CONTRIBUTION OF DRYLAND FORESTS TO RURAL HOUSEHOLDS LIVELIHOODS IN KISHAPU DISTRICT, SHINYANGA REGION, TANZANIA

BY

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ABSTRACT

A study to estimate the extent of dryland forests contribution to rural households was conducted in Kishapu District. Specifically, sources of cash income for rural household expenditure were analysed, proportions contribution of cash and non cash of dryland forests was estimated and problems facing dryland forest management were identified and analysed. Four villages were purposely selected and households were randomly selected by proportion from each village and household categories, households were stratified by wealth. Primary data was collected from 318 households using household questionnaire survey. Qualitative data was analysed by content analysis and quantitative data was analysed by multiple regression. Study revealed that, farm income was the major source of total annual household income by 43%, livestocks (24.8%), forests (19.5%) and non-farm (11.9%). The overall total annual household income was TAS 2 702 386 per household, dryland forests contributed TAS 190 662 as cash and TAS 336 751 as non cash which represented 7% and 12.5% of total household income respectively. Study revealed that most households (77.4%) in the study village experience shortage of forest products. All households (100%) depended on firewood as source of energy for cooking and per capital consumption was 0.7 m^3. Theft of trees was the most serious problem which faces management of forests in Kishapu District, protection was suggested as a solutions. Cotton was found to be the major source of cash for small and medium household expenditure while cattle were the major source of cash for large household expenditure. The multiple regression analysis indicated farm income, forest income, non farm income, size of farm, education, household category and farm size significantly contributed to annual total household income. The study recommends introduction of improved energy saving stove, practise natural regeneration, enhancing value of gum and conducting research on domestication of plants producing valuable forest products and market research on forest products.

DECLARATION

I, Hadji Mnyamuru Seif Hatibu, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my original work and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

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The above declaration confirmed

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DEDICATION

In loving memory of my beloved daughter, the late Mariam (Mamu) who inspired my life.

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CHAPOSA	-	Charcoal Potential in Southern Africa
DFID	-	Department of International Development
FAO	-	Food and Agriculture Organisation of the United nation
FBD	-	Forestry and Beekeeping Division
GDP	-	Gross Domestic Products
HASHI	-	Hifadhi Ardhi Shinyanga
ICRAF	-	International Centre for Research and Agroforestry
MNRT	-	Ministry of Natural Resources and Tourism
NAPC	-	National Agricultural Policy Centre
NBS	-	National Bureau of statistics
NFP	-	National Forest Program
NAFRAC	-	Natural Forest Resources and Agroforestry Centre
NTFP	-	Non Timber Forest Products
NSGRP	-	National Strategy for Growth and Reduction of Poverty
PRSP	-	Poverty Reduction Strategy Paper
SPSS	-	Statistical Package for Social Sciences
SUA	-	Sokoine University of Agriculture
TAS	-	Tanzania Shillings
UN	-	United Nation
URT	-	United Republic of Tanzania
VEO	-	Village Executive Officer
WHO	-	World Health Organisation

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Million of people throughout the world extensively use forest products from natural forests (Koziell and Sander, 2001; Lawes *et al.*, 2004). These forest products are harvested for both subsistence and commercial use either regularly or during time of needs, therefore they are important to people's livelihood especially those who live in rural areas. Due to large endowment of large forest resources Tanzanians get varied of forest products which includes timber and non timber. Non timber forest products are any products or services other than timber which are produced by forests (Adepoju and Salau, 2007).

In Tanzania dryland forests are estimated to cover an area of about 24.7 million hectares (ha) (Mbegu and Mlenge 1984). In Shinyanga region dryland forests are considered as important natural resources which constitute 30 - 40% of income to household livelihood (Monela *et al.*, 2005; HASHI, 2002). Dryland forest provides generous goods and services which includes fruits, vegetable, medicinal plants, resins, gums, fibres and grasses, these forest products are indispensable source of livelihood to households living in rural areas. Dryland forests were for long overshadowed by humid forests and has received increased policy and research attention only in the last few decades. Researchers now put much effort on the determination of monetary value of dryland forests as well as their contribution to overall livelihoods. For instance, the studies by Neumann and Eric (2000) and Campbell *et al.* (1991) showed that forest products contribute from over 50% of the total livelihood income in some area to less than 20% in others. On the other hand, various studies shows forest products exploitation compliments other livelihoods activities (Shackleton and Shackleton, 2004). According to study conducted in Shinyanga dryland

forests provided estimated benefit of Tanzania Shillings (TAS) 14 046 per person per month which was higher than National consumption of TAS 8500 per person (Monela *et al.*, 2005). Conservation of drylands forests now helps countries in many ways through contributing to the national budget with exported products such as gum arabica as well as improving rural household livelihoods.

For the past three decades, there has been growing awareness of the importance of dryland forests, this growing awareness is not only for the role they play in the subsistence economy of household but also the real contribution to the economies of many developing countries. Dryland forest contribute to poverty alleviation through generation of income, providing food and improve nutrition, medicine and cash earnings Chikamai and Kagombe (2002) cited by Feto (2009) (Chikamai *et al.*, 2009). Research done in Tanzania found that farmers were deriving up to 58% of their cash income from the sale of honey, charcoal, fuel wood, wild fruits and vegetables (CHAPOSA, 2000). For many households the money earned from collecting, selling and processing forest products provide an indispensable contribution to household income and food security. Income from forest product enables rural households to purchase consumable goods and pay for basic expenses. However, most of the information on the dryland forest principally concentrates on gum and woods, there are still a lot of studies needed from various localities to get reliable statistics on the contribution of dryland forests in Tanzania. World wide the semi arid areas are geographical areas which are understudied (Mortimore, 2008). Therefore, the focus of this study is to provide information on the extent of dryland forest contribution to rural livelihoods and examine problems facing dryland forests resources.

Forest sector is among the major sector of the economy in Tanzania, unfortunate its contribution tends to be underestimated because often makes their input outside the cash

economy or the benefit are indirect. In Tanzania the role of forest sector in economic development has not been fully recognised. For instance, the Poverty Reduction Strategy Paper (PRSP) 2000/03 discusses the forest sector as cross-cutting issue of environment and fails to capture the analytical and policy objectives elaborated in National Program and Forest Policy. The national forest policy emphasise forests are renewable natural resources, they are national assets to be protected and enhanced for the well being of people and the nation (URT, 1998). The lack of attention is attributed by limited availability of adequate data and largely outdated making it difficult to assess the sector's present contributions.

The focus of this investigation is to analyse the direct financial contribution of dryland forest to rural household livelihoods in semi arid areas. The assessment of indirect and intangible benefits such as value of environmental services is excluded from the scope owing to limited time and resources. The principal aim is to provide decision makers at village, District, Regional and National level with hard data on the contribution of dryland forest to rural households in semi arid areas of Tanzania. The basic information will assist in raising awareness of policy makers on forests potential or to warn them against possible negative implication on rural household livelihood situation if the contributions of dryland forest products are ignored. Also the study is expected to inspire professional at District level to gather more information on forest products so that reliable data will become available.

1.2 Problem Statement and Justification

Dryland forest contribution to livelihood in rural households is generally widely recognised. Due to inadequate information on the contribution of dryland forest to rural livelihoods it has been challenging to draft viable intervention strategies. The consequence forests are not sufficiently considered due to lack of data on their contribution to rural

livelihoods (Lokina *et al.*, 2008). Dryland forests have been seriously undervalued and much attention has instead been directed towards managements of tropical humid forests (CIFOR, 2005). Economic valuations have been done for other forest ecosystem such as humid forest, but very few studies have been carried out in drylands (Madzwamuse *et al.*, 2007). As pointed out by Muys *et al.* (2006) and Mortimore (2008) tropical dryland forests have received less scientific attention than moist forests, despite their high ecological, environmental and economic importance of being situated in rural areas where most people live.

Due to inadequate studies which demonstrate the links between rural livelihood and dryland forest have led to underestimation or complete omition of drylamd forests in local and national development strategies. (Oksanen *et al.*, 2003; Oksanen and Mersmann, 2002). Kessy (1998) highlighted the need to investigate the importance of forest products to the daily life of the local communities in their effort to make ends meet. A number of studies suggest that less recognised forests such as dryland forests are important to household livelihoods (Vedeld *et al.*, 2004). Few studies already show as much as third of rural household income comes from forests resources (Campbell *et al.*, 2002). It is now acknowledged that forest resources play essential role in local and national economies (Kaimowitz, 2003; Angelsen and Wunder, 2003; Sunderin *et al.*, 2003). At the moment the constrains on dryland forest includes insufficient information which explicitly illustrate the extent of cash and non cash contribution of dryland forest products to rural household's (Ruiz Perez *et al.*, 1997).

Little data available are not presented in a meaningful way to planners and decisions makers and when it exists do not given the right weight. As such there is a need to find ways and means of influencing policy through information generated from research.

Despite the contribution of restored dryland forests to livelihoods, rarely their contribution is acknowledged in quantitative terms by Government leaders (Monela *et al.*, 2005).

In conversion research there is tendency to underestimate the non cash contribution of dryland forests to livelihood in terms of products and services. Most reports on forestry indicate the number of trees, forest cover improved, amount of timber sold rather than livelihoods. The low sector's contribution to the Gross Domestic Product (GDP) is due to unrecorded consumption of other forest products and services. Despite the immerse importance of forest products, their value are rarely taken into assessing GDP (Secretariat of the Conservation on Biological Diversity 2001). Much of the data on dryland forest goods and services is unavailable, insufficiently detailed, appear in isolated case studies or is aggregated in a way it is difficult to identify their contributions (Barrow and Mogaka, 2007). Since reliable data are absent, it is difficult to give an overview of the major commercial forest products in Africa (Andel, 2006). Various forest products are sold in nearly every market place in Africa, Asia and America, but little is known about their contribution to the local and national economy of the countries (Andel, 2006). Few countries register forest products that are sold, where, in what quantities and at what prices. Unlike agricultural products no regular monitoring and evaluation of the resources, market chains, and socio-economic contribution of the forest products at National level. Occasionally other forest products other than timber sometimes appears in the National statistics (Andel, 2006). Still much is not known on the real benefits provided by dryland forests in terms of quantified economic contribution to the household (Monela *et al.*, 2005).

The core problem is that little is known about the extent of dryland forest contribution to the rural household livelihood in semi arid areas of Shinyanga and their contribution is not

by explicitly focusing on the contribution of dryland forest to rural household livelihood in Kishapu District from wide variety of goods.

1.3 Study Objectives

1.3.1 Overall objective

The overall objective is to assess the extent of dryland forests contribution to rural household livelihood in Kishapu District, Shinyanga region, which is one of the remnant dryland forests in Tanzania.

1.3.2 Specific objectives and hypothesis

(i) To analyse the sources of cash income and expenditure of rural households.

(ii) To estimate the proportion contribution of cash and non cash income from dryland forests to rural household annual income.

(iii) To identify and analyse dryland forest problems in relation to cash and non cash income from forest products.

The following hypotheses were tested.

(i) The null hypothesis (Ho): Dryland forests do not contribute to the rural household's livelihood.

(ii) The alternative hypothesis (HA): Dryland forests contribute to the rural household's livelihood.

1.4 Limitation of the study

1.4.1 Language barrier

Questionnaire survey was conducted by using *swahili* language which most people speak and understand. Most enumerators were able to speak the sukuma language, few enumerators were accompanied by local interpreters who assisted when the interviewee was not able to speak and understand *swahili* language. This ensured good understanding during the interview and eventual data collection.

1.4.2 Local units of measurements

Most households use local units of measurements which are not standard measure, therefore local units of measurements were used in collecting data to avoid misunderstanding during data collection, later local measurements were converted to standard units.

1.4.3 Reliance on farmer's memory

Majority of households did not keep records therefore probing techniques were used to elicit information such amount collected, sold and consumed. Questions asked during the interview was focused on everyday life which need simple recall memory, example daily, weekly, monthly or seasonal consumption estimates, so results are estimates given by respondents.

1.4.4 Lack of cooperation from respondents

Some respondents were not willing to give information which they consider to be sensitive such as number of livestocks owned fearing probably this study was linked to tax collection. However, this problem was resolved by supplementing information through discussions with key informants.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Forest in Tanzania

Tanzania has forest resources of about 38.8 km^2 or 41% of the country's 886 000 km^2 total and area is covered by forests and woodlands (FBD, 2002). These forests provide a wide range of goods and services. Tanzania has about 540 central Government forest reserves which cover a total of 13 million ha (URT, 1998). Forests and woodlands are key elements in the livelihoods of hundreds of thousands of households across Tanzania as they provide many of the basic benefits and opportunities to rural and urban communities for sustainable livelihoods. The forest sector contribution to GDP is estimate to be about 2-3% (MNRT, 2001).

2.2 Dryland Forests

Drylands are generally defined in climatic terms as lands with limited rainfall, characterized by low (100-600 mm annually), erratic and highly inconsistent rainfall levels (Unite Nations, 2000). White and Nackoney (2003) defined dryland in term of the ratio of the mean annual precipitation to mean potential evapo-transpiration which ranges from 0.05 – 0.065. The main characteristics of dryness is the negative balance between annual rainfall and evapo-transpiration rates, high temperatures during the rainy season cause much of the rainfall to be lost in evaporation. The drylands are particularly fragile ecosystems due to harsh climatic conditions. Biological and economic productivity are inherently low in drylands due to adverse climatic conditions, but yet they provide a wide range of ecosystem goods and services that are fundamental to the livelihoods of millions of people (Adeel *et al.*, 2008). More than 50% of Tanzania mainland is described as semi arid drylands which receives less than 570 mm of rains in nine out of ten years (Hatibu, 2000).

Dryland tropical forests are composed of mosaic of different ecosystems including dense dryland forest, open forest and woodland and scrub like savannahs. There are 238 million ha of dryland forests in the world and Africa alone has 64% of that amount (Dupuy *et al.*, 1999). Dryland forests are fragile ecosystems that sustain the livelihoods of millions of poor people in developing countries (Adeel *et al.*, 2008). However, the capacity of drylands to provide products and services is continuously declining due to desertification, resulting in dwindling forest products and affecting human well-being and development opportunities in drylands. Therefore change in land management practices and Government policies are urgently needed to reverse the continuing decline of dryland forests. Drylands encompass grasslands, agricultural lands, forests, and urban areas and occur on all continents. They represent more than 40% of the global land area and are home to nearly a third of the global population, 90% of them live in developing countries (Millennium Ecosystem Assessment, 2005). Globally 75% of the poor people live in rural area and this is certainly true in most African countries where poverty is predominantly a rural phenomenon (Anderson *et al.*, 2005). For example, Pimentel *et al.* (1997) estimate that over 300 million people in the world deliver part or their entire livelihood from forests. It is estimated that over two third of African 600 million people rely directly or indirectly on forests for their livelihoods (CIFOR, 2005).

In Tanzania dryland forests are estimated to cover an area of 24.7 million ha (Mbegu and Mlenge, 1984). Dryland forests of Tanzania are intermediate forests between closed woodland and grassland, grasses are more dominant than trees and the dominant tree species are acacia. Shinyanga is one of the regions in Tanzania which is found in the semi arid areas, its vegetation is dominated by dry land forests (Otysina, 1993). Major part of the rural population in Tanzania depends of forests as energy sources (firewood and charcoal), subsistence farming, free ranging livestock and other products (PMO-RALG,

2007). The Tanzania National Policy reported that, the dependence on forests for various products and services is expected to continue for a long time to come (URT, 1998). Due to the anticipated steady increase in population, from this point of view dryland forest conservation efforts should consider that, over 75% of the country's population lives in rural areas and greatly depend on agriculture and natural forests for their livelihoods (HBS, 2002). Over 90% of Tanzanians rely of fuel wood for domestic energy supplies (URT, 1998). People in rural areas still depend on forest resources for fundamental requirements to human life like food, shelter, energy, and traditional medicines (Falconer and Arnold, 1991). A number of studies have demonstrated that less recognized aspects of rural economies such as forest products can be important to household livelihood just like agriculture which is a traditional activity in rural areas (Byron and Arnold 1999; Vedeld *et al.*, 2004; Monela *et al.*, 1999).

2.3 Forest Products and their Importance to People's Livelihoods

The term forest product means wood and non-wood products that are collected from the forests. All botanicals and other natural products extracted from the forest other than timber are known as Non Timber Forest Products (NTFPs) (FAO, 1990). NTFPs are components of the forest system that exist in nature and are generally not cultivated but have a perceived economic or consumption value sufficient to encourage their collection from the forests. NTFPs are also referred as all forest products that may be extracted from forest ecosystem and are utilized within the household or are marketed or have social, cultural or religious significance (Andel, 2006).

2.4 Categories and Uses of Forest Products

Forests contribute to most aspects of rural life by providing food, fodder, fuel medicines, building materials, and materials for all sorts of household items (FAO, 1995). However,

there is great variation in the extent to which forest products are used from area to area and even between households within a community. In this study, classification of forest products was based on purpose or uses categories such as food, fodder, construction, fuel wood, medicine, household utensils and farm implements (Andel, 2006).

2.4.1 Food products

As Andel (2006) stated that food products includes, wild fruits, vegetables, nuts, edible roots, bush meat, edible insects, honey and food additives like species, flavourings, food colorants, fermentation agents etc. Many forest products are harvested and they are used at households or sold as commercial goods. Fruits, herbs and mushrooms are among the most valuable forest products being harvested and sold in established markets throughout the world (Barfoot, 2006). Other food products include essential oils, honey, nuts, seeds and species. In many developing countries, wild forest plants comprise a great portion of the daily diet for many people, in Meatu District about 15 species of useful wild vegetables plants were identified to be consumed as relish food (Kagya, 2002). Falconer (1992) noted that forest foods will continue to contribute significantly to the diet of many rural households while a great variety of goods are gathered from forest and fallow lands. Many different fruits and seeds are eaten as snacks on farm or in the bush especially by children. Foods gathered from forests add diversity and flavour to the diet as well as providing protein, energy, vitamins and minerals (Falconer, 1992).

2.4.1.1 Fruits

In several African countries, wild fruits play important role in people's diet and contribute to the economy of rural communities (FAO, 2009). Fruits are used as food, beverages, and sources of essential oils for cooking, example fat extracted from seek kernels. Tamarind is best known for its fruits which are often eaten fresh but has many other culinary uses of

example in pickles, jams, candy, juice and sweetening of porridge. Tamarind fruit and leaves are reputed to have medicinal properties of anti-fungal and anti-bacterial and have been used in the past for complaints such as intestinal ailments and skin infections (International Centre for Underutilized Crops 1999; John *et al.*, 2004). Other fruits include *Adansonia digitata* which is used to make beverage and eaten law as food, *Vitex spp* eaten law as food, *Strychnos cocculoides* eaten as food. These fruits are occasionally found in local markets.

2.4.1.2 Wild vegetables

Leaves of wild plants such as trees, shrubs and herbs are good sources of food in arid areas. Wild vegetables sometimes serve as buffer food supplies during the periods of food shortage, this usually happens when extreme drought occurs. In the study villages during severe food shortages wild vegetables have been reported to be utilized as complete meals when maize or sorghum flour are not available. Indeed, these wild vegetables save the lives of thousands of poor people residing in rural areas. Kajembe (1994), Makonda (1997) and Kessy (1998) insisted wild foods are essential to the livelihood of rural people. Most wild vegetables become available during the rain season, thus they are dried and stored for future use. Nowadays dried vegetable are collected from villages packed and sold in local markets in town.

2.4.1.3 Honey

Honey and beeswax are non wood forest products that have a strong relationship with plants. In the natural environments, forests, woodlands and bush lands are major sources of nectar and pollen. Honey bees *Apis mellifera* are important insects which produce honey which is food and bee wax which is mostly used in industries to produce various products. About 138 000 tons of honey and 9200 tons of been wax are produced per year from about

9.2 million honey been colonies (MNRT, 2001). Most of the honey and bees wax produced is consumed locally and only small amounts are exported. In Tanzania beekeeping is undertaken as a traditional economic activity among households in rural areas.

2.4.1.4 Natural gums

Gum production especially gum Arabic, derived from *Acacia Senegal* is better documented than most non-timber forest products as it enters international trade. Sudan is the world's major exported most of the gum is obtained from natural regenerating trees on fallow field (Mortimore, 2008). Natural dryland forests of Tanzania are composed of different Acacia species. Up to 70% of gum arabica is mainly produced from *Acacia Senegal* and 15 – 25% from *Acacia seyal* (Chihongo, 2000). The semi arid areas which are estimated to cover about 50 – 60% of Tanzania contain vast areas of acacia woodlands. Most of the gum collected in Tanzania is exported overseas in an informal manner (Chihongo, 2000). On the other hand Tanzania has one of the largest export potentials for gum Arabica among the East African countries but the marketing is weak and not yet developed.

2.4.2 Medicine

Forests supply medicines for the vast majority of urban and rural people, traditional medicines are consistently ranked as one of the most valued forest products by local people. Falconer (1992) reported majority of people 80% use traditional medicines and rely on wild plants as their main medicinal source. Barfoot (2006) indicate there are many reports that caution the extraction of non-timber forest products from forests especially medicinal plants. It has been noted plants used for medicinal purposes are harvested more than any other product from the natural forests. World Health Organisation reported more than 4 billion people rely on traditional medicine for their primary health care. Egypt is the most important medicinal plant exporting country in Africa, and the fifth biggest exporter

of medicinal plants in the world. In the early 1990s, Egypt exported 11 250 tons of medicinal plants per year worth over US$ 12 million. Due to decline economy in most African countries, most people in rural areas will continue to rely on medicinal plants and traditional healers for their health care. The sustainable use of medicinal plants therefore is essential. Dryland forests has got varied plants that are used as medicinal, the use and trading is still locally done, most people in rural areas use medicinal plants as first option when they are sick. An estimate 80% of the world's population depends largely on traditional medicine mostly delivered from plants (Andel, 2006; Acharya and Tamrakar, 2010). More than 80% of the population of Burkina Faso relies on traditional medical treatments for common illnesses (Wittig and Hahn-Hadjali, 2005).

