate regulation, soil production, erosion control and mitigation of the effects of natural catastrophes (Ecological Society of America, 1997; Daily, 1997). The Millenium Ecosystem Assessment reported that 60 to 70% of our world's ecosystem services are deteriorating with dramatic consequences for those who are most dependent on their steady provision such as subsistence farmers. Throughout the Millenium Ecosystem Assessment the 'ecosystem services' concept is used to highlight the relationship between human welfare and natural wealth (IUCN, 2006; MA, 2005).

The distinction between "natural" and "human-dominated" ecosystems is becoming increasingly blurred, emphasize being on the natural end of the spectrum, for three related reasons. First, the services flowing from natural ecosystems are greatly undervalued by society. For most part, they are not traded in formal markets and so do not send price signals that warn of changes in their supply or condition. Furthermore, few people are conscious of the role natural ecosystem services play in generating those ecosystem goods that are traded in the market place. This lack of awareness helps to drive the conversion of natural ecosystems to livelihood whose economic value can be expressed, at least in part, in standard currency. The second reason to focus on natural ecosystems is that many human-initiated disruptions of these systems, such as introduction of exotic species, extinctions of native species

and alteration of the gaseous composition of the atmosphere through fossil fuel burning are difficult or impossible to reverse. Thirdly, if awareness is not increased and current trends continue, humanity will dramatically alter earth's remaining natural ecosystems within a few decades (Daily, 1997).

In Tanzania, the government is strongly determined to improve the livelihoods of its people by integrating different local sources of income sustainably, for example, agriculture, wildlife, forests and small-scale businesses (URT, 1998). Assessing the relative importance of such sources of income in the light of forest ecosystem services would reveal priority options for improving livelihood (URT, 2005). The majority of rural communities in the developing countries including Tanzania depend on the natural resources such as forest (Butler, 2006) for their livelihood. These resources supply a basic safety net for the poor rural people. For example, forest as an alternative source of income offers a range of ecosystem services such as fuel wood, water supply, honey, beeswax, building poles, fodder resources, fruits and medicinal plants (Sunderlin *et al.*, 2005; Giliba *et al.*, 2010).

2.2 Ecosystem Services from Forest Resources

The concept of ecosystem services is attracting increased attention as a way to communicate societal dependence on ecological life support systems (Daily, 1997; de Groot *et al.*, 2002; Gómez-Baggethun *et al.*, 2009). Forest ecosystem services are vital to our health and prosperity. These services contribute to the economic performance of a country and to individuals. A large-scale assessment of ecosystem services made by an international group of scientists and published as the

Millennium Ecosystem Assessment, grouped the services into four categories: supporting, provisioning, regulatory and cultural services (Diaz, 2006). Human survival and well-being depends utterly on these ecosystem services, and thus on the health of the ecosystems that provide them (Daily, 1997; Costanza *et al.*, 1998; McAlpine and Wotton, 2009). Forest ecosystem services like other assets provide benefits that enhance economic performance, offer new opportunities for investment and employment, and improve living standards and quality of life. And like other assets enhancing or diminishing the condition of forest resources increases or reduces the stream of benefits that can be derived from them in the future. Ecosystem services provide outputs or outcomes that directly and indirectly affect human well-being, and these considerations can link well to taking an economic approach (DEFRA, 2007).

2.3 Forest Ecosystem Services and Livelihood

Ecosystems provide more than the resources needed for material welfare and livelihood. In addition to supporting all life and regulating natural systems, they specifically provide health and cultural benefits to the people. Their loss is thus a significant barrier to the achievement of the Millennium Development Goals related to reduction of poverty, hunger and diseases (Wong *et al.*, 2005). Other health benefits include those derived from having a full complement of species, intact watersheds, climate regulation and genetic diversity (MA, 2005). Stresses on ecosystem services which include freshwater sources, food-producing systems and climate regulation could cause major adverse health impacts. Globally, approximately 80% of the human population relies on traditional medical systems

especially LDCs and about 85% of traditional medicine involves the use of plant extracts (MA, 2005).

Forest ecosystems provide a diversity of services vital for human well-being and poverty alleviation. The importance of ecosystems in providing the services that underpin every single productive and spiritual activity of human kind has been suppressed in the consciousness of many, and so ecosystems are mismanaged, abused and degraded (Shackleton *et al.,* 2008). Human beings derive benefit (or "utility") from the use of ecosystem services, either directly or indirectly, whether currently or in the future (MA, 2005). Provisioning services are a significant component of diversified livelihood portfolios, both for home consumption and income generation.

Poverty alleviation initiatives need to build on the inherent diversity of rural livelihoods rather than constrain it, through promoting a diversity of options, of which provisioning services should be seen as only one component of a suite of options (Shackleton *et al.,* 2008). It is postulated that, as human population increases, there is immediate increase dependence on ecosystem services for their livelihoods. The resultant increased pressure often has a negative feedback on the capacity of the ecosystems to deliver services. This can create a downward spiral of increasing poverty and ecosystem degradation (Shackleton *et al.,* 2008).

2.4 Forest Ecosystem Services and Conservation

Ecosystem services are increasingly reaching economic decision-making through the widespread promotion of market based instruments for conservation such as markets for ecosystem services (Bayon, 2004) and so-called payments for ecosystem services schemes (Engel *et al.*, 2008; Pagiola, 2008; Gómez-Baggethun *et al.*, 2009). Forest ecosystem services, as other nature's services, have been claimed to be of great economic value and in valuation studies, ecosystem services frequently fetch higher values than alternative land uses. Global efforts to conserve forest resources have the potential to deliver economic benefits to people through ecosystem services. Forest ecosystem conservation is an attempt to save for future generations plant species that are declining as a result of ecosystem modification (Kumar, 2010). While provisioning services may provide the most readily marketable benefits, they need to be conserved.

The major aspect of forest ecosystem conservation is to sustain the integrity of ecosystems while providing goods and services to an increasingly diverse set of public interests (Naveh, 1994). More recently, the concept of "sustainable development" – often defined as conserving natural resources to meet present human needs has led to greater consideration of the long term impacts of forest resource uses. Meanwhile, the cumulative impacts of numerous forest resource uses have led many scientists and resource managers to conclude that forest ecosystem resources like water quality, and other natural resources can only be conserved through cooperative efforts across large landscapes (PCSD, 1996). Conservation has therefore found itself at a cross road between meeting the demand of local people for

sustainable livelihood and ensuring the preservation of forest resources (Roe and Elliot, 2005).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area Description

3.1.1 Location

Shume-Magamba Forest Reserve is located in Lushoto District West Usambara Mountains. It is one of the thirteen blocks forming the Eastern Arc Mountains of Tanzania and Kenya, along the Albertine Rift. It is comprised of 12 000 ha of moist montane forest, which is a gazetted forest reserve, with 2 500 ha under exotic plantation. The area is located at 04° 40' S and 38° 15' E with an altitude of 1,900 m above sea level in the West Usambara Mountains (Lovett, 1996). Administratively, Shume-Magamba Forest Reserve is sorrounded by 21 villages with 6 wards (Lushoto, Kwai, Lukozi, Shume, Mazinde and Manoro wards) (Figure 2).

