ECONOMIC VALUATION OF SELECTED NON-TIMBER FOREST PRODUCTS IN CHIWALE GENERAL LAND FOREST: A CASE STUDY OF MASASI DISTRICT, MTWARA REGION-TANZANIA

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ABSTRACT

The study was conducted to assess the economic valuation of selected Non-Timber Forest Products (NTFPs) around Chiwale General Land Forest (CGLF) in Masasi District-Mtwara. The value of NTFPs is not well known in other forest including CGLF as case study, since few studies have been done mainly on the economic value of firewood, food security, medicinal plants and poles in the Eastern Arc Mountains forest (Udzungwa), North Ruvu Forest Reserve, Zaraninge forest in Bagamoyo. This study intended to identify main NTFPs extracted from the study area, estimating the quantity of NTFPs extracted from the forest, assessing the monetary value of NTFPs and analyze the factors influencing its extraction. The study was conducted through Households questionnaire, Focus group discussion, Key informant interviews and Market Survey in three villages surrounding CGLF. Data were analyzed by using Statistical Package for Social Sciences (SPSS) where both quantitative and qualitative information's were captured. The study identified different valuable NTFPs like firewood, bamboo, thatch grass, poles, fruits and charcoal. It was observed that socio economic factors like sex of respondent, education level and household size was statistically significant at $p < 0.01$ influenced extraction and use of NTFPs. The average quantity per household per year of firewood was 96 head loads with a value of TZS 96 000; the average quantity of Bamboo per household per year was 288 head loads with a value of TZS 288 000; thatch grasses with average quantity of 216 bundles with monetary value estimated at TZS 108 000 per household per annum, 10 poles were observed to be harvested per household per year with average value of TZS 10 000, the quantity of charcoal harvested per household per year was 1104 (20kg) bags valued to TZS 2 208 000 and the quantity of fruits harvested per household per year was 270kg valued to TZS 135 000. From the sample of 90 households it was estimated that the community earns about TZS 42 383 000 and the value of NTFPs for the

whole population was ranging between 6 895 432 500 and 8 204 674 500 per annual. It is recommended that for sustainability of NTFPs in CGLF, the Government has to initiate and support community with education emphasizing on sustainable use of NTFPs.

DECLARATION

I, James Elikana, 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.

_____ _____

James Elikana Date

(MSc. Student)

The above declaration is confirmed by

_____ _____

Dr. L. P. Lusambo Date

(Supervisor)

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LIST OF ABBREVIATIONS AND SYMBOLS

^{0}C	Degree Celsius
AP	Average Price
AV	Annual Value
BV	Bequest Value
CFAF	African Financial Community Franc (Franc de la Communaute Financier Africaine)
CGLF	Chiwale General Land Forest
CIFOR	Center for International Forestry Research
DUV	Direct Use Value
EAM	Eastern Arc Mountains
FAO	Food and Agriculture Organization of the United Nations
IUV	Indirect Use Value
Kgs	Kilograms
Mm	Millimeters
MNRT	Ministry of Natural Resources and Tourism
MTEP	Masasi Township Enviromental Profile
N	Population
NBS	National Bureau of Statistics
NTFPs	Non Timber Forest Products
NUV	Non Use Value
OV	Optional Value,
P	Price of the product
SPSS	Statistical Package for Social Sciences

SUA	Sokoine University of Agriculture
TAS	Tanzanian Shillings
TEV	Total economic value
UNEP	United Nations Environment programme
URT	United Republic of Tanzania
US$	United State Dollars
USD	United State Dollars
UV	Use Value
V	Gross Value
WB	World Bank
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Non-timber Forest Products (NTFPs) are defined as biological material other than round wood or timber that may be extracted from natural ecosystems, natural forest plantations or in agro forestry systems used in household, marketed or has social-cultural or spiritual significance (Wickens, 1991; FAO, 1990, 2001). According FAO (2001) NTFPs are all biological material other than timber, which are extracted from the forest for human use, NTFPs including all tangible products, natural, crafted or processed, derived from forests or any other land under similar use, other than timber. They also include foods, medicines, oils, resins, gums, tannins, bamboos, fuel wood, charcoal, and wild meat sold and consumed either at local, national, regional or international level. NTFPs are also known as minor forest products and non-wood product, broadly defined to include all forest products except timber, wood chips, pulp and wood based panels (FAO, 1990).

It is estimated that 25% of the world poor are directly or indirectly depending on forest for their livelihoods (CIFOR, 2003; WB, 2000). Worldwide trade in NTFPs is very limited but it is significant to rural income generation through local markets. It is estimated that about 300 million people in tropical forest earn their income through selling NTFPs (Pimental *et al.,* 1997). Gupta and Guleria (1992) reported that 500 million people adjacent to forests in India are engaged in trading and exporting NTFPs to get their everyday earnings. NTFPs forms an important component in household nutrition, health and source of income where over 60% of the rural population in developing countries including Tanzania depend on medicinal plants from forests (Marshall, 1998: UNEP,

2002; FAO, 2004). Rural communities rely mainly on firewood for cooking while the urban population commonly uses charcoal. It is estimated for instance that 75% of households in Dar es Salaam use charcoal, while in other urban areas the charcoal users are approximately 54% of households (NBS, 2007). Rural communities are seasonally or occasionally involved in charcoal production and sell their products to middlemen who transport it to the major urban centers (Malimbwi and Zabahu, 2008). Therefore NTFPs save most of the rural household during famine, drought and before crop harvest (Kajembe *et al.,* 2000). Selling of forest and non-wood forest products like charcoal, honey, firewood and wild fruits provide more than 50% of the total cash income to the household in Tanzania (Monela *et al.,* 2000). Thus this makes NTFPs to provide additional income and employment to local communities living around forests.

Practical experience reveals that Chiwale General Land Forest (CGLF) in Masasi District has important role in human livelihoods at local level as it is a major source of household subsistence need and income due to its importance in supplying NTFPs used by local communities. However, the actual economic contribution of CGLF to the community is not clearly known. Therefore this study aim at conducting economic valuation of selected NTFPs to the community around Chiwale General Land Forest.

1.2 Problem Statement and Justification of the Study

1.2.1 Problem statement

Tanzania is endowed with vast forest resources rich in NTFPs and species diversity (URT, 1998). The NTFPs come from variety of plant parts, animals and bee productswhich are formed into diverse variety set of products.In the past, these resources

were viewed as minor forest products, however they have been reported to support the livelihoods of millions of people (Marshall, 1998; Madoffe and Munishi, 2005). The economic value of these NTFPs is not well known in other forest including Chiwale General Land Forest a case study forest in Masasi District, since few studies have been done mainly on the economic value of firewood, NTFPs on food security, medicinal plants and poles in some forests in the Eastern Arc Mountains (Udzungwa), North Ruvu Forest Reserve, Zaraninge forest in Bagamoyo (Maximillian, 1998; Kajembe *et al.*, 2000; Abdallah, 2001; Kilonzo, 2009). These studies however, do not give the holistic value of all NTFPs to other forests.

Therefore, this study aimed at assessing the economic value of selected NTFPs to the communities adjacent to Chiwale General Land Forest in Masasi District so that the communities could be aware of economic potential of the forest to their livelihood .This in turn could serve as an incentive for the communities to prudently manage the Chiwale General Land Forest.

1.2.2 Justification of the study

1.2.2.1 Significance of study findings

Findings from this study will contribute towards development of efficient ways of sustainable forest management and make communities aware on the forest situation and thinking ways of cautiously forest management. Policy makers, planners, decision makers and other stakeholders will make use of this information's to devise strategies for estimating the value of NTFPs and setting out the basis for sustainable forest

management. The findings of this study will also add value to the existing literature on economic value of forests and its management.

1.2.2.2 Why study non-timber forest products

Over 20 millions people in Tanzania depend on NTFPs to sustain their livelihood by direct use for households consumption and income generation URT (2008). NTFPs are among the most useful tropical plant resources, yet are poorly represented relative to other forest products like timber (Van Andel, 2006).Assessing the quantity and value of NTFPs and transform their use from subsistence development by incorporating them into mainstream forest products such as timber. Yet, knowing the economic value of non-marketed NTFPs helps to give more accurate accounts of the total income of gatherers, as well as better estimates of the economic value of the forest.

1.2.2.3 Why study in Chiwale forest, Masasi district

Chiwale General land Forest has an important role in human livelihoods at local level as it provides various NTFPs used by the local public. Dependence of the communities to Chiwale General Land has resulted to arguably serious degradation and current the forest is in a danger of extinction.

1.3 Objective of the Study

1.3.1 Main objective

The main objective of this study was to assess the economic value of selected Non-Timber Forest Products (NTFPs) in Chiwale General Land Forest Masasi District, Mtwara Region.

1.3.2 The specific objectives

The specific objectives of this study were to:

i. identify the main NTFPs extracted from Chiwale general land forest
ii. estimate the quantity of NTFPs extracted from Chiwale General Land Forest
iii. determine the monetary value of NTFPs extracted from Chiwale General Land Forest
iv. analyze the factors influencing extraction NTFPs in the study area

1.3.3 Research questions

The research work strove to answer the following questions:

i. What kinds of NTFPs are found in the forest under the study?
ii. What are the most preferred NTFPs extracted from Chiwale general land forests?
iii. How much NTFP are collected from Chiwale General Land Forest?
iv. What is the worth of NTFPs extracted from the study area?
v. What factors influence the collection and use NTFPs specifically in the study area?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Forest Resources in Tanzania

Tanzania is endowed with forest and woodlands resources. Forest resource statistics in Tanzania have been reported by various sources: FAO (1992) and URT (1998) indicated that forest resources amount to 33.5 million ha. FAO (2002) give estimates of 38.5 million ha; Malimbwi (2003) estimate forest resources to be 34 million ha; while Butler (2006) estimate forest resources in year 2005 to be 35.257 million ha. According to Monela and Abdallah (2007) conservative estimates indicate that Tanzania has forests and woodlands occupying a total of 33.5 million hectares of the land area. As summarized in Table 1, they comprise of high closed forests, closed and open miombo woodlands, and coastal mangroves. Out of 33.5 million ha, 12.5 million ha are set aside and gazetted as production and protection forests and woodlands reserves, of which, 11.9 million ha are under the central government's Forestry and Beekeeping Division and 0.6 million ha are under village council (local governments). This implies that about 21 million ha of forests and woodlands are unreserved forest lands under private management by farmers, which have become to be known as forests on general land. Extensive miombo woodlands are unique forest ecosystem are available in this huge forest resource endowment, and are potentially a very useful frontier for economic development (Lusambo, 2009).

Table 1: Distribution of forest area by type, use and legal status

Forest by type, use and legal status		
Forest type	**Area 1000 ha**	**Proportional in %**
Forest other than mangrove	1 141	3.4
Mangrove	115	0.3
Woodland	32 299	96.3
Total	**33 555**	**100.0**
Use of forest land		
Production forest land	23 810	71.0
Protected forest area	9745	29.0
Total	**33 555**	**100.0**
Legal status		
Forest reserve	12 517	37.3
Forest in national park	2 000	6.0
Non reserved forests	19 038	56.7
Total	**33 555**	**100.0**

Source: MNRT (2001)

2.2 Non Timber Forest Products status: An overview

The non-timber forest products include wood fuel (fuel wood and charcoal) and products that are not timber, like bamboo products, carvings, wild foods and fodder (FAO, 1999; Chettleborough *et al*., 2000). NTFPs may be gathered in the wild or from trees outside forests or produced in forest plantations and agro forestry schemes (Carr *et al*., 2008). The importance of Non timber forest products (NTFPs) is being increasingly recognized due

to their economic value as well as high cultural value in developing countries (Baker, 2001). It is estimated that 80% of the people in the developing world use NTFPs for health and nutritional needs (FAO, 1997). Many of these NTFPs are important sources of income and employment for rural people and some are even traded at the international level (Lorbach *et al.,* 1999; Akinnifesi *et al*., 2005; Chemonics International Inc., 2008).