2.4.3 Fuel wood

In the context of this study firewood is defined as woody biomass used for fuel without processing, in contrast to charcoal. Fuel wood or wood fuel is a concept covering both firewood and charcoal (Andel, 2006; Johnsen 1999). Rural households rely on fuel wood for all their energy needs. Most fuel wood is collected from forests, farms and bush fallow. Forests contribute significantly to the energy sector as a direct source for biomass energy, fuel wood from natural forests and plantations accounts for 93% of total energy consumption in Tanzania. The estimated per capita consumption of wood fuel is 1 m^3 round woods per annum (World Bank, 2005). The National Forest Programme estimates 95% of Tanzania's total wood consumption was consumed as fuel wood in 1999 (40.4 million m^3), out of this 265 million m^3 was consumed in the rural as firewood and 13.4 million m^3 in urban areas mainly as charcoal (MNRT, 2001). Shinyanga region is one among the regions in Tanzania which have been identified with fuel wood deficit (FAO, 2005). Fuel wood is mostly collected by women, the National Household Budget Survey estimates the average distance of household in Shinyanga to collect fuel wood is 4.2 km

(NBS, 2001). In the study conducted in 2004 shows that the distance to collect firewood could be shorter if the household have an access to *ngitili* (Monela *et al.*, 2005).

Estimates of fuel wood consumption per person vary according to urban or rural use, climatic zones, season, local availability of wood and the method of collecting statistics. Rural consumption of fuel wood per person is generally considered to be higher than urban due to easier access to resources and grater consumption for cooking and heating. Quantitative assessments of local fuel wood consumption have been made in Tanzania, results varied widely from around 1 m^3 to 3 m^3 of firewood per person per year, suggesting the people adjust their consumption patterns in response to availability. The 1970 FAO estimate for Tanzania placed annual rural household consumption at 2.2 m^3 per person, estimates in mid 1980 were rather lower with range of 1.5 – 1.7 m^3 per person (FAO, 1980). Mnzava (1991) estimated the average wood fuel use per capital was about 1.5 m^3. Also Ishengoma and Ngaga (2000) cited by FBD (1999) found the average consumption of wood fuel per capital per year in five urban areas was 1.03 m^3, the per capital wood fuel consumption per urban area was Dar es Salaam 0.6 m^3, Mbeya 0.99 m^3, Dodoma 0.9 m^3, Arusha 1.86 m^3 and Mwanza 0.81 m^3. Kaale (2005) estimated the per capita fuel consumption to be 1 m^3. In Tanzania it is estimated that firewood consumption for general domestic uses in areas with abundant firewood supply range from 1.5 m3 to 2.5 m^3 while wood deficit areas have consumption levels as low as 0.5 m^3 per capita per annum (Lyimo, 2006). The main source of primary energy in rural areas is woody biomass, the reliance on wood based biomass and the use of inefficient wood stove technologies are listed among the leading culprits of the deforestation. Deforestation is a serious threat to the biomass resources which is predominantly natural forests, annual rate of deforestation is estimate to be from 90 000 to 2 000 000 ha (2004 estimates).

2.4.4 Animal folder

Most households often practices free range system of livestock keeping (Falconer, 1992). Forests play a significant role in feeding domestic animals through the provision of fodder from trees, shrubs and grasses. The importance of fodder trees has received recognition by the wider scientific communities in recent years. Then it is assumed that fodder plants are important components of animal feed particularly as suppliers of proteins and supplement feed in dry season.

2.4.5 Construction materials

This includes forest products like palm leaves or grass for roof thatch, building pole and withies (Andel, 2006). Building materials such cement and aluminium roofing sheets are available, but majority of rural households cannot afford these building materials instead they rely on forests for their building materials. Falconer (1992) explained that in most cases, rural houses are made of mud and utilizing sampling size trees as standing poles and raphia or bamboo to produce a lattice. While species are sought after for particular needs a great variety of different materials are used even within one community.

2.4.6 Household utensils and agricultural equipment

This encompasses forest products such as agricultural and household equipment. Household items include mortars, furniture and sleeping mats, hoe handle and other tool handles, farm implements, crop storage containers, crop dryers, baskets, crop drying mats, fish traps and other household equipment. Most items are made within the household rather than being purchased and every household uses items made from forest in their daily life (Falconer, 1992). All these categories of forest products are found in the study area except wild animals. However, in depth study on the quantitative contribution of these products either for household subsistence or for generating cash income is not available. Currently

the communal forests are under immense pressure from local people. This problem will continued unless the communities as a whole are involved in the management dryland forests and benefit sharing mechanism is developed as an alternative solution.

2.5 Forests Problems

About 90% of the people in Africa rely upon fuel wood as source of energy, on the other hand fuel wood is the second major cause of deforestation throughout the developing world UN (1994) cited by FBD (1999). The use of fuel wood increases pressures on forest biomass and leads to local deforestation particularly in arid areas where demand is high and biomass growth rates are low (Baldwin 1987). Direct drivers of trees in drylands are natural processes such as droughts and human interventions at the local level such as deforestation and overgrazing (Geist and Lambin, 2004). About 60% of the woodlands in Tanzania do not have any legal status as noted by Mnzava (1991). It is in these woodlands where a lot of uncontrolled wood harvesting and charcoal production takes place. In this way, FAO (2001) estimated Tanzania is losing approximately 92 000 ha/year (0.2%) of its forest land through deforestation. The main reasons for deforestation are clearing for agriculture, overgrazing, wildfires, charcoal burning and over exploitation of wood resources (URT, 1998). Due to the high rate of deforestation, low land productivity and poor land use the Government reformed some of its environmental policy objectives to conserve these resources (URT, 1998).

2.7 Definition and Concept of Livelihood Analysis

Livelihood refers the means of securing a living (Ellis, 1998). The term livelihood attempts to capture what people do in order to make a living and resources that provide them the capability of build a satisfactory living, the risk factors that they must consider in managing their resources, and the institutional and policy context that either helps or

hinders them in their pursuit of a viable or improving living (Ellis and Allison 2004). In recent years, socio-economic analysis has been further extended with the development of techniques for livelihood analysis underpinned by conceptual frameworks such ass the sustainable livelihoods approach, these techniques help to provide a better understanding of the relationship between human society and natural resources (Scoones, 1998). For this reason the concept of a livelihood analysis has become central to development practice. A livelihood comprises of assets, the activities and access of the (mediated by institutions, social relation) that together determine the living gained by individual or household (Ellis, 2000).

Measuring and even defining livelihoods have got some difficulties and challenges, there have been harsh criticisms of assessments that rely too much on purely financial measures, and that often focus only on income (Kuster *et al.*, 2005). Although income is an imperfect measure of overall household livelihood, it is relatively easy to measure thus is a reasonable proxy for livelihood (Angelsen and Wunder, 2003). Therefore the contribution of dryland forest to rural household income in this study is evaluated as a share of annual household income from forest products. The livelihoods approach is concerned with people, it seeks to gain a realistic understanding of people's strengths in assets and how they make an effort to convert these into positive livelihood outcomes. With this approach people require a range of assets to achieve positive livelihood outcomes that people seek. As a result they have to seek ways of nurturing and combining assets they have in innovative ways to ensure survival.

Households use a variety of resources as inputs into their production processes as they attempt to meet and extent their livelihood needs. The sustainable livelihoods approach divides livelihood assets into five dimensions of human, physical, financial, natural and

social capital upon which livelihoods are build (DFID, 2001; DFID 1999; Ellis and Allison 2004). Human capital includes such as skills, education, ability to labour and good health. Physical capital includes the basic infrastructure, production equipments and produced investment goods. Financial capital includes financial resources which are available to people whether savings, supplies of credit or regular remittances or pensions money, savings, loan access. Natural capital includes the natural resource stocks form which resource flows e.g. dryland forests land, water and trees. Social capital includes the social resources such as networks, membership of groups, relationships of trust, access to wider institutions of society networks and associations. Household access to assets can be in form of ownership or the right to use these assets which influences household livelihoods. However, these asset categories are admittedly a little manufactured, and not all resources at people draw upon in constructing livelihoods fit neatly within the (Chambers 1987; Bebbington, 1999).

In the livelihoods approach, capitals assets are used through things which people carry out in search of a living referred as livelihood activities and strategies. The risk factors that surround making a living are summarized as the vulnerability context and the structures associated with Government (national and local), authority, laws and rights, and Natural Resource Management institutions are summarised as the policy and institutional context. People's livelihood efforts conducted within these contexts result into outcomes i.e. household livelihood within a mediate environment. These could be higher or lower material welfare, reduced or raised vulnerability to food insecurity, improving or degrading environmental resources, and so on.

2.8 The Household concept

Corbett argued that household is the most appropriate unit of analysis when looking at livelihoods because decisions about production, investment, and consumption are taken primarily at the household level (Corbett, 1988; Ellis 1998, 2000). The concept of household is widely accepted because in every society there are easily identifiable households within which people live. Economist define household as a domestic unit with autonomous decision making regarding production and consumption (Ellis, 1988; Roberts, 1991). The assumption underlying this definition is that a household has clear hierarchy of authority and the head of household having the power and exercise decision making over the household's resources. Also household was defined as a unit of consumption and consisted of all the people who usually at and slept under the same roof and who shared the same bundle of incomes to support their consumption (Averbeke and Khosa, 2007).

2.9 Livelihood in Rural Households

Rural households their income is assumed to be earned from farming and forgets forest products make up a share of household income. Study conducted in Zambia shows subsistence and cash income from forest contributed 50% of the rural household income (Mutamba, 2003). Forest products as a source of income have significant contribution to household cash; rural households when they are constrained in cash for basic expenses, cash income generated from forest have shown to plays a vital role in meeting various expenses. Cash income from forest are important in terms of timing, coming mostly at times when households have little from seasonal activities like cropping (Arnold and Townson, 1998). Rural people's livelihood do not only depends on agriculture as the main source of income, thus can not stand alone in an analysis of rural livelihoods (Bryceson, 1997). In Tanzania agriculture provides 51% of total household income while 40% of rural household income is derived from sources outside farm production (HBS, 2002). The

literature on rural livelihoods consistently recognizes the importance of off-farm and no-farm sources of income (Bernstein, 1994).

2.10 Education

The latest estimates on the literacy status of Tanzanians from the 2007 Household Budget Survey reporters 27% of the population cannot read and write. There is more illiteracy among women 34% than men 20% (BHS, 2007). Education is an important ingredient for sustainable natural resources management and development. Kajembe and Luoga (1996) argued that education tends to create awareness, positive attitudes, values and motivation. Education also tends to stimulate self confidence and self reliance, therefore there may not be development without education. Education is regarded as key to better opportunities for employment, accessibility to information, services and independent and correct actions with regard to survival and development (Luhasi, 1998). Malaise (1978) asserts that given everything else, educated rural households are more productive in agriculture and are likely to have more off-farm income earning opportunities than the non-educated. Therefore, education promotes better management of household resources and reduces pressure on the easily accessible natural resource.

2.11 Conceptual Framework of the Study

The livelihoods approach is concerned with people, it seeks to gain and understand how people make an effort to convert assets into livelihood outcome. No single category of assets on its own is sufficient to yield all varied livelihood outcomes that people seeks. The conceptual framework in Fig. 1 illustrates how dryland forests as natural assets are transformed and contribute to the total household income. Dryland forest which are natural assets and other assets and socio-economic variable such as farmland, number of person per household, education, age , gender, non-farm income, and household categories are

combined and transformed through activities into outcome which is household livelihood. The total annual household income was estimated through cash and non cash income from main sources of income which are farm, forest, livestock and non farm.

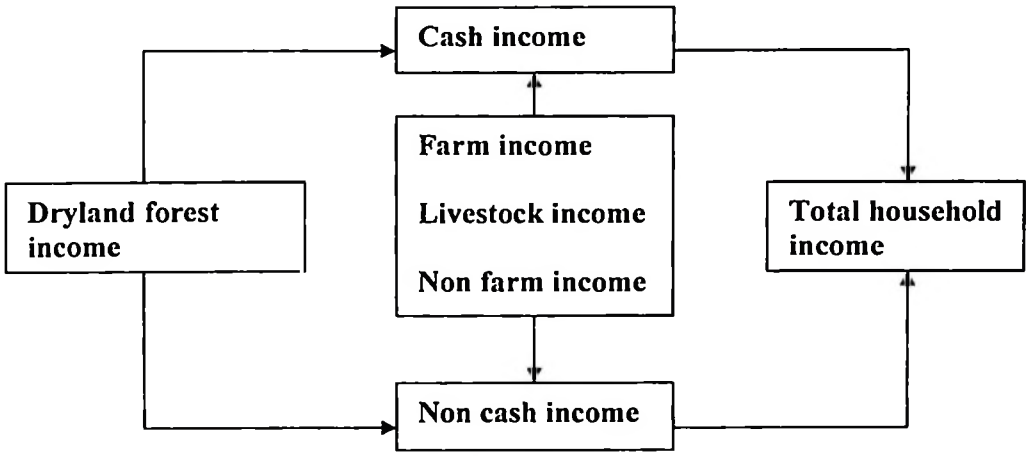

Figure 1: Conceptual framework for the study

Source: Adapted from DFID SL guidance sheet 2.1, 2000

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

3.1.1 Geographical location and area

Kishapu District is located on the South - East of Shinyanga region as shown in Fig. 2. The district headquarter Mhunze is about 60 km from Shinyanga Municipal. The District lies between latitude 3°15"S – 4 ° 00"S and longitude 32°45" - 34 °07"E (URT, 2009). In the East the district borders Meatu District, to the North Maswa district, to the North – West Kwimba District, to the West Shinyanga rural and Urban districts, to the South by Nzega and Igunga districts, Tabora region. Kishapu district covers an area of 4039 km^2 which makes Kishapu District as the 6^{th} largest district in Shinyanga region (URT, 2007b). About 2% of the District area is covered by natural forests, 47% is used for agriculture, 18% is grazing land, 5% is used for settlement and 28% of the remaining land is composed of gulley and rocks (URT, 2009).

3.1.2 Administrative units

Kishapu district is one among the eight districts of Shinyanga region. Kishapu district was inaugurated in 2000, it was curved out from Shinyanga rural district (URT, 2007b). Administratively Kishapu District is divided into 3 Division namely Kishapu, Mondo and Nyegezi, these divisions comprises 20 Wards, 103 Village and 627 Sub -Villages.

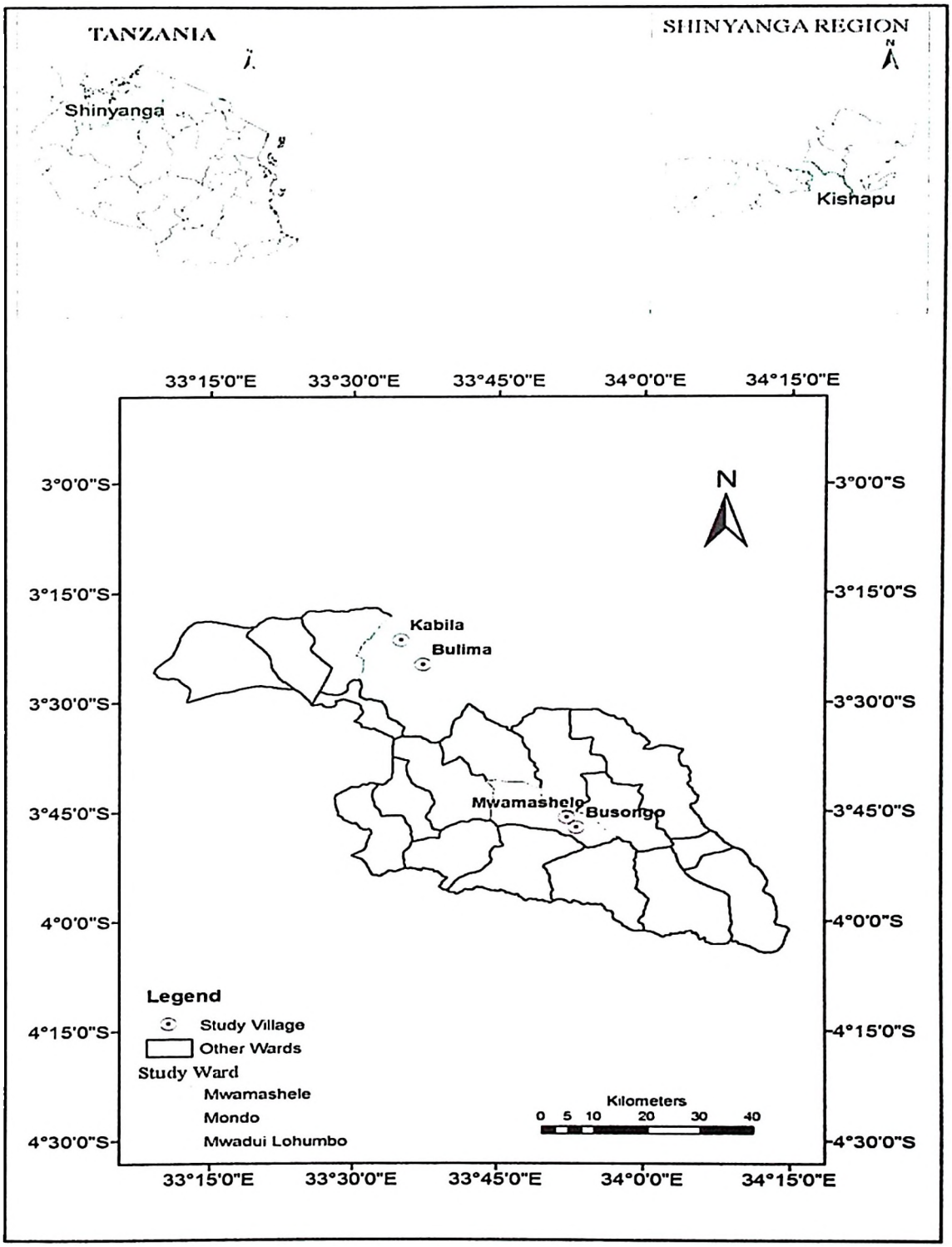

Figure 2: Map of Kishapu District showing location of study villages

Source: Kishapu District Council with some modifications

3.1.3 Climate

Kishapu District is characterized as semi arid area (HASHI, 2002). Kishapu district has dry tropical climate with clearly distinguished rain and dry season. The mean rainfall range from 450 – 900 mm per annum and normally the rain season starts mid October and ends in mid May. Rainfall is unreliable with higher variability within and between seasons (Otysina, 1993). Dry season commence mid May and ends in mid October (URT, 2007b). The mean maximum temperatures vary between 28°C and 30°C while the mean minimum temperature ranges between 15°C and 18°C (Kessy *et al.*, 1988).

3.1.4 Relief and soils

The district is characterized by detached hill with outcrops and grasses in between, the altitude varies between 1 000 to 1 500 m above sea level. Greater part of Kishapu District is dominated by black clay soils with areas of a red loam and sandy soil (URT, 2007b). According to the FAO soils classification, black to grey clay are found in centres, often fringed by molten sandy soils (Kessy *et al.*, 1988). Kishapu District has mineral deposit of Diamond and gold situated at Mwadui and Itilima respectively.

3.1.5 Vegetation

The natural vegetation of Kishapu district is dominated by acacia species such ass *Acacia tourtilis, Acacia polycantha* and *Acacia nilotica*, other important tree species include *Balanite, Albizia and Commiphora* (HASHI-ICRAF, 1997). Severe deforestation which took place during the 1920s and 19390s during the colonial campaign to eliminate tsetse fly habitats followed by shifting cultivation and overgrazing left the land almost treeless with few acacia and baobab trees (HASHI-ICRAF, 1997).

3.1.6 Population

According to the 2002 Tanzania National Census Kishapu District had the human population of 240 086 of which 124 845 was males and 115 241 was female (URT, 2003). The average size of households was 6.1 persons per household and average population density of 60.1 persons per km^2. Based on the 2002 National population and housing census with 3.9% rate of population increase, in 2009 Kishapu District population was estimated to be 313 512 which make Kishapu the 4^{th} populous district after Bariadi, Maswa and Shinyanga rural (URT, 2009).

3.1.7 Socio-economic activities

Majority of the households in Kishapu District are engaged in subsistence agriculture and livestock keeping (88.1%) which are the major economic activities, Forestry and fishing (6.3%), Mining (0.90%), Petty trade (0.90%) and others (3.9%) (URT, 2009). The major ethnic group found in Kishapu district is Sukuma, there are also substantial number of Nyiramba and Taturu in the eastern part of the District (URT, 2007b; URT 2009. Major food crops grown in the district include maize, sorghum, paddy, bulrush millet, legumes, sweet potatoes, green gram, chickpea, ground nuts, bambara nuts and cowpeas while major cash crops are cotton and chickpeas. Livestock keeping contribute 25 – 30% of the total local revenue sources, types of livestock kept are cattle, sheep, goats, donkeys and chicken dominated by indigenous breeds. Livestock products and services include meat, traction power, hides and skins, milk and milk by products and eggs. It is estimated that between 20 – 30% of the livestock population in the Shinyanga region are found in Kishapu (HASHI, 2002). In 2006 the district was estimated had 254 839 cattle, 80 202 goats, 55 394 sheep, 3620 donkey and 4 121 dogs, projection used the annual growth rate of 1.6% (URT, 2009). According to Household Budget Survey (2000/01) Kishapu District was identified as poorer than the national average in terms of income poverty (HBS, 2002).

Rural households frequently experience household food insecurity. The average per capital income of residents per day was TAS 727 which is below 1 US$, on average per capital income per year is TAS 262 000 (URT, 2009).

3.1.8 Education

Kishapu District have highest literacy rate of 64.4% among the district of Shinyanga region which is above the Shinyanga region total literacy rate of 58% for household member. However Kishapu is among the District in Shinyanga region with the lowest literacy rate of 54% among head of households which is below the Shinyanga region literacy rate of 59% for the head of the household in Shinyanga region (URT, 2007a).

3.1.9 Household building material

Almost 94% of all main houses in the district had walls build using mud bricks, followed by poles and mud (4%) and cement bricks (2%). About 94% of main household has mud as the flooring materials, grass is the most popular roofing materials accounting for 58% as the main roofing materials followed by grass/mud 27% and corrugated iron sheets 15% (URT, 2009).

