

**THE CONTRIBUTION OF FOREST PRODUCTS TO RURAL LIVELIHOODS IN
NKASI DISTRICT, RUKWA, TANZANIA**

BY

ANSBERT SEVERIN RWAMAHE

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE
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ABSTRACT

This study was conducted in Nkasi District, Rukwa region, Tanzania, with the overall objective of assessing the contribution of forest resources in improving the livelihoods of rural communities. The focus was on various ways in which local communities in the study area earn income through forest resources. Similarly, the study focused on the types and quantities of the forest products and establishment of the contribution of the products to household income. Primary data were collected from household survey in the study area by using questionnaire, PRA techniques and check list for key informants. Data collected during PRA were analysed with the help of local community. Content and structural-functional analysis techniques were applied for qualitative data and information. The quantitative data were analyzed by using Statistical Package for Social Sciences (SPSS) programme. The secondary data were obtained from the District Natural Resources Office. The results show that indigenous forests provide various types of forest products with substantial contribution to the livelihoods of the household. The forest products comprise about 21% of the total annual household cash income. Likewise, the study quantified the annually utilized forest products per household to be around TAS 186 815. The study also identified endangered plant species orchids which is widely traded and consumed by about 63% of the sampled households. The study shows that most of the forest resource users utilize forest products that require licenses. It was further noted that most of the users do not acquire licenses. Based on the findings of the study, it is recommended that contemporary forest management approaches such as Community Based Forest Management (CBFM) and Joint Forest Management (JFM) should be employed in order to ensure sustainable use of forest resources.

DECLARATION

I, ANSBERT SEVERIN RWAMAHE do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my own original work and it has not been submitted for a degree award in any other University.

Ansbert Severin Rwamahe
(MSc. Candidate)

Date

The above declaration is confirmed

Prof. John Francis Kessy
(Supervisor)

Date

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To my beloved mother Mrs. Mectrida N. Rwamahe and my late father Severin Rwamahe who jointly laid the foundation of my education.

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LIST OF ACRONYMS AND ABBREVIATIONS

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DRC	Democratic Republic of Congo
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
FPDs	Forest Products
IUCN	International Union for the Conservation of Nature
Kg	Kilogram
Km ²	Kilometre square
MNRT	Ministry of Natural Resources and Tourism
NRO	Natural Resources Office
NWFPDs	Non-wood Forest Products
SADC	Southern African Development Community
TAS	Tanzanian Shillings
URT	United Republic of Tanzania
WCA	Wildlife Conservation Act
WFPDs	Wood Forest Products
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Tanzania's total land surface area is 94.8 million ha. Most of the part of the land has diverse natural resources ranging from forests, wildlife, water, fish, minerals and fertile soils. The country is endowed with natural forests and woodlands distributed throughout. According to Chihongo (1992), Tanzania forest resource supporting the environmental and economic needs is based on 44 million hectares of natural forests consisting of riverine and montane high forests, savanna woodlands and grasslands, mangrove forests along the coastal belt and man made industrial plantations and community forests existing as reserved and unreserved forests. The mean national forest cover in the country reaches 37% (FAO, 2001a). Approximately 13 million hectares of these habitats are legally protected and managed as production or protection forest reserves (Massao, 2005). The total area of productive forest land is estimated at 34.6 million hectares of which consists of 78% of the total forest area (Chihongo, (1992). Likewise, MNRT (2000) reports that about 71% of the forest area in Tanzania is used for productive purposes.

The country has about 34 million people and majority of them depend on subsistence agriculture and natural resources such as forests, fish, wildlife and soils for their livelihood with use of the environment and natural resources accounting for 66% of gross domestic product (Severre, 2003). Forest resources are important to people who depend on forests for food, shelter, medicines, energy and income. For centuries people have hunted animals, gathered food and collected firewood from the forests. Currently, forest resources are becoming scarce compounded by illegal and unsustainable logging, fuel production, wildlife poaching, encroachment of agriculture and shifting cultivation (Sene, 2000). The

forests are coming under ever increasing pressure while people are being driven into even greater poverty (Sene, 2000).

Tanzanians undertake various activities which involve utilization of forest resources in order to enhance their livelihoods. Most of these activities play a great role in poverty alleviation (Severre, 2003). These activities are to be wisely undertaken otherwise they can pose adverse impacts on forest resources which in turn may deter the process of poverty reduction through deterioration of forests.

The link between households income and forest resources management is of great importance to national prospects for economic growth and poverty reduction (Kallonga *et al.*, 2003). The economies of the rural communities in Nkasi district are largely a product of the use of land and forest resources. The district is blessed of different types of natural resources with natural forests covering more than 2 000 Km². People in this district like many other districts in the country undertake various human activities in order to sustain their living. Most of them are poor and do depend on forest resources for generation of income. However, the contribution of the forest resources towards rural livelihoods is not quantified.

1.2 Problem statement and justification

Natural resources play an important role in rural development and the economy of the nation. Over 75% of the country's population lives in rural areas (World Bank, 2002). The majority of these people depend on the environment and natural resources for their livelihoods. The link between livelihoods and natural forests management is of fundamental importance to national prospects for economic growth and poverty reduction. The need to study such linkages cannot be over-emphasized.

The dependence of Tanzanian livelihoods on forests covers the basic requirements for human living such as food, shelter, and energy. For example, over 90% of Tanzanians rely on fuel wood from trees and other vegetation for their domestic energy supplies (Kallonga *et al.*, 2003). People in rural areas continue to rely on wild plants, animals, and insects for food, trees and shrubs for fuel and building materials, wild plants for traditional medicines and soil and water for producing crops (Mariki and Shechambo, 2003). However, there is no explicitly narration on the contribution of these forest resources to the rural people.

Tanzania has the ambition of alleviating poverty by year 2025. One of the strategies to achieve this goal is sustainable utilization of natural resources, forests being one of them (URT, 2000). Despite of the importance of forest resources, the extent to which they contribute towards livelihoods is not adequately determined. In Nkasi district, there are many natural forests that play a great role in improving rural communities' standards of living. Most of these natural forests are within Protected Areas such as Lwafi Game Reserve, Chala Forest Reserve, Loasi River Forest Reserve, Kizi Forest Reserve, Mfili Forest Reserve and Nkamba Forest Reserve. Other forests are outside of the Protected Areas and within village land for example Myula, Swaila, Mlambo and Miombo forests. Despite of the importance of these forests they have been deteriorating due to human activities which are environmental unfriendly a fact that will lead into unavailability of services and benefits for the present and future generation(s).

Currently little is known about the contribution of forest resources towards livelihoods of Nkasi people. Therefore, this study aimed at determining the contribution of forest resources towards household livelihoods and suggesting measures to achieve sustainable utilization of forest resources in the study area.

1.3 Objectives

1.3.1 Overall objective

The overall objective of this study was to assess the contribution of forest resources to rural livelihoods in Nkasi District.

1.3.2 Specific objectives

- (i) To identify various ways in which local communities in the study area earn income through forest resources.
- (ii) To identify types of products obtained from natural forests.
- (iii) To quantify consumed products from forest resources into monetary terms.
- (iv) To establish the contribution of forest products to household income.

1.4 Research questions

- (i) What are the ways through which local communities earn income from forest resources?
- (ii) What types of products are obtained from forests?
- (iii) What is the value of consumed forest products in terms of money?
- (iv) How much do the forest products contribute to the household income?

1.5 Research hypotheses

Null hypothesis (H_0): Forest resources have no significant contribution to household's livelihoods.

Alternative hypothesis (H_1): Forest resources have significant contribution to household's livelihoods.

1.6 Conceptual framework

The conceptual framework summarized in Figure 1 shows the relationship between forest resources, households' livelihoods and poverty reduction. The contribution of forest resources to livelihoods is explained in terms of benefits which are derived from forests by rural communities through undertaking various human activities such as agriculture, livestock grazing, beekeeping, charcoal making and firewood collection, lumbering, and wildlife hunting. These activities are supported by land, forest resources and water.

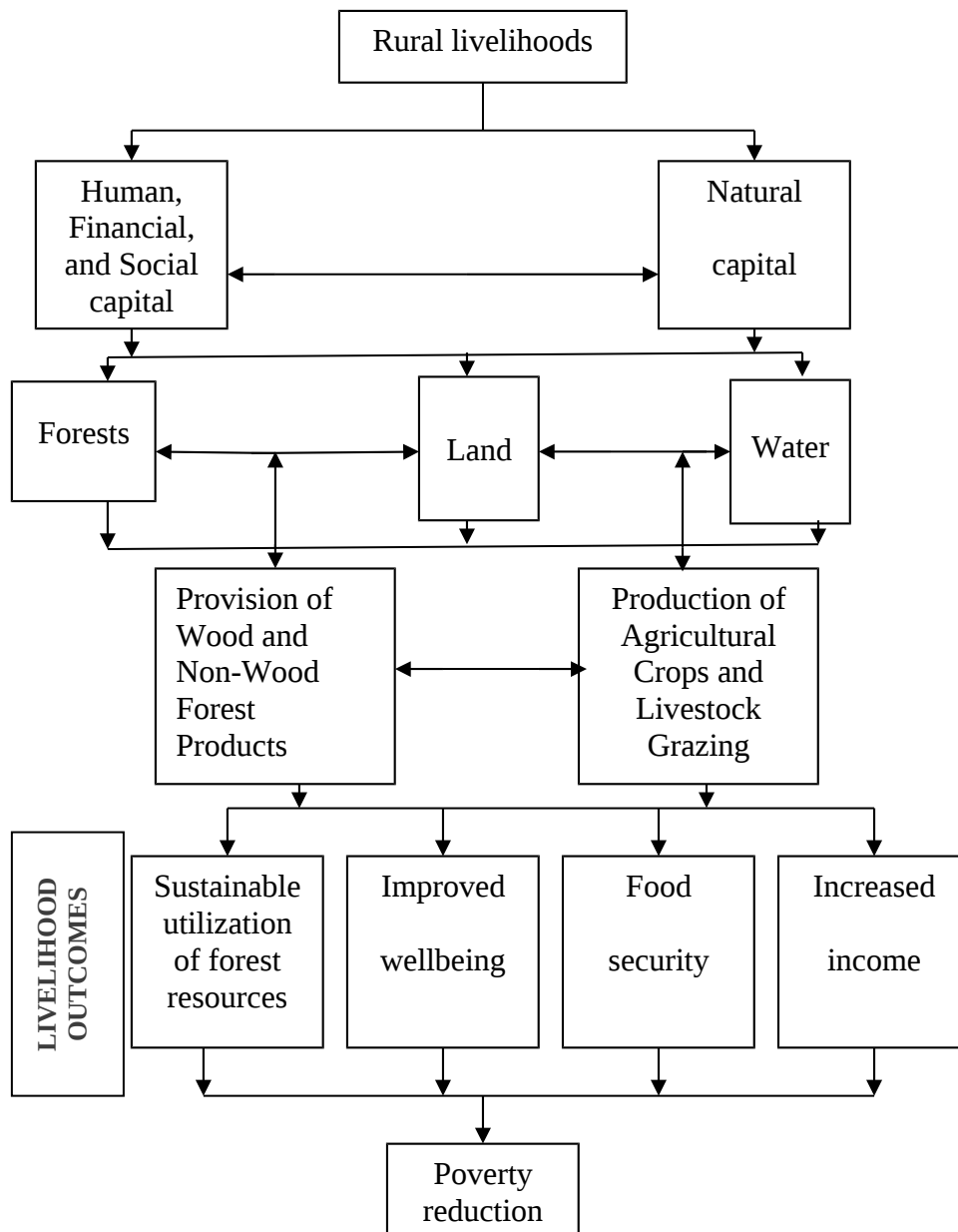


Figure 1: Conceptual framework for the study

It further elaborates that there is interdependence between agriculture (i.e. production of agricultural crops and livestock grazing) and different types of forest products (i.e. wood and non-wood forest products). These influence the livelihood outcomes which includes increased income, food security, improved wellbeing and sustainable utilization of forest resources. Finally, it explains that livelihood outcomes are the indicators of poverty reduction.

The relationship between Figure 1 and the research objectives lies on natural capital that among other natural resources it includes forest resources. Human, social and financial capital influences the use of forest resources whereby rural people obtain most of their necessities from forests.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of concepts

2.1.1 Natural resources

Natural resources are naturally occurring substances that are considered valuable in their relatively unmodified form. By definition, natural resources are features of natural ecosystems and species that are of economic value and that may be exploited. Also, features of particular segments of ecosystems, such as air, water, soil, and minerals (Rees, 1985).

The same source reports that a commodity is generally considered a natural resource when the primary activities associated with it are extraction and purification, as opposed to creation. Thus, mining, petroleum extraction, fishing, forestry and wildlife are generally considered natural-resource industries, while agriculture is not.

Natural resources are commonly divided into two major types, which are renewable and non-renewable natural resources. Renewable natural resources are those, which can restock (renew) themselves at approximately the rate at which they are extracted, if they are not over-exploited for example forests, wildlife and fish. Non renewable natural resources sometimes called stock resources are substances which have taken millions of years to form and so from a human perspective are now fixed in supply. They include soil, as well as water, wind, tides and solar radiation (Rees, 1985).