3.1.2 Climate

The area has two rain seasons, September to November and March to April with a mean annual rainfall ranging from 600 mm to 2000 mm. A minor and unreliable rain (Mluwati) occasionally occurs in August and September. The area has annual temperature ranging between 16° - 22°C (Haruyama and Toko, 2005).

3.1.3 Geology and soils

The main soil of Shume-Magamba forest is Eutoric Nitosol, considered being one of the most fertile soils among tropic ones. The geology is composed of the late Pre-Cambrian rock of the Usagara system, metamorphic rocks of gneiss type with two main highland soil types; the Humic Ferrisols in the drier areas and Humic Ferralitic soils in the more humid and wet areas (Pfeier, 1990).

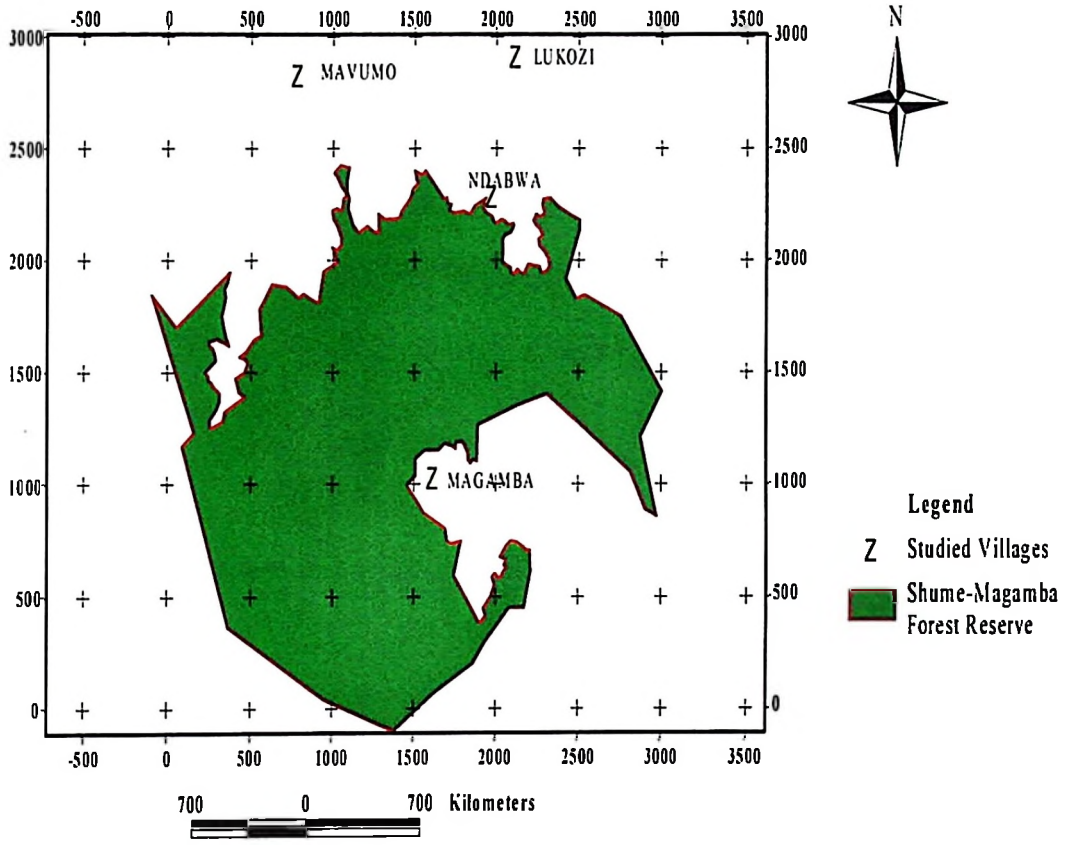

Figure 2: Map of Shume-Magamba Forest Reserve showing the location of study villages

3.1.4 Vegetation

Due to humid and stable climate, the mountains have been covered by evergreen forest. The highly diverse forest left in this area is regarded as an important biological system of the ecoregion. The dominant vegetation is typical tropical rain forests with very high biodiversity (Haruyama and Toko, 2005). Most forests cover extensive areas of the wetter eastern, southern and northern sides of the mountains (Lovett, 1996). Most dominant species in the West Usambara Mountains are *Ocotea usambarensis, Podocarpus spp, Parinari excelsa,* and *Newtonia buchananii.*

3.1.5 Population

Shume-Magamba Forest Reserve has a total population of 75720 people (URT, 2002). There are several ethnic groups living around Shume-Magamba Forest including Sambaa, Mbugu, Pare and other immigrants from other diverse groups such as Chaga and Zigua. The local ''sambaa'' language is very rich in botanical and ecological terms as far as ecosystem services are concerned (Haruyama and Toko, 2005).

3.1.6 Socio-economic activities

Shume-Magamba Forest has been deforested and turned into farm land. The severe deforestation caused by excessive human pressure have lead to serious soil erosion (Haruyama and Toko, 2005), as well as decrease in amounts and reliability of rainfall and river run-off (Johansson, 2001). As the area is rich in soil fertility both food and cash crops are produced. The food crops produced include maize, cassava, and vegetables like tomatoes, cabbage and onions. Fruits like apples, pears, avocado, plums and apricots are also produced. Other crops grown in multistory home gardens include bananas, sugarcanes, irish and sweet potatoes with cash crops like tea and coffee, which are grown on small plots and are the major source of income to smallholder farmers in the area.

3.1.7 Sampling design

Multistage sampling strategy was used. In the first stage, a purposive sampling technique was employed in selecting 4 villages out of 21 villages surrounding Shume-Magamba Forest Reserve of which two villages were proximity to the reserve

and other two villages were far from the reserve in order to determine the influence of forest ecosystem services to household livelihood. In the second stage, random selection of household within each of the 4 identified villages was done (Table 1). Random sampling aimed at minimizing bias as every individual in household had an equal chance of being selected. The sampling units in this study were households. The sampling intensity was 5% of the total number of household in each village as recommended (Boyd *et al.*, 1981). The household here was taken as the unit of analysis because it is where all decisions are primary taken (Thomson and Metz, 1997).