The annual world market of wild plant products is estimated at US$ 60 billion, and this market continues to grow by nearly 20% each year caused by rapid urbanization, resulted in big cities becoming centers of demand for NTFPs from outlying rural areas and across national boundaries (Van Andel, 2006). In 1996, the trade monitoring network TRAFFIC estimated the global market for medicinal plants at US$ 1.3 billion. These statistics do not show the percentage of the cultivated plants or the percentage of true NTFPs involved. Since reliable data are absent, it is difficult to give an overview of the major commercial NTFPs in Africa, the Caribbean and the Pacific (Van Andel, 2006). NTFPs tend to provide an important non-financial supplement to the livelihoods of rural people. In Tanzania NTFPs utilization tend to be of low intensity and rarely provide significant incomes (Chemonics International Inc., 2008).

2.3 Harvested NTFPs

2.3.1 Wood fuel

Wood as the main source of energy in the country accounts about 90% of total energy utilization (MNRT, 2001). About 92% of total energy in Tanzania is generated from miombo wood land (Shechambo *et al*., 2001). Charcoal is the single largest source of household energy in urban areas, as it is considered easy and cheap to transport, distribute

and store (URT, 2011). Approximately 75% of the urban residence use charcoal as source of fuel although other uses kerosene, fire wood, and gases (Monela *et al*., 1993). In sub Saharan countries fire wood is the main source of energy which accounting over 85% of population in Namibia, 90% of population in Malawi, 70% of population in Zambia and 80% of population in Mozambique rely on wood based energy (Mogaka *et al.*, 2001).

2.3.2 Poles

Poles are mostly used in construction activities in rural areas and towns, requirement of community living near the forests resources for building are met from forest (Abdallah, 2001). Maximillian (1998) reported about 90% of household in Northern Ruvu Forest Reserve in Kibaha district are pole built. Madofe and Munishi (2005) found community surrounding Chambogo Forest Reserve in Same District depend much in forest for poles. Poles are major NTFPs across Tanzania with few commercial markets and are used primarily for personal construction needs (Gunning, 2008). Construction sector includes residential, commercial buildings and the infrastructure development projects. Field observations show that contraction consumes mostly soft wood sawn timber and significant small poles. Utility poles include all poles used for transmission to support electric and telephone lines, village electrification increases utility pole consumption (URT, 2011). Globally traditional construction activity uses poles which are highly required due to being cheaper and easy to obtain (Obiri *et al*., 2002).

2.3.3 Bee products

Tanzania has a high potential of bee resources, which is estimated to be 9.2 million colonies capable of producing about 138 000 tons of honey and 9200 tons of

beeswax/year (Kajembe *et al.*, 2000; URT, 2003). Beekeeping is a source of food and income generating through sale of their products. Honey is nutritionally valuable as it provides energy and important source of non-proteneous animal food product. It is believed to have medicinal properties, as it helps against infections, promote tissue regeneration, and reduce scarring (Hutton, 1996). Honey treats various diseases like intestinal infections, ulcers, liver disturbances, gastrointestinal disorder and it is used for local brew in most African countries (Kilonzo, 2009).

2.3.4 Mushrooms

Tanzania has 31 most common edible mushroom species, occurring in miombo trees, which have mycorrhizal fungi in their root system (Harkonen *et al*., 1995; Kajembe *et al*., 2000). The largest diversity of edible mushrooms exist in the southern and western parts of the country, most of which are covered with miombo woodlands. Over 31 species of edible mushrooms are known to occur in Tanzania (Harkonen *et al.*, 2003).

2.3.5 Medicinal plants

It has been estimated by the World Health Organization (WHO) that 80% of the world's population relies on traditional medicines (Marshall, 1998). Studies on traditional medicinal plants have shown that about 1000 plant species are used in traditional medicinal practice in Tanzania which represents 10% of the country's flora (Kajembe *et al.*, 2000). Forest provides traditional medicine to 70% of Tanzania (Marshall, 1998; Madoffe *et al.,* 2006). Medicinal drugs derived from forest make an important global contribution to health care. In India, about 2000 medicinal plant species have been

identifiede to treat heart ailments, cancer, stomach ulcers, and various other disorders (Karki, 2001).

2.3.6 Wild vegetables

Wild vegetable plants are utilized on a daily basis and most probably they make up an important source of vitamins served as a side dish with staple food most commonly maize stiff porridge (*Ugali)* (Matilla *et al.,* 1997; Kajembe *et al.,* 2000; Kilonzo, 2009). Wild vegetables are most widely consumed NTFPs in the most rural communities in devaloping countries (FAO, 1997). A number of vegetable species have been recorded in different studies. Ogle and Grivetti (1985) recorded 48 species in Swaziland, while in Tanzania, Maximillian (1998) found out only six species in Kibaha; Uiso and Johns (1996) identified 19 species in Tarime District, Mapolu (2002) mentioned about 20 species in Tabora District and Nyigili (2003) reported 11 species consumed in Mbozi District. According to McGregor (1995), only a few of the many wild vegetables eaten actually come from the woodlands, the rest are found in disturbed areas growing as weeds.

2.3.7 Wild fruits

In Tanzania a total of 83 fruit tree species have been recorded, most of which occurs in Miombo woodland. Monela *et al.* (2000) argued that *Adansonia digitata, Brachystegia microphylla, Kigeria Africana, Sclerocarya birrea* and *Tamalindus indica* are potential wild fruit from miombo woodland. Uiso and Johns (1996), assert that a total of 38 species of fruits are used in Tarime District, 21 of which are wild. Out of the wild species 14 were

recorded in the food frequency data and it was found that on the average fruits contributed about 11% of all foods consumed.

2.3.8 Fodder, thatch grass and fibres

Miombo woodlands are fairly rich in browsing species, fodders from trees and shrubs are particularly important during the dry seasons when availability of grasses is markedly reduced. The importance of dry grass cannot be overstated; most houses in rural sub-Saharan countries including Tanzania are thatch grass built. Dry grasses are used for thatching and making fences around compounds (Kajembe *et al.,* 2000). Kessy (1998) reported wide spread use of ropes by local people in house constructions and production of a range of woven baskets and mats from palm, grass, bamboo and climbers.

2.4 Factors Influencing Extraction of NTFPs

Forest resources in Tanzania fall under different right of ownership and property regimes, forest in general land (miombo woodland), government forest reserves and private or community forest (MNRT, 2001). Forest in general land mostly is woodlands which lack proper ownership and management and is the area where most of NTFPs are extracted therefore NTFPs are said be ``no one's property".

Poor economic environment has made magnitude of rural people depend directly or indirectly from forest resources as immediate solution to their problems (Hassan *et al.,* 2002). Poor social economic bases cause poor society to depend on biological resources

like constructions poles, food, energy and other related resources (Kajembe and Luoga, 1996). Rapid population growth reduces land availability for arable land (Oslon *et al.*, 2004). The frequency of local people's visits to the forests to extract NTFPs is mainly determined by social economic factors such as age, education level, household size, occupation and distance between homesteads and forests (Lorbach *et al.,* 1999). Not only that, forest based activities provides 50 million people with jobs in developing countries (CIFOR, 2003). The recent estimates by the World Bank (2004) show that over 90% of the 1.2 billion people living in extreme poverty depend on forests for some part of their livelihoods.

2.5 Monetary Value of NTFPs

The forest dependencies are estimated to be quarter of the world poor that direct or indirect depends on forest for their livelihoods (CIFOR, 2003: WB, 2000). Most of direct and indirect benefits derived from forest are not commercially supplied and traded in the market (Hassan *et al.,* 2002). Grimes *et al*. (1994) likewise demonstrate that the value of NTFP is many times higher than other components of rainforest value in Ecuador. Mongaka *et al*. (2001) show that in Namibia non-timber woodland products has a value in excess of $180 million a year, more than 450 times commercial logging. This means some values of forest goods and services are not recorded or informally traded (Maximillian, 1998). In Kenya forest resources are thought to contribute more than 10% of the population to a total annual value of almost USD 100 Million (Mongaka *et al.,* 2001). Kowero and Okting`ati (1994) observed that the contribution of forest sector to Tanzania economy has been examined in the bases of marketable forest and forest related products. Nkana and Iddi (1991) pointed out that charcoal, and building poles, chairs, baskets, decoration from bamboo provide income through their sells in Kondoa District.

Many of these NTFPs are important sources of income and employment for rural people and some NTFPs are even traded at the international level (Lorbach *et al.,* 1999). In Tanzania, forest sector employ about 3 percent of paid labor and over 3 million in informal sector, are selling NTFPs (Kaale *et al.*, 2000).

2.6 Total Economic Value (TEV)

Total economic value (TEV) is the sum of use and non-use values of the forest. Forest use values refer to willingness to pay to make use of forest goods and services. Such uses may be *direct,* like extractive uses, or *indirect,* like watershed protection or carbon storage. Use values may also contain *option values,* willingness to pay to conserve the option of future use even though no use is made of the forest now. Such options maybe retained for one's own use or for another generation (Adepoju *et al.,* 2007)**.**

Forest non-use values (include Existence and bequest value) relate to willingness to pay which is independent of any use made of the forest now or any use in the future. Non-use values reveal the multi-faceted nature of the motivations for conservation, like being driven by concerns about future generations, the 'rights' of other sentient beings (Adepoju *et al.,* 2007).

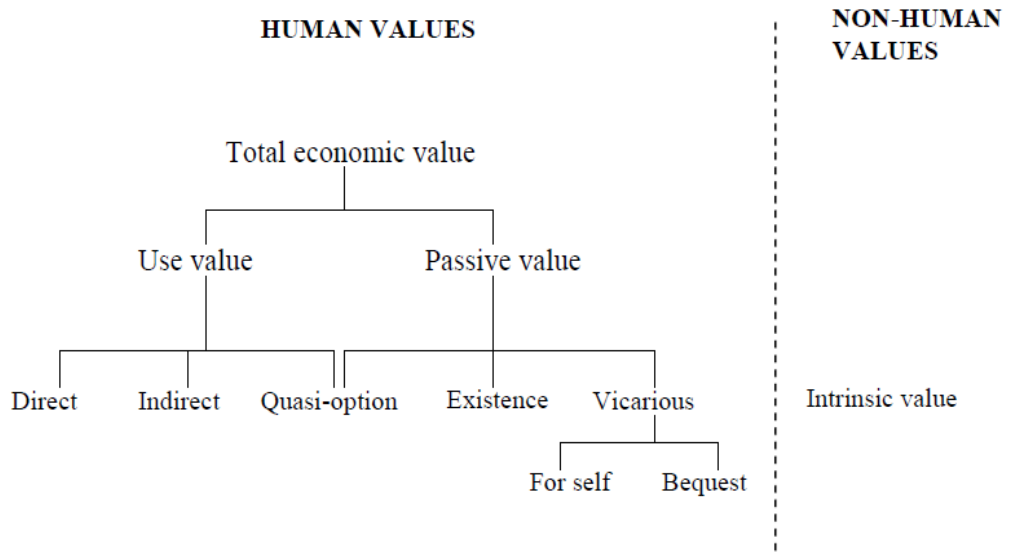

Figure 1: Component of total economic value of woodland/forest.

Source Lusambo, (2009)

The total economic value of the forest can then be estimated by summing individual use and non-use values. So total economic value (TEV) can be represented by the equation as:

TEV = UV + NUV = [(DUV + IUV + OV)] + [(XV + BV)]

Where =UV is the use value, NUV nonuse value, DUV is direct use value, IUV is the indirect use value, OV is optional value, XV is existence value and BV is bequest value. TEV is the value that is lost if a forest area is converted too their uses or seriously degraded.