Mineral resources are generally non-renewable and, once a site's non-renewable resource is exhausted, it is considered to be useless for future extraction, barring technological improvements that allow economic extraction from the tailings. As pointed out by Rees (1985) Technological improvements may also allow future extraction of metals at lower concentrations than at previous times, which convert low-grade resources into ore, and may re-open or expand mines. Both extraction of the basic resource and refining it into a purer, directly usable form, (e.g., metals, refined oils) are generally considered natural-resource activities, even though the latter may not necessarily occur near the former.

2.1.2 Sustainable use and development

Sustainable use, both extractive and non-extractive, is a dynamic process toward which one strives to maintain biodiversity and enhance ecological and socio-economic services, recognizing that the greater the equity and degree of participation in governance, the

greater the likelihood of achieving these objectives for present and future generations (Slater and Twyman, 2003). Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs. Sustainable development is based on socio-cultural development, political stability and decorum, economic growth and ecosystem protection, which all relate to disaster risk reduction (Brundtland Commission, 1987).

2.1.4 Food security and household income

Food security can mean very different things to different people, depending on their professional backgrounds and experience. For example, a nutritionist might associate food security with food habits, norms and malnutrition; an agricultural economist might focus on food production and processing at the local level (Nyborg and Haug, 1994). All these aspects are important, but they are not adequate in reflecting the broader definition of food security as it currently is manifested in development goals. The most common and widely accepted definition of food security is that suggested by World Bank (1986): 'access by all people at all times for enough food, for active health life'. The key elements that determine food security at any point in time are; availability of enough food for an active and health life, the access to it and the guarantee that one has the access to it at any given time (Maxwell and Frankenberger, 1992).

2.2 Diversity in livelihoods

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it

can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1992). Livelihood implies a means of living (set of activities a human being apply to earn everyday life) (Hornby, 1992).

The concept of 'livelihoods' has moved analysis away from narrow parameters of production, employment and income to a much more holistic view which embraces social and economic dimensions, reduced vulnerability and environmental sustainability, all within the context of building on local strengths and priorities (Shackleton and Cousins, 2000). This recognizes that households pursue a range of livelihood strategies based on the assets (natural, financial, social, human and physical capital) they have to draw on and the livelihood outcomes they wish to achieve. The ability to access various combinations of assets helps to determine how vulnerable or healthy a livelihood may be.

The livelihoods of the poor are complex and dynamic, typified by a diverse portfolio of activities that not only enhance household income but also food security, health, social networks and savings. Most households draw on a range of activities and income sources and these include casual and permanent wage employment, remittances, welfare grants, crop production, animal husbandry, natural resource use, and other means of income generation through small enterprises like sewing and brick-making. The contribution of different strategies varies with social identity and is constantly shifting as household members adapt to changes in the internal and external environment. For this reason the concept of 'major livelihood sources' and the classification of households into pre-determined categories can be misleading and can result in the disregard of less obvious activities (McAllister, 2000).

2.3 The linkage between forest products and livelihoods

Forests play a vital role in supplying products and services for agriculture, livestock keeping, domestic needs and some other livelihood activities. For livestock, forests provide grasses and leaves for fodder, and leaf-litter for animal bedding. For agriculture animal manure and bedding is composted to maintain soil fertility. According to Kessy (1998) forests in East Usambara for example are important to farmers as far as food security is concerned. The source revealed that a lot of farming activities were taking place under the forest canopy where leaf litters increase soil fertility and improves agricultural crop production. Forest provides a range of edible NWFPs, which are consumed directly as food such as wild fruits, mushrooms, wild meat and wild vegetables. Forests also supply raw materials for agricultural implements (such as ploughs and knives) and the charcoal needed by blacksmiths to make them.

Forests also provide wide range of goods such as fuel-wood, timber, medicines, building materials, and inputs to industries. According to Pimental *et al.* (1997), services on which human activity depends include watersheds, carbon sequestration and soil fertility are also accrued from natural forests. Exploitation of natural forests provides the livelihoods for a high proportion of the country's population.

The importance of natural forests to Tanzania's economy has increased in recent years. This trend is likely to continue, given the competitive advantage that the nation's biological wealth confers. The FAO (1991) pointed out that collection and processing of babassu palm (*Orbignya barbosiana*) fruits in Northern Brazil provided a major source of income to millions of tenants farmers who have few other opportunities for earning cash. Similarly, in the Philippines the FAO (1991) revealed that poor farmers were most dependent on income from rattan collection. Products obtained from forests contribute

towards households' income indirectly through saving money which would have been used to purchase substitute commodities. Income earned from forest based activities is used to purchase other food stuffs, which is an indirect contribution to food security.

2.3 Wood products

Forests provide watershed protection, wildlife habitat, recreation and wood product production, often simultaneously on the same area. Timber harvesting, provide useful materials demanded by society, income, jobs for communities related to the primary and secondary manufacturing and sale of wood products (Tormoehlen *et al.*, 2000). Young, healthy forests serve as reservoirs of carbon dioxide uptake from the atmosphere, and trees processed into long-term products, like housing and furniture, store that carbon for long periods of time (Tormoehlen *et al.*, 2000).

Woodfuels provide income for many people through its sale and trading. With ease of access both to the resource and markets, large numbers of the landless and very poor gather and sell wood for fuel, and large numbers of farmers harvest and sell it as well. Woodfuel retailing is a major source of income for the poor and can be one of the main sources from forest product activities (Anorl and Persson, 2003).

Poor households rely overwhelmingly on woodfuels as their household energy source. In developing nations alone, some 2.4 billion people (more than a third of the world population) rely on wood or other biomass fuels for cooking and heating (IEA, 2002). For example, nearly all rural households in Kenya, Tanzania, Mozambique, and Zambia use wood for cooking, and over 90 percent of urban households in these countries use charcoal imported from the countryside (IEA, 2002). In India, 62 percent of rural households depend on woodfuels (Vadivelu, 2004).

Wood used as fuel is fundamentally important in the household economies of the rural poor. It is not only a source of energy in the home, but a supplemental source of cash income through the collection, processing, and sale of firewood and charcoal. Charcoal in particular, due to its high energy content and easy portability is an important income producer and a sole source of employment for many. In Kenya alone, the charcoal economy is estimated at about 23 billion Kenyan shillings per year (on a par with tourism as an income generator) (Kantai, 2002).

Activities of selling and trading in woodfuels represent principal source of income for people who involve themselves in such business. This was found to be the case, for instance, for about 125,000 people of Dar es Salaam, Tanzania, in the 1990s (USAID Tanzania, 2003). Sometime, fuel wood or charcoal for some people provides a supplemental, transitional or seasonal source of income, or serve as 'safety net' in times of hardship. However, low prices and high levels of competition that ease of entry into the activity usually create, often mean that woodfuel selling generates little surplus for those who engage in it. This keeps most of those who engage in it poor, and discourages investment in more efficient production (or sustainable management or renewal of the resource) (Arnold and Persson, 2003).

2.4 Non-wood forest products

Non wood forest products consist of goods of biological origin other than wood derived from forests, other wooded land and trees outside forest (FAO, 2000). Examples of these products include traditional medicines, honey and beeswax, tubers, wild animals, fodders and fibres, wild fruits, mushrooms, and wild vegetables.

The medicinal value of plants is due to the presence in them of special substances having a particular physiological action on the human body. Commonly such substances are alkaloids, some of which are powerful poisons if administered unwisely, while others are dangerously habit-forming. Yet in small quantities skillfully administered, even the most poisonous or dangerous drugs can be of value to human health and well-being (Chihongo, 1992). Throughout the world thousands of different plants are used for medicinal uses, many of them only locally by rural populations especially in the developing countries.

As it has been pointed out elsewhere, much of forestry output remains unrecorded and goes to subsistence consumption as part of peoples basic requirements such as medicinals, fuelwood, fodder, and the alike. Most of the medicinal herbs is traded informally in both rural and urban areas and is therefore unrecorded. Kahatano (1997) reported a total of 98 plant species and 12 animal species being traded locally as traditional medicine. This implies that a good amount of income can be obtained through selling traditional medicine and this has a substantial contribution to household income. Reliance on traditional medicine in Tanzania is significant, and there is no reason to suppose that it will decrease (Otieno, 2000).

The underground storage organs of wild plants; which are collectively known as tubers are considered important energy as well as income sources for many people in different communities who live close or adjacent to natural forests. According to FAO (2000) roots and tubers that are obtainable from wild plants are very few. For those used as food (flour for porridge) once obtained take long processes in processing before they come to be safe to eat since in most cases they contain toxic substances. Tubers are very small and are too few to constitute a complete meal. An example of a root is *Commiphora spp.*, while examples of tubers are *Eriosema spp* and orchids.

Honey and beeswax products are viable sources of rural income, not only in Tanzania, but in many areas in the SADC region. At the same time beekeeping provides one economic justification for the sustainable management of the natural forests particularly miombo and montane woodlands which possess a number of prolific nectar producing tree species. Beekeeping to a large extent, can serve as an important source of income for those living in buffer zones surrounding conservation areas, and the low population pressure within the forest reserves makes them excellent for Honey and beeswax production. Honey is a high-carbohydrate food, valued as a source of sweetness and diversity in the Tanzanian diet (Kihwele and Bradbear, 1989). Honey is highly regarded as a tonic or medicine and is given to nursing mothers and the aged. In Tanzania Honey is widely used in the manufacture of honey beer which is a lucrative business as income earner at community level. Honey has also social value, as it is used at various important ceremonies, for example marriage and circumcision. This is especially true for the Maasai (Kihwele and Bradbear, 1989). Since many beekeepers produce and sell their honey locally to end-users who offer better prices than cooperative societies, there are no statistics on the extent of this enterprise in rural communities. Most of the honey is consumed locally or sold through unofficial channels (Chihongo, 1992).

Wild animals provide food security in the form of cheap protein supplements to people living in or around forests and grasslands. Game hunting in districts of Kiteto and Mbulu in Arusha region, for instance is done by poisoned arrows. Certain plants are employed in manufacture of arrow poisons from the wild flora of Tanzania. The same toxins are used in water poisoning to stan fish and wild game, by the native tribes of the Hadzabe and Barbaig inhabiting Mbulu and Singida districts respectively, who are believed to be remnants of the Bushman. Licensed individuals can also hunt animals for game meat to

urban populations in the northern tourist circuit and elsewhere in the country (Chihongo, 1992).

Given the rising demand for bush meat, hunting has become in many cases more lucrative than agriculture. In forested areas of Gabon for instance, the recent economic recession and drop in cocoa prices have prompted the majority of village men to rely on wildlife exploitation as a primary means of generating income (FAO, 1995).

Fodders and fibres make a significant contribution to domestic livestock production which in turn contributes towards households' income through influenced milk and meat supply. In addition, fodder contributes to maintain draught animals which produce manure for organic fertilizer thereby supporting agricultural production (Wickens and Goodwin, 1984; Wickens, 1986). This results into maintenance of food stability and improving households' income through selling of surplus crops. Fodder from trees and shrubs are particularly important during dry season when availability of grasses is markedly reduced. Normally livestock graze inside the forests during dry season when resources within public lands have been exhausted. Lawton (1992) and Tuite and Gardiner (1990) observed that up to eleven tree species and shrub species found in *Miombo* woodlands are browsed.

Azmy and Haron (1992) reported that the major uses of bamboo in rural areas of Malaysia are for food and building materials. There are a large number (an estimated 1032 in 1989) of bamboo based cottage industries in peninsular Malaysia, which provide a source of income to rural people. These include those producing handcrafts, poultry cages and vegetable baskets.

There are thousands of species of wild fruits consumed world wide. Fruits are most commonly consumed raw and as snacks. In Tanzania most fruits are valued as food for

children and largely collected by children while in forest. Hines and Eckenman (1993) argued that where exotic fruits such as papaya, banana and mango are planted, little use is being made of wild fruits. Likewise where a large number of indigenous fruits trees have been retained or planted the variety of exotic fruits is small. A study carried out in Tanzania revealed that there are over 40 forest food and fruit-bearing species (FAO, 1983).

Edible fungi belong to family of *Agaricales*. The heavy rains wake up the grass, and soon the first mushrooms appear. This is the mushroom-hunter's paradise! No where else in Africa can you find such a profusion of mushrooms: milk caps, russulas, amanitas, chanterelles etc. most of them are abundant in the miombo woodlands because almost all of the trees are ectomycorrhizal: their roots live in symbiosis with mushroom mycelia (Harkonen *et al.*, 2003). In Tanzania, natural mushrooms are used mainly as subsistence and very small portion being sold. On the other hand, according to Sumba (2005) some mushrooms are used as medication, for instance, preliminary studies involving the use of a formulation comprising a mixture of powdered fruit bodies of several wild medicinal East African mushrooms in the treatment of patients with Kaposi's sarcoma (an opportunistic skin cancer affecting patients afflicted with HIV/AIDS) show promising therapeutic results.