Table 1: Demography and distribution of selected households in the study area

Village	Total population	Male	Female	Household Number	Household sample
Magamba	4960	2279	2681	1111	38(29)
Lukozi	6500	3000	3500	1200	32(24)
Mavumo	3659	1447	2212	537	33 (25)
Ndabwa	914	452	462	351	28 (22)
Total	**16033**	**7178**	**8855**	**3199**	**131(100)**

Note: Numbers in brackets represents % sample of household

3.2 Data Collection Methods

3.2.1 Primary data collection

Several methods were used for primary data collection. These include household questionnaire survey, focus group discussion and participant observation. Data collection was preceded by a preliminary survey in order to be acquainted with the study area. During this survey (2-3) households from each of the 4 identified villages was randomly selected and interviewed for pilot test in order to check the reliability and validity of the questions and modify it to fit the local condition.

3.2.1.1 Questionnaire survey

Both closed and open-ended questionnaires (Appendix 1) was used to interview heads of households and key informants like village leaders and extension officer in order to gather various information in relation to the study. The questionnaire was designed in such a way that permits acquisition of both quantitative and qualitative ecosystem service informations. Data collected based on respondents perceptions on the types of forest ecosystem services derived from the forest; livelihood contribution in terms of income, food, and health; the role of household member in sustainable use of those forest ecosystem resources within gender context and constraints towards their sustainable use in improving livelihoods. In closed ended questionnaires a number of alternative answers were provided while in the open ended questionnaires respondents were free to give their own answer views. This was done to avoid yes/no answers and to encourage maximum discussion.

3.2.1.2 Focus group discussion

Focus group discussion was done in four selected villages surrounding Shume-Magamba Forest Reserve. The focus group was comprised of 6 – 10 respondents of which men and women were incorporated. The meeting addressed general information of household characteristics, types of ecosystem services derived from the forest, potentials of forest ecosystem services to livelihoods in terms of income, food, and health; the role of household member in sustainable use of those forest ecosystem resources within gender context and constraints towards their sustainable use in improving livelihood. A checklist (Appendix 2) was used to guide the

discussion which was undertaken with key informants including village government leaders, elders and natural resource committee members.

3.2.1.3 Researcher's direct observation

Direct researcher observation was made on the selected household to observe general situation of various ecosystem services existing in the area. The aim was to enable the researcher to understand what ecosystem services are available in the study area and its potential to household livelihood. Kajembe and Luoga (1996) reported that researcher acts as a part of community being studied to build rapport with the community studied. In this method, researcher was able to get more appropriate answers to questions and important information's from the study as the researcher was part and parcel of their community.

3.2.2 Secondary data

Secondary data were obtained by consulting various relevant government documents i.e. text books, journals, pamphlets and various reports in the libraries of both SUA (SNAL) and District level. Other informations were obtained from different on line web resources, villages, District and forest projects.

3.3 Data Analysis

Both qualitative and quantitative data were analysed using Statistical Package for Social Science (SPSS) computer software tool. Qualitative data collected through verbal discussion and open ended questionnaires were broken down into smaller meaningful themes and analysed to bring statistical meaning. This helped the

researcher to ascertaining attitude of the respondents. According to Kajembe (1994) this technique can be used to explain the way social system and the manner in which they relate to the physical environment.

Prior to data analysis using SPSS, coding was first done to summarize information based on formulated ecosystem service variables. Data were explored for distribution of responses and central tendency (means, percentage and frequencies). Cross tabulation involving Chi-square test were employed to test the relationship between gender` and contribution of forest ecosystem services to household livelihood.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Characteristics of Respondents

4.1.1 Age

The study findings revealed that, about 50% of the respondents were in the age group between 30-50 years, followed by those who were aged above 50 years (26%) and (24%) below 30 years (Table 2).

Table 2: Age of the respondent in the study area

Study village	Age categories (years)			Total
	<30	30-50	>50	
Magamba	26(10)	32(12)	42(16)	100(38)
Lukozi	25(8)	56(18)	19(6)	100(32)
Mavumo	24(8)	45(15)	31(10)	100(33)
Ndabwa	18(5)	75(21)	7(2)	100(28)
Total	**24(31)**	**50(66)**	**26(34)**	**100(131)**

Note: Numbers in brackets are frequencies

This implies that majority of the respondents aged between 30-50 years were energetic with efficient knowledge regarding utilization of forest ecosystem services that contribute to household sustenance. According to Yanda *et al.* (2005) the age between 31 – 50 years, reflects energetic people with full engagement in socio-economic activities. Respondents aged over 60 years rarely participate in income generation activities probably because they are considered as economically not active (Ishengoma, 1998).

Results showed no significant difference ($p>0.05$) between the age group of the respondents and the ecosystem services derived from the forest. This implies that age

of the respondent had no influence on the type of ecosystem services derived from Shume-Magamba Forest Reserve.

4.1.2 Gender

The study revealed that 63% of the respondents were males while 37% were females (Table 3). This implies that, majority of the household in the study area were male-headed and this is typical characteristics of traditional African societies.

Table 3: Percentage distribution of sex of the respondent in the study area

Study village	Sex category		Total
	Male	Female	
Magamba	55(21)	45(17)	100(38)
Lukozi	69(22)	31(10)	100(32)
Mavumo	54(18)	45(15)	100(33)
Ndabwa	75(21)	25(7)	100(28)
Total	**63(82)**	**37(49)**	**100(131)**

Note: Numbers in brackets are frequencies

The results further showed that, male-headed households were much aware on types of forest ecosystem services as compared to female-headed households. Results are similar to those reported by Lema (2003) where the proportion of male headed households (73%) was higher compared to their female counterparts in Morogoro Rural District. Nevertheless, results indicated no significant difference between gender and the types of forest ecosystem services at probability level 5% ($p=0.281$).

4.1.3 Education

Results from the study showed that, 78% of the respondents attained primary education, followed by 16% who had no formal education. No one reported to have

tertiary education (Table 4). This implies that majority of the respondents were literate hence they can read, write and could be knowledgeable regarding the ecosystem services derived from the forest.