2.7 Economic Valuation Techniques of NTFPs

It is relatively easy to give a monetary value to the NTFPs that are sold, even though the approach used by Peters *et al.* (1989) – using the market price of the NTFPs to estimate the maximum total income that can be earned if all available NTFPs were sold – has been severely criticized (e.g. Godoy *et al.,* 1993). However, when there is no market for the

NTFPs, the methods of evaluation are not as straight forward. While environmental economists and ecological economists have done extensive research on hypothetical markets, the techniques they have developed are not always suitable to estimate the value of non-marketed NTFPs. Most NTFPs are consumed by rural populations in developing countries, with often poorly developed markets. Even when there are markets, people might find it difficult to give a monetary value to goods that have never been sold or purchased.

Lusambo (2009) pointed out different techniques of valuation needed to estimate the economic value of forest, also other researcher has pointed out different technique used to estimate other NTFPs such as medicines, fertilizers, ornaments, thatching and roping materials, fuel wood, or construction material. The values of the amenities that the forest provides – such as soil conservation, its roles in the hydrological cycle, in the preservation of biodiversity, and as tourism and recreation destination, which some also consider as NTFPs which needs different economic valuation techniques, related techniques are available for measuring the economic value of marketed and non-marketed NTFPs.

2.7.1 Market price method

This estimates economic values for ecosystem products or services that are bought and sold in commercial markets. The market price method can be used to value changes in either the quantity or quality of a good or service. It uses standard economic techniques for measuring the economic benefits from marketed goods, based on the quantity people purchase at different prices, and the quantity supplied at different prices (Lusambo, 2009).

2.7.2 Hedonic pricing method

It is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes (Lusambo, 2009). The basic premise of the hedonic pricing method is that the price of a marketed good is related to its characteristics, or the services it provides.

2.7.3 Travel cost method

The travel cost method is used to estimate economic use values associated with ecosystems or sites that are used for recreation (Adepoju *et al.,* 2007). The basic premise of the travel cost method is that the time and travel cost expenses that people incur to visit a site represent the "price" of access to the site or measuring the time the people spent collecting the NTFPs from the forest, and then giving a monetary value to the time (Shrestha *et al.,* 2002). Thus, people's willingness to pay to visit the site can be estimated based on the number of trips that they make at different travel costs. This is analogous to estimating people's willingness to pay for a marketed good based on the quantity demanded at different prices (Lusambo, 2009).

2.7.4 Damage cost avoided, replacement cost, and substitute cost methods

These methods do not provide strict measures of economic values, which are based on people's willingness to pay for a product or service. Instead, they assume that the costs of avoiding damages or replacing ecosystems or their services provide useful estimates of the value of these ecosystems or services (Adepoju *et al.,* 2007; Lusambo, 2009).

2.7.5 Productivity methods

These estimate economic values for ecosystem products or services that contribute to the production of commercially marketed goods. It is applied in cases where the products or services of an ecosystem are used, along with other inputs, to produce a marketed good (Lusambo, 2009).

2.7.6 Contingent valuation method

It is used by ecological economists to estimate the economic value of a wide variety of goods, from protected areas, all kinds of ecosystem and environmental services (Dharmaratne *et al.*, 2000; Bulte and Van Kooten, 1999). It can be used to estimate both use and non-use values, and it is the most widely used method for estimating non-use values. The contingent valuation method involves directly asking people, in a survey, how much NTFPs they have collected would be worth in the market, or how much they would be willing to pay for specific environmental services.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

3.1.1 Geographical location

The study was conducted in Chiwale General Land Forest in Masasi Districts Mtwara Region. The study involved three villages namely Chiwale, Mkwapa and Kivukoni out of five villages adjacent to Chiwale General Land Forest. The forest covers a total area of 1513 ha and it is located between latitudes 10^0 and 12^0 to the South of the equator and between longitudes 36^0 and 38^0 East of Greenwich at altitudes between 750 – 930 meters

above sea level west of Masasi Township. The forest is open access covered by miombo woodland (MTEP, 2007).

3.1.2 Climate

Prevailing winds are the critical determinant factors for change of climate in Masasi District. The rainy season starts from December to April. The peak is usually reached in January, but occasionally in March or April. The total amount of annual rainfall tends to vary with altitude. The rains vary from 893mm at Masasi Town to 832mm at Lukwika village; the mean annual rainfall is 900mm. The District average temperature is 25^0C while the highest temperature is 32^0C and the lowest temperature is 22^0C (MTEP, 2007).

3.1.3 Vegetation

Chiwale General Land Forest is rich in natural tree species referred to as Miombo woodland, which is characterized by dominance of *Brachystegia spp.* and *Julbernadia spp*, despite that in some places various tree species, bamboo and grasses are found. However, natural vegetation cover has decreased in most parts due to human activities especially tree felling, wreck, bush fires, new settlement establishment, shifting cultivation (slush and burn), as well as charcoal production which is a common practice. Exotic/alien tree species have been planted in various areas in parts of the villages. These include mangoes, oranges, cashew nut trees, *Sena siamea*, Neem trees, Sclerocarya, Chrismas tree (*Delonixregia*) and Leucaena (MTEP, 2007).

3.1.4 Soil

Soil of most parts of the area is sandy loam and in other areas sand clay soils are predominant. Areas within river valleys are dominated by blackish sand loamy soils. The areas within flood plains are dominated by blackish sand loamy soils.

3.1.5 Population and economic activities

According to district population projections conducted in 2009 it was estimated the three villagers to have a population of 2739 out of 355 318 district population. The population growth rate is 2.1 percent against the national average of 1.4 percent as per population projection (URT, 2003). The main economic activities of the people in Chiwale is agriculture, charcoal making, weaving and selling various forest products so as to supplement their daily livelihoods. Timbers are also illegally logged from the forest.

3.2 Research Design

The study was carried out using a cross section research approach. This is the most common in survey research as it makes possible to ask questions and collect data at a single point in time (Kothari, 2004).

3.2.1 Sampling procedure and sample size

3.2.1.1 Sampling procedure

The overall objective of the study was to have a study sample which is sufficient and representative of the required population. Three out of five villages surrounding Chiwale General Land Forest were purposively selected based on their accessibility and proximity to the forest. A simple random sampling technique was used to select respondent households in the study villages. Sampling frame was drawn from an updated list of

household register found in the hamlet/village. Thirty responents in each village were interviewed.

3.2.1.2 Sample size

According to Boyd *et al.* (1981), recommended a sample size of five percent of the total population to be used to form a sample. A 5 % of total population should not be less than 30 ($X \geq 30$). Studies from other researchers have suggested the same sample size to be used. According to a rule of thumb says that for doing analysis of variance you will need 30 units, if data collected do not have at least 30 respondents, then the data could be unstable. Sample size of 30 is the "magical" number is due to this being a large enough sample for the Central Limit Theorem to take effect. Regarding to Bailey (1994) who recommended a sampling intensity of at list 30 households is regarded as enough sample size (regardless of the population size) used in social science. From these recommendations the sample size selected in the study area was based on Bailey (1994)

Table 1: Sample size in the study area

Wards	Villages	Total household in the village	Required sample according to Boyd *et al.*(1981)	Sample size according to Bailey (1994)
Chiwale	Chiwale	1105	56	30

	Kivukoni	1082	54	30
Namatutwe	Mkwapa	550	30	30
Total		**2739**	**140**	**90**

So based on the total number of households (2739) in the three villages surveyed and sampling intensity of at least 5% appropriate sample size of 90 household in three villages was determined as shown in the Table above.

3.3 Data Collection

3.3.1 Reconnaissance survey

Prior to the actual data collection, a reconnaissance survey was conducted in the study area. This was considered very important because it enabled the researcher to introduce himself before respective village leaders, pre-testing measuring instruments and to get a general picture and familiarizing with the study area. Two households were selected randomly from two villages surrounding the study area and the results were used to modify the questionnaire to fit the actual conditions.

3.3.2 Actual data collection

Two types of data were collected from the study area namely primary and secondary data. Primary data were collected from the field through semi-structured questionnaires and market survey. Checklists for Key informants interview, Focus Group Discussion and Direct observations were used in order to allow cross checking the collected information (triangulation) (Olsen, 2004). The data collected included different NTFPs extracted;

quantity of NTFPs extracted annually, total income obtained per year from NTFPS extraction and factors influencing extraction and use of NTFPs in the study area.

Secondary data were data obtained from the district Natural Resources Department records in the study area. Furthermore, publications, journals, books and electronic databases were accessed through SUA National Agricultural Library and other local libraries e.g. Masasi district library. These data were used to supplement the primary data, by extracting information on what has been done in relation to NTFPs and trade.

3.3.2.1 Questionnaire survey

Structured and semi structured questionnaires with closed and open-ended questions (Appendix) were used to collect socio-economic information from respondents. The information collected involved data on diversity of NTFPs extracted, used and sold, costs, parts used, season of collection, quantity of NTFPs gathered and other market information. With open-ended questions respondents were free to give their own answers and maximum discussion was encouraged. For closed-ended questions a number of alternative answers were provided for respondents to make selection. This two-sided approach (closed and open ended questions) aimed at obtaining clearly focused responses while at the same time deriving reasons and supporting arguments.

3.3.2.2 Focus group discussion

Focused group discussions were employed to encourage collective response of different opinions about specific NTFPs. The study focused on age groups and gender of respondent regarding involvement on use and extraction of NTFPs. The focused group discussions comprised 10 people with experience on NTFPs, different age classes but dominantly those with more than 30 years in the study villages to give information on

NTFPs. This assisted the researcher to gather gender associated information on collection and use of NTFPs. This number of people involved in focused group discussion is consistent with the proposed nunber of 7-10 in Lusambo (2009).

3.3.2.3 Key informants interview

Key informants included three village leaders, two natural resource commetee membes and three elders were asked to provide more information in relation to different types of NTFPs utilized and quantities extracted from the forest. Similarly, traditional healers with greater knowledge on the issue to be discussed were consulted to give additional information on types and parts of plants species used as medicine as well as ailments they cure. Check list was designed and used to collect these informations.

3.3.2.4 Market survey

During market survey, information on market price, how prices change across seasons, market capacity and quantities of different NTFPs that reach in the market was collected. Types, prices, and amounts of NTFPs supplied and sold at the market were recorded. Total sales per year were also determined so as to obtain the total income. This was done at Markets and households located in the study area where NTFPs from Chiwale General Land Forest were traded. Sellers and buyers of NTFPs were interviewed to give the average amount of the products sold/purchased per day. The amount of these products were determined by converting the local measuring units to conventional units like kilogram. The market chain information was also collected linked to markets, and actors in the trade were made through questionnaire.

3.4 Data Analysis

Data collected through household survey was coded and analysed using Statistical Package for Social Sciences (SPSS) where qualitative and quantitative variables were analysed.

3.4.1 Qualitative data

Content analysis method was used to analyze in detail the component of verbal discussions which were held with different respondents through focused group discussion and key informants.

3.4.2 Quantitative data

Data collected from semi structured questionnaires was summarized, edited, corded and analyzed using the Statistical Package for Social Sciences (SPSS) computer programme to generate quantitative statistics. Descriptive statistics for example frequencies, percentages and means were computed. Inferential analysis was conducted to show the relationship between NTFPs collected and social economic factors which include age, education level, household size, residence duration, distance from the forest and occupation. Multiple regressions model below was used to determine relationship between dependencies of social economic factors on NTFPs

$$Y= A+B_1X_1 +B_2X_2 +B_3X_3 +B_4X_4 + B_5X_5\ldots+ B_nX_n+\varepsilon i \quad \ldots\ldots(1)$$

Where: Y= Dependent variable, (Quantity of NTFPs)

Xs= independent variables (Social economic factors),

A= Constant, Bs= Regression Coefficients, εi= Random Error.

3.4.3 Valuation of NTFPs

Data on quantities (*Q*) of each NTFPs collected through market survey was converted to conventional units (e.g. kilogram).