Herbaceous plants and young leaves are used as vegetables and provide essential vitamins. *Gnetum africanum* is a central African forest creeper. Its perennial forage is consumed in large amounts as vegetable. The leaves are gathered and cut into slices. These can be eaten low and green but are generally added to meat and fish dishes at the end of the cooking time. They constitute a significant source of protein, particularly essential amino acids and mineral elements (MEMA-Natural Woodlands Management Project, 2000).

Forests have been an important source of gum where people collect them from within surrounding areas. According to Chihongo (1992) the product could have potential for increased exports, since after liberalizing trade in 1986, there has been an increase in the production of gum Arabic thus resulting into the increased quantities being exported. The product is being tapped from the forest trees and is mainly used in the confectionary industries (FAO 1995).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study area description

3.1.1 Geographical location and area

Nkasi district is one of the four districts of Rukwa Region. The district lies between latitudes 7⁰ to 8⁰ South and longitude 30⁰ to 31⁰ West. It is bordered by Mpanda district to the North, Sumbawanga Municipal to the East, Sumbawanga Rural and Zambia to the South. Furthermore, the district is bordered by The United Republic of Congo (DRC) to the West (Figure 2).

The district has a total area of 23 124 Km² of which 19 375 Km² is land, 3 749 Km² is water. The total area of 2 228.36 Km² is under Lwafi Game Reserve and 5 100 Km² arable land. The whole district has 87 villages whereby out these six villages were studied. The studied villages include Kakoma, Katongolo, Tambaluka, King'ombe, China and Ng'undwe (Figure 2). Other studied villages such as Katongolo, Ng'undwe and King'ombe are near Lake Tanganyika that is found within the Great Rift Valley.

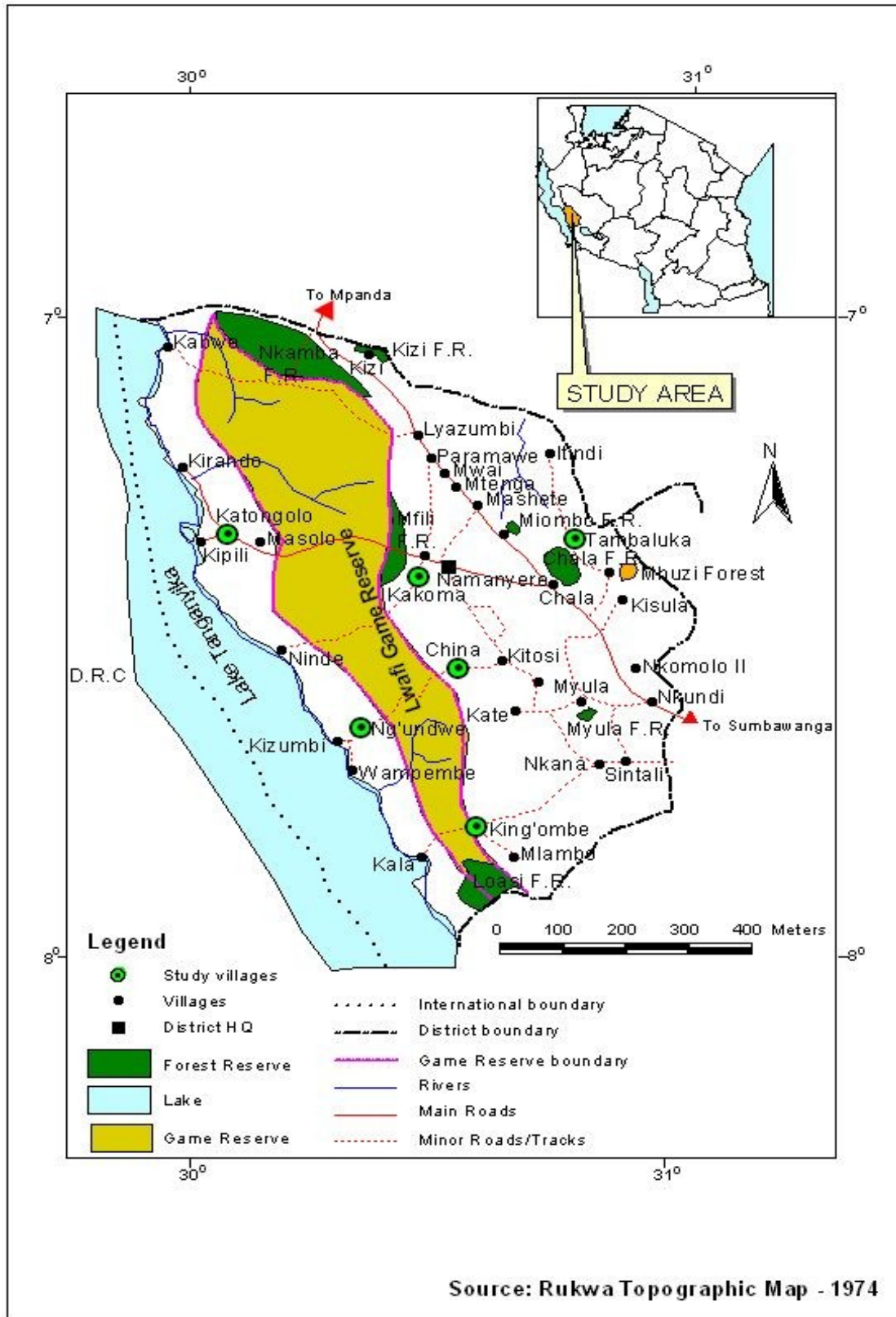


Figure 2: The Map of Nkasi district showing study villages

3.1.2 Population and ethnicity

Nkasi district has the total population of 228 885 of which 112 744 are males and 116 142 females (URT, 2005). The average growth rate is 4.8% per annum which is above the national population growth rate (i.e. 3.3%) (URT, 2005).

The district is multi-ethnic. The major groupings in the district are the '*Fipa*', '*Nyika*', '*Wakwa*', '*Pimbwe*', '*Konongo*', and '*Rungwa*'. Recently, immigration has resulted in the emergence of other groups in Nkasi district for example, the '*Sukuma*' are pastoralists who have been pouring into the district in search of pastures for their large herds of cattle. Other immigrants include different ethnic groups from DRC (Tanganika, R. personal communication, 2006).

3.1.3 Topography and climate

Nkasi district may be divided into several areas according to topographical features. Since most of the district lies within the western branch of the Great East African Rift Valley, its characteristics are related to the rift valley system of East Africa. Within the district there is a rift valley Lake Tanganyika, whose water level is at 772m above sea level, but whose depth reached 500m below sea level (Sikazwe, 1990).

The district has a dry sub-humid with one long wet season from mid November to mid May and one dry season. Annual rainfall varies from 800mm to 1300mm depending largely on elevation. The heavy rainfall is occurring along the Lake Tanganyika. The areas with relatively low rainfall (800 – 900 mm) include eastern Namanyere and Kirando. The temperature in the district may be divided into two categories; the Ufipa plateau and Lake Tanganyika zone. The Ufipa plateau is cold during the rain season and hot during the dry

season whereas the Lake zone is hot throughout the year. The annual minimum temperature is 15 °C and maximum temperature is 26 °C (Sikazwe, 1990).

3.1.4 Vegetation cover

Nkasi district consists of the vegetation of woodlands, grasslands montane and riverine forests. Woodland covers most of the sloping areas which separate the Ufipa plateau from Lake Tanganyika. The woodlands are of the Miombo type. The vegetation type of the Ufipa plateau is grassland, including some bushes and wooded grasslands (Sikazwe, 1990).

Forests in Nkasi District are found in two categories of land namely; public land and forest reserves which are also divided into two categories of ownerships. These two categories of ownerships include; central government and local government. The distribution of these forests is presented in Table 1.

Table 1: Central Government and District Council Forest Reserves in Nkasi District

Central Government Forest Reserves	Area (sq. Km)
Nkamba Forest Reserve	235.45
Chala Forest Reserve	33.00
Kizi Forest Reserve	326.48
Loasi Forest Reserve	334.65
Lwafi (Game reserve forest)	2 228.36
Total	3 157.94
District Council Forest Reserves	Area (sq. Km)
Mfiri Forest Reserve	46
Miombo Forest Reserve	12
Myula Forest Reserve	20
Total:	78

3.1.5 Economic activities

The major economic activities in Nkasi district are farming, fishing, livestock keeping and trading. The district has about 5 100 Km² of arable land. The food crops grown in the district include maize, beans, sunflower, finger millet, cassava, sweet potatoes, irish potatoes, rice and bananas. Fishing activities are mainly undertaken by people living along Lake Tanganyika. The area of water within the jurisdiction of Nkasi district is 3 749 Km².

3.2 Methodology

3.2.1 Sampling procedure

3.2.1.1 The sample size

The study population included a representative sample of households in the study area. The sampling unit was the household. Random selection was used to obtain households from six villages found in six out of thirteen wards in the study area. Villages from which

the sample was drawn include Kakoma, Katongolo, Tambaluka, China, Ng'undwe and King'ombe (Figure 2). The criterion for the selection of these study villages was proximity to forest resources. This criterion was used for the reason that distance to forest resources influences human activities undertaken by rural communities, which in turn affect rural livelihoods.

In each selected village, 5% of the total households was randomly sampled (Table 2). According to Kajembe and Luoga, (1996) in order for a random sample to be a representative of that population should at least constitute 5% of the total population. The interviewed households consisted of female and male headed households. Heads of the households were the key respondents but other members of the households were encouraged to attend in order to supplement information.

Table 2: Number and proportion of households sampled in each study village

Name of the village	Total number of households per village	Number of respondents per village (sample size)	Percentage sampled
Kakoma	337	17	5
Katongolo	514	26	5
Tambaluka	378	19	5
China	567	29	5
Ng'undwe	400	20	5
King'ombe	341	17	5
Total	2537	128	5

3.2.1.2 Sampling design

Purposive random sampling was applied in selection of the samples for interview. A list of households in a village obtained from the register was used as a sampling frame. Purposive sampling was used in choosing the wards and villages by taking into consideration areas with natural forests (Figure 2) whereas random sampling was used in selecting households in the village. The cross-section research was used in this study. The design was favoured because it allows for data to be collected at a single point in time and can be used for a descriptive study as well as for determination of relationship between

variables (Bailey, 1998). By one point in time means that data are collected in as short a time as is feasible (Singleton and Straits, 1993).

3.2.2 Data collection

Data collected in this study included socio-economic data (age, gender, occupation, education, economic activities, income, forest products utilized at the household level and access to natural forests). Demographic data that were collected include; human population, household size, ethnic composition. Secondary data were collected from Nkasi District Office. These data provided information on general aspects and specific issues such as records of economic activities related to natural forests in the district including beekeeping, lumbering, charcoaling and hunting of wild animals.

3.2.2.1 Participatory Rural Appraisal (PRA)

General information on main economic activities undertaken by the communities on natural forests, their management and various sources of households' livelihood were obtained through PRA techniques particularly using semi structured questions. The above information was supplemented by data obtained from key informants (extensionists and village leaders) and Focus Group Discussion.

3.2.2.2 Questionnaire Survey

A structured questionnaire with closed and open-ended questions was used to collect primary data such as households' background information, economic activities, forest products utilization and management of natural resources (Appendix 1).

3.2.3 Data analysis

Both qualitative and quantitative methods of data analysis were used in this study. Data collected from communities through Participatory Rural Appraisal (PRA) techniques was analyzed with the help of the local people to get immediate feedback.

Data analysis for quantitative data was done by using Statistical Package for Social Sciences (SPSS). The data were first coded in a form suitable for addressing research questions and the employed method of analysis. For the case of qualitative data, verbal discussions that were held with different respondents were analyzed in details with the help of content analysis method. Through breaking them down into smallest meaningful units of information. This helped the researcher to ascertain values and attitudes of respondents (Kajembe and Luoga, 1996).

3.2.3.1 Analytical model

Inferential analysis was also carried out to provide an idea about whether the patterns described in the samples were likely to apply for the whole population from which the samples were drawn (de Vaus,1986). In this regard a multiple regression model was employed in order to predict whether or not the dependent and independent variables are significantly related and measure the strength of their relationship.

The multiple linear regression model is described as;

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e$$

Where:

Y= the observed value of the dependent variable [Income per year (TAS)]

a = Constant

b₁ to b₈ = independent variables coefficients

X₁ = Sex of the respondent (Dummy: 1 if male, 0 if female)

X₂ = Age of the respondent (years)

X₃ = Marital status (Dummy: 1 if married, 0 if otherwise)

X₄ = Education level (years in school)

X₅ = Family size (No.)

X₆ = Farm size (Hactares)

X₇ = Distance from natural forest (Km)

X_8 = Owning farm near natural forest (Dummy: 1 if own, 0 if otherwise)
 e = Random error

The model and the Hypothesis testing

The developed linear regression model described above was used in testing the hypothesis. In doing the hypothesis testing, the dependent and independent variables were defined as follows:

The dependent variable

Total household income per year. This was the dependent variable because it was hypothesized that the impact of the factors that influence income from forest resources would be reflected on the total household income earned.