Table 4: Education level of the respondent in the study area

Study village	Education category				Total
	No formal	Adult	Primary	Secondary	
Magamba	24(9)	5(2)	68(26)	3(1)	100(38)
Lukozi	nr	6(2)	88(28)	6(2)	100(32)
Mavumo	18(6)	nr	82(27)	nr	100(33)
Ndabwa	21(6)	nr	75(21)	4(1)	100(28)
Total	**21(16)**	**3(4)**	**78(102)**	**3(4)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

According to Mbwilo (2002) actions and attitudes concerning use of available natural resources reflect the level of education. Education level however had no significant difference with regard to the types ecosystem services derived from Shume-Magamba Forest Reserve (p=0.548). This implies that awareness on the types of forest ecosystem services could probably be based on experience, formal knowledge and skills of the local people.

4.1.4 Resident duration

Majority of respondents (93%) were found to have stayed in the study area for more than 20 years followed by a few (5%) who had stayed 11 – 20 years (Table 5).

Table 5: Resident duration of the respondent in the study area

Study village	Duration of resident (years)			Total
	1-10	11-20	>20	
Magamba	5(2)	11(4)	84(32)	100(38)
Lukozi	nr	9(3)	91(29)	100(32)
Mavumo	nr	nr	100(33)	100(33)
Ndabwa	nr	nr	100(28)	100(28)
Total	**2(2)**	**5(7)**	**93(122)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

This implies that, the longer duration of residence in the area could probably increase knowledge on the types of ecosystem services derived from the forest. Similar results were reported by Paullo (2007) in Kilwa District who reported that longer duration of residence increases knowledge on the availability and utilization of forest products and services.

The analysis from Chi-square showed no significant difference between residence duration and the types forest ecosystem services (p=0.495). The implication is that resident duration is not a determinant factor for knowledge on the different ecosystem services derived from the forest in the study area.

4.1.5 Marital status

Results indicated that the majority of respondents were married (86%), followed by 12% who were single and the rest of the results are shown in table 6.

Table 6: Marital status of the respondent in the study area

Study village	Marital status category				Total
	Married	Single	Divorced	Widow	
Magamba	76(29)	21(8)	3(1)	nr	100(38)
Lukozi	84(27)	13(4)	3(1)	nr	100(32)
Mavumo	88(29)	6(2)	nr	6(2)	100(33)
Ndabwa	96(27)	4(1)	nr	nr	100(28)
Total	**86(112)**	**12(15)**	**1(2)**	**1(2)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

This implies that, married heads of the household are more knowledgeable regarding uses of ecosystem services derived from forest as compared to unmarried. Results concur with Muywanga (2004), typical African belief that four hands can produce better than two hands and married couples are likely to be more productive than a

single person due to labor supply, hence household well-being. According to McKean (1998) marital status influence decision making at household level. Understanding of the distribution of marital status of the respondent is important so as to examine both direct and indirect benefits of forest products and services to household livelihood (Lebora, 2007).

The Chi-square test showed that, marital status of the household head had significant difference (p=0.001) regarding the types of forest ecosystem services.

4.1.6 Household size

Results showed that 55% of the households had more than 6 individuals and the rest of the results are shown in Table 7.

Table 7: Household size of the respondent in the study area

Study village	Household size (people)			Total
	1-3	4-6	>6	
Magamba	16(6)	24(9)	60(23)	100(38)
Lukozi	9(3)	41(13)	50(16)	100(32)
Mavumo	12(4)	30(10)	58(19)	100(33)
Ndabwa	7(2)	29(11)	64(15)	100(28)
Total	**12(5)**	**33(43)**	**55(73)**	**100(131)**

Note: Numbers in brackets are frequencies

The observed size of the household seems to be larger than the national average of 5 people per household as reported by URT (2002). The implication could be that, increase in household size means higher availability of labor and hence increase in the uses of forest ecosystem service for home consumption and income generation for household livelihood. Similar results have been reported by Mkenya (1994) who

pointed out that a large family of more than eight members is common because of extended family network and also determines the population level, growth characteristics and resource use pattern.

Chi-square revealed no significant difference between household size and awareness on the types of forest ecosystem services ($p=0.689$). This means that increase in household size significantly does not increase the awareness on the types of ecosystem services derived from forest.

4.1.7 Occupation

The result indicates that majority of respondents (95%) were found to be farmers and the rest of the results are shown in the table 8. The major food crops observed to be cultivated in the study area were potatoes, maize, beans and vegetables (i.e. cabbage, tomatoes and carrots).

Table 8: Occupation of the respondent in the study area

Study village	Occupation category			Total
	Farmers	Employed	Small business	
Magamba	79(33)	10(1)	11(4)	100(38)
Lukozi	100(32)	nr	nr	100(32)
Mavumo	97(32)	nr	3(1)	100(33)
Ndabwa	100(28)	nr	nr	100(28)
Total	**95(125)**	**1(1)**	**4(5)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

This implies that almost all respondents were involved in farming and are aware regarding utilization and availability of forest ecosystem services in the study area. Similar findings have been reported by Makwaia (2003) in Arusha Region; Bonifasi (2004) in Lushoto District and Mkanta and Chimtembo (2002) in Tabora Region

where majority of the respondents were smallholder farmers. Elsewhere Mukul (2007) reported similar occupation of the respondents in Bangladesh. Further analysis however revealed no significant difference between types of ecosystem services derived from Shume-Magamba Forest Reserve and occupation of the respondents ($p=0.293$).

4.2. Forest Ecosystem Services

Results from this study revealed that, provisioning services mainly water supply, fuel wood, medicinal plants, wild fruits and vegetables, grazing land, food and constructions materials were the most identified ecosystem services by the majority of households (73%). The rest of responses are as shown in Figure 3.