The value of each NTFP was obtained by multiplying the average market price of each product by its quantity using the formula below.

V= Q x P……..(2)

Where;

V= Gross Value,

Q= Quantity of NTFPs,

P= Price of the product.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Characteristics of Respondents

4.1.1 Gender

The distribution of NTFPs collector's and sellers in the study area was approximately equally by gender but dominated by male. Table 3 indicates 51.1% respondent of NTFPS users were male while 48.9% were female which show no big variation on NTFPs collection between man and woman.

Table 2: Percentage distribution of respondent by sex in the study area

Gender	**% of responses**
Male	51.1
Female	48.9
Total	**100.0**

Various studies have been done concerning gender involved in NTFPs collections which have revealed that collection of forest products at the household level entails a set of gender roles played by both men and women (Kajembe *et al.,* 2000). Mhapa (2011) observed that in Njombe District male respondents were dominant in collection, processing, transportation and marketing of NTFPs. Robinson and Kajembe (2009) reported from studies conducted in Nguru South Mountain in Morogoro that bush meat, honey, udaha (black pepper), charcoal, poles and ropes are collected by male. Research in Meatu District, Tanzania discovered that collection, processing and sale of forest vegetables and fruits (NTFPs of low quality) were done by women while men sold high

valued products like honey and medicinal plants due to their ability to travel for the products (Kagya, 2002). Katani (1999) examined that, in Mwanza District firewood and wild foods (fruits and vegetables) are collected from the forest by women. Hence women are knowledgeable about tree species suitable for fuel wood, vegetables and fruits. On the other hand, men are responsible for the collection of fodder for livestock; hence men were knowledgeable with different fodder plants for different animals.

This trend has also been observed in Zimbabwe, where it was reported that a significant difference across gender exists in terms of different resource demands (Campbel *et al.*, 1991). Fernandez (1994), reported that both women's and men's generation, adaptation and use of knowledge and technology are shaped by the economic, social, cultural, political and geographical contexts in which the two sexes live, but which each (gender) experiences in a different way. In the villages of Gumla, Hazaribagh and Simdega districts of Jharkhand, India women were reported to be the main collectors, processors and marketing agents of NTFPs (Gharai and Chakrabarti, 2009). This implies that NTFPs collection and trading in Chiwale General Land Forest is slightly dominated by male which might be caused by female involved in other activities which provides less participation of female in NTFPs collection and man have sufficient time and ability to follow NTFPs over distance while woman are involved in trading and processing of NTFPs.

4.1.2 Education level

In this research the results revealed that 77.8% of respondents have attained primary levels of education, 2.2% attained secondary school education and 20% have not attended

even a formal education (Table 4). Thus most of the NTFPs collectors and traders in CGLF have attained a primary education and are not employed by formal sectors. The majority are also involved in agriculture, NTFPs collection and trading during off seasons. This could be implying that collecting and trading NTFPs in CGLF is influenced by most of villagers who have not attended further formal education and lack employment in formal sector.

Table 3: Percentage distribution of education level of respondents in the study area

Education level	**% response (n)**
Secondary education	2.2 (2)
Primary education	77.8 (70)
None	20.0 (18)
Total	**100.0 (90)**

The education level of rural Africans can influence their reliance on NTFP trading or producing. Kamanga *et al*. (2009) found that households in Africa with higher education levels generally have more reliable sources of income opportunities and generally wider asset bases. In a more specific survey of African NTFP producers, Arnold *et al*.,(1994) found that half of the respondents involved in grass, cane, and bamboo enterprises had no education, while most of the rest had only primary education and those owning forest products trade enterprises were only slightly better educated. "In contrast, very few woodworking proprietors had no education and more than a third had qualifications beyond the primary level". Paulo (2007), observed that increase in education level decreases significantly extraction of wild vegetables, wild mushrooms, medicinal plants and poles in Kilwa District. Kilonzo (2009), noted that increase in education level especially that of secondary level, decreases significantly extraction of bush meat, wild

fruits, wild vegetables, honey, poles, wild mushrooms, firewood and medicinal plants. Skills and education increase working efficiency and productivity, making households with more educated heads more entitled to income and food (Mhinte, 2000; Mhapa, 2011).

4.1.3 Marital status

In the study area majority (88.9%) of NTFPs collectors and traders were married, followed by 6.7 % who were widow and single 4.4 % (Table 5). This implies that NTFPs collectors and traders in CGLF were married thus NTFPs was important for sustaining households' income.

Table 4: Percentage distribution of marital status of respondents in the study area

Marital status	**% responses (n)**
Married	88.9 (80)
Single	4.4 (4)
Widow	6.7 (6)
Total	**100.0 (90)**

Married families' result into increase of the size of the family which increases the demand of various resources. The dominance of the married in NTFPs collection and trade has been reported by various Africa researchers. In Southern Nigeria 34% of the male NTFPs dealers (marketing inclusive) were single, 65% of them were married while 16% of the female were single, 84% of them were married (Egbule and Omolola, 2005). Mhapa (2011), reported in Njombe District – Iringa (83%) of NTFPs collectors and traders were married, followed by 11% who were single, widowed 4percent and divorced 2 %.This probably results from the fact that collecting and trading of NTFPs adds premium income

to the household economy in both villages which makes all groups of people in the community to engage in collection of NTFPs.

4.1.4 Occupation of respondents

In the study area majority (97.8%) of NTFPs collectors and traders were farmers who their main economic activities are crop farming and NTFPs collection during agriculture off seasons. Employed and jobless contributes about 1.1 percent (Table 6). This means that NTFPs collectors and traders in CGLF were farmers thus NTFPs was important for sustaining households' income to farmers.

Table 5: Percentage distribution of occupation status of respondents in the study area

Occupation	**% response (n)**
Farmer	97.8(98)
Employed	1.1 (1)
Jobless	1.1(1)
Total	**100.0(90)**

According to the survey conducted from the study area, farmers were the main collectors of NTFPs. This imply that most Tanzanians are being involved in NTFPs activities simply because they are of great value to them. A study conducted in Kilosa District by Nduwamungu (2001) reported farming as the economic mainstay of rural people.

4.1.5 Age group category

About 52.2% of NTFPs collectors and traders in the study area were aged between 18-35 years, followed by 25.6% who were above 46 years and 22.2% were aged between 36-45 years (Table 7). This means that the youth aged group was dominating collection and trading of NTFPs. This could probably have been influenced by being energetic,

commitment of societal developmental needs, lack of formal employment, lack of basic entrepreneurship capital and NTFPs in the study area are regarded as common pool resources which can be accessed freely by any one.

Table 6: Percentage distribution of age group category of respondents in the study area

Age category	**% response (n)**
Youth (18-35)	52.2 (47)
Adult (36-45)	32.2(30)
Elders (above 46)	25.6 (23)
Total	**100.0 (90)**

Mhapa (2011) observed that, about 55% of NTFPs collectors and traders in Njombe District were aged between 30-50 years. Kilonzo (2009) in Nyanganje forest reserve observed that collection of wild vegetable, honey and poles decrease as one moves from age class 18-30 years, through age class 30-60 years, to the age class above 60 years. These results imply that adults have a lot of experience on sources of wild vegetable, honey and pole species and are able to distinguish between poisonous and non-poisonous species of wild vegetables. Shackleton and Shackleton (2004) in South Africa found that *Marula* beer and brush (NTFPs) traders were less than 35 years, although some older women were involved. The age range for bamboo traders among interviewees in Ethiopia was 16 – 51 years (Andargatchew, 2008). The results from this study imply that most of the respondents are young people who are active and can walk long distances and extract most of NTFPs to secure household food security, primary health care and cash income.

4.1.6 Economic activities contributing to household income of villagers surrounding CGLF

In the context of this study, economic activities contributing to income generation have been grouped into four categories namely agriculture, business, and livestock and NTFPs collection (Fig. 1). Agriculture as main economic activity which contribute about 75% of household income, NTFPs contribute about 11% of household income per year higher than the value estimated by census statistics which is estimated to be 5 % (NBS, 2007). Business and trading of other items contribute about 10% and livestock keeping contribute about 4percent to household income per annum. The results might be reflecting to most respondents are primary educated who lack formal employment therefore engaging in agriculture as the main income generating activity. NTFPs collection and trading is done to supplement agriculture income as NTFPs are common pool resources which can be accessed by everyone in the village.

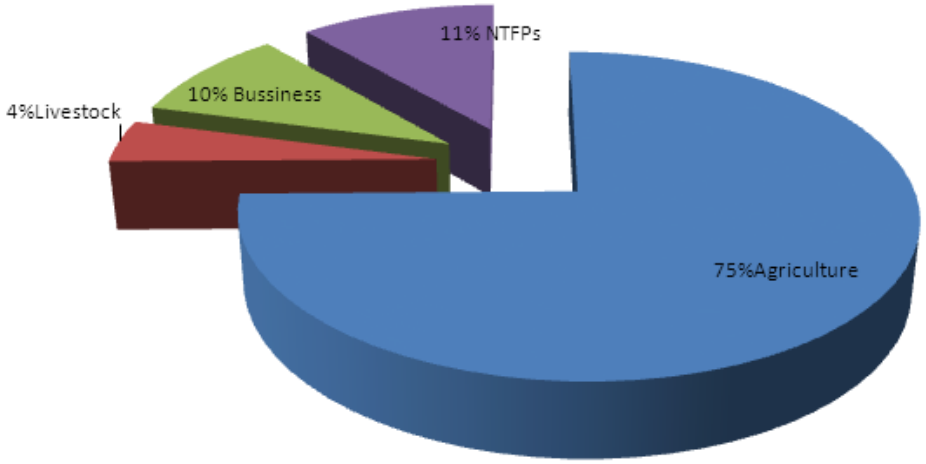

Figure 2: Percentage share of main income sources of respondents in villages around CGLF

Other researchers have observed various contributions of NTFPs on household income. Robison and Kajembe (2009), reported NTFP value accounted for an average of 12% of household annual wealth surveyed in villages around Nguru forest Morogoro. Schaafsma *et al.* (2011), observed NTFPs contribute about 13% to household income in Eastern Arc Mountains (Morogoro and Tanga). The two observations are higher than that estimated by census statistics (NBS 2007), which is around 5percent, and may be a reflection of the proximity of our sample households to forest areas. Mhapa (2011) observed that only 2percent relied on sole NTFPs trade for income generation in Njombe Township less than that observed by NBS on contribution of NTFPs.

4.2. Category of Valuable NTFPs Collected from CGLF

4.2.1 NTFPs identified through household interview

Communities around Chiwale General Land Forest seem to extract variety of NTFPs throughout the year for their daily subsistence and income generation. These products are collected from the general land forests, farmlands and woodlands. From household questionnaires NTFPs extracted from the forest werecategorized into 6 major groups, as per Table 8.

Table 7: Catergory of NTFPs collected by communities around CGLF, Masasi-Mtwara, Tanzania

NTFPs	**% response (n)**
Firewood	97.7(88)
Bamboo	61.1(55)
Poles	42.2(38)
Thatch grass	72.2(65)
Fruits	3.3 (3)
Charcoal	5.6 (5)

4.2.1.1 Firewood

Firewood is the major source of energy in most rural areas in subsaharan Africa used for cooking and heating. In this study, 97.7% of respondents are involved in firewood collection which is the main source of energey used for cooking, heating and bricksburning. Bricks are usually dried using firewood and thus, this increases firewood consumption in the study area. This could probably be due to the reasons that firewood is the only cheaper, available and affordable primary source of energy in this area. Lusambo (2009) reported that Tanzanian energy balance is dominated by biomass-based fuels, particularly wood fuel (firewood and charcoal) which account for > 90% of primary energy supply. In sub Saharan countries fire wood is the main source of energy which accounts over 85% of population in Namibia, 90% of population in Malawi, 70% of population in Zambia and 80% of population in Mozambique (Mogaka *et al.*, 2001).