Independent variables

Sex of the household head (SEX)

Usually, sex is a very important factor that influences income-generating activities to be undertaken by a particular person. The hypothesis here was that male household heads would tend to undertake income generating activities related to forest resources because of the ability to participate in these activities as opposed to females.

Age of the respondents (AGE)

Normally age is a very crucial factor, which influences income-generating activities. The hypothesis here was that older household heads with exception of very elderly ones would tend to undertake income-generating activities, which are related to forest resource base because of their experience in these activities implying high income earned from forest resource base as age increases.

Marital status (MSTS)

The behaviour of the household in terms of responsibilities and social stability is depicted by the marital status of the household head. Thus, marital status influences the household income from forest resources. In this case it was hypothesized that married people would earn more income from forest resources due to having many responsibilities which in turn necessitates them to participate in income generating activities related to forests.

Education level (NUMED)

The respondent's education level was considered as an important factor influencing creativity through which household income is earned. Number of years in education was expected to influence the income earned from forest resources in the study area. According to Monela and Abdallah (2007) well educated and wealthier societies (mostly industrialized countries) and their socio-economic activities are different compared to poor, less educated societies in developing countries. Therefore, it was hypothesized that the more the number of years in education the more the income accrued from forest resources.

Family size (FMSZ)

Family size is a very essential factor in influencing the available labour for the particular household. The hypothesis in this case was the larger the household size the larger the income earned from forest resource base, other factors held constant due to availability of required labour for undertaking income generating activities based on forest resources.

Farm size (FRM)

The size of the farm plays an important role in amount of crops harvested and earned income. In this case the hypothesis was that; the larger the farm size the larger the household income from both agricultural crops and forest products because in most cases

large farms are located near or within forests the fact that influences the owner to derive income from forest resource base.

Distance from natural forest (DFRT)

The distance of communities from the natural forests influences income-generating activities associated with forest resource base. Here the hypothesis was that the household income increases with decrease in distance from natural forest; implying that the less the distance from the forest the larger the income from forest resource base and vice versa.

Owning farm near the natural forest (ONF)

The location of the farm is an important factor, which influences income-generating activities related to forest resource base. It was hypothesized that households owning farm near indigenous forests earn more income from both forest resource base and agricultural crops, since nearness of the farm to forest resource base lead to easy access and utilization of forest products as well as increased agricultural crops due to fertile forest soil.

Statistically, the hypothesis tested was:

$$H_0 : HI \neq f(SEX, AGE, MSTS, NUMED, FMSZ, FRM, ONF, DFRT)$$

± ± ± + ± + + ±

(Indicating that there is no correlation between dependent variable and independent variables; $b_1 \dots b_8 = 0$)

Against;

$$H_1 : HI = f(SEX, AGE, MSTS, NUMED, FMSZ, FRM, ONF, DFRT)$$

± ± ± + ± + + ±

(Representing that there is either positive or negative association between dependent variable and independent variables; $b_1 \dots b_8 \neq 0$)

The signs (+ and +/-) underneath each factor indicate that the hypothesized effect of that factor on HI was caused by an increase in that particular factor.

Test for multicollinearity

Multicollinearity refers to the existence of a perfect or exact linear association between some or all independent variables of a regression model. In this particular study, before testing the above model, multicollinearity among independent variables was tested. A correlation analysis between the independent variables was made in order to achieve the aforementioned test. The correlation coefficients (r-values) were used to indicate how strong the intercorrelation along with the variables (if any) was by bearing in mind the resultant r^2 values.

3.2.3.2 Quantification of forest products

Benefits obtained from natural forests in the study area were quantified into monetary terms. The quantification was based on the quantity and assigned value of each particular forest product utilized per household. Each respondent was asked to mention and value the quantity of each forest product utilized by his/her household per month/year. Basing on the assigned value by each respondent, the average in terms of Tanzanian shillings (TAS) for each product was obtained and then the average value per unit of a particular forest product was multiplied by the average quantity utilized per annum to get the value (TAS) per year of that particular forest product. Mathematically the quantification of different forest products identified in the study area was as follows:

$$AVHH = AQHH \times AVPU$$

Where;

AVHH = Average value of the particular forest product per household per year (TAS),

AQHH = Average quantity of the particular forest product utilized per household per year,

AVPU = Average value of a particular forest product per unit (TAS)

The summary of value of encountered products is presented in section 4.8.2 of this dissertation. The procedures that were used for quantifying each type of forest product are presented in the following subsections.

3.2.3.2.1 Firewood

The value of utilized firewood per household per year was calculated based on the assigned value by the respondents. Each household head was asked to assign the value of one head load of firewood utilized in his/her household assuming that those utilized firewood were to be bought in the market.

3.2.3.2.2 Charcoal

Some of the respondents in the study area involve themselves in charcoal making for the purpose of earning income while at the same time they use charcoal for domestic consumption. Respondents of this nature were asked to value the amount of charcoal consumed by their household and if they were to buy it, how much money they would have paid. Here the unit, which was used to establish the quantity, was a bag of 50 kg.

3.2.3.2.3 Wild vegetables

Different types of wild vegetables in the study area are commonly collected and consumed. Every respondent who consume wild vegetables in his/her household was asked to establish the consumed quantity (in kilograms) per month/year. The established quantity was based on fresh weight. After establishing the quantity, then the respondent was asked to assign the value to one kilogram (1 Kg.) of wild vegetables. In this case one

kilogram of wild vegetables was approximately found to contain six piles of fresh vegetables.

3.2.3.2.4 Bush meat

Those respondents who used bush meat were asked to value the meat they used. The unit that was used to value the bush meat was kilogram (kg) whereby the respondent in question was required to assume that he/she is buying the utilized meat from the market.

3.2.3.2.5 Orchid tubers

The study area was found to consist orchid tubers which are commonly eaten in many households. Every respondent who consumed orchid tubers in his/her household was asked to value the utilized quantity consumed. The unit used for valuing this particular forest product was kilogram.

3.2.3.2.6 Reeds

Reeds are among the wild products utilized in the study area. Those respondents who use reeds in their households were required to value the amount of reeds they use. The unit used for valuing was head load.

3.2.3.2.7 Poles and tool handles

Poles and tool handles are important forest products and were found to be commonly used by the respondents in the study area. The respondents were asked to value poles and tool handles they use. The unit of valuation was the number.

3.2.3.2.8 Wild fruits

The study area was found to have diversity of wild fruits, which are commonly consumed by household members. Every respondent who eat wild fruits in his/her household was asked to establish the quantity eaten per month/year and then assign the value on the established quantity. The unit used to determine the value was kilogram (1 kg.) and it was estimated that one kilogram consists of four piles.

3.2.3.2.9 Traditional medicine

In most African countries, traditional medicine is the very important component in the health sector. Respondents in the study area were found to use traditional medicine to cure different diseases. Every respondent who use traditional medicine was required to mention how many times he/she uses medicinal plants to cure different diseases per month/year and finally was asked to value the medicinal plants that are used to provide the medicine for curing a single disease. In this case, the unit that was used for valuation was treatment of a single disease using traditional medicine (TM).

3.2.3. 2.10 Honey

The study area is dominated by miombo woodlands hence supports the activity of beekeeping. Respondents who get honey from forests for their home consumption were asked to value the amount of utilized honey per month/year. The unit that was used for valuation is litre (Ltr.).

3.2.3.2.11 Fibres

In many rural areas forest trees are known to provide valuable fibres which are used for different uses. Respondents who obtained fibres from forest trees were asked to value that particular product whereby the unit used was number of piles. Basing on the quantity of fibres utilized per month/year respondents were able to assign the value on that used quantity.

3.2.3.2.12 Mushrooms

The miombo ecosystem in the study area provides the communities with varied and nutritious diet of mushrooms. Respondents who consume mushrooms in their households were required to establish the amount utilized per year and thereafter assign value to that particular quantity. In this case, the unit used was kilogram whereby each kilogram was on average found to consist of three piles of fresh mushrooms.

3.3 Problems faced in data collection

There were some difficulties for some of the respondents in estimating the number/quantity of forest products sold and or utilized by their households. However with the help of the accompanied forest staff it was possible to make more reasonable estimates. It was also difficult to obtain scientific names of all plant and animal species because of their abundance as a result some of the species were left in their vernacular names for future identification.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

Results and discussions of the study are presented in this chapter. Various issues concerning natural forest products and their contribution to household livelihoods in Nkasi District are discussed. The chapter is divided into five sections presenting findings and discussions on cash earning activities, FPDs and household income from forest resources. Further, comparison between cash income from FPDs and other sources of income is presented and a linear regression model developed.

4.2 Cash earning activities in the study area

It was found that households' income in the study area is obtained through undertaking different cash earning activities such as farming, forest products, livestock keeping, small business, local brew, fishing, carpentry, wage labour and others which include masonry, brick making, black smith and traditional healing (Table 3). Among them farming was found to be the leading activity whereby 88.3% of the respondents reported to earn money through selling agricultural crops that were mainly maize, beans, sunflower, finger millet and cassava. The results imply that the majority of the people in the study area are largely dependent on agricultural activities, livestock keeping and collection of forest products for their household income. This indicates that there is a correlation between household income and natural resources such as soil, water and forests thus for the rural household livelihood to become sustainable there must be proper management of natural resources.

Table 3: Distribution of respondents by economic activities (n = 128)

Category label	Count	Percent
Farming	113	88.3
Forest products	37	28.9
Livestock keeping	27	21.1
Small business	26	20.3
Local brew	21	16.4
Fishing	14	10.9
Carpentry	6	4.7
Wage labour	4	3.1
Others	6	4.7
Total	254	198.4

Data was based on multiple responses therefore percentages would not necessarily add to one hundred.

4.2.1 Farming

It was observed that most of the households in the study area grow more than one crop, including both food and cash crops. The main food crops were maize, beans, cassava and finger millet. Most of the respondents reported to also sell some of the harvested surplus food crops to earn income. Reported cash crops included sugarcane, ground-nuts, sunflower, and vegetables such as egg plants, cabbage and tomatoes. The average income per household per annum obtained from agricultural crops was highest with the mean of TAS 135 158.00. This amount of money accrued from selling crops is as much as necessary to meet the basic requirements for the ordinary household in Nkasi district. These results are in line with those of Mtei (2002) who reported that agriculture continued to be the basis of livelihood of 80% of Tanzanian population. Also according to Winrock International (2006), agriculture provides livelihoods for 82% of the population in Tanzania whereby the sale of agricultural products has been the main source of cash income for about 62% of Tanzanian households.

4.2.2 Forest products

This study found that 28.9% of the respondents earn cash income from forest products (Table 3). This implies that rural communities in the study area apart from depending on

other economic activities for cash income for example agriculture, livestock keeping and fishing also depend on forest products. Forest based activities that were reported to be undertaken by the respondents for the sake of earning cash income were charcoaling, lumbering, trade in orchid tubers, firewood collection, beekeeping, and others such as home crafts. The average income generated from these activities was about TAS 57 000.00. This amount of money is almost 50% of the rural household income. According to Anorld and Persson (2003) income earning activities based on marketable forest products may be seasonal or year-round, or may be occasional when supplementary cash income is needed.

These results compare with those of Coomes and Barham (1997) who did a study in Amazonia and reported that in most study regions, forest peoples pursue numerous activities to generate subsistence and commercial income, some of which are feasible only in certain seasons or under particular conditions. Also Makonda and Gillah (2007) report that their research conducted in six communities 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.

The dependency on forest resources implies that for some households in rural communities, the forest based activities may be the principal source of income. This means that forest resources, contribute to household income and life support thus poverty reduction.

4.2.3 Livestock keeping

About 21.1% of the respondents reported to earn cash income through selling some of their livestock (Table 3). The average income earned from livestock per household per

year was TAS 18 152.00. It was observed that the livestock kept in the study area included goats, sheep, pigs, cattle chicken and ducks. WWG (2004) reported that pastoralism in Tanzania, makes profitable use of relatively harsh and dry lands, and provides a living for over 400 000 Tanzanians. However, the study found that many respondents of Katongolo, Ng'undwe and King'ombe villages do not keep cattle because they concentrate much on fishing activities.

4.2.4 Small business

In this study, 20.3% of the respondents reported to earn income through involving themselves in small businesses (Table 3). The common commodities that were reported included those required daily for most of the households such as salt, soap, kerosene, matchboxes and other small items commonly sold in the local markets. It was found that on average each household earns TAS 26 836 per annum from small businesses. According to Mfaume and Leonard, (2004) in Tanzania, entry into small business entrepreneurship is usually not seen as a problem; one can start small business at any time and in any place.

4.2.5 Local brew

It was found that 16.4% of the respondents earn income through local brewing (Table 3). Respondents reported that this trade is carried out by both women and men. It was observed that the main raw materials for local brew in the study area are maize, finger millet and cassava. However, these agricultural crops are mainly used as staple foods. The study revealed that local brew is the common alcoholic beverage in the study area as it is affordable by the majority than commercially produced beer. These findings concur with WHO (2004) who reported that in the United Republic of Tanzania, domestically

produced “homemade” or “informal-sector” drinks continue to dominate the market and local drinking habits. Through this cash earning activity, the accrued cash income which was found to be TAS 64 286 per household per annum is used to meet different requirements of the household members including school fees for school children.