3.2 Research Design

Cross – sectional study design was applied in data collection, information gathered represents what is going on at only one point in time (Olsen and George, 2004). By using this research study design a subject of population was selected, and from these individuals, data were collected to answer research questions of interest.

3.3 Sampling Design

Taking into account time allocated to conduct study and resource available, four villages were purposively selected to constitute the sample frame. These include Kabila, Bulima, Busongo and Mwamashele villages. Selection of villages was based on existence of dryland forests, accessibility, and the past efforts which had been done by HASHI project of restoring natural vegetation on degraded lands (HASHI, 2002). The unity of the study was household, therefore sampling of households for the interview was done in such a way each household had an equal chance of being selected. A list of households residing in each village was compiled, drawn from village registers and information from key informants (Jagger, 2008). Names of all heads of the households in each village were written on piece of paper; later households were stratified into rich, middle and poor by using household characteristics predetermined by key informants during the focused group discussion. Due to variability in the study population (households) in the study villages stratified random sampling was done to ensure we get representative sample from each groups within the population (Lucey, 2002; Thassim *et al.*, 2005). Households were randomly selected from each village according to proportions (n=318 households). From each wealth category then *n* pieces of paper bearing names were randomly sampled by proportion to get representative households for interview from each study village.

3.4 Sample Size

Formula presented below was used to determine the sample size (Kessy and Anderson 2009; Kessy *et al.*, 2010; Israel, 2009).

$$SS = \frac{Z^{2} * (p) * (1-p)}{C^{2}}$$

Where: SS = Sample size

Z = Z value is the abscissa of the normal curve

p = Percentage picking a choice, expressed as decimal

C = Confidence interval, expressed as decimal

Correction for Finite Population

$$\text{New} \quad SS = I \frac{SS}{1 + \frac{SS - I}{pop}}$$

Where: pop = population

3.5 Sample Size Distribution

Total of 318 households were randomly selected from four villages as shown in Table 1. The number of sampled households was obtained by using the formula presented in sub-section 3.4. Sampled household from villages and household categories was obtained by proportion as presented in Table 1.

Table 1: Sample size distribution and village demographic characteristics

Village	Male	Female	Total	Households	SampleHH	Rich	Middle	Poor
Kabila	1 996	1 765	3 761	470	82	17	24	41
Bulima	1 816	1 972	3 788	616	107	21	54	32
Mwamashele	1 517	1 612	3 129	419	73	7	44	22
Busongo	843	1 010	1 853	319	56	4	37	15
Total	**6 172**	**6 359**	**12 531**	**1 824**	**318**	**49**	**159**	**110**

Note: HH = Household

3.6 Methods of data collection

3.6 Primary data collection

Natural Forest Resources and Agroforestry Centre (NAFRAC) staffs were trained as enumerators, the staffs were knowledgeable and have experience with research on rural livelihoods. To obtain information on income derived from dryland forest, farm, livestock and other sources used annually, respondents were asked how much they collect per week, month or season. Total household income was calculated using actual market price of

goods in the village (Murphy *et al.*, 2005). Estimates of values are based on exchange values where buyers and sellers exchange goods for money or other goods. If forest product is not traded their value was estimated by willingness of buyers to pay for specific goods under defined conditions. To ensure common understanding during data collection locally meaningful measurement units were used such as acres, oxcart, head load, bags and tins. To assist in conversion experienced traders were contacted to get standard unit for each local unit used (Appendix 1). Primary data collection technique involved preliminary visits, focused group discussion, observation, wealth ranking and designed questionnaire administered at household level.

(i) Preliminary visits

Data collection was preceded by preliminary visits to villages in order to familiarize with study villages, build rapport, introduce study to village leaders and pre-testing of the questionnaire. Through preliminary visits general information about villages was collected, and the relation for further fieldwork was built up. Pilot test of the questionnaire was performed in Bulima village to check the feasibility of techniques and to determine the reliability of measurements and validity (Hopkins, 2008).

(ii) Focused group discussions

Group interviews are often powerful and efficient methods of collecting information (Chambers, 1994). Focused group discussion was conducted with key informants selected by Village Executive Officer (VEO). Key informants were knowledgeable people within the village who knew very well the village surroundings and know most people within the village, teams in each village was made up of males and females. Focus group discussions were used to collect community level data. Such information included agricultural crops grown, forest products collected and used, other sources of income, local forest products

prices, local units of measurements for various products, local criteria of identifying households, wealth ranking of household and indigenous tree species found in the study area. Developed checklist was used to guide focused group discussion with key informants as shown in Appendix 2.

(iii) Household wealth ranking

Wealth ranking technique was used to stratify households prior to the survey (Timsina, 2003). Wealth ranking was used for the purpose of social identification of households in study villages. Key informants in study villages were facilitated and came out with wealth criteria which are locally used to identify households into social groups. Wealth ranking of households in each village was carried out with key informants based on established wealth criteria, all households with the village were placed into respective wealth categories.

(iv) Questionnaire survey

Questionnaire was administered by enumerators at household level, open and closed ended questions were designed to collect data from households as shown in appendix 3. Data collected include household general information such as demographic characteristics, gender distribution, occupations of head of household. Information on household's natural assets endowments which include farming land, forest and livestock were assessed in terms of quantity sold and consumed. Data of interest was household income i.e. cash and non-cash sources described under farm, livestock, dryland forest and non farm. Sources of cash for small, medium and large expenditures, problems related to dryland forest management, accessibility and availability of dryland forest products for sale and household consumption. The questionnaire was adopted form the forest poverty tool kit (Shepherd and Blockhouse, 2007), with major modifications which I believe was an improvement.

The questionnaire was designed in that questions asked did not require detailed memory and was therefore answerable with a high degree of accuracy. Highly disaggregated data was collected, and the aggregated during analysis.

(v) Participant observation

Observer become part of the situation studied by collecting information through observing the reality was is going on or what exist. Through this technique observer can see some issues which are sensitive or sometimes respondents will try to avoid or don't answer (Kessy, 1998). Example sometimes size of cattle pen was used to estimate the number of cattle owned through observation. Participant observation was used by researchers to check definitions of terms that participants used in focused group discussion and household interviews, observe events that informants may be unable or unwilling to share or observe situations informants have described in interviews. By pretending to be part of the community the researcher gained the confidence of the persons being studied, so that the presence does not interfere with the natural course of events (Kajembe and Luoga, 1996). This technique helps in clarify information from surveys, what people have or don't have, who does what and who doesn't. It enables understanding of motivations and perceptions and helps capture the view of minorities and other groups. Equity may be assessed by observing differences in what people do or have, when, where and how (Ashley and Hussein, 2000).

3.7 Secondary Data Collection

Secondary data was collected from books, reports, scientific papers from Sokoine National Agricultural Library, Regional Administrative Secretary office Shinyanga, Kishapu District Council, NAFRAC and through internet.

3.8 Data Analysis

3.8.1 Analysis of qualitative data

Qualitative data obtained through observation, discussion and wealth ranking was analysed with the help of the local communities. Content analysis was employed to analyse qualitative data. The total content of communication collected through verbal discussions was broken and condensed to some set of categories that are meaningful and represent some characteristics of research interest (Singleton *et al.*, 1993; Kajembe and Luoga, 1996).

3.8.2 Analysis of quantitative data

Statistical Package for Social Science (SPSS) program version 16 and Microsoft excel were used to analyse quantitative data. Data was edited, coded and entered in computer for analysis. Multiple regression analysis was used to ascertain the relationship between the dependant and independent variables. The variable of interest was the dependent variable total household income while the independent variables were annual farm income, dryland forest income, non farm inform, household category, marital status, size of farmland, size of the household, age and education. Quantitative socio-economic data had been analysed using descriptive statistical methods which involved calculation of dispersion, central tendency and frequencies. Tables, histograms and pie charts are used to summarise data in order to understand the distribution of replies from households which explain household livelihoods.

Multiple linear regression analysis was done to assess independent variables which statistical significant contribute to household income. Multiple linear regression procedures were selected because they had been widely used in social and natural sciences research and are easier to handle (Chianu and Ajani, 2008; Kessy and O'Ktingati 1994). Multiple

linear regressions was adopted in order to know which independent variables statistically contribute to rural household income in the study village by describing the relationship between dependent variable and independent variables.

The multiple regression model was developed using independent variables which are defined below. By using multiple regression coefficient (β), the equations was developed.

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + ... + \beta_n X_n + e_i$$

Where:

Y	=	Total annual household income
A	=	Intercept
β_1 to β_n	=	Independent variable coefficient
X_1	=	Annual dryland forest income
X_2	=	Annual farm income
X_3	=	Annual non farm income
X_4	=	Size of household
X_5	=	Age of the head of the household
X_6	=	Education of head of household
X_7	=	Household category
X_8	=	Size of farm land
X_9	=	Marital status
X_{10}	=	Gender of head of household
e_i	=	Random error

3.8.3 Prior assumptions of independent variable and expected signs

Total Annual Household Income (TAHI): The total annual household income was assumed to be contributed by various sources and factors within the study area such as farming, livestocks, dryland forest, non farm income.

Dryland Forests Income (DFoI): It was assumed that the more the household used dryland forest products the more dryland forest products contribute to total annual household income (+).

Farm Income (FaI): Farm income was assumed to contribute positively to the total annual household income (+).

Size of Household (SHH): Determines the supply of labour for the household, large household size means available labour force which could be engaged in various household activities to generated household income (+).

Age: Age of the head of the household was assumed positively to influence household income. Young people have energy to open bigger farm and collect forest products than aged people (+).

Education (ED): It was assumed that educated persons have knowledge and access to information which could be utilized to generate more income. Therefore it was hypothesized that educated head of households had opportunity to generate more household income (+).

Household category (HHC): Rich households are expected to have high income and than poor households (+).

Size of farmland (SFa): Households own farming land are assumed to posses the means of earning more household income, the bigger the farm size the higher the income, assumed other factors held constant (+).

Marital status (MS): Married couple was assumed to be more organized in households thus they are able to generate more income (+).

Gender (Gender): Male headed household was assumed to be rich than female headed households, hence they have high household income than female headed households (+).

Non farm income (NFaI): Income from other sources besides farm and forestry contributes positively to total household income (+).

3.8.4 Hypothesis testing

The hypotheses tested were:-

(Ho): $\beta = 0$ implying that the regression coefficients are equal to zero and thus there is no correlation between dependent (Household income) and independent variable (sources of income and socio economic); against

(Ha): $\beta \neq 0$ implying that the regression coefficients are not equal to zero and thus there is either a positive or negative correlation between dependent and independent variables.

Ho: TAHI = f(DFoI, Non FaI, FaI, HHC, Gender, MS, Age, ED, SHH, SF)
+ + + + + + + + + +

Ha: TAHI = f(DFoI, Non FaI, FaI, HHC, Gender, MS, Age, ED, SHH, SF)
+ + + + + + + + + +

The Ho was rejected where $p<0.05$ by using two tailed T-test at 95% level of significance.

3.8.5 Multicollinearity

Assessment of the possibility of multicollinearity among independent variables was tested by performing correlation matrix (r^2), the r^2 value helped to select critical variable for regression analysis. To assess the goodness of fit of the regressions model to the data, the magnitude of R^2 value was used to determine the goodness of fit of the model to the data set. The high the value of R^2 the better the goodness of fit is the model.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter has been divided into five sections. The first section provides information on the influence of socio-economic characteristics of sampled household to the total annual household income. The second section provides the proportions contributions of the main sources of income which are farm, livestock, dryland forest, farm and their respective cash and non cash incomes to the total household income. Also indicate which variables significantly contribute to total annual household income. The third section provides information on identified problems which households face in management of dryland forests. The fourth section describes identified sources of cash for small, medium and large household expenditure. Firth section fifth section which is the last section describes and shows independent variables which statistically significantly contributes to the total annual households income. Results are presented in tables, charts, maps and brief summaries, for easier understanding, comparison and made between the study findings and other studies.

4.1 Household Characteristics

4.1.1 Household category

In order to understand the contribution of dryland forests, social grouping of households was important. Social grouping of households was done by using household wealth ranking technique, local criteria for social identification were used. In the study villages Sukuma ethnic tribe was the majority. Principally they make social identification of households base on number of cattle and land owned. Other criteria include number of oxen ploughs, bicycles and size of dryland forest traditionally known as *ngitili.* Study found that, traditionally sukuma tribe group households into three wealth categories namely rich *(Nsabi)*, Middle (*Hambo hambo*) and Poor (*nghabi*). The reported

characteristics of each household category and their respective percentage are presented in Table 2. Rich households owned more than 30 cattle and had more than 35 acres of land, the rich household category represented 15.4% of households in the study villages. The middle class household owned more than 5 cattle but less than 29 cattle and owned more than 5 acres of land but less than 31 acres, middle class households represented 50.6% of households in study villages. Poor households include households which owned less than 5 cattle and less than 6 acres of land, households in this category represented 34% of household in study villages.

Table 2: Household categories found in Kishapu District

Wealth category	Percentage (%)	Livestock (Cattle)	Land owned (Acres)	Food
Rich	15.4	> 30	> 35	Surplus
Middle	50.6	29 -5	30 -6	Subsistence
Poor	43	4 - 0	5 -0	Subsistence or deficit

Household categories indicated that, about half of households (50.6%) in the study villages had sufficient household income, about 1/3 of households (34%) had household income which was not sufficient and few household (15.4%) had sufficient household income and had surplus income. The international definition of poverty of 1 dollar/day/person was not used to categorise household because it did not fit the poverty realities and all people didn't know how much one dollar. Among the household categories the rich household per capital household income of TAS 1 493 was the only one which was above 1 US$. This means about 15.4% of households in study villages had household income above the poverty line while the remaining 84.6% was below the income poverty line. The percent of households in the study villages which are below the income poverty line was higher than the reported national average of 34%. The 34% of households which are regarded as poor household in the study villages was higher than the national estimated of 17% of the population in Tanzania which fall below the food poverty line (Keenja, 2004; NBS, 2007).

Study results concur with the assertion that poverty is mostly a prevalent phenomenon in rural areas.

The social grouping household into wealth categories of poor, rich and middle found in the study area was similar to other communities (NAPC, 2008; Wiskerke, 2008). Even some of the indicators used to determined wealth such as farmland owned by household are similar (Dercon and Krishnan, 200 cited in Abdulai and CroleRees, 2001). Household income differences between households in the rural areas are an important indicator of social differentiation in the villages. However there are some areas where households are grouped into more than 3 groups but still the aim of grouping had the same basic idea of showing diversity of household income among household in rural areas, example Richards *et al.* (2003) stratified sample households into four wealth categories of rich, middle, poor and extreme poor.

4.1.2 Gender of the head of the households

Gender of head of households in the study villages is presented in Table 3. There were more male headed households (83%) than female headed households (17%) in the study villages. Most of male household heads was married (96.6%) while most of the female household heads was widows (67.3%) and divorced (24.5%). The difference between male and female headed households was important since has implication in household income. In Sukuma tribe male headed households have great income earning opportunities due to greater control of productive resources. Therefore the higher percentage of male headed households suggests that most households in the study village have adequate household income. Generally it is believed that male headed households are richer than female headed households if the mean income is considered. The percentage of female headed household in study villages was higher (17%) than the regional percentage of female headed

household of 15% reported in the National Agriculture Census Survey of 2002/2003 (URT, 2007a). However the percent of female headed households of 17% in study village was lower than reported national average of 25% (NBS, 2007).

Table 3: Gender of households

Gender	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Male	264	46	142	76	83.0
Female	54	3	19	32	17.0
Total	**318**	**49**	**161**	**108**	**100.0**

4.1.3 Ethnic groups

Table 4 shows tribes of head of households in study villages in Kishapu District. The major ethic group among head of households was from Sukuma ethnic group which represented 96.9% of households in study villages. Other tribes found in the study villages was Nyiramba 2.2%, Kimbu 0.6% and Nyaturu which make up the remaining 0.3%. The study results whereby Sukuma tribe was dominant ethnic group in Kishapu District concur with agricultural sample household survey held in 2002/2003 (URT, 2007b).

Sukuma ethnic group are agropastoralists. Since the Sukuma tribe was dominant tribe in the study village most of their traditions were dominant, such as the traditional management of grazing lands through *ngitili* system was a vivid example. In sukuma tribe a patriarchal system is followed, men inherit land, livestocks and other important resources from their fathers and wives move to their husbands upon marriage. This makes males to be predominant key decision makers within the household.

Table 4: Tribes of household's heads in study villages

Tribe	Frequency of response	Response (%)
Sukuma	308	96.9
Nyaturu	1	0.3
Nyiramba	7	2.2
Kimbu	2	0.6
Total	**318**	**100.0**

4.1.4 Marital status of head of households

Marital status of head of households in the study villages in presented in Table 5. Most head of households (81.7%) in the study villages were married while the remaining respondents were widow (12.5%), divorced (4%), separated (0.9%) and single (0.6%). About 1.9% of interviewees were females who were interviewed on behalf of their husbands. Since most head of households was married, it means they are more organized in terms of labour and responsibilities within the household hence they had higher household income than widows, divorced, separated and single households. World Bank (2001) cited by Botha (2003) reported that female headed household are poorer than male headed households. The main reason was due to limited access to productive resources, divorced and widows are left without resources which the singles has no right to inherit. Female headed households were reported had access to fewer assets, less land, less livestock, fewer personal possessions (Morris *et al.*, Undated). The other reasons was, women are more involved in food security at the household and busy with household chores, thus they have little time available for being engaged in other economic activities which could earn them income.

Table 5: Marital status of head of households in study villages

Marital status	Frequency of response	Household category			
		Rich	Middle	Poor	Response (%)
Married	260	45	149	73	81.8
Single	2	0	0	2	0.6
Divorced	13	0	2	11	4.1
Widowed	40	4	17	19	12.6
Separated	3	0	0	3	0.9
Total	**318**	**49**	**161**	**108**	**100.0**

4.1.5 Education of the head of the household

Education of head of households was accessed as measure of human capital to households. Table 6 shows the education level of heads of households in the study villages. Most heads of households (55%) had primary education, few (3.8%) attended adult education and 0.9% attained secondary education while 4.3% was illiterate. Generally this gives an impression the education level of most head of households is relatively low because primary education is still a basic education.

Table 6: Education levels of households heads in study villages

Type of education	Frequency of response	Household category			
		Rich	Middle	Poor	Response (%)
Illiterate	128	26	49	53	40.3
Primary school	175	20	106	49	55.0
Secondary school	3	0	3	0	0.9
Adult education	12	3	3	6	3.8
Total	**318**	**49**	**161**	**108**	**100.0**

The NBS (2001) and NBS (2007) reported poverty levels was strongly related to the education of the head of households, household in which the head has no education are now five time more likely to be poor than household with a head of household educated above the primary level. Therefore the literacy rate of the head of the household in study area of 58.8% was not sufficient to influence decision making which would result in higher household income. Few households (0.9%) have secondary education, means few households their household income are likely to be higher. Also Kessy and Njana (2009) reported higher level of education puts households in better understanding of existing livelihood challenges and better postponed to choose better alternative solutions to existing problems and undertake household livelihood strategies which are environmentally friendly. The 40.3% of illiteracy of head of households found in study villages was higher than reported national illiteracy rate of 27.5% (NBS, 2007). The higher illiteracy rate could be explained by past efforts in education. The education system in Shinyanga is less

developed compared to other region due to absence of active involvement of church missionaries in the past education, tradition of Sukuma preferring cattle herding than schools and Sukuma parents preferring bride price thus did not send girls to school. The literacy rate of the head of household in the study village was higher (59.7%) than Kishapu District literacy rate of 54% which was reported in the National Agriculture Census Survey held in 2002/2003 (URT, 2007a). The cause of variation might be the increase of head of household who have completed primary and secondary schools between 2002 and 2009 as shown in the profile of Kishapu District Council (URT, 2009). However, the literacy rate of 59.7% in the study village was lower than the national literacy rate of 72.5% (NBS, 2007). The relative low literacy rate is driven by the low number of secondary schools and the tendency of using children's in livestock keeping.

The relative low level of education in the study villages suggests negative bearing to the management of dryland forests. Level of education was considered an important factor at household level, the higher the literacy rate of the head of household the higher the probability the head of households are able to make sensible decisions regarding household livelihoods in relation to forest resources (Maro, 1995; Kamwenda 1998). Mbwambo (2000) reported that people who are better educated tend to plant more trees for their own uses as opposed to less educated ones, planted trees reduces dependency on the natural forests. In a study conducted in Malawi education of the household head showed a positive trend with food crops, cash crops as well as forestry income sources (Botha, 2003).

4.1.6 Main economic activities

The main economic activities in the study villages are presented in Table 7. Most of households (98.1%) in study villages are farmers, this suggests that farming contributed higher income to the total annual household income to most households in study villages in

Kishapu District. Average household income of main sources of income was calculated from quantity of source against the prevailing local prices. Computed overall average household income from farm component was the highest TAS I 133 569 followed by TAS 587 546 from livestock, TAS 399 466 from dryland forest and TAS 320 083 from non farm income. Most households practice subsistence farming while other activities are undertaken as the income diversification strategies in case of farm income fluctuate.

Table 7: Main economic activities of households in the study village

Economic activity	Frequency of response	Household category			
		Rich	Middle	Poor	Response (%)
Farmer	312	48	157	107	98.1
Employed	3	0	2	1	1.0
Business	2	0	2	0	0.6
Traditional healer	1	1	0	0	0.3
Total	**318**	**49**	**161**	**108**	**100.0**

The high percentage of household (98.1%) depended on farming as the main economic activity is the study villages concur with the report which indicated farming employs over 80% of the rural households (Abdallah and Sauer 2005). But the percentage was higher than 75% reported in human development report (URT 2007c). The percentage of household found in the study villages which depends on farming (98.1%) concur with national Agriculture Census Survey results which indicated most households in Kishapu District ranked farming as the first economic activity which contributes to household livelihood (URT, 2007a).

4.1.7 Ownership of farming land

Table 8 shows the status of ownership of farming land in the study area. Most of sampled households (91.2%) owned farming land while few households (8.8%) were lands less. This means most households own means which contributes to household farm income, this results is in line with the results in section 4.1.6 of this study.