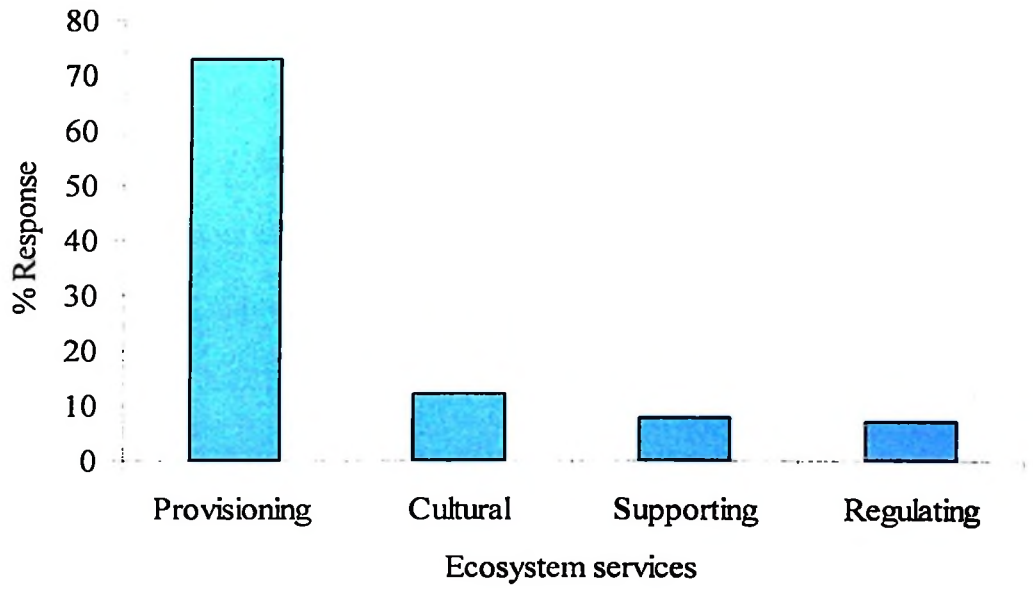

Figure 3: Identified forest ecosystem services by communities around Shume-Magamba Forest Reserve

Results imply that majority of the respondents are knowledgeable on the types of provisioning services available due to their importance for livelihood. Arnold and Perez (1998) noted that large numbers of rural households in Africa continue to generate some of their income from forest products and services. Similar findings are reported by Antwi (2009) at Bobiri forest area in Ghana where provisioning services were classified as very important forest ecosystem services followed by regulating services. According to Shackleton *et al.* (2008) in arid and semi arid areas of South Africa, regulating services were not consumed directly or sold to generate income, thus their role in supporting livelihoods and buffering against poverty was less easily demonstrated compared to provisioning services.

4.3 Potentials of Forest Ecosystem Services to Livelihood

The values of forest ecosystem services to users' lies on the way are used to maintain rural livelihood. The users focused on the forest ecosystem services which were readily available on daily basis and generate income to household. Provisioning services are the most clearly recognizable of all the types of services, because they provide direct and indirect products people can use (SWH, 2009). According to focus group discussion and personal observation, it was noted that communities in the study area were benefiting more from ecosystem services both direct and indirect.

4.3.1 Direct benefits to livelihood

Communities in the studied villages were found to depend mostly on provisioning services as their direct benefits, however focus group discussion noted the amount of ecosystem products collected per month/season which was taken as indicator to meet

the demand for household livelihood in terms of fuel wood etc. Cavendish (2000) reported that forest product and services are critically important to local forest users as a primary, supplementary or emergency source of income. A similar situation could be assumed for communities around the study area.

Firewood consumption at household level

Results showed that 62% of household in the study area collect fire wood for home consumption outside the reserve (Table 9). The actual fact however is that at least few respondents (37%) of both men and women do use firewood collected direct from the reserve for household consumption (Table 9).

Table 9: Gender and household firewood consumption from the reserve in the study area

Respondent category	Quantity of firewood (Bundles)			Total
	<5	5-10	None	
Male	37(30)	1(1)	62(51)	100(82)
Female	37(18)	2(1)	61(30)	100(49)
Total	**37(48)**	**1(2)**	**62(81)**	**100(131)**

Note: Numbers in brackets are frequencies

These imply that probably majority of the respondents feared to reveal the truth regarding fuel wood consumption from the reserve to avoid being prosecuted from utilizing the services or were ignorant on the quantity they can consume. The results are similar to the study by Maximillian (1998) in Kibaha District and Lema (2003) in Morogoro Rural District where majority of households used firewood for home consumption. Elsewhere, results also conform to those reported by IEA (2002) and Williams and Shackleton (2002) where rural households have been reported to use firewood as their primary source of energy in southern Africa.

Income generation

Result indicated majority of the respondents (88%) were uncertain on the amount of money earned from selling firewood (Table 10) implying that firewood does not have any contribution in terms of income.

Table 10: Gender and income earned from selling firewood in the study area

Respondent category	Income per month (Tshs)					Total
	<10000	10000-30000	30000-50000	>50000	None	
Male	2(2)	4(3)	1(1)	3(2)	90(74)	100 (82)
Female	4(2)	4(2)	4(2)	2(1)	86(42)	100(49)
Total	**3(4)**	**4(5)**	**2(3)**	**2(3)**	**88(116)**	**100(131)**

Note: Numbers in brackets are frequencies

A similar assumption could be made with regards to fear of being caught by forest officers or could be ignorance on the firewood been sold and lack of earning records. However, few respondents (4%) mentioned firewood to contribute 10,000-30,000 Tshs per month at household level. The results are different to those reported by Barany *et al.* (2005) in Mozambique where households are more dependent on income from the sale of forest products (i.e., firewood) and most of the activities requires firewood as an input (i.e., brewing, food vending). Results are also contrary to those reported by Mukul (2007) in Bangladesh where villagers entirely or moderately depend on the surrounding forest reserve for selling of firewood to provide cash income.

However, Chi-square test indicated no significant difference between gender and the income generated from selling firewood ($p=0.831$) in the study area. This is to say that gender had no effect over the income generated from selling firewood as provisioning service in the study area.

Honey consumption at household level

Result from this study showed 75% of the respondents were uncertain on the quantity of honey being used for home consumption followed by (24%) respondents who indicated to consume 1 – 10 litres annually (Table 11).

Table 11: Gender and quantity of honey used in the study area

Respondent category	Quantity used (litres) annually			Total
	1-10	11-20	None	
Male	23(19)	2(2)	75(61)	100 (82)
Female	25(52)	nr	75(37)	100(49)
Total	**24(31)**	**1(2)**	**75(98)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

Results are contrary to the study by Lema (2003) in Morogoro Rural District who reported that 3 litres of honey on average are being consumed by household annually. The results in table 11 further indicate that, women (24%) consume at least large quantity of honey as compared to male (23%). This implies that women use amount of honey in most of the household as emergency medicine for children's diseases and as diet.

Income generation

As indicated in Table 12, majority of the respondents (89%) do not generate income from selling honey but few respondents (5%) earned at least little income from selling honey.

Table 12: Distribution of income earned from selling honey by households in the study area

Respondent category	Income earned per month (Tshs)					Total
	<10000	10000-20000	21000-50000	>50000	None	
Male	2(2)	2(2)	2(2)	2(2)	92(74)	100 (82)
Female	4(2)	nr	8(4)	nr	88(43)	100(49)
Total	**3(4)**	**1(2)**	**5(6)**	**1(2)**	**89(117)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

The reason for this could probably be the fact that communities in the study area do not have adequate knowledge on modern methods of honey production such as use of modern beehives. The few collectors simply collect honey from dead tree trunks and traditional beehives. These findings are not in line with the study conducted by Monela *et al.* (2000) in miombo woodlands of Tanzania where honey contributed significantly to the cash income of local communities.