4.2.6 Fishing

About 10.9% of the respondents reported to earn income through undertaking fishing activities in the study area (Table 3). These respondents were found in Wampembe and Kirando divisions located along Tanganyika shoreline. It was revealed that the majority of fishers use nets, although traditional traps and hooks are also still commonly used. The study observed that, some of the fish from the study area are sold to the Democratic Republic of Congo (DRC) and others are sold within the study area which is then traded in Namanyere town and Sumbawanga Municipality. The average income accrued from fishing was TAS 130 285 per household per annum. FAO (2001b) reports that annual harvest levels in Lake Tanganyika ranges from 165,000 - 200,000 metric tonnes, volumes that translate into annual earnings of millions of US dollars. Tanzania’s share of the total lake wide catch in 1995 was around 31%, equivalent to 55 000 metric tonnes. This implies that rural communities dwelling along the Lake generate considerable income through undertaking fishing activities.

4.2.7 Wage labour

Almost all sampled households comprised mainly of peasant farmers. Employed people in the study area were found to fall on casual form of employment. About 3.1% of the respondents reported to earn income through casual labour basis. These results imply that most of the household labour force works in farm and non-farm activities that are non-wage. This trend is not similar to that of Monela *et al.* (2000) who reported that in the

rural areas about 15.4% of the labour force was earning income through working as casual labour. This probably due to the fact that most of the households in the study area their income opportunities do not differ much as a result few people are capable of employing others. According to Mbilinyi and Nyoni (2000) the largest number of poor people lives in rural areas constituting 60% of all rural households.

4.2.8 Carpentry

About 4.7% of the sampled households involve themselves in carpentry. It was reported that different furniture that are commonly demanded such as beds, chairs, doors and windows are being manufactured and sold. It was further found that boats, tools and handles are produced. The raw materials for these equipments are timber, which are obtained from natural forests. Carpenters reported to buy timber of their choice particularly mninga (*Pterocarpus angolensis*) that produce furniture of high quality. On average TAS 124 750 is earned per household per annum in the study area. The connotation of these results is that, carpentry contributes to household income in the study area through utilization of natural forest resources that are principal source of raw materials.

According to Mwang'ombola (1987) who did a study in Kilimanjaro region, wood working industries, especially carpentry were found to be the second among small industries in the area with a rough physical count of about 270 units in operation. Further, basing on the study conducted by FAO (1992) in six countries, furniture production is one of the most common small-scale enterprises.

4.2.9 Other activities

Other activities that were found to generate cash income in the study area are masonry, brick making, black smith and traditional healing. These activities were reported to be undertaken by 4.7% of the respondents. These results indicate that few people are involved in these activities plausibly because most of these activities require special expertise.

4.3 Collected forest products in the study area

Respondents were asked to mention products, which they obtain from natural forests. The study revealed that sixteen types of forest products were collected (Table 4). It was found that at least every household obtain more than one type of forest product. Firewood had higher frequency and this indicates that most of the respondents in the study area use firewood for cooking. Other forest products mentioned include; medicinal plants, poles and tool handles, orchid tubers, wild fruits, wild vegetables, bush-meat, fibres, honey, mushrooms, reeds, charcoal, timber and others which include thatch grass, carvings and termites. These results imply that products obtained from natural forests were playing a role towards the livelihoods of the people in the study area. Furthermore, the reported products are individually discussed in the coming sub-sections of this dissertation.

Table 4: Reported types of forest products obtained from forests in the study area (n=123)

Category of forest product	Number of respondents	Percent
Wood		
Timber	15	12.2
Charcoal	19	15.4
Firewood	116	94.3
Poles and tool handles	83	67.5
Non-wood		
Wild fruits	72	58.5
Medicinal plants	98	79.7
Wild vegetables	71	57.7
Orchid tubers (Chikanda)	77	62.6
Honey	31	25.2
Bush meat	55	44.7
Mushrooms	24	19.5
Fibres	39	31.7
Reeds	19	15.4
Others	11	9.0

Data was based on multiple responses therefore percentages would not necessarily add to one hundred.

UNEP (2005) reported that the importance of environmental income to the poor can be judged at different scales. For example, at the global scale, the World Bank estimates that 90 percent of the world's 1.1 billion poor (those living on \$1 or less per day) depend on forests for at least some of their income. At the national level, for instance more than 80% of rural people are poor and traditionally rely on existing non-wood goods and services in Tanzania, Mozambique, Malawi, Zimbabwe and Zambia (Makonda and Gillah, 2007). Likewise, Kallonga *et al.* (2003) reports that over 90% of Tanzanians rely on fuel wood from trees and other types of vegetation for domestic energy supplies. Furthermore, URT (2000) reported that as much as 50% of households' cash incomes in some rural areas of

Tanzania are derived from the sale of forest products such as charcoal, honey, wild fruits and firewood.

4.3.1 Wild vegetables

Table 4 shows that 57.7% of the respondents eat wild vegetables. It was found that on average each household consumed 39.12 Kg of wild vegetables annually. Respondents mentioned five plant species commonly used as wild vegetables in their households as shown in Appendix 3. It was reported that most of these wild vegetables are available throughout the year and during the food shortage sometime are used as main dish. This indicates that the use of wild vegetables is popular in the study area. These results conforms with those of Forestry and Beekeeping Division (1999) who reported that in pronounced severe cases of food shortage wild vegetables form complete meals where staple (maize, millet flour) is not present. This implies that wild vegetables have a role to play in terms of household food security and income.

4.3.2 Wild fruits

The study identified 14 tree and shrub species of wild fruits commonly used in the study area as shown Appendix 3. It was found that 58.5% of the respondents eat wild fruits (Table 4). Collected wild fruits were reported to be sold in the local market in order to earn income and others consumed by household members. The consumed amount of wild fruits was found to be about 11 Kg per household per annum. Most of the respondents reported that wild fruits are available from September to June the period that is mainly wet. It was revealed that in most of the households, children are involved in collection of wild fruits than adults. This is probably due to the fact that children are capable of traveling as a group for the long distance while playing with each other having the target of collecting fruits in the wild. This is not the case for adults where in most cases every

movement should have a particular objective and priority for instance farming and harvesting hence for them it is not easy to move a very long distance aiming at collecting wild fruits alone. Adults reported to collect wild fruits during the time of undertaking farming activities either in case their farms are located near the forest or they pass through the forest while going or coming to/from the farm. This signifies that wild fruits contribute towards household livelihoods in the study area.

4.3.3 Mushrooms

The study identified four species of mushrooms commonly consumed in the study area as shown in Appendix 6. Table 4 shows that 19.5% of the respondents reported to eat mushrooms in their households. This figure is low if compared with the number of edible mushrooms in Tanzania that exceeds one hundred species as it was reported by Chihongo (1992) plausibly due to the fact that in most cases mushrooms in the study area are found far from residential areas particularly near or in the forests. As such, children who are main collectors do hesitate to enter into the forest because of fearing wild animals. In addition to that areas where diversity of mushrooms is found are considered too far away to warrant a trip with the purpose of collecting mushrooms. Further, the availability of other types of foods such as fish (from Lake Tanganyika) and various types of domesticated vegetables such as egg plants (*Lycopersicon spp.*), tomatoes (*Lycopersicon esculentum*), cabbage (*Brassica spp.*), amaranth (*Amaranthus spp.*) and spinach (*Spinacia oleracea*) found in the study area could also affect the use of mushrooms. This argument agree with that of FAO (1992) who argued that some forest foods, especially leaf vegetables and wild animals, are consumed throughout the year by rural households but most widespread use of forest foods, however, is in meeting seasonal food shortages.

However, it was found that mushrooms are collected every day during the peak season, which is between October and April. Normally this is rainy period which favours the growth of most species of mushrooms. These findings conform to those of Harkonen and Mwasumbi (1995) who reported that mushrooms are consumed every day among the Hehe, Bena, Sambaaa, Nyiha, Nyamwezi and Makua during the rain season.

4.3.4 Bush meat

In the study area bush meat is of great importance. The study identified 18 wild animal species eaten as shown by Appendix 5. About 44.7% of the respondents reported to eat bush meat in their household (Table 4). These results imply that wild animals in the study area have a role towards household food security and income. These results on one hand conforms and on the other hand are contrary to those of FAO (2000) who reported that bush meat is of great importance in the central parts of Tanzania (i.e. Singida, Arusha and Dodoma) and to lesser extent in southern part of the country. Table 5 shows that dik dik (38.4%) and warthogs (36.6%) are commonly eaten in the study area probably because these wild animals are distributed everywhere even outside the protected area.

Table 5: Distribution of respondents on use of wild animal species (n = 112)

Name of wild animal	Scientific name	Frequency	Percent
Warthogs	<i>Phacochoerus aethiopicus</i>	41	36.6
Hippopotamus	<i>Hippopotamus amphibious</i>	5	4.5
Dik dik	<i>Rychotragus kirkii</i>	43	38.4
Elephant	<i>Loxodonta Africana</i>	7	6.3
Buffalo	<i>Syncerus caffer caffer</i>	20	17.9
Warthog	<i>Phacochoerus asthiopicus</i>	4	3.6
Kudu (Greater/Lesser)	<i>Aepyceros melampus/ Strepsiceros imberbis</i>	3	2.7
Bushbuck	<i>Tragelophus scriptus</i>	20	17.9
Hare	<i>Oryctolagus cuniculus</i>	5	4.5
Guinea fowl	<i>Numida spp.</i>	7	6.3
Hartebeest	<i>Alcelaphus buselaphus cokei</i>	11	9.8
Duiker - common	<i>Sylvicapra grimmia</i>	2	1.8
Impala	<i>Aepyceros melampus</i>	3	2.7
Common mole	<i>Cryptomys hottentotus</i>	17	15.2

It was revealed that to a large extent, wild animals in the study area are illegally hunted by using weapons like *gobole* (Muzzle loader), arrows, snares, and stones. These findings are in line with interviews between Rolf and Tim (2006) who argued that most wildlife in Tanzania is actually killed by people who have no license at all and usually these are villagers who set snares or go out with dogs or with a muzzle loader and kill whatever they encounter. The plausible reasons as to why wild animals are poached is that bush meat is in demand and cheaper than domestic meat and secondly government officials are found very far away from rural people a fact that lead to the impossibilities of traveling on foot to the office in order to obtain hunting license. However, it was also found that wild animals in the study area on the other hand are legally hunted whereby few people who have officially acceptable weapons are being issued hunting licenses during the period of hunting season which begins from July and lasts in December.

4.3.5 Honey

It was found by this study that honey is collected from forest trees, traditional beehives, and underground fissures. Table 4 shows that 25.2% of the respondents involve themselves in beekeeping and honey collection from natural forests. It was also observed that the study area is surrounded by natural forests particularly miombo woodland which favours beekeeping. It was also observed that trees which are used to hang beehives are not cut down making beekeeping to be an income generating activity while at the same time conserving forests. Kessy *et al.* (2007) also argued that the miombo woodlands of Tanzania constitute the main source of wide range of non-wood forest products including honey and beeswax. Kihwele (1991) reported that beekeeping in Tanzania is carried out using traditional methods that account for 99% of the total production of honey and beeswax in the country and about 95% of all hives are traditional including log and bark hives.

4.3.6 Orchid tubers

The study identified a valuable plant species known as orchids which produces tubers. This plant species is locally known as *Chikanda*. Table 4 shows that 62.6% of the respondents eat orchid tubers in their households. It was revealed that edible orchids in the study area grow naturally in the wild principally in forests whereby people collect them for the purpose of home consumption and income generation. Orchid tubers are commonly eaten and traded in the study area thus contributing towards households' food security and income. The tubers of orchids, which were reported to be eaten and sold, are principally from the genera *Disa*, *Habenaria* and *Satyrium*. These tubers were found to be prepared through boiling. When well cooked they are used as snacks and also can be prepared and used as relish and eaten with the staple food stiff porridge.

4.3.7 Medicinal plants

This study identified 18 plant species that are used to cure different human diseases. Table 4 indicates that 79.7% of the respondents use traditional medicine for curing various diseases in their households, including head ache, wounds, stomachache, malaria, diarrhea and anemia as shown in Appendix 3. Some of the respondents reported that traditional medicines are sold in the market to earn income. However, it was observed that only 0.8% of the respondents earn cash income through selling traditional medicine. The implication of these results is that many of people in the study area use traditional medicine for curing various diseases thereby sustaining their livelihoods. This could be due to affordability of traditional health services. According to URT (2002), quite a good number people go for alternative complementary therapies like traditional medicines in order to offset the expensive modern healthcare services.

These results are in line with those of Chihongo (1992) who reported that as many as 80% of Tanzania's rural people rely on herbal traditional medicines from the indigenous forests, as their primary health care, though commendable efforts have been made to avail medical facilities.