Table 8: Ownership of farming land

Own farm land	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Yes	290	49	157	84	91.2
No	28	0	4	24	8.8
Total	**318**	**49**	**161**	**108**	**100.0**

Farming land was valuable natural asset which was essential for livelihoods in the study villages, household with more land utilize it for farming and renting to others. The more land a household has the more likely it pursues farming and livestock keeping which require enough land for production and grazing respectively. The average size of farming land owned by household was about 18 acres, the minimum being 0 and the maximum 260 acres. The average land of 18 acres owned per households in study villages was higher than the regional average of 8.5 acres per household and the national average of 5 acres per household (NBS, 2007). The percentage of households owned land in the study villages was higher than national average of around 87% households reported in household budget survey (NBS, 2007). The higher average land ownership in study villages was due to skewed land ownership where about 15% of rich households are estimated to own more than half of farming and grazing lands in study villages. Also moderate population density of 60.1 person/km^3 reported in Kishapu district was the contributing factor to higher average land owned per household.

Farm size has implications on household's income, more farmland means more farm income and probably acquire extra income from tree retained on farm land as indicated in section 4.2.3.7 where 27% of household collect forest products from farm land. For many rural households in sub-Saharan Africa, land was a key asset and serves multiple uses including cultivation, sustaining livestock, storing wealth, and providing collateral for financial credit (Lay *et al.*, 2007).

4.1.8 Trends of household income

Trend of change in household income in study villages in Kishapu District for the last 10 years is presented in Table 9. Most households (57.2%) mentioned their household income is getting worse while few households (21.7%) said their household income has remained the same and (21.1%) households their income has improved.

Table 9: Reported changes of household income in study villages (2009 – 2010)

Income change	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Improved	67	19	38	10	21.1
Same	69	4	37	28	21.7
Getting worse	182	26	86	70	57.2
Total	**318**	**49**	**161**	**108**	**100.0**

Reported change is household income showed most household income has decreased, the major reason of getting worse was frequent droughts in study villages. As observed earlier farming was the main source of income to most households in the study villages and depends on rainfalls. By study villages being located in semi arid where rains are not reliable suggest that, the worsening of household income was linked to erratic rainfalls. Kashuliza *et al.* (2002) noted heavy dependence on rainfall is among the limiting factors on food production in Tanzania. Also Morris *et al.* (Undated) reported semi-arid areas are risky environments from the perspectives of low and unpredictable rainfall thus timely ploughing, planting, labour for weeding are important for optimum harvest outcomes. Frequent drought are natural phenomenon and is part of life in the study villages, therefore farmers should cultivate types of crops which are drought resistant.

4.1.9 Age distribution of head of household

Table 10 show the age class distribution of head of household by wealth categories in study villages. Most of the heads of households (49%) are between the age of 41 and 60

years which is still considered as productive age, therefore they can effectively participate in household activities which contribute to household income. The 41% of head of households in this study who are between 30 and 44 years they are still within the range comparable with the national average of 38.7% for the rural household, national Household Survey (2007) cited by Kessy and Njana (2009).

Table 10: Age class distribution of households heads in study villages

Age class (Years)	Rich	Middle	Poor	Total	%
22 -30	1	1	7	9	2.8
31 -40	3	32	19	54	17
41 -50	8	44	26	78	24.5
51 -60	15	46	17	78	24.5
61 -70	14	30	23	67	21.1
71 -80	6	7	10	23	7.3
81 -90	1	1	4	6	1.9
91 -98	1	0	2	3	0.9
Total	**49**	**161**	**108**	**318**	**100.0**

4.1.10 Other household parameters

4.1.10.1 Age of household head

The average age of head of household was 53.7 years, the minimum age was 22 years while the maximum age was 98 years as shown in Table 11. Most head of households were aged individuals who own land, still energetic and experienced with village environments, therefore these factors are likely to contribute to household income. The average age of the head of household in the study village was higher than the moderate average age of 47 years reported by the National agriculture census Survey (URT, 2007a). People of order age in Western Kenya have been observed their main income source of income was from farm while most young people depended on non farm activities because they don't own farming land (Chianu *et al.*, 2008).

Table 11: Descriptive statistics of socio economic variables in households

Variable	N	Range	Minimum	Maximum	Mean	Standard deviation
Age (Years)	318	76	22	98	53.76	13.979
Residency (Years)	318	95	1	96	40.49	21.498
Household size (Person)	318	22	1	23	8.01	4.011
Farm size (Acres)	318	260	0	260	18	11.004

4.1.10.2 Size of households

The average size of household was 8 persons, the minimum was 1 person and the maximum was 23 persons as shown in Table 11. The household size suggests and household has adequate manpower which could be engaged in productive activities which contribute to household income. Also large household size means high consumption units within the household. The average household size of 8 people per household was higher than the regional average household size of 6.3 and national average of 4.9 respectively (URT 2007b; URT 2003). The average size of 8 person per household found in the study villages was similar as the one which Kagya (2002) found in her study in Meatu District. The household size in study villages was higher than 6.4 persons reported by the National Agriculture Census Survey (URT, 2007b), 6.1 in Kishapu District profiles (URT, 2009) and 6.1 in population and National housing census of 2002 (URT, 2003). The size of households in sample villages was high due to the fact that people from other areas are attracted by small scale diamond and gold mining which are happening near sampled villages. This is justified by the number of males which is high than females in Table 1.

4.1.10.3 Residency

The average years of residency within the study villages was 40 years, the minimum was 1 year and the maximum was 96 years, it seems most households in the study villages have been settled for more than one generations but there are still some new households which area still coming in the study villages. The average 40 years of residency suggest most household are experienced with the village environment and has sufficient indigenous knowledge which contribute to total household income.

4.2 Decomposition of Household Income

Households are used as the unit of analysis in this study for the reason that it is the most common domestic unit on which production and consumption is taking place (Ellis, 1998; Roberts, 1991). Therefore household was more reliable unit to determine the extent of dryland forest contribution to rural household income. The contribution of dryland forest was evaluated as a share of total annual household income. Income is used to measure household livelihood because it is relative easy to measure and is a reasonable proxy for livelihood (DFID, 10999; Angelsen and Wunder, 2003). The value of dryland forests resources in this study was determined by direct valuation method (Zonon, 2007). This approach provide insights into values at a local level according to the ways communities make use of natural resources and the variation between the values that different members of community may attach to the same resource.

To find out the contribution of various sources of income to the total annual household income, household incomes was decomposed and calculated according to sources of incomes. Total household income included cash income and subsistence income (Cavendish, 2000). Cash and non cash use values were collected at a household level in order to ascertain annual household livelihood per households. Household income sources were grouped into 4 major sources. Farm income was calculated based on crops grown in farm. Livestock income was calculated from livestocks and their products. Forest income was calculated from forests products. Non-farm income was calculated from non agricultural sources, wage labour, petty business, and remittance excluding forestry as non-farm income (Ellis, 2000; Reardon, 1997). Annually household income was computed through the valuation of all crops grown, all livestock, all incomes from forest and all income from non farm activities as reported in the forth coming sub – chapter.

4.2.1 Farm contribution to household income

Farm gross income was calculated based on collected information of estimated quantity of annual crop harvested against prevailed local market prices of respective crops.

4.2.1.1 Types of crops grown by households

Table 12 indicate types of farm crops grown by households in study villages in Kishapu District. Crops grown by most households in the study villages was maize (98.1%), cotton (90.6%), sweet potatoes (88.1%), green gram (74.5%), groundnuts (67.3%) and cowpeas (64.5%). Other crops grown were sorghum, paddy, chickpea, bambara nuts, sim sim, tobacco, sunflower and tomatoes. The average quantity of the main crops harvested per household was cotton 1224 kg, maize 7.5 bags, sweet potatoes 3.3 bags, green gram 1.1 bags, ground nuts 2.3 bags and cowpeas 0.7 bags. Since these crops are grown by most households it means they directly contribute to the total annual household's income when they are consumed and indirectly when they are sold.

Table 12: Types of farm crops grown by households in the study villages

Type of crop	Frequency of response	Response (% respondents)
Maize	312	98.1
Cotton	288	90.6
Sweet potato	280	88.1
Green gram	237	74.5
Ground nuts	214	67.3
Cowpeas	205	64.5
Sorghum	160	50.3
Paddy	128	40.3
Chickpeas	119	37.4
Bambara nuts	46	14.5
Sim sim	46	14.5
Tobacco	36	11.3
Sunflower	35	11.0
Tomato	26	8.2
Onion	18	5.7
Sugar cane	14	4.4
Bulrush millet	10	3.1
Finger millet	6	1.8

Kishapu is one among the districts of Shinyanga region found in semi arid areas on the eastern part of the region, unfortunately most households in this district prefer to grow maize as staple food (URT, 2004). According to climate farmers in study villages are advised to cultivate sorghum and millet as food crops because they are drought resistant crops, most people do not like to cultivate these crops because they are perceived as famine or food for poor households.

4.2.1.2 Non cash income contribution of farm crops

Table 13 shows types of farm crops preferred for household consumption in the study villages. Maize was the type of crop consumed by most households (65.2%) in study villages. The overall average consumption of maize per household was 6.6 bags per year which had non cash income of TAS 237 871. However, there was a difference in maize consumption between household categories, rich households consumed an average of 12 bags per annual with non cash income of TAS 428 327, this amount was above the overall average of 6.6 bags of maize. Middle household consumed 6.9 bags of maize per annual which has non cash income of TAS 251 553, poor households consumed 3.5 bags of maize per year with non cash income of TAS 126 944 which was lower than overall average consumption. The difference in consumption among household categories was due to size of household and availability of maize to respective households.

Table 13: farm crop contributing to non cash income to household income

Type of crops	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Maize	266	40	133	93	65.2
Sorghum	79	13	49	17	19.4
Bulrush millet	8	2	4	2	2.0
Paddy	21	6	10	5	5.1
Sweet potatoes	31	4	18	9	7.6
Chickpeas	3	2	0	1	0.7
Total	**408**	**67**	**214**	**127**	**100.0**

Note: N=408 Because of multiple response from 318 households

The non cash contribution from maize of TAS 237 871 was the highest contribution which contributed 46.2% of total non cash income to the farm component. Therefore maize contributed almost about half of the non cash income of the farm component which was significant contribution. Households in study villages are mostly small scale farmers primarily producing for subsistence. Study results concurred with reported finding that maize was the major food crops in Tanzania Mainland (NBS, 2008).

4.2.1.3 Cash income contribution from farm crops

Table 14 shows types of farm crops which contribute cash income to household income in the study villages. Cotton was the major source of cash which contributed cash income to most household income (63.9%). Other farm crops which contributed cash income were green gram, chickpea, paddy and maize. Cotton as individual crop contributed 81% of cash to the farm component and 47% of total income of farm component. Cotton had the highest contribution of cash income because most households (90.5%) in the study villages cultivate cotton as the main cash crop. The overall average annual cash income realized from sold cotton was TAS 541 787 per household from 1237 kg. The minimum amount of cotton sold by household was 20 kg worth TAS 8800 and the maximum was 17 800 kg worth TAS 7 120 000. However, there was a difference of cash income earned from cotton among household categories, rich households on average earned TAS 1 036 849 from 2392 kg of cotton, middle households earned TAS 531 373 from 1208 kg of cotton and poor households earned TAS 300 400 from 643 kg of cotton. The difference in cash income was due to differences in average amount of cotton sold by respective household categories. Few household (1.8%) reported they didn't realized cash income from cotton because they didn't own farm lands which were suitable for cotton cultivation and others were land less.

Study results are similar with the National Agricultural Census Survey of 2002/2003 which indicated most households (63.9%) in Shinyanga region their main source of cash income was from cotton (URT, 2007a). Study results which indicated the main source of cash was from cash crop disagree with Roland-Holst and Otte (2007) who reported in most developing countries majority of rural household cash income was delivered by selling food crops.

Table 14: Types of farm crops which contribute cash income to households

Crop	Frequency of response	Response (%)
Cotton	280	63.9
Green gram	48	11.0
Chickpea	25	5.7
Maize	15	3.4
Paddy	18	4.1
Tobacco	12	2.7
Sunflower	11	2.5
Sugar cane	5	1.1
Tomato	4	0.9
Sorghum	3	0.7
Sweet potato	3	0.7
Ground nuts	2	0.5
Onions	2	0.5
Bamabara nuts	1	0.2
Sim sim	1	0.2
None	8	1.8
Total	**438**	**100.0**

Note: N= 438 Because of multiple response from 318 households

Even though the world market price for cotton as traditional cash crops has been on the decline over many years due to globalization and trade liberalization, many farmers in the study villages still regard cotton as important cash crop. However, a closer look at the real cash income contributed to rural household in study villages traditional food crops such as maize and paddy also contributed cash income.

4.2.2 Contribution of livestock to household income

In the study village Sukuma tribe was dominant tribe as shown in section 4.1.3 of this study. In Sukuma tradition livestock especially cattle was regarded as an asset and symbol

for prestige and wealth. In Sukuma tradition cattle are used to pay dowry, man is expected pay dowry in form of cattle to a woman's parents at marriage. Livestock management demands manpower for herding and land for pasture, thus livestock are suited in households with adequate lands. Livestock are renewable assets, ready sources of cash, quality nutrients in human diet and are often essential for important social and cultural obligations.

4.2.2.1 Ownership of livestocks

Table 15 shows households which own livestocks in study villages. Most household (76.1%) owned livestock while few households (23.9%) did not own livestock, most of households (78.93%) which did not own livestock belonged to poor households. Since most households own livestock, therefore livestocks directly and indirectly contributed income to most households in the study villages. Livestocks contribute to household livelihoods in terms of food such as meat and milk and product like hides, they also provide draught power and source of manure. Livestocks contributed cash income to household when they are sold and non cash income when they are consumed by households. Few households (23.9%) in the study villages did not own livestocks, this means about ¼ of households in the study villages their household incomes was not contributed by livestock. Ownership of cattle in the study villages was concentrated among wealth households, but there are processes whereby households without cattle can get access to key livestock services such ass transport and ploughing, in many cases this was based on reciprocity. In some cases the poor household may look after the cattle of the wealth household in return for having their fields ploughed. In some cases, farmers have farm implements but did not have oxen, in these cases farmers team up with oxen owners and till their fields together. All households (100%) in rich household category kept livestocks, most household (90%) in middle household category kept livestock and few

household (44.4%) in the poor households kept livestock. Study results are similar to other studies which show in developing countries majority of households at village level even the poor and landless owned small livestocks such as chicken (Mac *et al.*, 2005).

Table 15: Households which own livestocks

Own livestocks	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Yes	242	49	145	48	76.1
No	76	0	16	60	23.9
Total	**318**	**49**	**161**	**108**	**100.0**

4.2.2.2 Types of livestock kept by households

Table 16 shows type of livestocks kept by households in study villages. Most households kept chickens (71.5%), cattle (64.2%) and goats (61.3%), other types of livestock kept was sheeps, dogs, pigeons, cats, ducks, pigs and donkeys.

Table 16: Types of livestocks kept by households in study villages

Type of livestock		Frequency of responses	Responses (% respondents)
Chicken	(S)	227	71.4
Cattle	(L)	204	64.2
Goat	(M)	197	61.3
Sheep	(M)	141	44.3
Dog		112	35.2
Cat		97	30.5
Pigeon	(S)	30	9.4
Ducks	(S)	19	5.9
Donkey	(L)	7	2.2
Pigs	(M)	4	1.2

Note: S = Small livestock, M = Medium livestock L = Large livestock

It was observed all households kept chickens by traditional free range system. Small livestocks especially chicken and medium livestocks such as goats are kept even by poor households in the study villages, this means these types of livestocks contributed directly or indirectly to most household incomes in study villages. The percentage of major types of livestock kept by households in study village was above the reported national average

percent i.e. 65% chicken, 25% cattle and 49% goats (NBS 2001). The higher percentage is attributed by sukuma tribe being agro pastoralists where livestocks play a key role in their livelihood system. Further more, chickens are mainly owned and managed by women and are often essential elements of female headed households which are believed to be poor (Mack *et al.*, 2005). The 71.5% of household which keep chickens in study villages by traditional free range system was almost similar to the reported 80% of the global chicken population being kept by free range production systems in many countries (Mack *et al.*, 2005). Also chicken contribute food with rich protein source and provide cash income to poor households (Gujit, 1994; Alders, 1996; Kitalyi and Mayer, 1998). The study results which shows in study villages chicken was kept by almost every households was similar to what was observed in western Kenya where chicken was the most widespread livestock owned by households (Chianu *et al.*, 2008).

4.2.2.3 Non cash income from livestocks

Chicken was the type of livestocks which was frequently consumed by most households (44.2%) in the study villages as shown in Table 17. other types of livestocks which contributed non cash income were goats and sheep. Therefore chicken contributed significant non cash income to more than half of the household (57.9%) in the study area. The overall average number of chicken consumed per household was 7 chickens per annum with average non cash value of TAS 31 011. Chicken are important to rural households because they supply additional income and high quality protein (Mack *et al.*, 2005). The high consumption of chicken was attributed by Sukuma tradition which allowed female to make decision to consume small animals such as chicken but not large animals. The average non cash income contributed by livestock component was TAS 507 763, the maximum non cash income was 2 300 000 and the minimum was TAS 500. Therefore on average the non cash income contributed 75.7% to the total income of the

livestock component, this suggests most livestocks were consumed by households in the study villages.

Few households (20.6%) in study villages their household incomes was not contributed by livestocks because they didn't own livestocks. The difference in percentage between households which their income was not contributed by livestock 20.6% and 24% reported in section 4.2.2.1 of this study is explained by a system whereby rich households distribute some of their livestock to relatives who don't own livestock. The relative have the right over milk, manure and assistance of ox-plough during farming season.

Table 17: Types of livestocks frequently consumed at households

Type of livestock	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Chicken	165	26	88	51	44.2
Goat	86	17	55	13	23.1
Sheep	32	13	17	2	8.6
Duck	7	0	5	2	1.9
Cattle	6	1	4	1	1.6
None	77	8	27	42	20.6
Total	**373**	**66**	**196**	**111**	**100.0**

Note: N = 373 because of multiple response from 318 households

4.2.2.4 Cash contribution from livestocks

Livestock in addition to other functions provide insurance to rural households, livestocks especially cattle are considered as reserve resource to most households. Households in the study villages reported sales of various types of livestock as a way of raising cash to cover various expenses. Table 18 shows type of livestock which contributed cash income to households in the study villages. Cattle were the most common type of livestock which was reported by 37.3% households as source of cash to households. Other types of livestocks which contributed cash to household income were goats, chicken and sheep.

Table 18: Type of livestocks which contribute cash income to households

Type of livestock	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Cattle	136	39	85	12	37.2
Goat	76	8	47	21	20.8
Chicken	58	1	26	31	15.9
Sheep	16	5	7	4	4.4
Duck	1	0	0	1	0.3
None	78	7	24	47	21.4
Total	**365**	**60**	**189**	**116**	**100.0**

Note: N = 365 because of multiple response from 318 households

On overall average cattle contributed cash income of about TAS 674 468 per household per annum by selling 3 cattle the minimum cash income was TAS 300 000 from 1 cattle sold and the maximum cash income was TAS 4 500 000 from 15 cattle. Livestock are sold by household through formal and informal market channels in which prices of livestock are fairly consistent. On average livestocks provided average cash income of TAS 163 107 per household annually which constituted 24.3% of average total cash of livestock component. This suggests that, smaller number of livestock were sold by households in the study villages. The minimum cash income from livestock was TAS 2000 and the maximum cash income was TAS 4 500 000, the amount of cash income from livestock in any particular year was determined by the number of animals sold. Cattle sales are rare in the study village unless there was an urgent need of cash or distress, thus livestocks was renewable assets and ready source of cash (Mack *et al.*, 2005). The importance of livestock as an essential asset to rural household livelihoods around the world is well understood (Roland-Holst and Otte, 2007). In the study village it is well recognized that wealth status is largely a function of the number of cattle owned.

Study results revealed there was a difference in cash income earned among households categories from livestocks, rich households on average earned TAS 326 450, middle households earned TAS 166 000 and poor household earned TAS 47 750. In general, most

households (71.6%) in the study village their total households income was contributed by cash from livestocks while few households (28.4%) their total household income was not contributed by livestock because they didn't own livestock, this was based on 318 interviewed households.

4.2.3 Contribution of dryland forest to household income

Dryland forest provide a range of benefits such as direct use values, indirect use values, option values and existence or non-use values (Safriel *et al.*, 2002; Krutilla, 1967). Many of these services can be valued quantitatively, while others are intangible. Most of forest products are not traded hence economic valuation becomes difficult, thus they are not properly accounted for in valuation (Shylajan and Mythili 2007). Keeping this in mind, this study tries to documents and demonstrates the contribution of dryland forests to rural household livelihoods in terms of subsistence and cash income by using household data. Gross income of forest products was calculated by multiplying the total quantity collected by their respective market prices (Shylajan and Mythili 2007). For non market forest products, willingness to pay method was used to make valuation (Mahrajan and Khatri-Chhetri, 2008).

4.2.3.1 Tree species found in the study area

Various tree species were mentioned by key informants during focused group discussions held in sampled villages. The list of common tree species found in the study villages and their use are presented in Table 19. Tree species mentioned has various used which include subsistence and cash income generation. Mbuya *et al.* 1994 reported trees and shrubs provide a wide range of benefit in terms of products and services.