Schaafsma *et al.* (2011) reported that, about 95% of respondents in Eastern arc forest are involved in firewood collection and use. Kilonzo (2009) observed that 94% of respondents around Nyanganje Forest Reserve in Morogoro are involved in firewood collection and use. Msemwa (2007), scrutinized that 98% of households surveyed in Kilosa District used firewood in their homes as primary energy source. Abdallah (2001) found that about 84% of the population in Tabora Rural District depend on firewood as a source of energy for cooking and heating at household level. From these results it is oviously that demand for firewood as a primary source of energy at household level in Tanzania is high. From enterviewed respondents the amount of firewood was for just domestic consumption defferent from that reported by Msemwa (2007), and Kilonzo (2009) in Kilosa district and Nyanganje Forest reserve where it was observed that collected firewood were also sold.

Findings from this study identified few similar tree species used for firewood identified by Kilonzo (2009) like *Burkea africana, Brachystegia bussei, Pseudolachnostylis maprouneifolia, Dalbergia melanoxylon.* Bevan (2003) in Nachingwea identified also few similar tree species used for firewood like *Pseudolachnostylis maprouneifolia, Dalbergia melanoxylon and* "Msimbiti" identified in local name. These are mostly used due to their high calorific value, less ash and have less smock which can impare its uses. From this study various tree species were identified as mainly used for fire wood during focus group disscusion,among the tree species are listed below in Table 9.

Table 8: Tree species in CGLF Masasi Mtwara used for fire wood

Local name	**Botanical name**
Mpindimbi	*Vitex doniana*
Mpande	*Millettia stuhlmannia*
Mchejesya	*Crosspteryx febrifuga*
Mnepa	*Pseudolachnostlylist spp*
Mkarati	*Burkea africana*
Mpingo	*Dalbergia melanoxylon*
Mtomoni	*Diplorhynchus mossambicensis*
Msolo	*Pseudolachnostylis maprouneifolia*
Mtanga	*Albizia verscolor*
Mchenga, Mtondo	*Julbernardia globiflora*
Myombo	*Brachystagia bussei*
Mbambakofi	*Afzelia quanzensis*

4.2.1.2 Bamboo

Bamboo poles, were found to be the most used materials for house construction and artisarnal activities in the surveyed villages. About 61.1% of the respondents in the study area are engaged in bamboo collection. The results show larger average use of bamboo

probably due to that bamboo poles are cheaper, available and can be used to produce a wide range of artisans items like woven baskets, mats, harvesting, drying, winnowing basket *(nyungo)*, large carrying baskets (*tenga*), and storing agricultural produce (*vihenge*). Also bamboos are used by rural communities in the study area for houses construction, roofing and fencing. Diversity of products obtained from Bamboo as NTFP have attracted most communities in the study area to engage in collection and use of bamboo. Ingram *et al.* (2010), reported 77% of NTFPs collectors in Cameroon are involved in Bamboo collection and use, (51%) of bamboo are harvest throughout the year, (44%) harvested only in the dry season while 5percent harvested in the rainy season only. These shows significant contribution of bamboo sector in household income and provide employment through selling bamboo products.

The bamboo species commonly harvested in a study area and used in construction and artisan activities is the low land bamboo *(Oxytenanthera abyssinica).* Msemwa (2007), and Kilonzo (2009) in Kilosa District and in Nyanganje Forest Reserve mentioned a similar bamboo species used for construction.

4.2.1.3 Poles

Building poles were found notto bemostly used as construction materials under the study perhaps due to most of houses in the study area were built by using bricks and bamboo used for roofing and fancing. About 42.2% of the respondents in the study area collects and use poles for bulding porpuses. The results are different to those reported by Kilonzo (2009), who observed that 91% of respondent were involved in pole collection in Nyanganje Forest Reserve. Paulo (2007), also observed that 97% of the respondents in Kilwa District are involved in poles collection. The variation in poles utilization could

probably be due to the difference in number of poles consumed domestically. In the study area it was found that 10 poles are extracted per household per year. This differs from other researchers who observed that 500 poles can be used to construct a three rooms house in Nyanganje forest reserve Morogoro (Kilonzo, 2009). Rovero (2007), observed that 600 poles can be used to construct a two rooms house in Mazumbai, Tanga, Tanzania. The difference might be due toavailability of alternative construction materials (bricks and bamboo), size and design houses constructed.

Findings from this study identified the most used tree species as poles to be: *Pseudolachnostylis maprouneifolia* (msolo), Msimbiti, *Dalbergia melanoxylon* (mpingo), *Millettia stuhlmannia* (mpande), *Pterocarpus angolensis* (mtumbati) *and* mseva. Kilonzo (2009) identified few similar tree species like *Brachystegia bussei, Combretum adenogonium, Dalbergia melanoxylon, Uapaca nitida* andbamboo species such as *Oxytenanthera abyssinica* to be highly favoured for poles in making permanent houses, because of their durability, straightness, length and resistance to insect damage as perceived by local people in Nyanganje Forest Reserve. From this study other tree species that were identified to be used for poles from focus group discussions are listed below.

Table 9: Tree species in CGLF Masasi Mtwara used for poles

Local name	**Botanical name**
Mpingo	*Dalbergia melanoxylon*
Mpande	*Millettia stuhlmannia*
Mgungu	*Acacia polycantha*
Mwanzi	*Oxytenanthera abyssinica*
Mtumbati	*Pterocarpus angolensis*
Mbambakofi	*Afzelia quanzesis*
Msolo	*Pseudolachnostylis maprouneifoli*

4.2.1.4 Thatch grasses

Thatch grass were found to be the most used materials for roofing, fencing, traditional rural housing and animal pens. About 72.2% of the respondents in the study area are engaged in thatch grass collection. Schaafsma *et al.* (2011) observed that 734 bundles of thatch grass are harvested in EAM per annum. Result of the study demonstrate that demand for thatch grass in the study area is high probably because they are cheaper, available and affordable resource that can be accessed by even poor community members and mainly collected for consumption purposes and contributes to non‐cash household income. The common thatch grass species collected in the study area are *Hyparrhenia rufa* which is mostly demanded by the community because are long enough, cheaper and available close to or in the villages. Other types are *raphia species* (palm leaves) and sedges collected in flood plain of forest.

4.2.1.5 Wild fruits

In the study area fruits were observed to be collected on seasonal bases by children or both male and female especially during food shortage periods. Results from this study observed that 3.3 % of respondents in the study area utilize wild fruits to sustain main food specifically during starvation otherwise are collected in small quantity by both family normal for home consuption. The results indicatesfew families are involved in wildfruit collection different from those reported by other researchers. Kilonzo (2009), who observed that 85% of respondents interviewed in Nyanganje Forest reserve, Morogoro reported to collect and utilize wild fruits as main food during famine. Mapolu (2002), noted that almost all (99%) of the respondents in Tabora District utilize wild fruits as a bite. The difference can probably be caused by fewwild fruit species richness in

the study area and inadequate knowledge on the edibility of wild fruits. Presence of variety of cultivated fruits discourage collection of wild fruits.

The fruits harvested from CGLF that were frequency mentioned include: -*Syzygium cuminii* (Zambarau), *Adansonia digitata* (Ubuyu), *Tamarindus indica* (ukwaju), *Schererocarya birea* (embe ng`ongo pori) and *Annona senegalensis (*mtope mwitu). Other tree species identified during focus group discussion named in their local names include Nachipondo, Nakasonga, Msakalawe, Mpindimbi and Mpulukututu. Similarly, Monela (2000), in miombo woodland mentioned few similar fruits species like those identified in the study area.

4.2.1.6 Charcoal

Charcoal is the single largest source of household energy in urban areas, as it is considered cheap and easy to transport, distribute, and store (Christian, 2009). Results from this study observed that 5.6 % of respondents are involved in charcoal making. Kaale *et al.*(2000) observed that, at least 300 bags of charcoal leave the forest daily, which suggests a total of 9000 bags or more are produced per month from Coastal areas to Dar es Salaam. Total annual charcoal consumption in Tanzania is estimated at 1 million tons, and annual supply of wood needed for this is estimated at 30 million cubic meters. It is estimated that as many as 160 000 earth kilns are used each year, or 438 per day to meet such demand (Christian, 2009). In the study area results demonstrate that few respondents are involved in charcoal production perhaps due to that 97% of the residences in the study area use fire wood as the main source of fuel for cooking and heating. Few respondents involved in charcoal collection specifically during land clearing for agriculture where charcoal is produced from logs remaining in the farm. Commercial

charcoal production is discouraged by bad market condition in the study area as civil workers are the main client for charcoal in the study areas.

From this study identified tree species used for charcoal making are *Julbernardia globiflora* (mchenga), *Pericopsis angolensis* (Mwanga), *Pseudolachnostylis mapronuneifolia* (Msolo) and other tree species identified by their local names like Mchejesya, Mjembe, Mseva and Mjanda. Bevan *et al.* (2003) identified few tree species in Nachingwea similar from this study.

4.2.2 Common NTFPs identified in CGLF through key informant interview

The common NTFPs identified during Key informants enterview were recoded and those which was commonly used by the local communities were metioned and presented as in the Table 11 below.

Table 10: List of NTFPs identified through Key informants

NTFPs	**% respondents**
Fire wood	94
Poles	41
Bamboo	59
That grasses	76
Charcoal	30
Honey	6
Wild meat	12
Medicinal plant	20
Mushroom	6
Ropes	6
Withies	6
Wild vegetable	12
Wild fruits	24

4.2.3 Common NTFPs identified in CGLF through focus group discussion

NTFPs identified from focus group discussions are presented in Table 12 and discussed in the following sub-sections.

Table 11: List of NTFPs identified through focus group discussions

Village name	**Non – timber forest products identified**
Chiwale	Fire wood
	Poles
	Bamboo
	Charcoal
	Mushroom
	Thatch grasses
	Honey
	Wild fruits
Mkwapa	Fire wood
	Poles
	Thatch grasses
	Charcoal
	Bamboo
	Medicinal plants
	Ropes
	Withies
	Wild fruits
	Wild vegetable
	Wild meat (rats, birds, hare, buffalo, common dike)
Kivukoni	withies
	Fire wood
	Poles
	Thatch grasses
	Charcoal
	Wild fruits

	Bamboo
	Ropes

4.2.1.7 Medicinal plants

In the study area the respondents interviewed were mostly not engaged in collecting and trading medicinal plants despite the product mentioned to be among the potential NTFPs for income generation and treating various ailments. This means that most of the populations in the study area are using modern medicines for their health care.

Results from traditional healers was observed to utilize medicinal plants like *Pseudolachnostylis maprouneifolia* (msolo), *Julbernardia globiflora* (mchenga), *Annona senegalensis* (mtope mwitu), *Diplorhynchus mossambicensis* (Mtomoni) and *Crosscephalum mannii* (mdaa) collected from roots, leaves, bark or both plant parts (Kilonzo, 2009; Kitula, 2007; Abdallah, 2001) observed relatedfew plant species and parts of plants used in Nyanganje Forest Reseve, New Dabaga Ulogombi Forest Reserve and Tabora Rural Districin Tanzania.

Identified medicinal plant species are used to treat various diseases like stomach pain, headache, hernia, heart diseases, eye diseases, loss of appetite, *degedege*, stroke, chest pain, pnemonia and crazyness. These herbalists were observed to earn an average of TZS 51 000 per annum and between TZS 3 000 to 20 000 per dose of single treatment for any disease. Herbalist were obseverd to collectan average of three bundles of medicinal plants per trip, the collection is done frequently within a week depending on availability of people attending treatment. An average of fourteen people are treated by herbalist per annum, the number of people treated per year seem to be smaller because most of the

villagers are treating their diseases at a nearby dispensary and others buy medicines from pharmacies in Masasi Township.