4.3.8 Reeds

These are plant species of the family *Poaceae*. The study found that, reeds are commonly used in the study area for different purposes such as making mats, household decorations, baskets, fencing and local ceiling boards as shown in Appendix 4. This indicates that reeds have numerous uses which are important in every day life in rural areas hence playing the role towards household livelihoods. About 15% of the respondents reported to collect and use reeds in their households (Table 4). It was also found that mats made of reeds are used as mattresses and floor cover. These findings are in line with those of Turpie (2000) who

found that reeds in Rufiji floodplains and delta are harvested for various purposes including making fences, chicken coops, grain storage containers, mats and house construction.

4.3.9 Poles and tool handles

It was found by this study that 67.5% of the respondents obtain poles and tool handles from forests (Table 6). Most of the collected poles and tool handles are for immediate home consumption whereas others are sold in order to earn cash income. Poles and tool handles are mostly used for construction of houses, fences, bed making, hoes and axe handles. The study identified 16 tree species that are used for poles and tool handles in the study area as shown by Appendix 3. This indicates that forests are a major source of wood used for tool handles and building purposes, particularly in the study area in which most traditional houses are built using poles and withes. These findings are in line with those of Monela *et al.* (2000) who reported that trees are also cut for the production of other wooden products such as dug-out canoes, handles, ladles and ornaments. Furthermore, Turpie (2000) reported that poles of a variety of thicknesses are cut from both forests and mangroves, mainly for use in construction. This implies that, poles play a part in improving livelihoods of rural people.

4.3.10 Fibres

It was found by this study that forest trees in the study area provide fibres that are used for tying together head loads of firewood, poles, roofing materials sewing bags of charcoal and handcrafts. The household survey in the study area revealed that 31.7 % of the respondents obtain fibres from forest trees such as *Acacia hockii*, *Stephania abyssinica* and *Cordia spp.* (Table 4). These fibres were frequently mentioned to be used for

handcrafts for instance mats and ropes that are made through weaving them until the strong rope is attained. Respondents reported that ropes are used for tying goats, sheep and cattle. Moreover, it was revealed sometimes these ropes are sold to obtain income. Chihongo (1992) reports that, in special cases, natural fabrics consisting of tough interlacing fibres that can be extracted from bark in layers and used as a substitute for cloth are obtained from *Ficus spp.* Such fabrics are reported to be commonly used in rural Kagera. These results indicate that fibres obtained from natural forests play different roles to rural communities thus contribute towards the households' livelihoods.

4.3.11 Firewood

The study revealed that people in the study area rely on traditional fuels essentially firewood obtained from natural forests for their energy. Table 4 shows that 94.3% of the respondents use firewood in their households for cooking. These results are in concurrence with the FAO (2001c) findings that in Tanzania more than 90% of people use fuel wood as a source of energy. This high dependency on firewood is due to lack and or high cost of other sources of energy such as electricity, kerosene and biogas in the study area.

Appendix 3 shows tree species used for firewood. The study identified 14 tree species used for firewood in the study area. Most commonly used species that were reported are *Brachystegia spiciformis*, kabamba “msikasi”, “mtomola” and “kifuku”. The probable reason as to why these species are preferred was that they last longer and they contain less soot. It was observed that one head load of firewood is capable of sustaining the household for about two to three days. These findings conform to those of Monela (1989) who reported that one head load of firewood lasts for about three days. Rough estimation of solid volume of head load of firewood showed that one head load is about 0.23 m³.

4.3.12 Charcoal

Table 6 shows the number of respondents in the sampled villages who obtain charcoal from forests. About 15.4% of the respondents reported to obtain charcoal from forests. This figure is low because the majority of the people in the study area do not use charcoal for cooking instead they use firewood. The study revealed that charcoal makers are the ones who use charcoal for cooking in their households plausibly because those who do not make charcoal do not see the necessity of buying it while firewood is freely available in their area. It was also reported that most of the produced charcoal is sold in order to earn income and very little is used for home consumption for the particular household of the charcoal maker. On average it was found that the income accrued from charcoal per household per annum ranges from TAS 100 000 to 200 000. Makonda and Gillah (2007) reported that in central parts of Tanzania, up to 70% of cash income of most of the villagers comes from charcoal production. The study identified six tree species commonly used for charcoal production in the study area as shown in Appendix 3. This implies that charcoal contributes to household income in the study area; also some tree species are most preferred for charcoal making than others.

Table 6: Responses on availability of various forest products (n = 128)

Item	Availability							
	abundant		fair		Scarce		don't know	
	count	percent	count	percent	count	percent	count	percent
Charcoal	7	5.5	2	1.6	119	92.9	0	0.0
Firewood	120	93.8	6	4.7	0	0.0	2	1.6
Poles	112	87.5	13	10.2	3	2.3	0	0.0
Wild fruits	100	78.1	13	10.2	0	0.0	15	11.7
Traditional medicine	98	76.6	20	15.6	0	0.0	10	7.8
Wild vegetables	87	68.0	31	24.2	1	0.8	9	7.0
Orchid tubers	43	68.0	34	26.6	4	3.1	47	36.7
Honey	6	4.7	81	63.3	4	3.1	37	28.9
Bush meat	13	10.2	67	52.0	12	9.4	36	28.1

Further, the study revealed that most of the charcoal makers in the study area do not possess licenses as a result when they are caught by the relevant authorities they are fined their charcoal become confiscated. The plausible reason as to why they do not obtain licenses could be that they want to get more profit from charcoaling. This implies that people who are close to natural forests do not see the importance of obtaining licenses from the authorized officials and the consequences of this habit could be the barrier for them to obtain their livelihoods from natural forests.

4.3.13 Timber

It was found that rural communities who live nearby the natural forests involve themselves in the business of timber production. Table 4 shows that 12.2% of the respondents reported to have obtained timber from nearby forests for the period of 2005 and 2006. This figure is low probably because most of the people who involve themselves in such business do not possess licenses hence some of them hesitated to mention that they deal with that kind of business due to the fear of being arrested. Similarly, timber cutting requires a substantial capital thus most of the people in rural areas are not financially capable to involve themselves in such kind of business.

It was also reported that two men cross cut saw are used by pitsawyers for cutting down trees and sawing timber. The main aim of timber sawing is to generate household income whereas some timber is used locally in production of furniture and dhows. The study identified eight tree species preferred for timber in the study area as shown by Appendix 3. Tree species which were found to be most preferred include *Pterocarpus angolensis* and *Schinus spp.* Monela *et al.* (2000) found that an estimate of about 12 000 trees are cut for the purpose of timber annually in Tanzania.

4.3.14 Other products

The study identified other types of products that are obtained from wild. These include thatch grass, carvings and termites. It was revealed that thatch grass and termites are commonly utilized by many households. Many respondents reported to obtain these products from open lands where there are no forests. With this regard, very few respondents reported to have derived thatch grass and termites from natural forests (4.9% and 3.3% respectively). In addition to that, 0.8% of the respondents reported to get wood materials that enable them to manufacture various types of carvings. It was further revealed by this study that other craftsmen manufacture carvings by using soils instead of using wooden materials.

4.4 Availability of different forest products in the study area

The study identified firewood as the most available natural forest product. Respondents were asked to categorize each forest product in terms of its availability in order to determine the extent to which forest products are available. Each product was either categorized as abundant, fair, or scarce. Table 6 indicates that 93.8% of the respondents said that firewood are abundant followed by poles and tool handles (87.5%), wild fruits (78.1%), medicinal plants (76.6%), wild vegetables (68.0%), orchid tubers (68.0%), bush-meat (10.2%), charcoal (5.5%), and honey (4.7%).

On the other hand, 63.3% and 52.0% of the respondents categorized honey and bush meat availability respectively as fair whereas 92.9% categorized charcoal as scarce. This indicates that the majority of people in the study area do not use charcoal for home consumption.

These findings indicates that forest products such as firewood, poles and tool handles, wild fruits, medicinal plants, wild vegetables, orchid tubers, honey and bush meat are

available to many households in the study area. This is because sometimes availability can be associated with demand of the particular forest product, which means that if a product is not demanded in the community people are likely to be unaware about its availability. This argument can be confirmed by charcoal as a product whereby 92.9% of the respondents reported that charcoal is scarce. This is probably because they use firewood for cooking in their households while the produced charcoal is always for commercial purposes. This supposition is supported by Kammen and Lew (2005) who reported that 90% of rural household energy in Kenya is from fuelwood and only 5% is from charcoal. Therefore, this implies that although charcoal is largely produced in rural areas it is not available for home consumption possibly due to household fuel choice.

4.5 Main sources of different forest products

It was observed that various forest products are obtained from different sources in the study area. These sources include public land, forest reserve, own farms and market. Table 7 indicates that most of the respondents obtain forest products from public land and it was found that more than 50% of the forest products are collected from public land with the exception of wild vegetables (41.3%) and honey (43.0%) which are obtained from own farms and market respectively.

Table 7: Responses on the main sources of different forest products in the study area

Item	Frequency	Source							
		Forest reserve		Public land		Own farm		Market	
		Count	percent	Count	percent	Count	percent	Count	percent
Charcoal	9	0	0.0	5	55.6	0	0.0	4	44.4
Firewood	126	0	0.0	120	95.2	6	4.8	0	0.0
Poles/tool handles	103	4	3.9	74	71.8	25	24.3	0	0.0
Wild fruits	115	11	9.6	103	89.6	0	0.0	1	0.9
Traditional medicine	118	5	4.2	103	86.4	3	2.5	8	6.8
Wild vegetables	104	0	0.0	43	41.3	56	53.8	5	4.8
Orchid tubers	81	23	28.4	42	51.9	0	0.0	16	19.8
Honey	93	0	0.0	40	43.0	3	3.2	50	53.8
Bush meat	45	7	15.6	35	77.8	2	4.4	1	2.2
Reeds	63	6	9.5	35	55.6	0	0.0	22	34.9
Fibres	52	2	3.8	42	80.8	8	15.4	0	0.0

Mushrooms	77	2	2.6	44	57.1	23	29.9	8	10.4
Timber	29	2	3.8	42	80.8	1	15.4	0	0.0

These results imply that, most of the forest products are obtained from forests that are found within the public land, which means that reserved areas are not highly disturbed. This is due to the fact that, in most cases forests that are not officially protected are neighbouring rural communities hence it is easier to collect forest products from public land forests rather than from protected forests. Mnzava (1991) argued that unfortunately most of the woodlands in Tanzania do not have any legal status and these are where a lot of uncontrolled wood harvesting and charcoal production takes place.

4.6 Factors influencing availability of forest products in the study area

It was found in this study that 59.8% of the respondents are not facing any obstacle with regard to forest products accessibility (Table 8). This indicates that forest resources needed by household for daily consumption in the study area are easily accessed.

However, 40.2% of the respondents (Table 8) reported that there are factor(s), which hinders them from deriving livelihoods from natural forests. It was revealed that the most common objection is the strict rules and regulations whereby 81.6% of the respondents reported that forest resources are not accessible due to rules and regulations. In relation to this aspect, respondents further said that sometimes they fail to obtain forest products because of not having licenses and when they obtain them without licenses sometimes their possession such as charcoal, timber and bush meat are confiscated and themselves end up being taken to court whereby they are either fined or jailed (Appendix 2).

Table 8: Factors hindering utilization of forest products in the study area.

Variable	Frequency	Percent
Facing hindrances in utilization forest products (n = 127)		
Yes	51	40.2
No	76	59.8
Type of hindrances (n= 49)		
Strict rules and regulations	40	81.6
Few forest resources	1	2.0
Poor technology	3	6.1
Lack of capital	4	8.2
Lack of physical ability to harvest the product (i.e. sick/too old)	1	2.0

4.7 Ways for improving forest products availability

Respondents were asked to give suggestions which if implemented would lead to increase in availability of forest products in the study area. Table 9 shows the suggested strategies for improving availability of different forest products that include involvement of rural communities in management activities, using alternatives such as tree planting, leaving management in the hands of the government, leaving management activities in the hands of the local communities and amending rules and regulation so as to ease access to forest resources.

Table 9: Opinions of the respondents about increasing availability of forest products (n= 51)

Suggestion	Frequency	Percent
Use of alternatives such as planting trees.	50	98.0
Communities should be involved in management	29	56.9
Rules and regulations should be amended so as to ease access to forest resources	23	45.1
Management should be left in the hands of the government	9	17.6
Management should be left in the hands of the community	6	11.8

These results indicate that some interventions need to be undertaken in order to enable rural people in the study area to have easy access to forest resources. Among these suggested interventions, tree planting was found to be the most appropriate way of improving forest products availability. Through planted trees, people will be able to obtain easily various forest products such as timber, building poles, firewood, charcoal and fruits. These forest products would also generate substantial household income hence improve the living standards of rural communities in the study area.

Other suggestions for improving forest products availability that were found to be applicable include community involvement in management activities and amendments of rules and regulations. These two suggestions will enable rural people to have easy access and utilize forest resources in a sustainable way. It was revealed by this study that rural communities in the study area are not involved in forest conservation activities as the result some of the forest resources particularly those that are found within the public land are likely to become exhausted because no body cares due to the fact that they are named as common property. According to Kallonga *et al.* (2003) in order to promote individual and community participation in environmental action public awareness should be raised as well as understanding the essential linkages between environment and development.