Table 19: List of common tree species found in study villages and their uses

Local name	Scientific name	Uses
Mhale	*Acacia nilotica*	Medicine (Roots, bark, leaves), firewood, charcoal, lumber, yoke, hoe handle, medicine for livestock (Seeds), fodder (leaves and pods) gum.
Malula	*Acacia drepanolobium*	Firewood, gum, hoe handle, medicine (leaves, roots), Yoke, Oxcart pole, cattle pen
Mgunga	*Acacia tourtilis*	Firewood, charcoal, gum, pole, hoe handle, medicine (leaves, roots), yoke, Oxcart pole, cattle pen, fodder (Leaves, pods).
Myuguyu	*Balanite aegyptica*	Hoe handle, firewood, charcoal, food (fruits), Yoke, medicine (Bark, fruits and roots).
Mtunduru	*Dichrostachys cinerea*	Medicine (Roots and leaves), cattle pen, fodder, firewood.
Mhushi		Firewood and gum
Msuha		Firewood and charcoal.
Bushishi	*Tamarindus indica*	Food (Fruits), firewood, charcoal, medicine (Roots, bark, leaves, hoe handle and yoke.
Mgu	*Acacia polyacantha*	Firewood, hoe handle, timber, yoke, gum, medicine (Leaves and roots).
Mponda	*Comiphora africana*	Medicine (Bark), firewood.
Mwandu	*Adansonii digitata*	Food (Fruits), medicine (Leaves and roots), rope, fodder (Leaves).
Mcgene		Shade, medicine (Bark), food (fruits).
Mnyaa	*Euphorbia tirucali*	Live fence, firewood, medicine.
Lusina	*Leucaena leucocephala*	Firewood
Muarobaini	*Azadirachta indica*	Medicine (Leaves).
Msingisa	*Maerma sp.*	Medicine (leaves), firewood, fodder.
Msubata	*Diospyros fischeri*	Yoke, medicine (roots and bark)
Mkuyu	*Ficus sycomorus*	Mortars, firewood, fodder.
Ilula mbuli	*Ormocarpum trichocarpum*	Medicine (roots, bark, leaves), firewood, fodder.
Mkaratusi	*Eucalyptus spp.*	Firewood, timber pole.

4.2.3.2 Forest products collected by households

Table 20 shows different types of dryland forest products collected by households in the study villages. The main dryland forest products collected by most households was firewood (100%), hoe handles (89.3%), roofing grass (75.2%), vegetables (72.9%), pestles (72%), tamarind (66%), chairs (65.1%), yoke (52.8%) and mortars (52.2%). Other types of forest products collected were fodder, pound, medicine and charcoal, Most of the forest products was collected and directly consumed by household and few were sold in local market to get cash. Therefore forest products directly and indirectly contribution to household income.

Table 20: Types of forest products collected by households

Product type		Frequency of response	% of response	Average quantity	Price	Estimated value
Firewood	(Oxcart)	318	100	1.75	15 000	26 250
Hoe handle	(Piece)	284	89.3	5.0	1 500	7 500
Roofing grass	(Bundle)	239	75.2	24.68	500	12 340
Vegetable	(Tin)	232	72.9	6.84	5 000	34 200
Pestles	(Piece)	229	72.0	3.1	1 000	3 100
Tamarind	(Tin)	210	66.0	3.0	5 000	15 000
Chairs	(Piece)	207	65.1	3.6	2 000	7 200
Yoke	(Piece)	168	52.8	3.0	5 000	15 000
Mortar	(Piece)	166	52.2	1.1	5 000	5 500
Fodder	(Acre)	150	47.2	16.73	25 000	418 250
Pound	(Piece)	147	46.2	1.39	500	695
Medicine	(Pieces)	111	34.9	140.1	500	70 050
Charcoal	(Bags)	105	33.0	14.86	9 000	133 740
Pole	(Piece)	81	25.5	6.99	4 000	27 960
Gum arabica	(Tin)	60	18.8	4.85	13 000	63 050
Tree	(Number)	54	16.9	4.75	30 000	142 500
Oxcart pole	(Piece)	52	16.3	2.7	15 000	40 500
Honey	(litre)	22	6.9	8.64	1 000	8 640
Milking vessel	(Piece)	21	6.6	1.38	1 000	1 380
Board game	(Piece)	9	2.8	1.1	2 000	2 200
Sisal pole	(Piece)	7	2.2	201.4	500	100 700
Total						**1 135 755**

Note: n = 318

Dryland forests and trees in the study villages has relatively low potential for timber production, but furnished wide range of wood and non-wood products which was vital for local people's livelihoods. All household in the study village collected firewood, normally firewood collection is done in October before the rain season. Green woods are collected by cutting entire tree which contributes to deforestation. Wild vegetables and tamarind fruits are collected once per year by most households 72.9% and 60% respectively. Types of forest products collected by households in rural households in Kishapu Districts for their household use was similar in term of use categories as those documented in villages located near Nguru South Mountains in Tanzania (Robinson and Kajembe, 2009).

In spite of difference in ecosystems between semi arid areas and moist forest such as the East Usambara forest products collected by rural households was similar from use category point of view. In both ecosystems most households collected forest product from forest reserves and few from sources out side of forest reserves. Major wooden household tools

used by most household were mortars, chairs/stools, tool handless and pestles/spoon. Medicine was collected by both males and females. Most households consumed wild vegetable and fruits and females were the main collectors, female were responsible in firewood collection. The major difference was on per capita consumption of forest products, example in Kishapu firewood consumption was 0.7 m^3 while in East Usambara was 1.7 m^3 as reported by Owen (1992) cited by Kessy (1998). The difference in per capita firewood consumption between these two localities was due to availability of firewood.

4.2.3.3 Cash income from dryland forest products

Table 21 presents types of forest products which were first ranked by households as source of cash in the study village. Gum arabica was first ranked by most household (14.2%) as source of cash income, other forests products ranked as source of cash income was charcoal (10%) and firewood (7.6%). Therefore gums contributed cash to household's income which participated in collection and selling of gum, all household categories their household income was contributed by cash from gum arabica. Some forest products such as tamarind fruits, medicines, pestles, hoe handles, yokes, chairs and honey are examples of products that were commonly found in rural markets while other was bought directly form producer by consumers.

Table 21: Forest products first ranked as source of cash income to households

Forest product	Frequency of response	Household category			Response (%)
		Rich	Middle	Poor	
Gum arabica	45	5	29	11	14.2
Charcoal	34	6	19	9	10.7
Firewood	24	7	13	4	7.6
Fodder	9	3	3	3	2.8
Tamarind fruits	6	0	1	5	1.9
Thatch grass	4	0	1	3	1.3
Hoe handle	3	1	1	1	0.9
Yoke	1	1	0	0	0.3
Poles	1	0	1	0	0.3
Medicine	1	0	1	0	0.3
Chairs	1	0	1	0	0.3
None	180	25	91	73	59.4
Total	**318**	**48**	**161**	**109**	**100.0**

Although most of the dryland forest products was not sold in market place, but trading occur locally at household levels. About 16% of sampled households (318) in the study villages was involved in collection and selling of gum arabica, on average households collected and sold about 72 kg of gum arabica worth TAS 70 169 per annum, the minimum amount of gum sold was 3 kg worth TAS 2210 and the maximum amount was 840 kg worth TAS 672 000. The average price of gum was TAS 13 000 per tin, traders buy gums arabica at TAS 500 by using container known as *shaba* which is equivalent to 1.5 kg depending on the weight of gum. Shilabu (2008) also reported the market problem of not using standard units to measure forest products in Maswa District. Besides the market imperfect, the potential of trade in gum arabica is not yet fully exploited in Shinyanga region where there are vast dryland forests (Monela *et al.*, 2005). The weakness of marketing of gum was the same as those identified on other forest products which include the lack of well developed markets resulted in low prices (Campbell *et al.*, 2002; Angelsen and Wunder, 2003; Kaimowitz, 2003). According to the export statistics, the price offered by the world market for gum arabica from Tanzania was low compared to other countries due to poor quality of gum which is exported without grading Kagya (2004) cited by World Bank (2005). Gum arabica collectors in field don't separate gum according to tree source as the consequence ends up with mixtures of tree gums.

Due to scarcity of trees and population increase in the study villages now day's firewood is sold and rarely collected as a free good. Poor household on average sold 2 oxcart (6.9 m^3) of firewood per annual which worth TAS 30 000, while rich and middle on average sold 4 oxcarts (13.6 m^3) and 1.3 oxcart (4.4 m^3) which earned cash of TAS 65 000 and TAS 19 167 respectively. The study results whereby firewood was sold as the means of earning cash in study villages was similar as in other rural areas (Velempini 2006) cited by (Madzwamuse *et al.*, 2007).

About 14.5% of households in the study villages were involved in selling charcoal as the means generating cash income. On average households sold 27.5 bags per annual which valued TAS 247 656, the maximum number of bags sold was 250 worth 2 250 000 and the minimum was 1 bag worth TAS 9000. By household category poor households sold more charcoal bags, on average they sold 74.2 bags of charcoal per annum which valued TAS 667 636, middle household sold 11.9 bags valued TAS 107 654 and rich households sold 15.3 bags worth TAS 138 333. Most poor households in the study villages did not own forest and trees, therefore it likely they contributed in deforestation in the process of getting raw materials for charcoal production.

In shinyanga region fodder is traded, some agropastoralists have specialized in establishing *ngitili* and sell grazing rights to sedentary pastoralists, as a result natural fodder is becoming a business. The price of fodder ranges between TAS 10 000 to 40 000 per acre, the value of fodder vary depending on the quality and quantity of fodder. On average households earned about TAS 89 444 per annual by selling about 3.4 acres, the maximum amount earned was TAS 250 000 from an average area of 10 acres and the minimum was TAS 50 000 from 2 acres of fodder.

Generally members of households have been observed to collect and sell various forest products, this tendency was similar as in other communities where type of forest products, this tendency was similar as in other communities where type of forest products traded among household categories was varied (Pustjarvy *et al.*, 2005). About 55.1% of households in the study villages did not ranked any forest product as source of income, these are mostly households which didn't own forest or trees. About 44.9% of households ranked forest products as source of cash, it means forests contributed cash to their household income. The average cash income from dryland forest products per household

was TAS 192 378 which is 34.4% of income of the forest component. The minimum cash income from dryland forest products was TAS 2000 and the maximum cash was TAS 240 000 per annum. The average annual cash income of TAS 192 378 per household from dryland forest products found in Kishapu District was higher than TAS 57 000 reported by Kagya (2002) in the study conducted in Meatu District. The difference might be due to study villages being near to Maganzo and Mhunze town where demands and price of forest products such as gum, charcoal and firewood are good. In the study villages there was about 5 traditional healers, on average traditional healers earned on average cash income of TAS 483 333 per annual by treating patient, the minimum cash income earned was TAS 350 000 and the maximum cash income was TAS 600 000 per annum.

Study results revealed there was substantial variation in cash income earned from forests products among household categories. Poor households earned on average TAS 328 172, middle households on average earned TAS 126 249 and rich households on average earned TAS 186 984. The tendency of the poor household to get more cash income from dryland forest than non-poor households was explained by different in resource endowments. Poor household has access to few assets example land, animals, implements, financial resources, education and skills, social capital, thus find forests as an attractive source of cash income since they are free, what they need was human power and little skills, they does not need capital investment (Dubois, 2003). Angelsen and Wunder (2003) pointed out that the poor often use forest products as means of generating cash due to lack of better alternatives. These findings concur with income diversification literature, which generally finds that better-off households diversify into the more favourable investments compared with poorer households (Barrett *et al.*, 2001). According to the Household Budget Survey of 2000/01, poverty was still high in rural areas in Tanzania. The poor who are the majority in rural areas rely heavily on natural resources, thus exploitation of forest resources for short term

benefit was preferred strategy for them (URT, 2000). The general picture was that most poor household in the study villages are more dependent on marketed forest products for cash income.

The season nature of forest products, limited local buying power, poor access to markets and seasonal supply limit the potential of forests products in the study villages to grow into sustained source of household income. About 33% of households in the study villages was involved in the trade of diverse range of forest products which was marketed locally, most poor households in study villages was engaged in selling forest products as a means of earning cash income than wealthy households. In the study area gum arabica, vegetable, tamarind fruits, fodder are sold in order to get cash for household expenses, this situation was similar to other places where cash from forest products was reported to be spent for household expenses (Jumbe *et al.*, 2005).

Gum Arabic has the potential of generating cash income to people living in rural areas of Kishapu District, the problem was gum collectors didn't have information of the price and they are not organized. According to Neumann and Hirsch (2000) the relative low cash income of collectors of forest products was caused by lack of information on prices of forest products, transportation and storage facilities. These conditions create opportunity for middlemen traders to place themselves as unavoidable links in the market chain. Besides the market imperfection in study villages forest products still contributed substantial cash to rural household income.

4.2.3.4 Non cash income from dryland forest products

Normally, households in the study villages use various forest products in their everyday life. Types of forest products which are most utilized by households in the study villages

are presented in table 22. The most common used dryland forest products by most households was firewood (100%), hoe handles (89.3%), roofing grass (75.2%), vegetables (72.9%), pestles (72%), tamarind fruits (66%). Chairs (65.1%), yoke (52.8%) and mortars (52.2%). Other forest products used by households are fodder, pounds, medicine, charcoal, poles, trees and oxcart poles. Firewood was first ranked as an important forest product consumed by most households (84.6%) in the study villages. Therefore the percentage figures suggests forest products contribute as non cash to the total household income of most households. On the other hand the percentages indicate there is great dependency on forest for firewood. Forest products utilized directly by households are obtained from various plant species found in the study area as shown in Table 19. Discussions of major dryland forest products utilized directly by household in the study villages have been discussed according to sue categories in forthcoming sub-chapter.

Table 22: Forest products utilize by households and their estimated non cash

Type of forest products		Frequency of response	% of response	Average quantity	Price	Estimated non cash
Firewood	(Head load)	318	100.0	1.64	15 000	24 600
Hoe handle	(Piece)	284	89.3	4.66	1 500	6 990
Thatch grass	(Bundle)	239	75.2	24.14	500	12 050
Vegetable	(Tin)	232	72.9	6.79	5 000	33 950
Pestle	(Piece)	229	72.0	3.1	1 000	3 100
Tamarind	(Tin)	210	66.0	2.78	5 000	13 900
Chairs	(Piece)	207	65.1	3.57	2 000	7 140
Yoke	(Piece)	168	52.8	3.0	5 000	15 000
Mortar	(Piece)	166	52.2	1.1	5 000	5 500
Fodder	(Acre)	150	47.2	17.36	25 000	434 000
Pound	(Piece)	147	46.2	1.39	500	695
Medicine	(Piece)	111	43.4	117.19	500	58 595
Charcoal	(Bag)	105	33.0	3.55	9 000	31 950
Poles	(Piece)	81	25.5	4.2	4 000	16 800
Trees	(Number)	54	16.9	4.6	30 000	138 000
Oxcart poles	(Piece)	52	16.4	2.4	15 000	36 000
Honey	(Litre)	22	6.9	9.0	1 000	9 000
Milking vessel	(Piece)	21	6.6	1.38	1 000	1 380
Board game	(Piece)	9	2.8	1.1	2 000	2 000
Sisal pole	(Piece)	7	2.2	136.0	500	68 000
Total						**918 850**

Note: N = 2 872 because of multiple response from 318 households

Fuel wood: Firewood

In the study villages was dominant source of energy for cooking in most households (100%) while few households (3.7%) used charcoal as shown in Table 22. Therefore, firewood contributed non cash income to the total annual household income of all household in study villages. Study results suggest cooking in the study villages depended on firewood, the results concur with the report over 90% of Tanzanians in rural areas rely on biomass energy for cooking (Johnsen, 1999; SPARKNET, 2006; URT 2003a). The percentage of households which use firewood in the study area was higher than 96% reported by Tanzania Agriculture Sample Census of 2002/2003 and national average of 73% of households which depend on firewood as main source of energy for cooking (NBS, 2007). The difference in percentage of households which use firewood may be due to differences in methods used in sampling and data collection. In most rural areas in African countries food is cooked by means of energy from firewood. In the rural areas of Kishapu District and elsewhere in Tanzania firewood is the main source of energy for domestic use. In a study in Kgalagadi District in Botswana, firewood was key resource to 89% of households (Madzwamuse *et al.*, 2007). Also in their review and synthesize work in South African it was observed firewood, wooden utensils, edible fruits, grass was used by 85% or more of households in the daily lives in rural areas (Shackleton and Shackleton 2004).

The overall average firewood consumption per household in the study village was 5.4 m^3 per annual with the average non cash income of TAS 24 960. With the average household size of 8 persons per capita firewood consumption was 0.7 m^3. The maximum household firewood consumption in the study villages was 20.4 m^3 with a non cash income of TAS 90 000 while the minimum consumption was 0.85 m^3 with non cash income of TAS 3750. However, rich households consumed more firewood with an average of 7.5 m^3 of firewood per household per annual, middle households consumed 5.8 m^3 of firewood poor

household per annum and poor consumed 4.4 m^3 of firewood per household per annum. The per capita firewood consumption of 0.7 m^3 of firewood was slightly lower than the estimated per capita consumption of wood fuel of 1 m^3 per annum (World Bank, 2005), 2 m^3 per (URT, 1997) and around 1.0 – 1.5 m^3 (Kaale 2005). Numerous estimates of biomass fuel consumption had been made on local and national, data on firewood consumption from Tanzania show wide variations in per capita firewood consumption. The variation is mainly brought by methods used to collect data and availability of firewood. According to Baldwin (1987) and Kaale (2005) consumption of firewood in households is associated with general availability of various fuels, affordability, climatic conditions, season, cooking habits and end use efficiencies. The low per capita consumption of 0.7 m^3 found in the study area was due to scarcity of firewood in the study area, Shinyanga region has been categorized among the regions in Tanzania with severe wood fuel scarcity (Kaale, 2005). Experiences from firewood consumption surveys for general domestic uses have shown areas with abundant firewood supply the per capita consumption ranged from 1.5 m^3 to 2.5 m^3 while wood deficit areas have consumption levels as low as 0.5 m^3 per capital (Maximillian, 1998; IUCN, 2000). The per capital firewood consumption of 0.7 m^3 found in the study village in Kishapu District was similar to reported averages of 0.7 m^3 per capital fuel wood consumption between 1992 and 1996 FAO (1999) cited by FBD (1999). Traditional three stone opens stoves was the main technique of cooking used by households in the study villages. The traditional three stone open fire stove lose about 90% of the total heat produced by the fire to the surrounding environment, only 10% is harness usefully (Rouse 1999; Kammen, 1995). Also Ishengoma (1987) reported traditional open fire cooking stove has an efficiency of only 5-7%. Due to low energy conversion efficiency of the traditional open three stone stove means households in the study villages use more firewood than necessary. Though this cooking technology appears to be extremely inefficient it is still the most common technique used by household in the study area.

Food: Wild vegetable and fruits

Dryland forests in the study villages contribute supplementary food source such as tamarind and variety of vegetables, about 72.9% of household in the study village collected and consumed various types of wild vegetables as shown in Table 22. Therefore, wild vegetable contributed non cash income to the household income. The overall average household consumption of wild vegetable was 6.7 tins with the overall average non cash income of TAS 33 728. The maximum wild vegetable consumed was 30 tins with the non cash income of TAS 150 000 and the minimum wild vegetable consumed was 1 tin valued TAS 5000 as non cash income. By household categories on average rich households consumed 7.1 tins of wild vegetable with non cash income of TAS 39 595 and poor household consumed 5 tins of wild vegetables with non cash income of TAS 25 000.

Leafy vegetables are consumed by rural households and enrich their diet with important vitamins and minerals (Falconer 1992). In the study villages wild vegetables are most available at the beginning of the rain season in December up to April, during this period some are consume as green vegetables while others are dried and stored for use during the dry season. The main collectors of wild vegetables are females as shown in Tables 23. In the study area dried vegetable are widely used by most households during the dry season when there are no green vegetables. The 73% of household which consume wild vegetable in the study villages in Kishapu District was lower than 94% households which Kagya (2002) found in study conducted in Meatu District, Shinyanga.

Wild fruits contribute to food security and nutrition at household level. *Tamarindus indica* are edible bearing tree species found in the study villages. Farmers often retain tamarind trees and protect them in their farm (Akkinnifesi, 2006). About 66% of households in the study villages used tamarind fruits to sweeten porridge as substitute for sugar. Therefore,

tamarind contributed non cash income to most households in the study villages. The overall average consumption of tamarind fruits per households was 2.7 tins per annual with the average non cash income of TAS 13 888 per annum. The maximum amount of tamarind fruits consumed per households was 18 tins with non cash income of TAS 90 000 and minimum amount consumed was 0.5 tin which had non cash income of TAS 2500. Study results shows the average household consumption of tamarind fruit did not vary much between household categories, on average rich households consumed 2.5 tins per year with non cash income of TAS 12 500. Middle households consumed 3.3 tins of tamarind fruits per annual which had on cash income of TAS 16 691 and poor households consumed 2 tins per year with non cash income of TAS 10 041. Few household buys tamarind by cash, most households practices barter system whereby maize of paddy was exchanged with tamarind fruits. Tamarind fruits have been reported to contain nutritionally useful quantities of macro and micro nutrients such as protein, carbohydrate, calcium, potassium and magnesium which our bodies require for normal body functions (Khairunnuur *et al.*, 2009). Therefore, substantial numbers of households (66%) in the study villages unknowingly use tamarind fruits as an alternative source of nutrients to alleviate malnutrition and to improve nutritional status in their households.

Animal food: Fodder

In the study villages about 47.2% of household used dryland forests (*ngitili)* and crop remains as feeding grounds for their animal. Therefore forest contributed indirectly to household income by increased milk production and animal weight. Such similar service has been reported in Handeni District where people consider woodland as first resource for cattle grazing (Karmann 1998). Also Desanker *et al.* (1997) reported the same for the miombo ecosystems of central Africa. In the study villages on average households used about 17.4 acres of pasture land with a non cash income of TAS 435 000 to feed their

livestock when grasses in communal grazing lands has been exhausted. In the study villages the maximum amount of pasture land utilized per household was 180 acres valued TAS 4 500 000 as non cash income and the minimum was 1 acre valued TAS 25 000 as non cash income. The amount of pasture land utilized by household categories vary depending on the numbers of livestock owned, on average rich households used 32 acres worth TAS 800 000 non cash income, middle households utilize about 14.2 acres worth TAS 355 000 as non cash income and poor households utilized 9.6 acres worth TAS 340 000 as non cash income. Stall feeding of cattle is not practiced in study villages, cattle are usually taken out by male for grazing and travel up to 4 and 10 km away from their villages.