However, according to focus group discussion, it was noted that honey was less profitable provisioning service because most of the respondents do not have appropriate beekeeping equipments, knowledge and management. The small amount of honey obtained was mainly used as food for home consumption and some for income generation. It was also noted that, one litre of honey was sold at 4000 Tshs. Findings also indicated no significant difference between gender and the income earned from sells of honey for household livelihood ($p=0.300$).

Medicinal plants consumption at household level

Majority of the respondents (77%) do not use medicinal plants to cure various diseases (Table 13), followed by 22% who consumed less than 5 bundles per month.

Table 13: Gender and quantify of medicines used in the study area

Respondent category	Quantity used (bundles) monthly			Total
	<5	5-10	None	
Male	24(20)	nr	76(62)	100 (82)
Female	18(9)	2(1)	80(39)	100(49)
Total	**22(29)**	**1(1)**	**77(101)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

Results implies that, probably communities in the study area are currently relying more on dispensaries and hospitals for their daily treatment. The results are contrary to the study by Kessy (1998); Luoga *et al.* (2000); Dery *et al.* (1999) who reported that rural areas of Tanzania rely more on traditional medicines, than on modern treatment due to scarcity of hospitals, dispensaries, lack of medicines and associated costs.

On the other hand, results in table 13 indicated that, men (24%) at least have been observed to consume medicinal plants compared to women (18%). The high percentage of men could probably be due to their access to the forest reserve as most of the medicinal plants are not found close to the forest boundary where women fear to be caught as it was noted through discussion.

Income generated

Results indicated that majority of the respondent, (85%) do not earn income from sale of medicinal plants implying little potential for livelihood security. However, a few of the respondents (8%) both men and women earn at least small income from sales of medicinal plants with higher number of women response (Table 14).

Table 14: Gender and income earned from selling medicinal plants in the study area

Respondent category	Income earned per month (Tshs)				Total
	<1000	1000-1500	1500-10000	None	
Male	1(1)	5(4)	6(5)	88(72)	100 (82)
Female	6 (3)	2(1)	12(6)	80(39)	100(49)
Total	**3(4)**	**4(5)**	**8(11)**	**85(111)**	**100(131)**

Note: Numbers in brackets are frequencies

Results indicated that, medicinal plants were generating an income and a person can earn 1500-10,000 Tshs per month. Similarly, Lebora (2007) in Lindi Rural District reported that, medicinal plants from forest reserve were generating an average income of Tshs. 3000 per month from a cured patient as a reward. Chi-square test indicated gender of the household to have no significant difference (p=0.196) to the income earned from sales of medicinal plants derived from Shume-Magamba Forest Reserve.

Water consumption at household level

Table 15 indicates, 61% of both men and women reported not to consume water from household's tapes. This implies that, majority of the respondents in the study area depend directly on water from streams from the forest for their household domestic consumption. The rest of the results are shown in table 15.

Table 15: Gender and water used from tapes for home consumption in the study area

Respondent category	Quantity used (litres)				Total
	<100	100-200	>200	None	
Male	33(27)	6(5)	nr	61(50)	100 (82)
Female	35 (17)	2(1)	2(1)	61(30)	100(49)
Total	**34(44)**	**5(6)**	**1(1)**	**61(80)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

Results seem to be in line with those reported by Turpie and van Zyl (2001) in South Africa who reported water flow system from forest provides a vast majority of environmental goods and services including water for home consumption.

Income generation

Result from this study showed 95% of the respondents were uncertain on the amount of money earned from sale of water from household tapes (Table 16).

Table 16: Gender and income earned from selling taped water in the study area

Respondent category	Income earned (Tshs)			Total
	1000-10000	>10000	None	
Male	1(1)	4(3)	95(78)	100 (82)
Female	4(2)	2(1)	94(46)	100(49)
Total	**2(3)**	**3(4)**	**95(124)**	**100(131)**

Note: Numbers in brackets are frequencies

Findings implying that water from tapes do not have any contribution in terms of income. A similar assumption could be made with regards to presence of forest streams which supply plenty water free of charge to the communities in the study area. Ho wever few respondents (3%) mentioned water from tapes contribute an average income of >10000 Tshs. per month (Table 16). According to focus group discussion it was noted that, little water from tapes was sold for home consumption and for making bricks at a cost of 500Tshs/bucket of 20 litres. The observations are different from those reported by Ngwenya and Kgathi (2006) in Botswana who reported that, fresh water for domestic use is the most obvious service that generates income for household livelihood.

Furthermore it was noted from focus group discussion that, water as one of the ecosystem services from forest streams was used to irrigate agricultural crops. However, the revenue generated from selling of these crops was used to cater indirect needs for household livelihood. These observations are similar to FAO (2007) who reported that forest ecosystem services provide sustainable water to various communities and most of this water is used in agricultural irrigation activities.

Poles for household use

Results from table 17 indicated that, majority of the respondent (96%) do not earn income from sale of poles. Through participant observation, it was noted that communities in the study area use mud bricks, burned bricks, timber and hedges around their homesteads. This probably might be the reason of having a small number of respondents reporting to earn income from sale of poles. Also people were generally reluctant to reveal the extent of cutting poles beyond their domestic use probably because they fear being prosecuted from utilizing the services.

Table 17: Gender and income earned from selling poles in the study area

Respondent category	Income earned per month (Tshs)			Total
	<100000	>200000	None	
Male	4(3)	1(1)	95(78)	100 (82)
Female	nr	2(1)	98(48)	100(49)
Total	**2(3)**	**2(2)**	**96(126)**	**100(131)**

Note: Numbers in brackets are frequencies, nr = no response

Similar observations were reported by Masanja (2004) in Coast Region that, most household use poles for their own requirements and not for sale and almost all cutting of poles is done illegally. Study results are not in line with those reported by

Lebora (2007) who argued that, poles are used for immediate household use like construction of houses, making of beds, storage facilities for storing harvested crops and fence around homestead hence generates income for household livelihood. The findings are also contrary to those reported by FAO (2011) that, although house construction styles have changed in some areas, majority of rural people still rely on their surrounding forest resources for the bulk of their house construction needs especially poles.