4.8 Household income from forest resources

4.8.1 Direct income from forest products

The direct contribution of natural forest products to household income was determined by using cash income obtained directly from forest products. Respondents were asked to mention forest based activities undertaken and the amount of cash income that they obtain directly from forest resources per annum as shown in Table 10.

Table 10: Cash income from forest products in the study area

Type of forest product	Amount of money earned (TAS) per year								
	< 100 000		100 000 – 200 000		>200 000		Row total		Mean annual household cash income
	count	percent	count	percent	count	percent	count	percent	
Charcoal (n = 19)	3	15.8	12	63.2	4	21.0	19	100	135 026.32***
Firewood (n =13)	6	46.2	4	30.8	3	23.0	13	100	116 769.92***
Timber (n = 15)	1	6.7	6	40.0	8	53.3	15	100	358 733.33***
Honey (n = 6)	3	50.0	2	33.3	1	16.7	6	100	29 616.67 ^{NS}
Orchids (n = 17)	6	35.3	8	47.1	3	17.6	17	100	82 970.59***
Poles (n = 8)	5	62.5	2	25.0	1	12.5	8	100	67 125.00*
Others (n = 11)	8	72.7	2	18.2	1	9.1	11	100	66 781.82*
Column total	32	36.0	36	40.4	21	23.6	89	100	-

N.B: NS = Non significant, * = Significant at P<0.05, ** = Significant at P<0.01, *** = Significant at P<0.00

It was found that about 40% of the respondents earn cash income from forest resources are accruing between TAS 100 000 to 200 000 per year while 36% and 23.3% are obtained less than TAS 100 000 per year and greater than TAS 200 000 per year respectively.

About 63% of the respondents who earn cash income from charcoal get between TAS 100 000 to 200 000 per year whereas 21.1% get more than TAS 200 000 per year and 15.8% less TAS than 100 000 per year. About 46% earn less than TAS 100 000 per year from firewood whereas 30.8% and 23.1% earn between TAS 100 000 to 200 000 per year and greater than TAS 200 000 per year respectively. Fifty three point three percent of

respondents was found to earn greater than TAS 200 000 per year from timber. Less than TAS 100 000 per year was earned by 50% of the respondents who obtain cash income from honey. About 47% was found to earn between TAS 100 000 to 200 000 per year from selling orchid tubers. Less than TAS 100 000 per year was found to be earned by 62.5% and 72.7% of the respondents who earn cash income from poles and other forest resources respectively.

The mean annual cash income earned from forest based economic activities undertaken by the respondents is also presented in Table 10. These figures are based only on the respondents who earn cash income from forest products. It was found that respondents who involve themselves in the activity of timber cutting earn directly the mean income per annum of TAS 358 733.33 followed by making and selling charcoal TAS 135 026.32, selling firewood TAS 116 769, selling orchid tubers TAS 82 970.59, selling building poles and tool handles 67 125.00, others TAS 66 781.82 and selling honey TAS 29 616.67. All forest based cash earning activities with exception of beekeeping were found to be significant with the indication that substantial amount of money is derived from these activities.

These results indicate that reasonable amount of cash income is accrued through undertaking different forest based income-generating activities. Chimakai *et al.*, (2000) reported the same, that the non-timber forest products are of considerable importance especially in the dry land areas where they form alternative sources of livelihood and they contribute to poverty alleviation through generation of income, providing food and improved nutrition, medicine and foreign exchange earnings. Likewise, Munishi *et al.* (1997) reported that 66.4% of households in seven administrative regions of Tanzania derive more than 15% of their incomes from forest products.

Natural forests neighbouring rural communities in the study area were found to provide firewood that is needed for different uses including cooking as the main use. It was revealed by this study that firewood is also sold in order to earn cash income. The study observed that sold firewood are mainly used for burning bricks and drying fish along the shore of Lake Tanganyika. This indicates that firewood is of great importance as it generates further income than what was observed by this study through various economic activities such as bricks burning and drying fish. FAO, (2000) reports that partly due to scarcity, much of the fuel wood has entered the market economy thus in fact, even in most of the rural areas, is becoming a commercial good. Therefore, this confirms the argument that firewood is generating cash income to households involved in such business.

Despite the fact that most of the respondents in the study area do not use charcoal for cooking it was found that, a good number of respondents involve themselves in the activity of charcoal making for the purpose of earning income. The probable reason is that, there is a high demand for charcoal by the people of Sumbawanga Municipality and Namanyere town, which is the head quarter of Nkasi district. It was observed that most of the charcoal produced in the study area is traded in these two major towns. These results concur with those of Turpie (2000) who reported that most of the charcoal produced in rural areas is not for local consumption, but is exported to major centres. The study also observed that the majority of people who deal with charcoal making activity in most cases do not obtain license a fact that lead them to be regarded as illegal charcoal makers thus ending up being fined and their charcoal confiscated. This indicates that a livelihood from forest resources is being intervened by the government in order to ensure sustainable use of the natural resources.

The study observed that timber in the study area are demanded for building purposes, furniture and constructing boats and canoes near the lake Tanganyika shore. It was observed that a single piece of timber is sold at the price ranging from TAS 800 to TAS 3 500. The study also revealed that many timber businesspersons from Namanyere town and Sumbawanga Municipality obtained their timber licenses from NRO in the study area (i.e. Nkasi District Council). The reason for this trend could be that people from these areas have enough capital to invest in that kind of business. However, it was discovered that large amount of timber is harvested than what is allowed for a particular license. This is probably because they want to make super profit and also the quantity required per a given license is not so clear whereby it written cubic meters (m³) without stating the exact amount. These findings are in concurrence with those of Ralph and Roper, (2005) who reported that illegal logging and illegal timber trade have become priorities for the economic and political forum for eight of the world's most industrialized nations. This could lead to both loss of revenues and forest resources. World Bank, (2002) estimates that \$US 15 billion of tax revenues are lost each year to illegal activities in developing countries that could be used to fund social services. Therefore, enforcement of the existing laws is needed to reverse the trend.

Beekeeping was found to be one of the activity in which some of the households earn cash income in the study area. As it is presented in Table 10, based on respondents who deal with beekeeping the mean household income per year from selling honey was TAS 29 616.67. These results signifies that the amount of money earned through the activity of beekeeping is low perhaps for the reasons that the price is low and people are not aware of this potential income generating activity. According to Kessy *et al.* (2007) who did a study in Tabora, poor producers of non-wood forest products are giving up processing in favour of other livelihoods due to prices being dictated by buyers who control the market. The producers do not necessarily have any long term commitment to the activity; they lack

adequate awareness and benefits obtained from different species (Kessy *et al.*, 2007). Further more, this argument is in concurrence with that of Mlay (1997) who reported such low utilization potential in Tanzania that the country is endowed with favourable environment for production of honey, beeswax and other bee products but the utilization of this potential is only 3.5% annually. However, these findings are contrary to Chihongo (1992) who argued that the production of honey and bee wax serves as poverty reducer in rural areas. This substantiates the suggestion that beekeeping in the study area is probably not sensitized enough despite the fact that Nkasi district has favourable conditions for that particular activity.

The study found that most of the natural forests in the study area possess highly valued plant called “*Chikanda*” (Orchid tubers) in vernacular language. Root tubers of terrestrial orchids particularly from species of genera *Disa*, *Habenaria* and *Satyrium* are collected from natural forests for the purpose of food and cash income. The orchid tubers are prepared and used as relish and eaten with the staple food stiff porridge. Table 11 indicates that the average cash income earned per household per year is TAS 82 970.59. The buyers of orchid tubers were categorized by the study into two categories named *local buyers* (those from within the study area) and *foreign buyers* (those from outside the study area such as Tunduma and Zambia). Businesspersons from Tunduma and Zambia were reported to visit the study area for the intention of buying orchid tubers when they mature, between April and August. During this period, one bag of fresh orchid tubers was reported to be sold at the average price of TAS 60 000.00. The trade in orchid tubers was found to be popular to the extent that even traders from outside the country understand the importance of the study area with regard to that particular forest product. The probable reason for this situation could be that orchids are abundant in the study area. These results are alongside with Wildlife Conservation Society (2003) who reported that there was a dramatic rise in demand of Orchid tubers in the past decade in Zambia, particularly in

urban areas which has triggered a growing commercial market and has now prompted traders to seek tubers from Tanzania's Southern Highlands, an important centre of endemism for upland species of orchids. This necessitates the proposition that orchid tubers have a great potential both locally and internationally hence if utilized wisely could have a significant contribution towards household and nation's income at large.

Findings of this study showed that poles are among the cash income sources in the study area. It was reported that these poles were mainly used for house construction as many houses were found to be built from poles; and making tool handles such as hoes, bush matchets, mowers and axes. It was reported that the piece of tree cut from the forest could be used as a pole as well as a tool handle whereby it is divided into pieces depending on the required length of the targeted tool handle. The average price of one pole or tool handle was established to be TAS 300.00 where as the mean cash income per household per year was TAS 67 125.00. The study revealed that not all the people who need poles and tool handles have the ability of obtaining them directly from the forest perhaps because they have other commitments or the activity itself is time demanding thus they are imposed to buy the product from dealers. This argument is supported by Maximillian (1998) who did a study in Kibaha district and reported that about 70% of poles are for immediate household consumption and the remaining 30% are sold. This impose the winding up that people who are involved in the business of selling poles are able to generate cash income.

Other forest products through which cash income is generated in the study area was also identified. These included mats made up of reeds, thatch grass (2%), wild fruits (1%), carvings (1%) and mushrooms (1%). The mean income per household per year for these other forest products were found to be TAS 66 781.82. These results inform that even those forest products that are not commonly traded could generate valuable household

cash income. This argument is in concurrence with that of UNEP, (2005) who argued that environmental income can be derived in several distinct ways especially where markets exist, goods harvested from ecosystems, such as fish, herbs, or fuel wood, can be sold for cash or exchanged for services like school tuition. Therefore, it can be concluded that almost every forest product could produce cash income provided that it is demanded in the society.

4.8.2 Indirect contribution of forest products to household income

The study disclosed that at least every household in the study area utilize more than one type of forest products. Table 11 shows that 92.1% of the respondents do perceive that forest products are contributing towards improving living standards of their households.

Table 11: Perception of respondents towards the contribution of forest products in sustaining livelihoods of their households (n = 128).

Perception	Frequency	Percent
Contributes	118	92.1
No contribution	2	1.6
Don't know	8	6.3

These results suggest that forest products have a significant contribution to household livelihoods though indirectly. This study tried to find out the extent to which forest products are contributing obliquely to household income. This was achieved through quantifying different types of forest products consumed at the household level. With this regard it was established that on average each household earn indirectly through using different FPDs the total of TAS 186 815.47 per year whereby firewood was found to contribute more than other FPDs having the average value of TAS 108 219.38 per household per annum. It was followed by wild vegetables, orchid tubers and bush meat comprising the average annual values per household per year of TAS 28 147.50, 19

171.88 and 18 394.49 respectively (Table 12). These outcomes denote that FPDs above are highly consumed in the study area probably because they are the main source of energy and food. On the other hand, reeds was found to contribute less having the average value of TAS 301.56 per household per year followed by fibres and honey with the average value of TAS 318.13 and 363.28 per household per annum in that order. This indicates that reeds, fibres and honey have less contribution towards household livelihoods in relation to other FPDs. According to UNEP, (2005) income might accrue to households through direct use of ecosystem services, for instance, by consuming bush meat and other wild foods, cutting fodder for livestock, using wood products in home construction, or eating produce grown in a home garden.

Table 12: Value of forest products utilized per household per year (n =128)

Item	Unit	Quantity/ household per year	Average value per unit (TAS)	Average value/ household per year (TAS)
Firewood	Head load	185.64	583	108 219.38
Wild vegetables	Kg	39.12	720	28 147.50
Charcoal	Bag	1.36	2500	2 695.31
Bush meat	Kg	28.08	650	18 394.49
Orchid tubers	Kg	19.17	1000	19 171.88
Mushrooms	Kg	9.77	500	4 884.62
Poles	No.	22.08	300	3 311.72
Wild fruits	Kg	10.94	200	2 187.50
Traditional medicine	TM	5.29	400	2 115.63
Honey	Litre	0.73	500	363.28
Fibres	No.	3.98	80	318.13
Reeds	Head load	1.51	200	301.56
Total/Average				186 815.47

TM = Treatment of a single disease using traditional medicine; TAS = Tanzanian shillings

These results imply that generally, FPDs are indirectly contributing significantly towards household's livelihoods and the people do realize the considerable contribution of the same. These findings are comparable with that of Monela *et al* (2005) who reported that the value of restored woodlands to rural people's livelihood amounts to US\$ 14 per person

per month (or about US\$ 1 200 per household per annum), in 833 villages of the Shinyanga region, with approximately 2.22 million people. This is significantly higher than the national average rural consumption of US\$ 8.50 per person per month (Monela *et al.*, 2005).