Construction: Roofing grass

Roofing grass was widely collected for household use by most households (75.2%) in study villages as indicated in Table 22. On average each households utilized about 24.1 bundles of grass annually with the average non cash income of TAS 12 050 per household. The maximum number roofing grass used per household per annum was 100 bundles of grasses worth non cash income of TAS 50 000 and the minimum number of roofing grass used was 1 bundle of grass with non cash income of TAS 500. On average rich households use 28.7 bundles of roofing grasses per annual worth non cash income of TAS 14 350, middle households use 23.4 bundles of roofing grasses worth non cash income of TAS 11 700 and poor households use 23 bundles of grasses worth TAS 11 500 as non cash income. Therefore the use of roofing grass by most household in Kishapu District was similar to other rural areas in Tanzania such as Geita District where most rural houses were thatched by grasses (Makonda, 1997). Maximillian (1998) reported consumption of 40 head loads per household in Kibaha District while Lema (2003) reported 48% of households in Morogoro rural District utilised an average of 17 head loads of thatching grass per

household per year for thatching. Many households in rural areas in Kishapu District have no money to buy corrugate iron sheet for roofing which are too costly and not available in remote rural areas, so people dependent on the grasses as roofing material which is around them. The 75.2% of household in the study villages which utilised grass and mud as roofing material was slightly lower than 79% household (Grass/mud roofs) reported in 2002/2003 during the National Agriculture census survey, the decrease in number of households using roofing grasses might be some household nowadays use corrugated sheets as roofing material. Kishapu was among the 2 district in Shinyanga region with a lowest percentage of households with grass roofs 5% (URT, 2007a). The lower in number was due to lack of grasses as roofing material, sukuma people used to thatch traditional houses by grasses, the mud and grass roofing style of today known as *'tembe'* is just a copping strategy, dryland forest which formerly supplied grasses has been degraded to the extent they do not provide roofing grasses. In Botswana thatching grass was reported to be the second most important forest products for rural people in Kgalagadi North after firewood (Amusa, 2000). Also Makongwa (1997) and Makonda (1997) indicate most households in rural areas in Malawi and Tanzania are thatched by grasses.

Medicine

Medicinal plants are still used in study villages both for human and livestock health. About 34.9% of households used traditional medicine from common tree species found in the study villages as shown in Table 22. The amount of traditional medicine used in the study area was determined by the number of frequencies of use against the number of person in the household. On average households in the study village used traditional medicine 117.2 times from plant parts per household per annum with non cash income of TAS 58 600. The maximum number of times traditional medicine used was 500 times worth TAS 250 000 as non cash income, the minimum number of times of using traditional medicine was 3 times

worth TAS 1500. The frequency of using traditional medicine among household categories did not differ, rich households used traditional medicine 119.3 times per annual worth non cash income of TAS 59 650, middle households used traditional medicine 112.8 times worth non cash income of TAS 56 350 and poor households used traditional medicine 123 times worth TAS 61 500 as non cash income. Therefore by using tradition medicine on average households saved about TAS 58 600 as non cash income which reduced household cash expenditure.

Farm implements: Hoe handle, yoke

Most household (89.3%) in the study villages used hand hoes in farming activities. On average households utilized 4 hoe handles per year worth non cash income of TAS 6000. The maximum number of hoe handles used by household was 18 hoe handles worth TAS 27 000 as non cash income, while the minimum number of hoe handles used per households was 1 piece worth non cash income of TAS 1500. The average number of hoe handles utilized by households categories differed slightly, rich households used 6 hoe handles per year worth non cash income worth TAS 9000, middle households used 5 hoe handles per year worth non cash income worth TAS 7500 and poor households used 4 hoe handles worth TAS 6000 as non cash income. Therefore, it is important to note hoe handles are important farm implement which indirectly contributed to household income and later household livelihood.

About half of household (52.8%) in the study villages used yokes. On average households in study villages utilized about 3 pieces of yoke per annual worth non cash income of TAS 15 000, the maximum number of yoke used in the study villages per household was 8 yoke and the minimum number of yoke used was 1 worth non cash income of TAS 5000. There was slight difference in quantity of yoke utilized among household categories, rich

households used an average of 4 yoke per annual worth non cash income of TAS 20 000, middle households used 3 yokes worth non cash income of TAS 15 000 and poor households used 2 yokes worth TAS 10 000 as non cash income. Therefore yokes contributed indirectly to the total annual household income of about half of households in the study villages.

Household utensils: Pestles, traditional chairs, mortars

Most household (72%) used pestle as traditional household tool for stir food while cooking. Study households on average used about 4 pestles per year worth non cash income of TAS 4000 as non cash income. The maximum number of pestles used by household in the study villages was 10 pestles worth TAS 40 000 as non cash income, the minimum number of pestles used was 1 pestle worth non cash income of TAS 1000. The number of pestles used by household categories was almost the same, rich households used an average of 4 pestles per annual worth non cash income of TAS 4000, middle household also used an average of 4 pestles worth non cash income of TAS 4000 and poor households used 3 pestles worth TAS 3000 as non cash income.

About 65% of households in the study villages used traditional simple chairs made by wood or wood and other materials. On average households owned about 4 chairs which had the non cash income of TAS 8000, the maximum number of chairs owned was 20 chairs with non cash income of TAS 40 000 and the minimum was 1 chair worth non cash of TAS 2000. The average number of chairs owned by all household categories was the same i.e. 4 chairs.

More than half of households (52.2%) in the study villages owned and used mortars for various purposes such as mill and grinding cereal crops. On average households owned

1 mortar worth non cash income of TAS 5000, rich households had maximum number of 2 mortars while middle and poor household owned 1 mortal. Mortars were reported to last up to 7 years depending on use, storage and type of tree species used during carving.

Therefore it is noteworthy to say dryland forest contributed highly as non cash income to livelihoods of households in study villages. By collecting and use forest products to meet daily needs of energy, shelter, food and medicine, households allowed scarce cash to be sued to secure other necessary livelihood such as education of children, investment in agricultural tools and investments which improve household livelihoods. Such a cost saving would best be reflected by replacement values of the goods that forest product substitute, rather than direct-use value based on actual prices (Shackleton and Shackleton, 2004). Despite and the importance and roles played by the forest products to the livelihoods, there is a problem of under estimation of their contribution to household's livelihoods which hamper the development of forest sector. According to existing national accounting system in Tanzania, the performance of the sector is measured in monetized goods as shown in GDP where sold forest products are the ones which are considered.

4.2.3.5 Collection responsibility of forest products

Responsibility of collecting forest product by gender in the study villages are presented in Table 23. The responsibility of collecting forest products has shown gender bias to some of forest products. Males was responsible in collecting roofing grasses (96.2%), fodder (92.6%), yokes (97.6%), milking vessels (95.5%), chairs (95.1%), trees (98.6%), oxcart poles (96.2%) and game boards (83.3%). Females were responsible for collecting firewood (74.5%), wild vegetable (99.1%) and pestles (96.9%). Collection of gum arabica and medicine in the study village was done by both male and females equally, Sukuma like other tribe have their own culture in which there was a gender division of labour, men and

women had different roles in collecting forest products. Females played a prominent role in collection and processing forest products such as firewood and wild vegetable, this was similar to others parts of Tanzania Geita, Mwanza, Lushoto and Shinyanga (Makonda, 1997; Katani, 1999; Kessy, 1998; Kagya, 2002). The role of women in collection of forest products was very important, most of the times it was the female who gather forest products, process them and either sell them to support the family or use them for family consumption (Hasalkar and Jadhav, 2004).

Table 23: Responsibility of collecting forest products by gender

Product	Male%	Female	Male and female %	No. of households
Firewood	14.2	75.5	11.3	318
Charcoal	49.0	39.4	11.5	104
Thatch grass	96.2	1.7	2.1	239
Fodder	92.6	2.7	4.7	148
Tamarind	27.4	51.4	13.8	208
Gum	1.7	25.9	72.4	58
Vegetable	0.9	99.1		231
Medicine	33.0	12.8	54.1	109
Honey	68.4	21.1	10.5	19
Yoke	97.6	2.4		168
Hoe handle	76.6	8.2	15.2	282
Pestles	3.1	96.9		226
Mortar	38.0	50.3	11.7	164
Pound	33.3	59.2	7.5	147
Milk vessel	95.5	4.5		22
Chairs	95.1	3.8	1.1	184
Tree	98.6	1.4		73
Poles	96.0	4.0		75
Oxcart poles	96.2	3.8		52
Sisal poles	100			8
Game board	83.3	16.7		6
Total	**1 478 (51.8)**	**1 085 (38.2)**	**282 (9.9)**	**2 839**

Culture and tradition in most African societies dictate who can or cannot participate in certain activities particularly when it comes to gender. The trends where females are major collector of forest products in particular firewood is borne by data from almost every country in Asia, Africa, and Latin America. Example in Zimbabwe (Campbell *et al.*, 1991) and India (Yadam *et al.*, 1996) women was involved in collection, processing and marketing of forest products including food and fuel wood for household consumption.

Generally study results revealed males collect more forest products 51.8% than female 38.2% and the remaining 9.9% was collected by both male and female as shown in Table 23. Men collected forest products which had high value in terms of commercial orientation such as thatch grasses, fodder, trees and poles while females collected forests products mostly consumed by household such as firewood, vegetable, tamarind, mortar, pounds and pestles. The study results from Kishapu District whereby male collected forest of commercial value and women collect forest products for subsistence was similar to the study conducted in Malawi and Zambia (Botha, 2003; Jumbe *et al.*, 2005). Rural households in Kishapu, Tanzania, as in other economically poor countries are often highly dependent on forests. Forest products such as fuel wood, fruits, vegetables and medicinal plants, played considerable role in livelihoods especially for household consumption and income generation (Narain *et al.*, 2005; Monela *et al.*, 2005; Mhapatra *et al.*, 2005; Cavendish, 2000).

4.2.3.6 Ownership forests, trees and access to forest products

About 50.6% of households in study villages owned dryland forest (*ngitili*) or trees on farms and around homesteads, while 49.4% of households did not owned forest or trees as shown in Table 24. Therefore, these figures suggests about half of households in the study villages household income was directly or indirectly contributed by dryland forests while the remaining half their household income was not directly contributed by forest products.

Table 24: Ownership of forests or trees and access to forest products

	Frequency of response			
	Yes		No	
Households owning trees or forest	161	(50.5)	157	(49.4)
Access to forest products	148	(46.5)	170	(53.5)
Are need of forest products satisfied	109	(43.3)	209	(65.7)
Surplus forest products	15	(4.7)	303	(95.3)
Buy forest products	145	(45.6)	173	(54.4)
Poor have less access while rich have more access to forest products	207	(65.1)	111	(35.9)

Note: ( ) = % of respondent, n = 318

About 46.5% households in the study villages felt they had access to forest product while 53.3% households felt they did not have access to forest products. This means more than half of households in the study villages experienced difficulties in getting forest products for household use. This suggests forest products had lower direct contribution to their household income. According to observation and discussion with respondents nowadays access to forests products is becoming difficult to most households due to population increase and fragmentation of household forest. Limited access is also aggravated by establishment of village forest reserves on formerly common land. Villagers who felt they do not have access explained bureaucracy and lengthy procedure of getting permits are some of the reasons which limit timely accessibility of households to forest products from village forests.

Most of households (65.7%) in the study villages felt their needs of forest products are not satisfied while 34.3% of households felt their forest products needs are satisfied as shown in Table 24. The percentage of those who are not satisfied was higher than households which did not own trees of forest (49%) in section 4.3.3.6 of this study. The difference happened because some of owned forest or trees are not able to supply needed forest products in terms of sizes and species, thus although some households own forests but their households needs are not met. Due to these circumstances some households sold forest products and earned cash income while other household spend cash to buy forest products. World wide there is an increasing understanding that forest products are key component to rural livelihood. However, issues of equity between forest products beneficiaries become a challenge. In the study villages most households (65.1%) felt rich households hand more access to forest products than poor households while 35.9% households felt there was an equal access between poor and non poor households. It was explained rich household has more access due to financial ability to purchase forest products when they are needed, also

sometimes nature of their household livelihood activities compel them to buy forest products such as fodder. Similar observation has been reported in a recent study on constrains and access to forest product in Burkina Faso where income of the household was among the significant determinants associated with access to forest products (Coulibaly-Lingani *et al.*, 2009).

4.2.3.7 Sources of forest products

Table 25 shows sources of forest products in the study villages. Most households (59.3%) collect forest products from household forest known as *ngitili*. Other sources of forest products were farmlands, communal lands and village forests. Therefore household forest contributed income to most household annual as cash and non cash income. Most people in the study villages have realized dryland forests are renewable natural assets which are important for their daily livelihood, they are sources of cash income and sources of forest products for household consumption.

Table 25: Sources of dryland forest products

Sources	Frequency of responses	Responses (%)
Household forests	210	59.3
Farm	95	26.8
Communal land	37	10.5
Village forest reserve	7	2.0
Homesteads	4	1.1
Woodlots	1	0.3
Total	**354**	**100.0**

Note N = 354 because of multiple response from 318 households

The study results which showed households forest contributed to the total annual households of most households concur with reported monthly value of benefits from *ngitili* per person in Shinyanga Region which was estimated to be TAS 14 046, this contribution was higher than the national average of TAS 8500 per month in the rural areas of Tanzania (Monela *et al.*, 2005; HBS, 2002).

4.2.3.8 Obligation of households to sources of forest products

Table 26 present various obligation mentioned by households regards to sources of forest products found in the study villages. Protection was the most frequently mentioned obligation by most households (41.5%). Other obligation mentioned were management of trees. The percentage of household mentioned the main obligation was protections are likely to be owners of household forests. To them protection was important activity because forests are regarded as assets which contributed cash to household income when forest products are sold and non cash when forest products was consumed at household. About 40% of households mentioned they didn't have any obligation to sources of forest products because they are not owners, they responsibility was to pay money for the products needed.

Table 26: Obligation of households to area where they collect forest products

Obligation	Frequency of response	Response %
Protection	141	41.5
No obligation	136	40.0
Manage/conserve tree	47	13.8
Plant tree	8	2.4
Pay for the products	7	2.1
None/no comment	1	0.3
Total	**340**	**100.0**

Note: N = 340 because of multiple response from 318 households

Most household forest was established by natural regeneration whereby nature was allowed take its own course, the only efforts required was protection during the initial years of establishment. Tree planting was mostly limited around homesteads and occasionally on farm boundaries.

4.3.2.9 Means of addressing shortage of forest products in household

Few households (22.6%) in the study village did not experience shortage of forest products, therefore they did not have strategies to address shortage. Table 27 shows the ways through which household used to address shortage of forest products at household

level. Most household (75.6%) bought forest products in order to address the shortage of forest products. Other households addressed forest products deficit by free offers, collect from farm tree, live fence and use crop residue such as maize and millet straws. The percentage of household which bought forest products (75.6%) was higher than 49.4% households which did not own forest or trees, the difference happened since owned forest were not able to supply required household needs.

Table 27: Means of addressing deficit of forest products in households

Means	Frequency of response	Response (%)
Buy	186	75.6
Free offer	27	11.0
Collect from farm	18	7.3
Collect from boundary tree and live fence	13	5.3
Use crop residues	2	0.8
Total	**246**	**100.0**

4.3.2.10 Problems faced in managing dryland forests

Despite the great benefit from dryland forests they have been observed to deteriorate, several problems are responsible for the decline of this resource. Table 28 present problems which households face in managing dryland forests in the study villages. Theft of trees was mentioned as frequent problem faced by most households (18.5%) in managing dryland forest in the study villages. Other problems faced were indiscriminate tree cutting (12.7%) and illegal grazing (11.4%). Problem mentioned by households contributed directly and indirectly to the decrease of forest products for both sale and subsistence use. Therefore these problems reduced the proportion contribution of forest products to the total annual household income. Substantial number of households (26.7%) did not give any comment on problems faced dryland forest because they didn't own forest or trees. Few households (10.1%) which owned forest mentioned they didn't face problems in managing household forest because forests are near homestead and they make frequent patrols.

The problems faced in managing dryland forests in the study villages could be explained and linked with real situation which exists within the study villages. About half of households (49.4%) in the study villages did not own forest or trees, most households (77.4%) experience shortage of forest products and about 53.5% of household are not financially capable to buy forest products. Therefore, under these situations some households are compelled to steal, also it is difficult for few households which own forest to protect efficiently their forest against many households which do not have money to buy forest products. Substantial number of households (26.7%) in the study villages did not gave their opinion on problems faced in managing dryland forest for the reason that they don't own forests, some households even though they didn't own forests managed to site problems faced in management of forest that's why the percentage was lower than the percent of household (49.4%) which did not own forest and trees.

Table 28: Problems faced in managing dryland forest in study villages

Problems	Frequency	Response (%)
Theft of trees	70	18.5
Indiscriminate tree felling	48	12.7
Illegal grazing	43	11.4
Scarcity of trees	28	7.4
Population increase	16	4.2
Scarcity of land	15	4.0
Drought	14	3.7
Too much time spent on patrolling	2	0.5
Slow growth rate of indigenous trees	2	0.5
Expanding farming lands	1	0.3
None/no comment	101	26.7
No problem	38	10.1
Total	**378**	**100.0**

Note: N = 378 because of multiple response from 318 households

Illegal grazing problem reported in study village correspond to reported livestock population in some districts in Shinyanga region which exceeded the carrying capacity by over 200% (URT, 1997). The present trends of increase in human and livestock population in Kishapu and heavy dependence on firewood for cooking from natural regeneration resulted in forest products deficit. Due to pressure on dryland forests the loss of forest

cover was estimated to be high in Kishapu District as well elsewhere in semi arid of Tanzania, estimates of deforestation in Tanzania ranges from 130 000 to 500 000 per ha annum (URT, 1997).

Problems of deforestation and eventually environment degradation in Shinyanga region in 1980s led to the establishment of regional based project known as HASHI project. This project was initiated by the Ministry of Tourism and Natural Resources in 1986, HASHI addressed forestry, land-use and livestock in an integrated fashion. Most problems which have been identified in study villages has been reported in the National Forest program (2000), these problems are deforestation, competing land uses for agriculture, livestock grazing, human settlements and over exploitation (Chihongo, 1993; MNRT, 2002; MNRT, 2000; Dallu, 2002). According to the Untied Nations Sudan Sahelian Office (UNSO), about 33% of Tanzania was affected by desertification, the most affected areas are those in semi-arid (URT, 1997).

Dryland forest problems reported in Kishapu District was somehow similar to other countries. In Ethiopia, dryland forests have been observed to decline due to sever droughts, overgrazing where cattle destroy seedlings and young trees and clearance of woodlands for the cultivation of crops (Andel, 2006). In Botswana overexploitation, overstocking and overgrazing continues to put pressure available fuel wood resources and fuel wood shortages around villages in Kgalagadi have been reported (Madzwamuse *et al.*, 2007). Continued degradation of dry forests in the study area poses serious threat to large number of households especially poor households which depend on forests for their livelihoods.

4.3.2.11 Suggested solutions to dryland forest problems

Table 29 shows suggested solutions to problems faced management of dryland forests in the study villages in Kishapu District. Most households (13.6%) suggested protection as a solution to problems facing dryland forest management. Other suggested solutions to dryland forest problems was to use natural regeneration as means of reforestation (13%), tree planting (12.1%) and to establish and use village by laws 10.2%. Significant percent of households (40.7%) did not suggested solutions to problems faced management of dryland forest because they didn't own forests or trees, the percentage was lower than 49.4% of households which did not own trees and forest, some households even though they didn't own forest or trees they were able to suggest solutions. Suggested solutions were meant to halt the decline of forests resource and increase the contribution of forest to household income through increased quantity of forest products in study villages.

Table 29: Suggested solutions to problems facing management of forests

Solution	Frequency of response	Response (%)
Protection of drylands	48	13.6
Use natural regeneration	46	13.0
Tree planting	43	12.1
Establish and use village by laws	36	10.2
Education of conserving dryland forests	20	6.6
Retain scattered trees on farms	9	2.5
Establish forest near households	5	1.4
Education of appropriate farm practise	3	0.8
No comment/suggestion	144	40.7
Total	**354**	**100.0**

Note: N = 354 because of multiple response from 318 households

Suggested solution indicate households value forests because they contribute to household livelihoods, thus they have the responsibility to make certain efforts to ensure sufficient forest products are available in the study villages. Household's suggestions were similar to the one which are found in the Tanzania forest policy (URT, 1998) and National Forest Program (MNRT, 2000). Studies from other countries provide lessons to problems found

in Kishapu which are associated with dryland forest management. In the short and long term there is a need for villages in Kishapu to develop their own rules and sanctions for managing communal grazing areas, this has been successfully done in Zimbabwe (Leach and Mearns, 1988). Suggested solutions of natural regeneration have worked in Ethiopia where dryland forests were threatened by gradual degradation and deforestation. Attempts include protection of existing forests, establishment of community woodlots, introduction and promotion of establishment of enclosures as agroforestry systems in order to promote natural forest regeneration. Through natural regenerations they have managed to rehabilitated thousands of hectares with indigenous tree species (Muys *et al.*, 2006). The natural regeneration has great chance to succeed in Kishapu because it is already familiar practice.

The result whereby 26.7% of households had no comments on problems face dryland forests and 40.7% of households did not suggest any solution leaves a lot to be desired. The actor oriented perspectives emphasized that actors knowledge of the problems that affects their production environment is one of the indicator of demand for solution (Garcia *et al.*, 1996; Cramb, 2000). The no responses coupled with finding that access and needs satisfaction of forest products differed between households and household categories suggests there are no simple solutions to problems facing dryland forests in study villages.

4.4 Non Farm Income

Non farm income refers to cash earned from non agricultural activities (URT, 2007a). This could be permanent or temporary informal employment. Sources of non farm income to household's income in the study villages are shown in Table 30. Casual labour contributed cash income to most households (23%) in the study villages. Other non farm income sources were petty trade (13.6%), remittance (22.1%) and loan (11.1%). Cash income from

labouring was highly available during farming season from November to May, main labour activities are land preparation, tilling, sowing, weeding, harvesting, threshing and hauling crop harvests. Casual labour brought immediate cash to households and doesn't need specialized skills therefore labourers get low wages. Most poor and middle households in study villages were engaged in casual labouring because most of them are not food secured as shown in section 4.1.1 of this study, thus relies on labouring to generate cash income in order to meets various household needs.