However, the findings also indicated that a few men (4%) earned a small income from selling poles than their women counterparts (Table 17). This is probably due to the fact that, men are culturally highly responsible for the collection of poles from the forest as compared to women in the area, hence obtain some small income for the household livelihood. Chi-square test indicated no significant difference ($p=0.376$) between gender of the household and the income earned from selling poles as one of ecosystem services derived from the forest.

4.3.2 Indirect benefits to livelihood

Majority of the respondents (66%) both men and women use subsistence income generated from sale of forest ecosystem services for food, health and education (Table 18), with higher number of responses from men. This implies that probably men do collect forest ecosystem products for commercial purpose to increase household income which in turn increases diversification of household livelihood.

Table 18: Gender and indirect benefits accrued from forest ecosystem services

Uses	Respondent category		Total
	Male	Female	
Food	10(8)	16(8)	12(16)
Health	1(1)	4(2)	2(3)
Education	2(2)	4(2)	3(3)
Infrastructure	nr	2(1)	1(1)
Food, health and education	70(57)	60(29)	66(86)
Both	11(9)	10(5)	11(14)
Uncertain	6(5)	4(2)	5(7)
Total	100 (82)	100(49)	100(131)

Note: Numbers in brackets are frequencies, nr = no response

Similar findings were reported by Nyingili (2003) who observed income from selling forest products and services being used for regular household expenditures. Similarly, Lema (2003) in Morogoro Rural District and Yasin (2011) reported that the income earned from selling forest products was used to buy food during scarcity, hence indirect contribution to household livelihood. According to McSweeny (2004) being able to collect and use forest resources to meet daily needs for energy, shelter, food and medicine, allows the scarce cash resources to be used to secure other household needs and the accumulation of the necessary assets for a more secure livelihood. Moreover, the cost-saving has benefits not only at the household level, but also the national level (Shackleton, 2001).

The role of daily use of forest ecosystem services in the provision of energy, food, medicine and shelter to the rural poor alleviates some of the costs that the government would incur had it to provide these services in rural areas. Thus, the government has vested interest in ensuring the sustainable supply and use of these resources until it is capable of providing such services (Shackleton, 2001).

4.4 User Groups and Conservation of Forest Ecosystem

Results indicated that men (66%) and (24%) are mostly involved in the forest protection and tree planting respectively while women (29%) are involved in law enforcement (formulation and uses of forest by-laws) (Figure 2). This implied that, there is clear gender division of labour at household level regarding the conservation of forest ecosystem to derive the services sustainably.

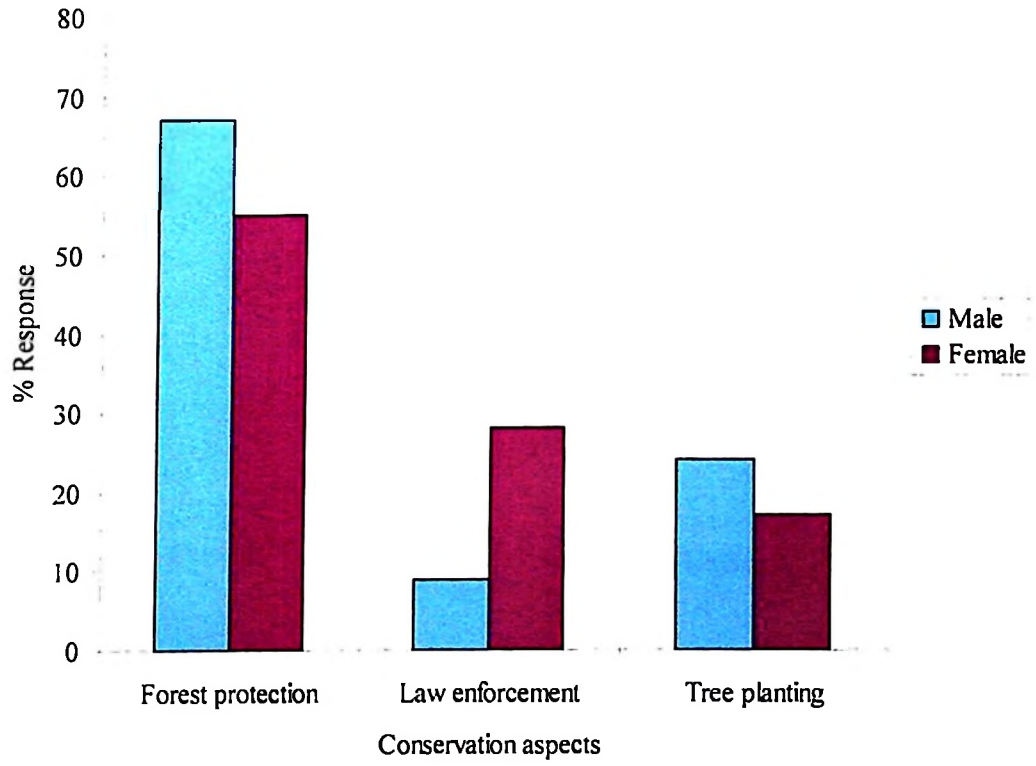

Figure 4: The role played by different user group in the conservation of ecosystem services

During focus group discussion it was noted that forest protection, tree planting and law enforcement were introduced by environmental committee in the study area as one of conservation strategies. It was further noted that both men and women are

now able to integrate conservation of forest ecosystem and development activity in their struggle to achieve sustainable development for household livelihood.

User groups are currently encouraged by environmental committee on the sustainable utilization of forest ecosystem in the study area by regulating and/or controlling accessibility of different forest products and services in the forest reserve. Similar observations has been reported by NEMC (2006) that, the government has undertaken a number of strategies that are conservation-oriented to enhance natural heritage, so as to meet the needs of the communities whose livelihood is directly linked with the ecosystems and resource use. The observations are also similar to Mukul (2007) in Bangladesh who reported that, people came to an understanding about the necessity of conserving forest ecosystem for their survival and to secure their future generations, through change mind set and in turn earn revenue in clear and authorized ways.

4.5 Constraints Towards Sustainable Use and Consumption of Forest Ecosystem Services

Results indicated that 45% of the respondents were uncertain on the constraints towards sustainable use and consumption of forest ecosystem services (Table 19). Fire incidences and planting crops near water sources were the main constraints to the sustainable use and consumption of forest ecosystem services in the study area as revealed by 30% of the respondents with higher number of women responses as compared to men. The rest of the results are indicated in table 19.