Table 12: Some tree species in CGLF Masasi Mtwara used for medicinal plants

Local name	Botanical name	Deaseses cured	Part of plant used	Price per dose (TAS)
Mshelisheli	*Artocarpus altilis*	Stomarch	Roots	3 000
Msolo	*Pseudolachnostylis maprouneifolia*	Maddness	Roots	20 000
Msolo	*Pseudolachnostylis maprouneifolia*	Hernia	Roots	5 000
Mtalala		Headech	Roots/leaves	10 000
Katatu/Sintatu		Witchcraft related deseases	roots	3 000
Nuvi		Hernia	Roots	5 000
Mtunda jiwe		Virus	Roots	5 000
Mchenga	*Julbernardia globiflora*	Stomarch	Roots	5 000
Mtomoni	*Diplorhynchus mossambicensis*	Hernia	Roots	5 000
Mnyawanyawa		Eye diseases	Roots	7 500
Mdaa	*Crosscephalum mannii*	Eye diseases (mtoto wa jicho)	roots	7 500
Msalanjasi		Heart diseases	Roots/ leaves	5 000

4.2.1.8 Wild meat

For people living in close proximity to forests, wild animals offer an important part of their diet; in some cases they supply the only animal proteins. The range of products consumed includes birds and their eggs, insects, rodent and other larger animals. The finding from this study discoveredthat few residents from the study area are involved in wild animal hunting as a source of protein for their families. This could be atributed by the fact that the forest is surounded or located near Lukwika/Lumesule and Misenjesi game reserves knowing that hunting near this area is illegal.

Results observed from focus group discussions mentioned some few species hunted in CGLF which include *Potamochoerus africanus* (wild pig), *Tragelaphus scriptus (*Ndandala/mbawala), *guena fowl (*kanga*), Papis cynocephalus (*ngedele/nyani), *Cephalophus natalensis (*Ngolombwe), *Syncerus caffer (*nyati) and rats. These animal species are similar to those observed by other researchers like (Kilonzo, 2009; Kajembe *et al.*,2000). The main hunters of wild animals were men.

Table 13: Some Animal species hunted in CGLF Masasi Mtwara

Sn	Local name	Botanical name	English name
1	Ngolombwe	*Cephalophus natalensis*	Duinker
2	Nyati	*Syncerus caffer*	Buffalo
3	Sungura	*Lepus canensis*	African hare
4	Ndandala/Mbawala	*Tragelaphus scriptus*	Bush buck
5	Ngedele/nyani	*Papis cynocephalus*	Yellow baboon
6	Nungunungu	*Hystrix cristata*	Pocupine
7	Nguluwepori	*Potamochoerus africanus*	Wild pig
8	Tembo	*Loxodanta africana*	Elephant

4.3 Quantity of key NTFPs collected from Chiwale General Land forest

The annual quantity of firewood collected per household was found to be 96 headloads. Therefore, a total of 8448 bundles of firewoodcollected annually from the forest. The average quantity of bamboo hervested per household per year was estimated to be 288 and a total of 15 840 bamboo headloads can be extracted annually. Results from this study have estimated the average amount of thatch grasses harvested in the forest per annum per household to be 216 bundles andtotal annual hervest was observed to be 14 040 bundles.Poles used per house hold in the study area per annum was estimated to10 poles per years.A total of 380 building poles can be extracted from the forest per year.

Average estimate of charcoal hervested per household per week was 23 bags which is equivalent to 1104 sacks of charcoal per year. The study showed that each household can collect an average of 1 kg of wild fruits per day during the season, an avarage of 90kgs can be collected per year per household. Therefore, a total of 270 kg of wild fruits are collected per year . The quantity of key NTFPs hervested from CGLF is shown in the table below.

Table 14: Quantity of key NTFPs collected from Chiwale General Land forest per year

NTFPs	Quantity	Number of Respondents (n=90)	Average Household collection per year	Collection pattern	Amount
Firewood (Head loads of 15 kgs)	8 448	88	96	Weekly	2 (25kg) Head load
Bamboo (head load of 15 peaces)	15 840	55	288	Weekly	6 Head loads
Poles (pole)	380	38	10	Annually	10 poles
Thatch grass(bundle)	14 040	65	216	Seasonal (6 month)	9 head load per week
Fruits (kgs)	270	3	90	Seasonal (3month)	1 kg per day
Charcoal (bags of 20kgs)	5 280	5	1 104	Weekly	23(25kg) bags

4.4 Monetary value of the NTFPs extracted from Chiwale General Land Forest

4.4.1 Firewood

Few households that were interviewed explained to purchase firewood. This is not surprising because all of the villages in study area were located relatively close to the forest and relatively distant from product markets. Socio economic studies conducted in three villages surrounding CGLF specified that one headload of firewood with an average of 15 kilogram is sold at a price of TZS 1000. and each household extract an average of two headload per week which is equivalent to 96 bundles of firewood per year.The annual value of firewood per household was found to be TZS 96 000. Therefore, a total of 8448 bundles of firewoodcollected annually from the forest is equivalent to TZS 8 448 000 (Table. 16). Schaafsma *et al.* (2011) observed that in the EAM, a total annual quantity of firewood collected is approximately 72 million head loads with annual values of TZS 16 000 to the annual household budget and the flow of benefits is in total TZS 36 billion per year (USD 25 million). Kilonzo (2009) observed that the headload of firewood weighing 20kg were sold at TZS 1000 at villages around Nyanganje Forest Reserve, Mhapa (2011) observed that a headload of firewood at Njombe were sold between 1000 to 2000 TZS at Ilembula and Makambako. It is estimated that over 5 million bundles of firewood are harvested yearly in the coastal areas with the market value of almost $ 750 000. Most of this is for subsistence use, with a very small proportion of the value realized in the form of cash income (Richmond *et al.,* 2002; Kaale *et al.,* 2000).

Maximillian (1998), observed the annual value of firewood in Northern Ruvu Forest Reserve, Kibaha District to be TZS 21 294 000 higher than the one observed in this study.

The differences may be explained by factors such as the market of firewood in kibaha township and Dar Es Salaam where there is high demandof firewood due to high cost of alternative sources of energy as well as level of household income.

4.4.2 Bamboo

Results have indicated that, a headload of bamboo (15 bamboo poles) is sold at a price of TZS 1000 per headload. This cost is low probably due to easy availability in a study area. An average headload of bamboo per household per year was 288 estimated at TZS 288,000. A total quantity of 15 840 bamboo headloads can be extracted from the forest annually with a value of about TZS 15 840 000 (Table 16).

The results show larger average use of bamboo probably due to bamboo poles being cheap and available NTFPs used for houses construction, roofing and fancing. Bamboo are alsoused by rural artisans to produce a range of woven baskets, mats, harvesting basket, drying, winnowing basket *(nyungo)*, large carrying baskets (*tenga*), and storing agricultural produce (*vihenge*). Winnowing basket *(nyungo)* in the study area was observed to be sold at TZS 1000.

Studies done by Masanja (2004), in coastal forests, observed that *Tenga* and winnowing baskets are sold at TZS 1000 and 1500 respectively in coastal towns which are not different from that observed in the study area. Ingram *et al.* (2010), reported that small scale bamboo collector in Cameroon can collect about 500 stems per year earning the average of 236 208 CFAF (USD 535.4) per year.

The findings on bamboo consumption per household per year in the study area was observed to be high which demonstrate that communities in the study area relay more on bamboo because they can probably produce a range of products, cheaper and availabe in adjacent forests.

4.4.3 Thatch grasses

The importance of dry grass for thatching cannot be overstated. Most houses in rural areas of Tanzania are of grass thatch. Dry grass is used for thatching buildings and making fences around compounds. Results from this study have estimated the average amount of thatch grasses harvested in the forest per annum per household to be 216 bundles sold at a price of TZS 500 per bundle with the annual value of TZS 108 000. A total of 14 040 thatch grass bundles can be extracted from the forest annually and estimated to a value of TZS 7 020 000 (Table 16). Demand for thatch grass in the study area is high because it is the main resource which is used as protective for roofing, fencing, traditional rural housing and animal pens and the most favored thatch grass is *Hyparrhenia rufa*. Thatch grass is an important seasonal source of income sold between villagers to assist those who are re-roofing or building new houses especially among poor families who cannot afford buying iron sheets. Thatch grass is seasonal collected between May and November. Masanja (2004) observed that grass is harvested in 50cm bundles, and very rarely sold for TZS. 200 – 500 per bundle in Rufiji and Bagamoyo, about 50 000 bundles of grass are harvested annually, this harvesting is estimated to be worth just over $ 5000 per year but is almost entire a subsistence value. Schaafsma *et al.* (2011), studied that in EAM thatch grass collection contributes to annual value with TZS 220 million (USD 0.16 million). High demand of thatch grass is influenced probably by lower financial position of the

communities in the study area. Thatch grass is commonly used in rural Tanzania for traditional constructions and roofing material because it is considered to be cheaper (Monela *et al.,* 2005).

4.4.4 Poles

Results from this study have indicated that,building pole estimated to be 10 kg is sold at a price of TZS 1000 per pole, an average of poles used per house hold in the study area per annum was 10 poleswith average annual value of TZS 10 000. It was observed that a total of 380 building poles can be extracted from the forest annually with the total value of TZS 380 000 (Table 16). The everage of poles used for construction per household yearly is lower comparedto results of other reseachers because in the study area houses are brickor bamboo pole constructed, roofed by bamboo poles and fances sorunding houses are bamboo or thatches built. Poles are used to stregthen coners of bamboo built houses or fances. The cost per pole is high probably due to most of these poles are sold to middlemans or clients from Masasi township who are selling or using for constructions.

Other reseachers have observed different quantity of poles used per household per annum, (Kilonzo, 2009; Lema, 2003), observed an average of 19 and 20 headloads of poles are used per household per year, in Morogoro Rural District and around Nyanganje Forest Reserve villages in Morogoro. Maximillian (1998), and Paulo (2007), reported 113 and 152 headloads of poles consumed per household per year in Kibaha and Kilwa District respectively. Masanja (2004), observed that the total net financial value (net value to households in terms of home consumption and cash income) of pole consumption is

estimated to be $9.2 million, or $575 per household per year in Coastal Forest (Rufiji and Bagamoyo) of which a large proportion is realized as cash income. Schaafsma *et al.* (2011), observed that pole collection in EAM Pole contributes around TZS 957 per capital with total annual quantity of 3.7 million poles, fetching a total value of TZS 2.2 billion per year. The findings on pole consumption per household per year show that local people in the study area probably do not rely very much on poles for construction rather than briks and bamboo.

A study done by Kilonzo(2009), in villages around Nyanganje Forest Reserve, Morogoro reported that annual present value of poles estimated to be about TZS 2,337,000 (USD 1 798). A study done by Msemwa (2007), in Kilosa District, Morogoro reported that the annual present value of poles estimated to be TZS 6.2 billion (USD 5.6 million). The value of poles from CGLF can be clarified by less quantity and value of poles harvested in CGLF is atributed with availability of alternative construction poles (bamboo) and bricks, also the location of the study area to the market limit more harvesting of poles.

4.4.5 Charcoal

Studies conducted in villages surrounding CGLF observed that a sack of charcaol with an average of 20 kilogram is sold at a price of TZS 2000 and each household extract an average of 23 bags per week which is equivalent to 1104 sacks of charcoal per year (Table 16). Charcoal can be made all the year around, but production increases dramatically during dry season and famine time, although less of it is made during farming seasons. Few households that were interviewed in study area purchase or use

charcoal because most of the villages locally collect firewood from adjacent forests. Bevan *et al.* (2003) estimated the price of a sack of charcoal at Nachingwea is sold between TZS 1000-1500 per sack of 20kgs, it is estimated that income from making charcoal is TZS 10 000 profit per month, this is greater than the income received from his four-acre shamba of cashew nuts which generates TZS 80 000 per year. The annual flow of benefits to charcoal producers in and around the EAM is 21 billion TZS per year (USD 15 million), Schaafsma *et al.* (2011). Low demand of charcoal is influenced probably by most communities in the study area use firewood as a source of fuel because it is cheaper and can be collected by everyone.