About 28.6% of household in the study villages was engaged in casual labouring. Poor household was the most involved in casual labouring (61.5%), middle households 36.3% and rich households 2.2%. On average households earned cash income of about TAS 63 761 per year from labouring, the minimum amount earned was TAS 6 000 and the maximum was TAS 350 000. However, by household category poor household got highest amount of cash TAS 78 268 which was above the overall average, rich household earned TAS 20 000 and middle household earned TAS 42 441. Therefore casual labour contributed 13.7% of cash income to the total non farm component.

Table 30: Sources of non farm income for households

Sources	Frequency of response	Response (%)
Casual labour	91	23.0
Petty trade	54	13.6
Remittance	44	11.1
Loan	44	11.1
Oxcart rental	25	6.3
Other	13	3.3
Farm rental fee	12	3.0
Salary	7	1.8
Traditional healing	5	1.3
Bicycle taxi	3	0.8
None	98	24.7
Total	**396**	**100.0**

Note: N = 396 because of multiple response from 318 households

Remittances have been widely reported to provide vital support to most rural households (Campbell *et al.*, 2002). Study results revealed contrary to this observation, few households

(11.1%) in the study villages received an average remittances of TAS 100 000, the minimum amount of remittance was TAS 10 000 while the maximum amount was TAS 500 000. Rich and middle households received high amount of remittance with an average of TAS 117 000 and 137 143 respectively while poor households received low remittance of TAS 62 500. In study village remittances were commonly submitted in form of cash, remitters in most cases were sons and daughters living in town or other villages. Study results show non farm component contribute cash income to most households (74.2%) in the study villages, while few households (25.8%) their household income was not contributed by non farm source. The overall average cash income contribution from non farm was TAS 463 979 per household per annum, the maximum cash income was TAS 788 000 and the minimum cash income was TAS 6000.

Kishapu was among the District which had few households with more than one member having off farm income 14% (URT, 2007a). The phenomena of non farm contributing to the household income have been reported in other places such as in Nepal (Maharajan, 2003). Also casual labour contribution to household income has been reported in Zambia and Malawi where labouring locally known as *'ganyu'* was a leading source of income from the non farm component in rural household (Mutamba, 2003; Botha, 2003). In Malawi the common practice of *'ganyu'* labour involves shot term work such as weeding on others' farms, labouring was an important source of cash income (Whiteside, 2000). Farmers with small land holdings have also be reported to resort on agricultural wage labour and other non-farm activities (Bryceson, 2000).

4.5 Proportions of Household Income

Proportions contribution of main sources of household income in study villages are presented as shown in Fig. 3. Farm income was the major source of total annual household

income and accounted 43% of household income. Other sources of income which contributed to total annual household income was livestocks (24.8%), forests (19.5%) and non-farm (11.9%). Therefore, total household income in study village was mainly derived from farm component.

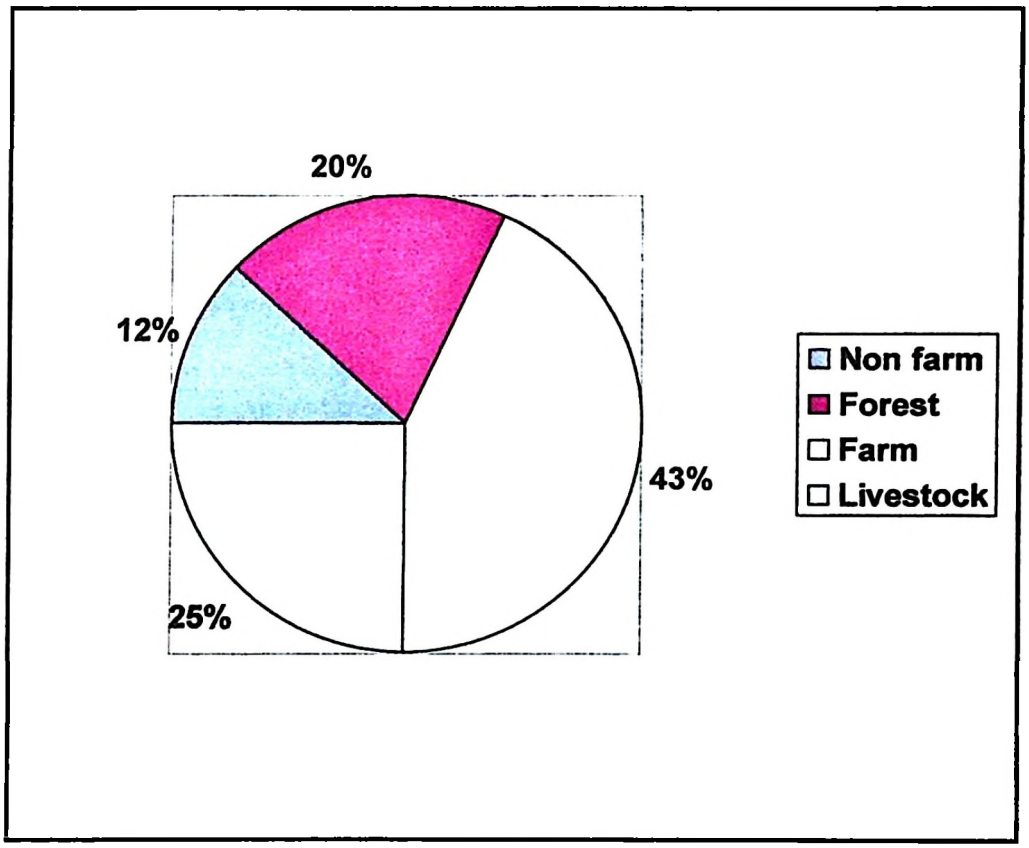

Figure 3: Proportions contributions of sources of income to rural households

Table 31 shows the proportions of cash and non cash income from the four main sources of household income in Kishapu District. The overall average annual household income was TAS 2 702 386 per household per annum, dryland forest cash income contributed TAS 192 378 and non cash contributed TAS 335 035 which represented 7% and 12% of annual total household income respectively.

Therefore, in sum dryland forest contributed 19.5% of the total annual household income. The overall annual household income from the study villages in Kishapu was slightly higher than the annual household income of TAS 2 071 516 which Shilabu (2008) found in study conducted in Maswa District which borders Kishapu in the North East.

Table 31: Proportions of household income in study villages (n=318)

Source	Cash income	Non cash income	Total income	%
Farm	668 482 (56.5%)	515 538 (43.5%)	1 184 020	43.8
Livestock	507 763 (75.7%)	163 107 (24.3%)	670 870	24.8
Forest	192 378 (36.4%)	335 035 (63.6%)	527 313	19.5
Non far	260 868 (81.5%)	59 215 (18.5%)	320 083	11.9
Total	**1 629 491 (60.2%)**	**1 072 895 (18.5%)**	**2 702 386**	**100.0**

Households in the study villages their income were mainly contributed by farm component (43.8%), the higher contribution of the farm component was attributed by most households (98.1%) in the study villages being farmers. The importance of farm component contribution was also reflected at national level where about 80% of the population was reported to be involved in farming (Kashuliza *et al.*, 2002). Cotton being a major crop in the study villages contributed 56.6% of cash to the farm component.

Study results indicated dryland forest products had an important role in rural household economies, higher percentage contribution was in non cash value (63.6%) while smaller (36.4%) contribution was in cash. Forest product which contributed to high non cash income were fodder TAS 422 261, medicine TAS 58 598, vegetable TAS 33 728. Charcoal TAS 32 064 and firewood TAS 24 688. Therefore, study results suggest forest products are mainly collected for household consumption and few are sold to generate cash which supplemented the total household income. Dryland forest contributed relatively low proportion to the total annual household income by less than 20%, scarcity of forest products and low prices accounted for small proportion. Besides livestocks being important

source of cash for small, medium and large household expenditure still contributed smaller amount of cash (24.3%) while non cash value was higher (75.7%). Generally the average proportion contribution between cash and non cash from the main sources on income was found to be 60.2% cash and 39.8% non cash.

Fig. 4 summarise the ranked sources of income by households in the study villages. Farm component was the highest first ranked source of income contributed to the total household to all households in the study villages, rich was an average of TAS 2 181 032, middle household was TAS 1 209 755 and poor households was TAS 653 194. The second ranked source of income was livestock to both rich and middle households i.e. TAS 1 223 688 and TAS 698 798 respectively, while for the poor was forest (TAS 475 749). The third ranked source income was forest (TAS 837 182) for the rich and middle (TAS 490 189) while poor was livestock (TAS 211 873).

When looked in terms of percentage value, non cash value of dryland forests products was higher by 63.8% this suggest they had important role in households than cash generated. Therefore non cash income from forest products contributed to household income in terms of subsistence value than cash income. Cash and in-kind generation from forest products provide relief in time of hardship, both non poor and poor households consume forest products through purchasing and bartering with maize, paddy and sweet potatoes.

Cash income contributed by forest products to total annual household income in the study villages in Kishapu District was higher (7.1%) than 1% regional average and 4% Kishapu District average reported in Tanzania agriculture sample census of 2002/2003 (URT 2007a). Variation in percentage cash contribution was due to difference in methodology applied in sampling, data collection and the detailed data collected on forest products sold.

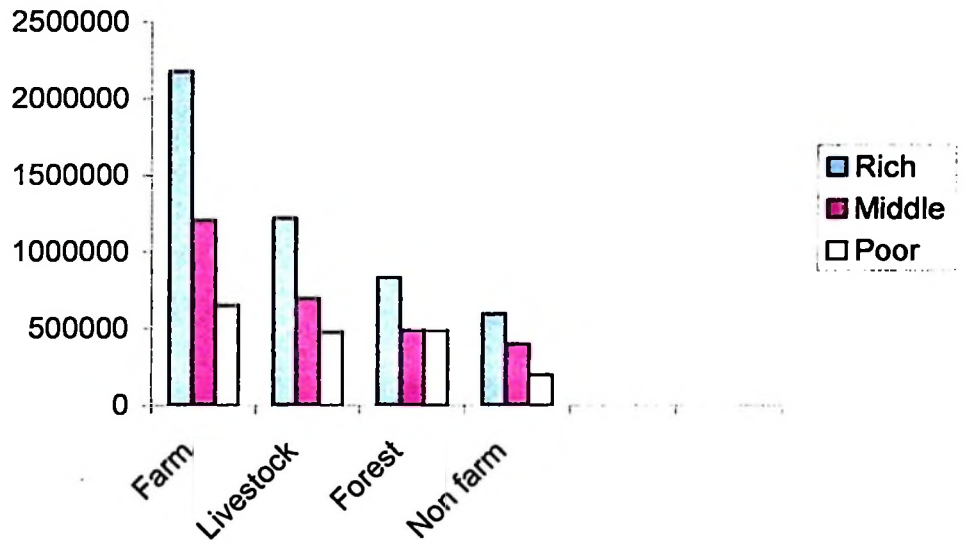

Figure 4: Highest sources of income contributed to total household income according to household categories.

The study results whereby dryland forest non cash value highly (63.8%) contributed to household income concur with Shackleton and Shackleton (2004) assertion that subsistence use of forest products represented bigger portion of value and cash income seldom account large share of household's total income.

In Tanzania agriculture contribute 51% of total household income while 40% of rural household income is derived from sources outside farm production (HBS, 2002; Abdallah and Sauer, 2005). The farm contribution of 43% to the total annual household income from the study areas was lower than the Nation figures of 50% due to low from production contributed by aridity of the study villages. Also the percentage contribution of non farm income of 11.8% was lower than 28% reported during the National agriculture survey of 2002/2003.

The high variation might be due to deployments of different methods in data collection. Several studies on the proportion contribution of sources of household income are available, but employment of different methods makes comparability of the results to be difficult, however few sources were selected for comparison purposes. An average sale of livestock's per household in the study was 6% which was similar to that reported in the National agriculture census survey of 6%. The average sale of forest products in the study was higher 7% than 4% which is reported in the some survey, the study results was higher due to detailed data collection regarding traded forest products at household level.

Absolute income from forests and the share of the total income from forests was an important indicator to what extent dryland forest products contribute to rural household livelihoods. Some studies on the forest contribution to rural household income generally converge on figures which range roughly from 4% to 50% of rural annual household income, this has been verified by studies in Asia as well as from Africa as shown on Table 32.

Table 31: Direct forest contribution to household income

% contribution to total annual household income	Country	Vegetation	Reference
22	South Africa	Savannah (Arid degraded)	Crookes (2003)
28.2	South Africa	Savannah (Arid degraded)	Dovies (2001)
19.3	Zimbabwe	Savannah (Arid)	Campbell *et al.* (2002)
15.2	Zimbabwe	Savannah (Miombo)	Campbell *et al.* (2002)
17.2	Zimbabwe	Savannah	Cavendish (2001) cited by Campbell *et al.* (2002)
22	Zimbabwe	Savannah (miombo)	Cavendish, (2000)
4 – 20	Cameroon	Lowland forest	Ambrose-Oji (2003)
12	Nepal		FAO (2009)
22	Tanzania	Savannah (semi arid)	Kagya (2002)
16	East Africa		Vedel *et al.* (2004)
20	Zambia	Savannah (miombo)	Puustjarvy *et al.* (2005)
20	Malawi		Fisher (2004)
50	Tanzania	Savannah (miombo)	CHAPOSA (2002)
30	Zimbabwe	Semi arid	Campcell *et al.* 2002
20	Zambia	Dry woodlands	Jumbe *et al.* (2005)

Study results highlighted the importance of decomposing the data by income sources, dryland forest contribution of 19.5% to household income in Kishapu District was similar to that reported by Kagya (2002), Jumbe *et al.* (2005), Fisher (2004) and Campbell *et al.*, (2002).

4.6 Sources of Cash for Household Expenditure

In the study villages households expenditure was categorised into small, medium and large expenditure. Small expenditures are generally regular everyday expenses which in most cases require little amount of money. Medium household expenditure includes expenses which happen on regular basis and in most cases they are predictable, these require substantial amount of money than everyday needs. Large household expenditure require large amount of money and in most cases they are not predictable.

4.6.1 Small or regular household expenditure

Table 33 shows different sources of cash for small or everyday household expenditure found in the study villages in Kishapu District. Cotton was the major source of cash for small household expenditure to most households (21.2%). Other sources of cash for small expenditure to households were casual labour (10.6%, chicken (8.8%), green gram (8.5%), and maize (7.8%). Cotton was the major source of cash for small household expenses because most households (90.5%) cultivate cotton as major cash crop in the study villages. Cotton contributed 81.1% of cash to the total cash income of the farm component and 47.8% of total income of the farm component. Chickens contributed 5.6% of cash to the total cash income of the livestock component. Casual labour contributed 13.7% of cash to the total non farm component. Also items such as goats, charcoal, gum, firewood were utilized as source of cash for small household expense in study villages because they are easily available and brought immediate cash income when they are sold. In study

conducted by Shilabu (2008) indicated firewood was sold for everyday to generate cash income for household needs, but sometimes firewood was sold to get cash for medium household expenses such as food. Table 31 indicated farm component was the major source of cash for small household expense to 51.6% of household in the study villages.

Table 32: Sources of cash for small household expenditures

Sources of cash	Frequency of response	Response (% responses)
Livestock		
Cattle	3	0.4
Chicken	71	8.8
Goat	24	3.0
Sub-total	**98**	**12.2**
Farm		
Cotton	172	21.2
Cow peas	5	0.6
Tobacco	22	2.7
Paddy	26	3.2
Maize	63	7.8
Green grams	69	8.5
Chickpeas	16	2.0
Sorghum	10	1.2
Sunflower	7	0.9
Sweet potatoes	4	0.5
Sim sim	2	0.2
Onions	5	0.6
Sugar cane	7	0.9
Tomato	8	1.0
Ground nuts	2	0.2
Finger millet	1	0.1
Sub total	**419**	**51.6**
Forest		
Medicine		
Charcoal	37	4.6
Gum Arabica	34	4.2
Hoe handle	3	0.5
Firewood	17	2.1
Sisal pole	2	0.2
Trees	1	0.1
Tamarind	2	0.2
Sub total	**96**	**12.5**
Non farm		
Traditional healing	5	0.6
Trade	47	5.8
Casual labour	86	10.6
Land rent	6	0.7
Ox cart rental	9	1.1
Others	9	1.1
Remittance	20	2.5
Salary	6	0.7
Loans	9	1.1
Bicycle taxi	1	0.1
Sub total	**198**	**23.7**
Grand total	**811**	**100.0**

Note: N = 811 Because of multiple response from 318 households

This means farm component contributed cash income to about half of the households in the study villages. Other components which are sources of cash for small household expenditure was non farm (23.7%), dryland forest products (12.5%) and livestock (12.2%).

4.6.2 Medium household expenditure

Table 34 shows various sources of cash for medium household expenses in the study villages. Cotton was the major source of cash to 33.6% of households for medium household's expenditure. Therefore, cotton contributed cash income to the total annual household in the study villages. Other sources of cash for medium household expense were goats, casual labour, gum arabica, maize and green grams. Cotton was the major source of cash for medium household expense because most households (90.5%) grow cotton as major cash crop in the study villages. Cotton as individual crop contributed 67% of cash to the farm component, goats contributed 45.6% to the livestock component, gum arabica contributed 46.4% to the forest component and casual labour contributed 45.4% to the non farm component. In general the farm component was the main source of cash to 50% of households for medium household expense, livestock contribute to 26.7% of households, non farm component contributed to 11.9% of households and forest component contributed to 11% households. The farm component contributed higher percent of cash to households because farming was the main socio-economic activity to most households (98.1%) in the study villages.

Charcoal, gum and firewood was used by few households as source of cash income for medium household because fewer households own forests and still most did not have surplus forest products to sell. Gum arabica was the source of cash to few households (16%), gum was mostly collected by youth who are in-school and those out of school, part of cash was spent for school expense such as school contribution, uniforms, exercise books

and shoes. Charcoals were also source of cash to few households (14.5%) for medium household expenses. Similar findings was reported in Meatu District, cash obtained from the sale of forest product was spent for essential family needs such as purchase of food, livestocks, house construction, pay for health care and school fee (Kagya, 2002). The study results whereby chickens were used as source of cash income for medium household expenses was similar to other places where cash income earned was spent to meet essential family needs such as medicine, clothes and school fee (Mack *et al.*, 2005).

Table 33: Sources of cash for medium household expenditures

Sources of cash	Frequency of responses	Response (%)
Farm		
Cotton	232	33.6
Green gram	31	4.5
Chick pea	16	2.3
Maize	34	4.9
Paddy	19	2.8
Sorghum	3	0.4
Sugar cane	3	0.4
Sim sim	4	0.6
Tomato	3	0.4
Sun flower		
Ground nuts	1	0.1
Sub total	**346**	**50**
Livestock		
Goat	84	12.2
Sheep	24	3.5
Cattle	24	3.5
Chicken	52	7.5
Sub total	**184**	**26.7**
Forest		
Firewood	12	1.7
Hoe handle	3	0.4
Drought bar	3	0.4
Gum Arabica	35	5.1
Fodder	5	0.7
Charcoal	18	2.6
Trees	1	0.1
Sub total	**77**	**11**
None	1	0.1
Non farm		
Remittance	12	1.7
Traditional healing	5	0.7
Land rent	3	0.4
Petty trade	19	2.8
Selling labour	37	5.4
Other	6	0.9
Sub total	**82**	**11.9**
Grand total	**690**	**100.0**

Note: N = 690 Because of multiple response from 318 households

4.6.3 Large household expenditure

Table 35 show sources of cash for large household expenditure in study villages. Cattle were the major source of cash for large household expenditure to 30.7% of households in the study villages. Cattle on average contributed 75.4% of cash income to the livestock component for large household expenses. Other sources of cash for large household expenditure were cotton (15.9%), contribution from relatives (14.6%), loans (14.2%) and goats (9.2%). Cattle was preferred type of livestock as the source of cash for large household expenses due to large size, therefore provide large amount of cash when they are sold. Cattle sales are rare in the study villages unless there is really urgent need at household. Livestock component was the leading source of cash for large household expenses to about 40.7% of household in the study villages, cattle and goats were the main contributor of cash. Other components which contributed cash was no farm income to 345 of households, farm components to 24.6% households and forest component to 0.6% households.

Households in the study area kept cattle as insurance against unpredictable events, cattle represented liquid assets that could be converted easily during urgent situation. Cattle are easily sold in the weekly livestock market nearby the study villages, even within study villages there are business mans buying cattle. Also Shilabu (2008) in study conducted in Maswa District found cattle are kept as insurance by households. In the study villages it was found they have good social capital networks which increase social relations against ill health or death when happens. Forest products are rarely used by households for large unpredictable expenses, the major reason was that forest products are not marketable when households are highly in need of immediate cash, also as observed earlier forest products like gum arabica which earned high cash are seasonal.

Table 34: Sources of cash for large household expenditures

Sources of cash	Frequency of response	Response (%)
Farm sources		
Cotton	76	15.9
Maize	23	4.8
Paddy	12	2.5
Chick peas	2	0.4
Tomato	1	0.2
Green gram	4	0.8
Sub total	**118**	**24.6**
Livestock sources		
Cattle	147	30.7
Goat	44	9.2
Sheep	4	0.8
Sub total	**195**	**40.7**
Forest sources		
Trees	1	0.2
Gum arabica	2	0.5
Sub total	**3**	**0.6**
Non farm source		
Contribution from relatives	70	14.6
Loan	68	14.2
Trade	10	2.1
Remittance	8	1.7
Sale of household asset	2	0.4
Selling of labour	5	1.0
Sub total	**163**	**34**
Grand total	**479**	**100.0**

Note: N = 479 because of multiple response from 318 households

Table 36 summarises the major sources of cash for small, medium and large household expenses in the study villages. Study revealed cotton, maize and goats were sources of cash for all categories of expenses.

Table 35: Summary of types of expenditure and sources of cash

Type of expenditure	Expense	Source
Small	Kerosene, soap, Match boxes, salt and cooking oil	Cotton, maize, goat, paddy, green grams, chickens, charcoal, firewood, gum arabica, remittance, petty trade, sorghum, tobacco and casual labour
Medium	School uniforms, school, contributions, household construction and repair, food, medicine, clothes	Cotton, maize, goat, paddy, green gram, chicken, charcoal, firewood, gum, remittance, petty trade, pole and labouring.
Large	Death funeral, sickness, fines	Cotton, maize, goat, cattle, loan and contribution.