Table 19: Gender views on the constraints towards sustainable use of Ecosystem services

Constraints	Respondent category		Total
	Male	Female	
Fire setting and planting crops to water sources	28(23)	35(17)	30(40)
Encroachment, agriculture and fire setting	5(4)	6(3)	5(7)
Illegal timber harvesting and firewood collection	21(17)	16(8)	19(25)
None	46(38)	43(21)	46(59)
Total	100 (82)	100(49)	100(131)

Note: Numbers in brackets are frequencies

However, households were not ready to disclose informations on the constraints towards the uses of forest ecosystem services. The reason for this could be fear that the researcher was investigating around the forest reserve. Similar results have been reported by FAO (2003a) that, fire setting, encroachment, illegal logging and agricultural expansion are the main problems causing loss of forest product and services especially in Eastern, Southern and Western Africa. Elsewhere, similar results are reported by CDRI (2010) in Cambodia that, several ecosystem services that contributed to household income gradually decreased over the period 1999-2008 due to illegal timber harvesting and clearing of forests for agriculture. These constraints facing forest ecosystem at Shume-Magamba Forest Reserve need to be overcome so that communities could achieve optimal products sustainably.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the results and subsequent discussion, the study concludes as follows;

i. The main forest ecosystem services identified by local people in the study area were provisioning services (73%) such as water supply, fuel wood, medicinal plants, vegetables, grazing land, food and construction materials, cultural services (12%) such as tourism and spiritual areas, (8%) regulatory services such as weather and lastly (7%) supporting services such as top forest soil and soil fertility.

ii. The potentials of forest ecosystem services to local livelihoods in the study area was not significant at probability level 5% due to the fact that most of these services are undertaken illegally, no formal markets, reliable informations and records currently existing for ecosystem services. However, the contribution of ecosystem services to livelihoods were highly uncertain to communities in the study area but in actual fact they provide both direct and indirect benefits for household livelihood though the income earned is too low. The small revenue generated by both men and women from sales of provisioning services were used to cater for food, health and education.

iii. The task of conserving forest ecosystem to derive services was based on gender. Men are mostly involved in the forest protection and tree planting while women are more involved in law enforcement thus attaining sustainable forest ecosystem utilization. Hence the study concluded that, there is clear division of

labour between men and women regarding conservation of forest ecosystem for the household livelihood.

iv. Several constraints towards the sustainable uses of forest ecosystem services were identified including fire incidences, planting crops near to water sources, illegal timber harvesting and encroachment for agriculture.

5.2 Recommendations

Based on the findings of the study the following recommendations are made to ensure future existence of forest ecosystem services in the study area:

i. Further study should be conducted to quantify what is in the field regarding forest ecosystem service in specific period of time (for example, every three years) to evaluate the trend of change of forest ecosystem services for livelihood of local communities.

ii. Efforts should be made by the government and NGOs in mobilizing and sensitizing communities on the gender role towards conservation of forest ecosystem. Emphases should be put on law enforcement and other conservation aspects to ensure sustainable use of forest ecosystem services.

iii. There is a need of developing efficient and effective formal markets for forest ecosystem services in the study area, thereby improved household livelihood.

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APPENDICES

Appendix 1: Questionnaire for Household survey

GENERAL INFORMATION

1. Village.....Harmlet.....Ward.....
2. District.....Date.....Recorder.....
3. Occupation:..... Education:..... Age: .....
4. Gender: Male ( ) Female ( )
5. Marital status: Maried ( ), Single ( ), Widow ( ), Divoced ( )
6. Years of residence .....
7. Family size: .....

SOCIO-ECONOMIC

1. Household main economic activities

Activity	Yes/No	Who is involved	Season/ time of the year	How often
Farming				
Employment				
Fishing				
Small business				
Others				

2. Estimated annual Income .....
3. Education level in years
    1. No formal education .....
    2. Adult education .....
    3. Primary education .....
    4. Secondary .....

4. Main sources of labour for household

    1. Family/household .....
    2. Hired labour only .....
    3. Both .....

ECOSYSTEM SERVICES

1. Do you know ecosystem services derived from the forest? YES/NO

2. Mention ecosystem servises derived from the forest

    I. .....
    II. .....
    III. .....
    IV. .....

3. Mention the provisition services derived from the forest

    I .....
    II .....
    III .....

4. Identify cultural services derived from the forest

    I .....
    II .....
    III .....
    IV .....

5. Do the ecosystem services contribute to household livelihood? YES/NO

6. If yes how?

I .....

II .....

III .....

IV .....

V .....

7. What are the role played by different user groups in conservation of the identified forest ecosystem services to improve community livelihood

I .....

II .....

III .....

IV .....

8. From those ecosystem services derived from forest, what quantity is taken for home consumption and for selling

Source	Quantity for home consumption (Kg, Lts, bags, Tshs)	Quantity for selling (Kg, Lts, bags, Tshs)
Bee products		
Medicinal plants		
Firewood		
Poles		
Timber		
Spiritual area		
Tourism		
Food		
Water		

9. Income derived from forest ecosystem service products

Source	Amount per day	Amount per month
Bee products		
Medicinal plants		
Firewood		
Poles		
Timber		
Spiritual area		
Tourism		
Food		
Water		

10. How do the income generated form selling forest ecosystem services being used

1) Food

2) Health

3) Education

4) Infrastructure

11. Are there any constraints in the sustainable uses of forest ecosystem services in improving livelihood? YES/NO

12. If yes mention them.

I .....

II .....

III .....

IV .....

13. Do you think it is important to conserve forest ecosystem services for livelihood?

YES/NO

14. If yes, how will you invest in the conservation.

I .....

II .....

III .....

IV .....

Appendix 2: Focus group discussion check list

Government leaders/Village elders

1. Do you know ecosystem services derived from the forest?
2. Mention ecosystem services derived from the forest.
3. Do the ecosystem services derived from the forest contribute to household livelihood?
4. How do they contribute to household livelihood?
5. Which user groups are responsible in the conservation of forest ecosystem services toward improved livelihood ?
6. How much do the community earn from selling different ecosystem services derived from the forest?
7. How does the income generated from selling forest ecosystem services used?
8. Are there any constraints in the sustainable uses of forest ecosystem services in improving livelihood?

Forest and natural resource officers

1. Does the community have access to forest ecosystem services?
2. What ecosystem services does the community derive from the forest?
3. How many times per week does community access these ecosystem services from the forest?
4. Do they generate income from selling of forest ecosystem services?
5. Do you charge for those ecosystem services derived?
6. Do the ecosystem services contribute to household livelihood?
7. How do the income generated form selling forest ecosystem services used?
8. Which user groups are responsible in sustainable uses of forest ecosystem services