4.4.6 Wild fruits

The study showed that each household can collect an average of 1 kg of wild fruits per day during the season, an avarage of 90kgs can be collected per yearper household (Table.16), which can earn the amount of TZS 45 000. Therefore, a total of 270 kg of wild fruits are collected per year during the season which can pay the annual value of TZS 135 000.

This situation is different from other areas research on valuation of wild fruits. The study done by Kilonzo (2009) observed that wild fruits collected per year at Nyanganje is valued to TZS 654 500. Msemwa (2007), found that 44kgs of wild fruits are hervested per annum per household at Kilosa District Morogoro Region with the annual value of TZS 386. Mhapa (2011), conducted a research at Njombe district found that prices of wild fruit varies depending to locality and consumers' concentration example a tin of 20 liters volume was sold from TZS 2000 to 3000 at villages and TZS 6000-10 000 at town market. The lower value of wild fruit could be due to that most households do not

purchase wild fruits because all of the villages in the sample are located relatively close to the forest where every member can easily collect and are relatively located far from markets and low wild fruit knowledge on their species, edibility, processing and storage. Akinnifesi *et al*. (2005) found that wild fruits' prices varied with time of season (availability) and location which could have resulted from other market.

Table 15: Economic values of NTFPs collected in CGLF Masasi-Mtwara, Tanzania

NTFPs	**Quantity**	**Number Of Respondents (n=90)**	**Average Household collection**	**Average Price (TZS)**	**Actual Value (TZS)**
Firewood (Head loads of 15 kgs)	8 448	88	96	1 000.00	8 448 000.00
Bamboo (head load of 15 peaces)	15 840	55	288	1 000.00	15 840 000.00
Poles (pole)	380	38	10	1 000.00	380 000.00
Thatch grass(bundle)	14 040	65	216	500.00	7 020 000.00
Fruits (kgs)	270	3	90	500.00	135 000.00
Charcoal (bags of 20kgs)	5 280	5	1 104	2 000.00	10 560 000.00
Total					**42 383 000.00**

Non-Timber Forest Products are often a vital source of foreign exchange and revenues. They are also essential to the rural household's economy. Results from this study showed that estmated sample total income accrued from the forest from NTFPs activities is TZS 42,383,000 annually (Table 16). The estimated total income obtained from the forest for the population of CGLF communities was observed to ranges between 6 895 432 500 and 8 204 674500 TZS (Table 17). These values are what would have been paid or compensated if the local community around CGLF were to be denied access to such NTFPs.

Kilonzo (2009), observed that total income accrued from the forest from NTFPs activities at Nyanganje forest reserve was TZS 45 169 300 annually. Robison and Kajembe (2007), found the average value of NTFPs collected by villagers around South Nguru Mountain Morogoro per week was valued to TZS 580 (Tanzanian shillings), equivalent to TZS 30 200 per year. This different in the value of NTFPs can be attributed by financial position of villagers, availability of alternative resources to NTFPs available, forest management systems and forest accesibility. The increase of awereness to NTFPs increases the extraction rate per household, as people become aware of the economic contribution of NTFPs to their livelihood.

Table 16: Economic value of NTFPs used by population of CGLF

NTFPS	**% using NTFPs**		**Consumption intensity per household per annual**		**Total household consumption in the population (N=2739)**	**Average Price (TZS)**	**Value of each NTFP `000 TZS**
	Descriptive statistic (sample)	Inferential statistic i.e. 95% C.I (population)	Descriptive statistic (sample)	Inferential statistic i.e. 95% C.I (population)			
Firewood	97.7	96.96 - 97.03	96	92 - 100	251 988- 273 900	1 000	251 988-273 900
Bamboo	61.1	60.97- 61.23	288	278 - 298	761 442-816 222	1 000	761 442-816 222
Poles	42.2	42.0 - 42.36	10	1 - 22	2 739-60 258	1000	2 739 -60 258
Thatch grasses	72.2	72.09 - 72.31	261	201 - 231	550 539 -632 709	500	275 269.5-316 354.5
Fruits	3.3	3.1 - 3.5	90	80 - 100	219 120 -273 900	500	109 560-136 950
Charcoal	5.5	5.4 - 5.6	1104	1 003 - 1,205	2 747 217-3 300 495	2000	5 494 434-6 600 990
Total value of key NTFPs for CGLF population							**6 895 432.5 –8 204 674.5**

Formula used to get inferential statistics at 95% confidence interval was for percentage using NTFPs

$X \pm 1.96 \sqrt{pq/n}$ ……..(3)

Where X = Value from the sample, p= proportional using NTFPs, q= proportional not using NTFPs and n=sample size reported using the product

Formula used to get statistics at 95% confidence interval of consumption intensity per household per annum,

$X \pm 1.96\ s/\sqrt{n}$……...(4)

Where x= average household consumption per annum, s= standard deviation n=sample size reported using NTFPs

Formula used to calculate the total house hold consumption in the population was to multiply the population size of the villages (N) and inferential statistic i.e. 95% C.I (population) for consumption intensity per household per annum. The value of NTFPs was obtained by multiplying the average price of respective NTFPs and total household consumption in the population (N=2739). Total value of NTFPs was obtained by summation of individual values of NTFPs.

4.5 Socio-economic Factors Influencing Extraction of NTFPs in CGLF

Extraction of NTFPs for household consumption, primary health care and income generation is to some extent influenced by a number of socio-economic factors such as income level, age distribution, education level, household size, residence durationand distance from the forest as presented in Table 18 for multiple regression model belowand discussed in the following sub-sections.

Table 17: Multiple Regression Results

Variable	Beta	P-Value
Constant	652953.960	0.792NS
X1 (Sex of respondent 1=male; 2=female)	-0.587	0.006**
X2 (Age of head of household, years)	-0.0030	0.840NS
X3 (Education level of respondent)	0.634	0.004**
X4 (Marital status)	-0.072	0.612NS
X5 (Household size)	-0.764	0.002**
X6 (Total number of years of residence)	-0.24	0.862NS
X7 (Distance to the forest)	-0.069	0.585NS

Key: N = 90, R^2 = 0.933, R^2_{Adj} = 0.838, Model (ANOVA) significant at p<0.01, *= statistically significant at p < 0.05. ** =Statistically significant at p<0.01. *** = Statistically significant at p < 0.001. NS =Not Statistically significant

From the table above, it can be stated that some of the explanatory variables in the model were statistically significant. Looking at the R square, it is 0.933 expressed as percentage; it means that the model explains 93.3 % of the variance in collection of NTFPs. of all the variables included in the model, the contributions of each towards the dependent variable in order of magnitude of betas.

Sex of respondent was statistically significant at p <0.01various NTFPs collected from the forest are gender characteristic. Fernandez (1994), reported that both women's and men's generate adaptation and use of knowledge and technology are shaped by the economic, social, cultural, political and geographical contexts in which the two sexes live, but which each (gender) experiences in a different way.

Household size was observed to be statistically significant at ($p < 0.01$). This shows that increase in household size affect significantly the extraction of NTFPs. It was further revealed that, increase in household size from 1-6 members, increases collection of bush meat, wild fruits, wild mushrooms, poles and medicinal plants but the increase is not significant (Kilonzo, 2009). The implication of these results could be that increase in household size means that the population is gradually growing. A rapidly increasing population has a direct correlation with the exploitation of forest products for subsistence use, primary health care as well as for income generation.

Education level of respondent the higher the education level of respondent the less involved in NTFPs collection. In the study area most of respondent were primary educated contributing to engage in collection of NTFPs ($p < 0.01$). Paulo (2007), observed that increase in education level decreases significantly extraction of wild vegetables, wild mushrooms, medicinal plants and poles in Kilwa District. This indicates that the higher the education level of the respondent the higher per capital income due to high skills and opportunity successfully diversify into other more income generating activities.

Some of the explanatory variables in the model were statistically not significant like number of years of residence (0.862), age of head of household (0.840), marital status (0.612) and distance from the forest (0.585). The results from this model corroborate well with earlier findings from other related studies.

4.6 Current General Condition and Availability of NTFPs in Chiwale General Land Forest

Sixty percent (60%) of respondents reported that there is decreasing of NTFPs availability, the decrease of the resources is influenced by increase in population resulted to clearing of forest for agriculture,introduction of new housing and shifting cultivation. Studies also have shown collection of firewood, charcoal, poles, thatch, fruits, vegetables and medicines have increased their demand which in turn resulted to decrease of NTFPs (Luoga *et al.*, 2000; Turpie 2000; Anthon *et al*., 2008; Robinson and Lokina 2011). Chiesa *et al*., (2009) reported collection and extraction of fuel wood (charcoal and firewood) and building poles resulted by population increase are considered to be the main causes of deforestation and degradation causing loss of NTFPs diversity. Tewari (1994), reported increase in the demand for the forest based products have increased pressure on extraction of NTFPs in forests.

Table 18 : Showing general condition and availability of NTFPs in CGLFs

NTFPs status	**%Despondence (n)**
Decreasing	60(54)
Increasing	31(28)
Same/unchanged	9(8)
Total	**100(90)**

Decrease in forests have resulted on community spending a lot of time and walking longer distance searching for NTFPs as compared to the past ten years which has impacted on livelihood of the community specifically on food security and household income. Thirty one percent (31%) of the respondents reported that NTFPs resources are increasing. Probably these are respondents who are very proximal to the forest who can

extract enough NTFPs and recognize their economic contribution to their livelihood. Nine percent (8 percent) of the respondents who reported the NTFPs to being unchanged, argued that utilization of NTFPs is just supporting household consumption, and therefore people extract just enough to sustain their requirements.

4.7 Participation of household members in collection of NTFPs in CGLF

Results from this study indicated that collection of particular NTFPs can be done by either men, women , children or both family members as illustrated in the Table 20 below.

Table 19: Household member participation in main NTFPs collection from CGLF

Collector	**NTFPs (%)**					
	Firewood	**Bamboo**	**Poles**	**Thatch grass**	**Fruit**	**Charcoal**
Husband	(15.6)	(50)	(35.6)	(4.4)	(1.1)	(5.6)
Wife	(73.3)	(7.8)	(4.4)	(65.5)	-	-
Children	(1.1)	-	-	(1.1)	-	-
Both	(7.8)	(3.3)	(2.2)	(1.1)	(2.2)	-

Results of this study as shown in the table above indicate that men are the main collectors of NTFPs. Men are mostly involved in collecting bamboo, poles and charcoal. Poles and bamboo are widely used for constructionand artisans activities while charcoal are sold to increase household income. Women are responsible for collecting firewood as primary source of energy at household level and thatch grass used as roofing and constructions material. Children are sometimes involved in firewood and thatch grass collection. Fire wood, bamboo, poles, thatchgrass and fruits are NTFPs mostly collected by both family members in the study area. Kilonzo (2009), noted that men are involved in pole collection in Nyanganje Forest Reserve. Robinson and Kajembe (2009), observed that

men are mainly engaged in collection of poles and charcoal, womens collects firewood, fruits are collected by both men and women and childrens can sometimes be involved in NTFPs collection at Nguru South Mountains in Morogoro. Masanja (2004) studied that male are the main collectors and user of bamboo while women are the main collectors of thatch grass and sedge in Rufiji and Bagamoyo. Ingram *et al.* (2010), observed that 90% of bamboo collectors in Cameroon were male contributing about 18% of household income. Generally men have greater access to cash economy and often generation of cash is their primary activity.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The specific objectives of the study was to identify the main NTFPs extracted in Chiwale General Land forest, to estimate the quantity of NTFPs extracted in Chiwale General Land forest, to assess the monetary value of NTFPs extracted from the forest and to analyze factors influencing extraction of NTFPs in the study area. Generally various NTFPs were identified as most valuable resources to the communities of the study area. The most identified useful NTFPs were firewood, poles, charcoal, bamboo, thatch grasses and wild fruits. Other NTFPs mentioned through focus group discussions was medicinal plants, honey, mushroom, wild vegetable, ropes, withies and bush meat. These NTFPs are among useful forest products to the communities adjacent the Chiwale general land forest in Masasi district. Recognizing the contribution of NTFPs to household income around CGLF has increased extraction of the mentioned products, though these products does not contribute to cash household income rather than direct consumption. Increase in population has also resulted to decrease in availability of NTFPs compared to the past ten years. Recently community members have to walk long distance to collect NTFPs which also have contributed to less of it collected except those family living proximity to the forest that collect to maximum.