Besides cotton, maize and goats other sources of cash for small and medium household expenses were green grams, chicken, gum arabica, charcoal, paddy, firewood, petty trade, casual labour and remittances. For large household expenses the sources of cash were cattle, goats, maize, cotton and contributions from relatives.

In general it was estimated that household in the study villages spent total of TAS 3 515 930 as cash from various source for various household expenditure as shown in Table 37. Farm component was the leading contributor of cash to household expenditure by contributing 36% of the total cash estimated.

Table 37: Estimated cash for various household expenditures

Product	Average	Price	Value
Farm			
Cotton	1 237	440	544 280
Green grams	1.2	75 000	90 000
Sorghum	7.2	15 000	108 000
Paddy	4.7	36 000	169 200
Maize	6	36 000	216 000
Tobacco	35	4 000	140 000
Sub total			**1 267 480**
Livestock			
Chicken	6	5 000	30 000
Goat	3	30 000	90 000
Cattle	2.3	300 000	690 000
Sub total			**810 000**
Forest			
Gum	4.8	13 000	62 400
Charcoal	27.5	9 000	247 500
Firewood	2.1	15 000	31 500
Poles	45	4 000	180 000
Sub total			**521 400**
Non farm			
Petty trade	55	11 250	618 750
Labouring	19	3 500	66 500
Remittance	2	26 900	53 800
Loan	2	44 000	88 000
Contribution	1	90 000	90 000
Sub total			**917 050**
Grand total			**3 515 930**

4.7 Statistical Analysis of Household Income

Analysis of quantitative primary data aimed to identify variable which significantly contributed to household income and how this relation can vary. Multiple linear regressions developed in section 3.2.2.2 was used to study the relationship between dependant variables total annual household income against independent variable which was farm income, forest income, non farm income, age, education, household category, marital status, farm size and household size.

4.7.1 Multicollinearity test

Independent variables were tested for multicollinearity to select critical variable for regression analysis. Multicollinearity test was done by using correlation matrix and the results are shown in Table 38. Gender and marital status variables were highly correlated (0.8) at 0.01 significant levels. Reseachconsultation.com (2007) and Pallet (2001) recommend if the bivariate correlation coefficient is 0.75 or higher in the same analysis it means there is multicollinearity then one of the variable should be omitted. These two variables are basically both measuring the same phenomenon or they both convey the same information. Therefore independent variable marital status was omitted in the multiple regression analysis.

Table 36: Correlation matrix results

	Gender	HH category	Marital status	Age	Education	Size of household	Size of farm	Forest income	Non farm income	Farm income
Gender	1									
HH category	0.235**	1								
Marital status	0.832**	0.217**	1							
Age	0.178**	-0.093	0.298**	1						
Education	-0.285**	-0.008	-0.319**	-0.183**	1					
Size of household	-0.179**	-0.447**	-0.190**	0.108	-0.055	1				
Size of farm	-0.122*	-0.445**	-0.075	0.185**	0.035	0.372**	1			
Forest income	-0.063	-0.279**	-0.018	0.110*	0.099	0.218**	0.463**	1		
Non-farm income	0.020	-0.115*	-0.031	-0.089	0.046	0.005	0.002	-0.038	1	
Farm income	-0.169*	-0.459**	-0.175**	0.029	0.039	0.474**	0.486**	0.306**	0.182**	1

** Correlation is significant at the 0.01 level (2-Tailed).

* Correlation is significant at the 0.05 level (2-Tailed)

Note: Due to high correlation coefficient value (Above 0.75) between marital status and gender, one variable was dropped in the multiple regression analysis.

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Table 37: Regressions statistics of sources of income and socio economic variables (Independent variable)

	Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
	B	Std error	Beta	t	Sig.	Tolerance	VIF
(Constant)	164189.004	247221.789		0.664	0.507		
Household category	-214234.104	56934.767	-0.073	-3.763	0.000***	0.649	1.541
Gender	40201.244	91286.832	0.008	0.440	0.660 ns	0.822	1.216
Age	568.051	2362.468	0.004	0.240	0.810 ns	0.889	1.125
Education	131086.341	40501.677	0.054	3.237	0.001***	0.875	1.143
Size of household	34819.158	9409.546	0.071	3.700	0.000***	0.681	1.469
Size of farmland	4212.797	1469.763	0.059	2.866	0.004**	0.593	1.687
Non far income	0.973	0.050	0.316	19.321	0.000***	0.926	1.080
Farm income	1.052	0.037	0.582	28.603	0.000***	0.598	1.672
Forest income	1.192	0.064	0.0337	18.705	0.000***	0.760	1.316

R^2 =0.922

*** = Significant at 0.01, ** = Significant at 0.05, ns = Not significant at 0.01 and 0.05

The multiple regression analysis indicated farm income significantly contributed to annual total household income (β = 0.582, t = 26.603, $p<0.01$). This was expected because farming was important for cash and subsistence to most households. The second most important variable contributed to total annual household income was dryland forests (β = 0.337, t = 18.705, $p<0.01$). Therefore the null hypothesis which was "Dryland forests do not contribute to rural household livelihoods" was rejected in favour of the alternative hypothesis "Dryland forests contribute to rural household income". Therefore annual total household income in the study villages was significantly contributed by dryland forests. Products from dryland forests were important for subsistence and cash income to rural household's livelihoods in the study villages. The third variable which significantly contributed to household income was non farm income (β = 0.316, t =119.321, $p<0.01$). The fourth variable which contributed significantly to total annual household income was household category (β = -0.73, t = -7.767, $p<0.01$). The fifth variable which significantly contributed to annual household income was size of households (β = 0.17, t = 3.7, $p<0.05$). Only 5 out of 9 independent variables included in the model were significant. All independent variables had expected positive signs with the exception of household category which had negative sign. It is also important to note that that the forest products are most significant than household category, non farm income and size of households. There was neither negative nor positive effect of gender and age on household income. This study provide the evidence of positive relationship between household income and dryland forest products, Therefore, dryland forest income has the potential of improving the livelihood especially to rural households.

Previous studies conducted by Bonifasi (2004) in Lushoto District and Maduka (2007) in Misungwi concurred with study results in some aspects. Farm income, forest income, size of households significantly contributed to total annual household income in both studies

while age did not significantly contributed to total annual household income in all studies. Contradiction on study results and previous studies was observed on farm size and forest income variables, probably this could be due to difference in methodologies used in data collection

4.7.3 Goodness of fit

Table 38 indicated the coefficient of determination (R^2) was 0.922. The R^2 statistics measure the extent to which the total variation of the independent variable is explained by regression equation. The R^2 interpret we have explained 92.2% of the original variability and left with 17.8 residual variability. Therefore the unexplained variable accounted for by variable not included in the model. Ideally, we would like to explain all of the original variability. The R^2 value is an indicator of how well the model fits the data, since the R^2 was close to 1.0 indicate we have accounted for almost all the variability with the variables specified in the model. Therefore, high values of R^2 suggest the regression model well explained the variation in the dependent variable. The model is well precise with no multicollinearity. The high R^2 values fits the data relatively well for survey data. Taken together the independent variable explained about 92.2% of the variation in the dependent variable i.e. searching for evidence of contribution rather than prediction.

4.7.4 Regression equation

From the result of the regression analysis found in Table 38 a linear regression was developed. In this model, a one unit change increase or decrease the total annual household income corresponding to coefficient for each variable indicated on the equation provided other variables are held constant.

THHI = f (HHC, Gender, Age, ED, SHH, SF, NonFal, Fal, Dfol)

$R^2 = 92.2\%$

CHAPTER FIVE

5.0 CONLUSION AND RECOMMENDATION

5.1 Conclusions

From this study it could be concluded dryland forests products play significant role and contribute to household livelihood in the study villages. Most households in the study villages depend on forest products for their nutrition and medical care, feeds for domestic animals, household equipments, construction materials and forest products are traded to get cash income. Study results indicated dryland forest statistically contributed to annual household income of rural households in semi arid area in Kishapu District. Detailed data collected on forest products was essential in determining to what extent forest products contributed to rural household economy and livelihood. Through this study we are undoubtedly in a position to know the importance of dryland forest than most people realised. Adequate policies and processes for the effective management of dryland forests require information about the exact economic value of forest products and also about the ways in which people use these forest products to sustain their livelihoods. This study have tried to generate basic information which could be the for appropriate decisions regarding the management of dryland forests, but also the contribution that dryland forest resource make to people's livelihoods, who uses the resource, when and how?.

This study showed dryland forest play several important roles to people in Kishapu District. Majority of households use dryland forests products directly as firewood, roofing grass for renovating, extending their existing houses and or constructing new ones, making agricultural and household equipments (hoe handles, pestles, chairs, yokes, and mortars) nearly all households use yokes and hoe handle as their main agricultural implements.

Various wild vegetables and fruits particularly tamarind fruits are consumed as food. Products such as gum arabica, firewood and fodder are sold, provide valuable additional source of cash income for household especially poor households, and on few occasions used as insurance substitutes. Most of these dryland forests are consumed 63%, if they are valued in monetary households could have paid an average of TAS 334 167 per annum which was substantial amount. Most households use forest products directly in various ways, some households sold forest products and obtained significant cash income. Cash income obtained from the sold forest products was spent on wide range of household expense such as food and clothes, thus enabled household to sustain their livelihoods. Study revealed the absence of insurance, combined with market imperfection has forced people to rely primary on livestock and forests assets as their insurance substitutes. Selling of gum arabica and firewood was mentioned by some households as either their first or second source of cash, study results clearly indicated that dryland forests are sources of cash for small and medium household expenditure.

Several conclusions have policy implication that can be identified from above. First, dryland forest products were widely used by rural households in study villages for both direct household consumption and income generation. Second, poor households used and benefited from forest products than middle and rich households. Third, the cash income and non cash income of forest products add crucial dimension to livelihood base of most rural households, this need to be appreciated by planners and decision makers. The direct use values of regular domestic forest products have the same order of magnitude as cash income from trade. Rural livelihoods in Kishapu District is no just about farming nor livestock husbandry , nor forest products but an interplay of all three within the matrix of livelihood, the relative proportion of which households seek to optimize livelihoods, respond to changing circumstances, spread risks and overcome challenges. Households in

the study area sell gum arbica directly to local buyer at low prices. There is little or absence of state regulation on the collection, grading and transit of gum arabica. Forest products such as gum arabica could be very beneficial product for rural households. It would be useful if government put emphasis in promoting tree gum farming and grading in order to enhance quantity and quality of gum arabica.

The main problem faced by households in management of household forests such as theft of trees, indiscriminative tree felling and illegal grazing are linked to prevailing situation in the study villages such as half of the households (49.4%) do not own forest or trees, most households (77.4%) experience shortage of forest products and 35.5% of households are not financially capable to buy forest products. Suggested solutions such as protection of forests, practise natural regeneration, tree planting and establish and use village by laws are likely to be potential solutions.

5.2 Recommendations

5.2.1 Shortage of forest products

Since study results revealed about half of households (49.4%) did not own forest of trees, most households (53.3%) feel the do not have access to forest products, most households (65.7%) are not satisfied with forest products and most households (54.4%) buy forest products for domestic use, its vital to provide solutions to forest product shortage. Firewood was the most important forest product collected and consumed by all households in the study villages, Kishapu District had the deficit of fuel wood consumption ($0.7m^3$) which is below the Nation average. In order to use efficiently little firewood available and reduce pressure on dryland forests it's vital to address the population's energy problems. Promotion and use of more efficient stove and other actions is an alternative approach for reversing the decline of dryland forests in semi arid areas of Tanzania. Innovative

technologies which minimally dependent on forest products such as improved cooking stoves, solar power and bio gas have the potential to reduce the pressure on fragile dryland forests. Improved cooking methods will use efficiently scarce firewood available and reduce the amount of firewood currently consumed by 100% of households. Indirectly the improved cooking stoves will reduce some of the problems facing dryland forest management in Kishapu District. Thorough analysis should be conducted on socio economic and cultural implications by engaging local communities in order to understand their needs and existing knowledge. Understanding and including the agenda of beneficiary is essential in addressing both broader environmental concern as well as issues directly affecting users.

5.2.2 Natural regeneration

Source of forest products to most households (59.3%) was from household forest known as *ngitili*, this traditional practise for reserving fodder has evolved over time and has worked well in dryland conditions. This practise have a long history of use in sukuma land but new practical know how is needed to configure them for application in today's context. The experiences of former HASHI project in Shinyanga have demonstrated that traditional approach can be effectively combined with new technologies to achieve better results.

5.2.3 Research in agro-forestry and marketing of forest products

Most household in the study villages are engaged in farming (98.1%) and livestock keeping (76.1%), therefore management of dryland forests should take this into account. The practise of agrosilvopastoral system appears to be most appropriate for sustainable management these areas. Research institution such as TAFORI should consider researching the potential of natural dryland forest in Kishapu and else where in semi arid areas to supply products for both livestock and human. Most of the researches in drylands

forest ecosystems are focused on wood production rather than management for multiple objectives. Sustainable forest management in these areas need to be integrated with other land uses which make it necessary to be familiar not only with the forest, pastoral and agriculture resources (e.g. honey and gums) present in the forests. Conservation of dryland forests while raising the living standard can be enhanced through domestication and commercialization of tree and their products. Research should be conducted to domesticate wild plants which produce valuable forest products to generate extra income and improve rural livelihoods, this will relieve pressure on threatened wild population. In order to improve marketing of forest products and to enhance benefit to households in the study area, the following are suggested; Market research should be done to understand trade channels and to encourage alternative channels if needed. In order to promote forest trade we need to know essential basic information about those doing the actual harvesting, what quantities are harvested fro forest, how the products are processed how they are marketed and who profits from the forest product trade. Dissemination of market information to local communities to ensure standard measurements is used and fair prices are paid to forest product collectors. Encourage formation of cooperative of forest product collectors associations to raise bargaining power to counter balance the power of buyers and negotiate realistic price for their products.

5.2.4 Enhance forest product value

Forest products such as gum arabica was ranked as the first source of cash income from forest component by 16% of households, it is advisable to sort and grade gum before selling in order to improve the quality. This could be achieved by establishing community based forest product association in areas where gum is collected. NGOs could assist local communities with setting up such associations.

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APPENDICES

Appendix 1: Products price and respective unit of measure

Bag of paddy	75 kg
Bucket of maize	15 kg
Bucket of tomato	10 kg
Barrel of cotton	89 kg
Oxcart of cotton	890 kg
Tin of gum arabica	45 kg
Oxcart size	3.4m3 (length 2.29m x 1.22m width x 1.22m height)

Agriculture crops

Bulrush millet bag	12 000/=
Sorghum bag	15 000/=
Maize bag	36 000/=
Cotton kg	440/=
Paddy bag	36 000/=
Ground nuts bag	27 000/=
Sweet potato chips bag	18 000/=
Green gram bag	75 000/=
Chick peas bag	36 000/=
Cow peas bag	15 000/=
Sunflower bag	12 000/=
Bambara nut bag	18 000/=
Sim sim bag	90 000/=
Finger millet bag	60 000/=
Sugar cane stem	200/=
Tomato bucket	5 000/=
Onion Bucket	9 000/=
Tobacco Rolls	4 000/=

Livestock

Cattle	300 000/=
Goat	30 000/=
Sheep	30 000/=

Donkey	150 000/=
Pigs	120 000/=
Chicken	5 000/=
Ducks	5 000/=
Pigeon	500/=

Forest products

Gum arabica (Tin)	13 000/=
Shaba	500/=
Firewood Oxcart	15 000/=
Head load	500/=
Charcoal (Bag)	9 000/=
Tamarind fruits (Tin)	5 000/=
Vegetable (Tin)	5 000/=
Medicine (Piece)	500/=
Honey (litre)	1 000/=
Pestle (Piece)	1 000/=
Mortar (Piece)	5 000/=
Pound (Piece)	500/=
Board game (Piece)	2 000/=
Milking vessel (Piece)	1 000/=
Chairs (Pieces)	2 000/=
Tree (Number)	30 000/=
Oxcart pole (Piece)	15 000/=
Building pole (Piece)	4 000/=
Sisal pole (Piece)	500/=
Yoke (Piece)	5 000/=
Hoe handle (Piece)	1 500/=
Roofing grass (Bundle)	500/=
Fodder (Acre)	25 000/= - 40 000/=
(5Acres)	1 Cattle (200 000/=)

Appendix 2: Check list for focused group discussion

1.0 Farm produces

1.1 List of agricultural crops in the village, estimated yield per acre and prices

1.2 Type of livestocks kept and current price.

2.0 Forest products

2.1 Type of forest products collected for household consumption and sale.

2.2 Current local price for each type of forest products identified.

2.3 Where do they collect forest product for household use and for sale. Do the collect free or buy.

2.4 What are their obligations to areas where they collect forest products?

2.5 Do they feel they have access to forest products to meet household needs?

2.6 What is their view regarding the access to forest products between rich and poor households.

2.7 Mention and rank important forest products for cash and for domestic use.

2.8 What are the main problems related to forest management and suggested solutions.

2.9 List of important tree and shrubs species found in the village.

3.0 Other sources of income

3.1 What are the other sources of income for most households?

3.2 Which source contribute significantly to household income

4.0 Source of cash for household expenditure

4.1 Define what are the everyday expenses and mention sources of cash.

4.2 Define what the regular predictable medium expenses are and mention sources of cash.

4.3 Define what are the large unpredictable household expenses and mention sources of cash.

5.0 Wealth category

5.1 How do they define a household?

5.2 What are the characteristics of defining household categories (Social identification or differentiate households.

5.3 Allocation of households in the villages into respective household wealth categories.

Appendix 3: Household questionnaire

I GENERAL INFORMATION

1. Name of interviewer.....Date.....
2. District: Kishapu
3. Division: 1 Mondo ☐ 2 Negezi ☐
4. Ward: 1 Mwamashale ☐ 2 Mwadui Luhumbo ☐ 3 Mondo ☐
5. Village: 1 Kabila ☐ 2 Bulima ☐ 3 Mwamashele ☐ 4 Busongo ☐
6. Household category: 1 Rich ☐ 2 Middle ☐ 3 Poor ☐
7. Name of the head of household.....
   Gender 1 Male ☐ 2 Female ☐
8. What is your tribe? 1 Sukuma ☐ 2 Nyamwezi ☐ 3 Nyiramba ☐
   4 Taturu ☐ 5 Nyaturu ☐ 6 ☐ 7 ☐
9. Marital status: 1 Married ☐ 2 Single ☐ 3 Divorced ☐
   4 Widowed ☐ 5 Separated ☐ 6 ☐
10. How old are you? (Head of household)..... Years
11. What is your level of education?
    Illiterate ☐ Primary school ☐ Secondary school ☐
    College ☐ Adult education ☐ University ☐
12. How long have you been living in the village?.....Years
13. What is your major activity?
    Farmer ☐ Worker ☐ Business ☐ Other ....(Mention)
14. What is the number of people living in this house?
    Total.....Male.....Female.....Adult.....Young.....
15. Does your household own farming land? Yes No
    How many acres?.....
16. In what ways the income in your household has changed over the years
    Have improved ☐ Have stayed the same ☐ Getting worse ☐

II FARM/AGRICUTURE PRODUCE

17. What crops do you grow?
    What is the common unit of measurements?
18. What is the estimated total harvest for each crop per year?
19. What is the price of each crop per unit?
20. What amount is normally consumed by household?

21. What amount is sold to get cash income?
22. Total income generated for each crop

Crop	Unit	Total harvest (Estimate)	Price (TAS)	Amount consume	Amount sold	Total income (TAS)

23. Which farm product is important for household consumption? .....
24. Which crop contribute to household income?.....
25. Do your household keep livestocks Yes ☐ No ☐
26. What types of livestocks do you keep?
27. How many are they for each type of livestock
28. What is the current price for each type of livestock kept?
29. How many livestocks are normally consumed by household annually?
30. How many livestocks are normally sold per annual?
31. Estimated total income from each type of livestock
32. Total estimated income

Type	Number	price	Number consumed	Number sold	Total

33. Which type of livestock is mostly consumed by household.....
34. Which type of livestock contributes to household cash income.....

III FOREST PRODUCTS

35. What products from trees and forest do the family collects for household consumption and sale
36. What is the unit of measurement?
37. What is the current local price for each type of forest product?
38. Could you estimate the amount of each forest products consumed by household per annual?

39. Could you estimate the amount of each forest products collected and sold per annual
40. Total harvest for each type of forest product
41. Total income for each type of forest product
42. Who collect forest products? (Male, Female, female and male) .

Product	Unit	Price	Amount consumed	Amount sold	Total harvest	Total income	Who collects

IV ACCESS OF FOREST PRODUCTS BY THE HOUSEHOLDS

43. Do you own forest or tree Yes ☐ No ☐
44. Where do you collect forest products for household use or for sale?
    Village FR ☐ Communal land ☐ HH Forest ☐ Farm ☐
45. Do you collect free or buy Free ☐ Buy ☐
46. What is your obligation to area where you collect forest products.....?

47. Do you feel you have access to forest products to meet household needs?
    Yes ☐ No ☐
48. What is your view on the access to forest products between rich households and poor households?
    Poor have less access ☐ Equal access ☐ Rich have more access ☐
49. Which are the most important forest products for cash income?

Forest product	Rank

50. Which are the most important forest products for subsistence use?

Forest product	Rank

51. Does forest products satisfy your needs (Consumption and sale).
    Yes No

52. How do you fill the deficit?
53. How do you dispose the surplus?
54. What are the main problems related to dryland forest management
55. What solutions do you suggest to the forest problems?

V. OTHER SOURCES OF INCOME

56. What are the other sources of income for your household?
57. Could you estimate the approximate value of cash income that your household receive from each source?
58. What are the frequencies for each source of income?
59. What is the total income for each source of income?
60. What is the total of other sources of income?

Type	Amount (TAS)	Frequency	Total/Year

61. Which among the other sources contributes significantly to household income?

VI SOURCES OF CASH FOR DIFFERENT EXPENDITURE

62. What are the sources of cash for small everyday expenditure (e.g. Kerosene, salts).
63. What are the sources for regular predictable medium expenses e.g. school uniforms and fees
64. What are the sources of cash for large unpredictable expenses e.g. funerals and sickness.