Results from this study clearly indicated that education level, respondent's sex and household size of respondents was statistically significant at $p< 0.01$. This determines the degree to which the communities engage in NTFPs extraction and use. Although some social economic factors like age of household heard, occupation, marital status, distance

from the forest and total year of residence in the study area were not statistically significant. It was observed that R2 was 93.3 % of the variance in collection of NTFPs.

It was observed that the annual values from different NTFPs accrued annually from firewood was TZS 8 448 000, bamboo TZS 15 480 000 poles TZS 380 000, wild fruits TZS 135 000, that grasses TZS 7 020 000 and charcoal TZS 10 560 000. It was observed that the value accrued by the population from NTFPs range between 6 895 432 500 and 8, 204 674 500. These are the values that can be obtained from the forest if these resources were sold in terms of money. Therefore, CGLF has valuable NTFPs which contribute to monetary value, use value and non use value to community adjacent the forest; therefore district government should take measures to plan for sustainable management of the forest due to its valuable NTFPs.

5.2 Recommendations

Based on the quantity and monetary value of non-timber forest products used by local communities in a study area, the following recommendations should be addressed to fill the gaps observed in this study to the communities living around the forest: -

i. Forest and NTFPs conservation plans should be addressed in the study area in order that resources are used in a sustainable manner, the study recommends the district and village council to introduce PFM and tree planting programme for advantageous NTFPs around villager's home stead to reduce pressure in the forest for sustainable forest management.

ii. Also it is recommended that inventory should be conducted in the same forest (as it was not done in this study) to identify more valuable NTFPs and acquiring local knowledge of NTFPs from the communities around the forest to be used by

extension officers and forest stakeholders to add NTFPs knowledge to other forest users.

iii. From the study it is recommended that forest based micro enterprises should be advocated by district government to empower traditional artisans and woman as main NTFPs stakeholders, solve constraints related to markets of NTFPs products, and do more training on new technologies, financial accessibility and introduction to more market niches. This regards to NTFPs product in the study area was observed to contribute more on non monetary value rather than monetary value to communities adjacent the forest.

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APPENDICES

Appendix 1:**Household survey questionnaires**

Section A: Background information

Village---------- Ward ----------

Household's identification number---------- Division ----------

Date ----------

1. Name of household head (Optional) ----------
2. Gender 01. Male---------- 02. Female----------
3. Age of a household head----------years
4. Education level of the respondent? 01.university and college 02.Secondary level 03. Primary level 04. Adult education 05. None
5. Occupation: 01. Employed 02. Farmer 03. Fisherman 04. Business 05. Jobless
6. Marital status: 01. Single 02. Married 03. Widowed 04. Divorced
7. Household size (number of people in household)

Age	Male	Female
< 18 years		
18-55		
>55 years		

8. What is your major sources of income? 01.Crop farming activities 02.Livestock keeping activities 03.Employment 04. Business 05. Others (specify)----------
9. What are main sources of food in the household? 01. Own produce from agriculture 02. Purchase from market 03. Gathering from the wild
10. How much did you earn for the last season (last 12 months) from each source above?

Soure	Quantity (last season)	Unit	Price per unit (Tshs)	Total earnings (Tshs)
Own produce from agriculture				
Purchase from market				
Gathering from the wild				
Other sources				

Section B: Availabilility and utilization of NTFPs in the village

1. Which year did you start residing in this village? ----------

2. What is the current availability of NTFPs compared to the past ten years time? 01. Decreasing 02. Increasing 03. Same/Unchanged

3. How far is the forest from which the NTFPs are collected? ----------(km)

4. Do you use bush meat? 01. Yes 02. No

If yes, what types of species of animals did you hunt for the last 12 months?

Species	Quantity last 12 months

5. Do you collect/use NTFPs? 01. Yes 02. N0

If yes, what types of non-timber forest products do you collect? ----------

NTFPs	Collected by whom*	Collected where	Frequency of collection	Quantity collected	Time spent collecting	Costs involved in collection

*1.Husband 2. Wife 3. Children 4. Both

6. For each type collected, answer the questions in the table below

Product	Enough for a meal	Enough for a day	Enough for two days	As much as possible
Firewood				
Honey				
Wild mushrooms				
Wild fruits				
Wild vegetables				
Wild animals				
Bamboo				
Raffia				
Charcoal				
Others				

7. Do you use medicinal plants? 01. Yes 02. No

If yes, fill in the table below

Local name	Botanical name	Part used			Disease(s) cured
		Leave	Bark	Root	

8.What are the major sources of income (or livelihood activities) for your household for the past twelve months (12 months)?

Income source	**Gross income per year (Tshs)**

9. Do you sell NTFPs collected? 01. Yes 02. No

10. If yes fill the table below

Source of NTFPs	Quantity collected	Units	Price per unit of product (Tsh)	Total income (Tshs)	Frequency of collection of NFTP

11. Out of the money earned from above, how much was used to buy food items for the past 12 months? ---------- Tshs.

12. What were the uses of the rest of money? ----------

13. What factors make you go for collection of NTFPs?

i.----------ii.----------

--------iii.----------iv.----------

14. What constraints do you face when you use NTFPs in this village (tick all that apply)?

(a) Restrictited by village government leaders

(b) Nearby forests are reserved forests

(c) There are enermy animals in the forest

(d) There is scarcity of NTFPs

15. Are there available markets for NTFPs in the village or nearby towns? 1. Yes 2. No

17. Who are the main buyers of NTFPs in the village? 1. Villagers 2. Middlemen from town

Section C: NTFPs preservations

1. Are you preserving NTFPs? 0. yes 02. No

2. If yes, why do you preserve them? 01. To use during shortage 02. For sale 03. Others (specify)----------

3. How do you preserve? 01. Sun dry 02. Smoking 03. Others (specify)

Thank you for your co-operation

Appendix 2: Focus group discussion

(a) What social services and infrastructure are available in the village?----------

(b) What are the different groups of people that deal with collection and use of NTFPs from CGLF?

(c) What are the main economic activities in the village? ----------

(d) What kinds of benefits are obtained from the forest? ----------

(e) What non-timber forest products are available and used in the village? ----------

Main NTFP extracted	Uses	Quantities (per day)	Where it is mainly sourced from? Eg farmland, woodland, forest reserve	Price

(f) For how long in the year are villagers full occupied and self-sufficient in NTFPs?

(g) Are there any bylaws guiding the use of NTFPs? What are they?

(h) What are the village strategies to ensure sustainability of NTFPs?

(i) Are there any cultural/ traditional/ customs governing utilization of NTFPs? 01. Yes 02.No.

(j) If yes mention them?

(k) How is the situation on the availability of NTFPs in the past 10 years compared to now?

(l) Are there any traditional healers in this village? 01. Yes 02. No

(m) Do you appreciate the role they play?

Thank you for your co-operation

Appendix 3: Checklist for Key informants

1. **Village government leaders/Natural resource committee members**

1) What is the total population in your village? ----------
2) When did you start living in this village?……
3) What are the general condition of the forest now compared to the time you came in this village?……
4) What can you comment on the availability of NTFPs in CGLF? 1. Increased 2. Decreased 3. Remained the same
5) What are strategies to ensure sustainability and availability of NTFPs?.....
.....
6) What are important forests and NTFPs collected from the forest? List them……
……
……
7) What could be the reasons for collecting NTFPs from the forest?.....
.....
8) Is there any licensing system used to control extraction of NTFPs from CGLF? 1. Yes 2. No
9) Are there any organized groups that deal with collecting and selling NTFPs in CGLF? 1. Yes 2. No
10) What are the village historical events in conserving the forest?.....
.....
11) What are the village forests resources use conflict that had happened in this village and how did you resolve them?

Conflict	**How resolved**

12) Are there any conservation actions taken towards the forest? 1. Yes 2. No
13) If yes to question 12 above, mention the actions……
……
14) What are the constraints in utilization and marketing situation of NTFPs in this village?.....
.....
15) In your opinion, what should be done to reduce the constraints mentioned above

Thanks you for your co-operation.

Appendix 4: **Market survey questionnaire**

1. Do you sell non-timber forest products collected? 01. Yes 02. No
2. If yes, what types of products do you sell? ----------
3. Where do you get them? 01. Collect yourself from the forest 02.Buy from collectors
4. If buy from collectors, how much did you spend for purchase for the last 12 months? ----------(TAS)

NTFP product	Time spent collecting (days)	Transport cost to the market	Cost of processing/harvest

5. If you have collected from the forest how much did you collect----------
6. How far is the market from the forest where the NTFPs are collected? (Km)----------
7. What is the unit price per item sold?
   Collect yourself---------- (TAS)
   Buy from collectors---------- (TAS)
8. How much money did you get for the last 12 months from selling NTFPs? ----------
9. How frequent do you sell the NTFPs? 01. Daily 02. Weekly 03. Monthly
10. What are the main NTFPs you sell/buy during the rain/dry season?

Main product	Price per unit(TAS)	
	Rain season	Dry season

10. In your opinion, is the market situation for NTFPs good or bad within this village?
11. Give reasons for the answer in 10 above.----------

Thank you for your co-operation.

Appendix 5: Questionnaire for forest workers

1) How long have you been in this district…….years
2) What is the general condition of the forest now compared to the past 10 years? 1. Very good 2. Good 3. Bad 3. Very bad
3) What can you comment on the availability of NTFPs in CGLF……..
4) What are strategies to ensure sustainability and availability of NTFPs?
   .....
   .....
5) What forests and NTFPs do people collect /use from the forest…….
6) What could be the reasons for collecting NTFPs from the forest?.....
   .....
7) Is there any licensing system used to control extraction of NTFPs from CGLF? 1. Yes 2. No
8) Are there any organized groups that deal with collecting and selling NTFPs in CGLF? 1. Yes 2. No
9) What are the village historical events in conserving the forest?.....
   .....
   .....
10) What are the village forests resources use conflict that have ever happened and how were they resolved?

Problem (conflict)	**Ways resolved**

11) Are there any conservation actions taken towards the forest? 1. Yes 2. No
12) If yes to question 12, mention the conservation actions……
    ……

13) What are the constraints in utilization and marketing situation of NTFPs in this village?.....
.....

14) In your opinion what should be done to reduce the said constraints?.....
.....

Thank you for your co-operation.

Appendix 6: **Checklist for traditional healers**

(a) When did you start traditional healing activity? ----------

(b) When did you start going to the forest for collection of NTFPs? 01. More than 10 years ago 02. 5 - 10 years 03. Less than 5 years

(c) How much plant medicines do you collect per harvest/trip----------

(d) How frequently do you go for collection of this product----------
01 Daily 02. Weekly 03. Monthly 04. Randomly

(e) What is the number of patients you have treated for the past 12 months?----------

(f) What is the average number of diseases attended per year? ----------

(g) How much money did you earn on average for the past 12 months?----------
Tshs.

H).Which species do you use in your activity? ----------

No	Local name	Botanical name	Part used	Disease cure	Earn/dose(TAS)
1.					
2.					
3.					

(i) Do you have any other economic activities? 01. Yes 02. No

(j) If yes, list them ----------

Thank you for your co-operation.