It was found that an estimate of about 185.64 head loads of firewood is harvested per household per annum having the total value of TAS 108 219.38 (Table 12). Assuming that an average head load weighs between 20 and 30 kg, this gives an estimate of annual per capita firewood consumption of 675 kg (27 head loads per capita per annum). This annual per capita firewood consumption is greater than that of Kaale *et al.* (2000) who found an average annual per capita fuel wood consumption of 523 kg in Ikwiriri (urban) and 600 kg in Mbunjumvuleni (rural). These results put forward that firewood is playing a great role in sustaining household livelihoods through providing energy required for cooking. The same energy if obtained from other sources such kerosene or electricity would have costed money.

Wild vegetables are obtained from leaves of wild plants like trees, shrubs and herbs and are a good source of household food and income in the study area. It was reported that wild vegetables are consumed during the period of food shortage. The study found that an average of 39.12 kg, constituting the local market value of TAS 28 147.50, are consumed per household per year. MEMA (2000) reported that almost the whole population for some 8-12 weeks entirely depends on fresh indigenous vegetable in the pre and early period of the rainy season. The implication of these findings is that, money is indirectly earned per household per year through eating wild vegetables.

This study observed that most of the households in the study area do not use charcoal for home consumption. Almost all the charcoal made is for earning cash income and only little is used to supplement firewood in their households. Charcoal was found to be made in furnace in the forests and traders from Namanyere town and Sumbawanga Municipality buy it directly from the place where it is made. It was found that 1.4 bags of charcoal are consumed per household per year having a market value of TAS 2 695.31. These results mean that charcoal is not contributing much indirectly towards household income.

The study found that hunting of wild animals is a common activity in the study area. The area was found to consist of different wild animal species due to the fact that it is neighbouring a Game Reserve called Lwafi, which hosts numerous wild animal species. For that matter then, many respondents in the area frequently use bush meat as their side dish of meat whereby most of the hunters do not seek hunting permits. It was reported that the main aim of hunting is to obtain meat for household consumption although it was also revealed that contrary to the WCA some of the hunters sell wild meat for the sake of earning cash income. However, it was very difficult to obtain the data of those who sell wild meat as this business is against the WCA and hunters of this kind do not obtain hunting licenses therefore they hesitated to reveal the real situation fearing of being captured. Secondary data from the study area indicates that an average of 23 hunters obtain hunting permits from the NRO in Nkasi district per hunting season and the average of 79 wild animals are being hunted per year with the total average local market value of TAS 6 320 000.00 (Table 13).

Table 13: Number of local hunters and wild animals legally hunted in the study area

Year	Number of local hunters	Number of wild animals hunted	Estimated value of wild animals hunted (TAS)
2003	38	151	12 080 000
2004	25	66	5 280 000
2005	16	51	4 080 000
2006	12	48	3 840 000
Total/Average	91 (23)	316 (79)	25 280 000.00 (6 320 000.00)

TAS = Tanzanian shillings; Numbers in parenthesis are averages

These estimates are relatively lower than those of Turpie (2000) who based on household survey data from Rufiji and came up with an estimate of 160 tons of game meat harvested for the whole study area per year with a gross market value of \$28 000 000.00. Further, it was found that bush meat consumption per household per year in the study area is 28 kilograms worth of TAS 18 394.49. These results are lower than that of TRAFFIC (1998) who did a study in rural areas of Kitui District, Kenya, and found that about 14.1 kg per month (or 169.2 kg per year) of bush meat per household is consumed by 80% of the households. This could be due to the fact that people in Nkasi district have other opportunities of getting protein foods such as fish, livestock meat and beans.

It was found that orchid tubers commonly known as *Chikanda* are widely eaten in the study area. It was also reported that orchid tubers are obtained from the wild particularly natural forests by both children and adult members of the family. The findings of this study showed that 19.17 kg with the local market value of TAS 19 171.88 are eaten per household per year (Table 12). This signifies that orchid tubers play a role towards both household income and food security in the study area. These results are agree with those of Wildlife Conservation Society (2003) who reported that *Kinaka* or *Chikanda* has been eaten by people in parts of Zambia, northern Malawi and south-western Tanzania for hundreds of years.

The study found that mushrooms in the study area are used mainly as subsistence and very small portion is sold. It was observed that the study area has enormous areas of woodland that have the diversity of the natural miombo ecosystems providing high potential of producing indigenous mushrooms. The amount of mushrooms consumed per household per year was found to be 9.77 kg worth of TAS 4 884.62 (Table 12).

It was observed during this study that most of the houses in the study area, their walls are made up of bricks that do not require poles. However, the roofs of most of the houses are constructed by using poles that are obtained directly from natural forests. Moreover, it was frequently reported that poles of different sizes are also used for manufacturing tool handles for various equipments in the household. The annual household consumption of poles and tool handles per household was found to be about 23 pieces with the local market value of TAS 3 311.72 (Table 12).

In the villages surveyed, it was discovered that fruits are used as food and beverages. It was found through FGD that in terms of contribution to the daily diet, the wild fruits do not normally account for much in terms of quantity but are very essential in terms of their contribution to the nutritional value of the diet. The findings of this study show that 10.94 kg of wild fruits are consumed per household per year having the local market value of TAS 2 187.50 (Table 12). It was frequently reported by key informants that children consume more indigenous fruits than adults who in most cases eat them when walking through the wild or while collecting other forest products and farming near the forest. This denotes that wild fruits are more valued by children than adults plausibly because children regard the process of collecting and eating wild fruits as leisure. These findings agree with those of MEMA (2000) who reported that many fruits are a major source of iron and some have a high protein and minerals such as calcium, magnesium and potassium.

The study found that a high proportion of households in the study area harvest medicinal plants for home consumption and about 5 kg are used per household per annum. Based on the household survey it was estimated that each household in the study area use medicinal plants more than five times annually to cure different diseases. This extent of use was established to have a local market value of about TAS 2 115.63 (Table 12). The formal health care is so expensive in Tanzania and Kenya that up to 70% of the rural poor rely solely on herbal medicines collected from forests and woodlands to remedy all but the most serious ailments (Maginnis and Jackson, 2002). Turpie (2000) based on household survey in Rufiji, estimated that about 98 tons of medicinal plants are harvested annually with a fairly high value per kg of about TAS 750 –1 400, and a total market value for the whole harvest of \$104 000. These results imply that, medicinal plants provide health care to households in Nkasi district consequently contribute in some way towards the income.

It was found that wild honey is collected from natural forests in the study area. Based on household survey, it was estimated that 0.73 litres of honey are consumed per household per annum with the local market value of TAS 363.28 (Table 12). Moreover, the study observed that the average local market value of honey in the study area is about TAS 500 per litre. These findings show that the quantity of honey consumed at the household level in the study area is little probably due to the fact that most of the collected honey is sold to local brewers in order to earn cash income. According to Chihongo (1992) honey in Tanzania is widely used in the manufacture of honey beer which is a lucrative business as income earner at community level. Therefore, it could be concluded that if promoted wild honey could generate good cash income to rural communities.

Forest trees provide fibrous materials which are used in various ways. Respondents mentioned different uses including materials, which constitute/made from fibres that

consist of ropes, mats, baskets, plaiting, beds and chair-seats as well as tying together things like firewood, poles as well as sewing bags of charcoal. Based on the household survey it was projected that 3.98 piles of fibres each containing an average of 20 – 50 pieces are consumed per household per annum with the local market value of TAS 318.13. These results mean that fibres from indigenous trees are utilized through undertaking daily activities probably due to rural people having enough knowledge about trees, which provide fibres and the need to use natural and locally found fibres instead of using other types.

The household survey in the study area observed that different households collect reeds from indigenous forests. The reeds were mainly reported to be used for making fences, decorations, baskets, washing places, temporary buildings and mats commonly known as “*misengele*” that are used as floor cover, mattress as well as ceiling board. It was estimated that on average 1.51 head loads of reeds are utilized per household per annum having the local market value of TAS 301.56. This suggests that reeds in Nkasi district have many uses plausibly because of the culture in community thus contributes towards household livelihoods.

4.9 Comparison of income from forest products and other sources

The study found that households in the study area depend on various sources of income such as agriculture, forest resources, livestock keeping and others. Results of analysis of variance (ANOVA) showed that there was a significance difference ($p < 0.001$) between the contribution of various sources towards the household income (Table 14).

Table 14: One-Way ANOVA for source of income by individual household in the study area

One – Way ANOVA				
Source	Sum of Squares	df	Mean Square	F-Value
Between groups	9.15E +11	3	3.050E+11	12.344***
Within groups	1.26E+13	508	2.47E+10	
Total	1.35E+13	511		

N.B: E+11 = 10¹¹; E+13 = 10¹³; between groups = various sources of income; within groups = error term; *** Significant at p<0.001

The average income per household per year obtained from agricultural crops was highest with the mean of TAS 135 158.00. This was followed by other sources of income (i.e. fishing, petty business, brewing, black smith, brick making, casual labour, masonry, carpentry and traditional healing in that order) TAS 62 281.00, followed by forest products with the mean TAS 57 010.00 cash income from forests and livestock TAS 18 152.00 (Table 15).

Table 15: Results of One-Way ANOVA testing differences in income from various sources by households

Source of income	Count	Sum (TAS)	Mean
Agricultural crops	113	17 300 224.00	135 158 ^a
Forest products	37	7 297 280.00	57 010 ^b
Livestock	27	2 323 500.00	18 152 ^c
Others	30	7 971 968.00	62 281 ^b

N.B: ^{a, b, c} Means with different superscripts letters are significantly different (p<0.05) following separation by Duncan Multiple Range Test

Based on these figures the contribution of forest products to the overall household income was found to comprise of 20.91%. Other sources of income apart from forest products were found to contribute 79.09 % (agricultural crops 49.58%, others 22.85% and livestock 6.66%) to the overall household income. These results imply forest products play a role to the livelihoods of the household through generation of cash income.

These findings are lower than the results that were presented by CIFOR, (1999) concerning the research conducted in six communities in Tanzania where it was found that farmers were deriving up to 58% of their cash income from the sale of honey, charcoal,

fuel wood, wild fruits and vegetables. The same trend was reported in Zambia by Bwalya and Jumbe (2007) that the importance of forest products account for 40% of the total value of household production and income whereas agriculture (including livestock) and other livelihood activities account for 37% and 23% respectively. The plausible cause of such difference could be that Nkasi district is producing enough crops a fact that enable people to get surplus that are sold to earn household income.

The magnitude of this proportion dictates the suggestion that rural communities in Nkasi district derive household income from forest products. Substantial household income from the sale of products could not be verified but there are sale of different products such as charcoal, firewood, timber, poles, tool handles, mushrooms, indigenous herbs, fruits, orchids, honey, thatch grass, wild vegetables and bush meat.

4.10 The developed linear regression model

This subsection presents and discusses the results for multicollinearity test and the linear regression equation.

4.10.1 Test for multicollinearity

The independent variables were tested before specifying the model so as to see if they are highly correlated or not. Variables that were tested for multicollinearity are presented in the correlation matrix below (Table 16).

Table 16: Correlation matrix

	SEX	AGE	MSTS	NUMED	FMSZ	FRM	ONF	DFRT
SEX	1.000							
AGE	0.230	1.000						
MSTS	0.568	0.438	1.000					
NUMED	0.028	-0.162	0.042	1.000				
FMSZ	0.320	0.367	0.603	0.079	1.000			

FRM	0.332	0.371	0.422	0.133	0.381	1.000		
ONF	0.313	0.389	0.601	0.044	0.523	0.326	1.000	
DFRT	-0.326	-0.395	-0.612	-0.088	-0.560	-0.563	-0.578	1.000

The results showed that there is correlation between variables to some extent. These results denote that it is not easy to achieve the situation that has perfectly uncorrelated variables. These results concur with Madnani (1994) who argued that, in practice neither perfectly correlated situation is often met among socio-economic variables. Since there is interdependence of various independent variables normally some degree of intercorrelation among the variables is experienced. The results signify that DFRT and MSTS had high correlation among the independent variables. Despite the fact that these variables had high correlation, they were accepted in the model as they were found to have the 'r' value of -0.612 ($r^2 = 37\%$) that was considered convincingly far from 100%.

4.10.2 The linear regression equation

Basing on the dependent variable (HIS), independent variables and coefficients the multiple linear regression equation is as follows:

$$\begin{aligned}
 HIS = & -13091 + 0.020SEX + 0.007AGE - 0.185MSTS + 0.074NUMED + 0.077FMSZ \\
 & + 0.602FRM + 0.210DFRT + 0.0360ONF \quad (R^2 = 50\%)
 \end{aligned}$$

The interpretation of the equation above is related to the one presented and described under subsection 3.2.3.1 of this dissertation. However, it is further discussed in the following subsections.

4.10.3 Significance tests

Variables that were accepted in the regression model were tested so as to find out if they were significant or not. The results of these tests are shown in Table 17 below

Table 17: Significance tests between the total household income and socio-economic factors

Independent variables	β	t-value	Significance
Sex of respondent (SEX)	0.020	0.255	NS
Age of respondent (AGE)	0.007	0.087	NS
Marital status (MSTS)	-0.185	-1.734	NS
Number of years in education (MSTS)	0.074	1.119	NS
Family size (FMSZ)	0.077	0.919	NS
Farm size (FRM)	0.602	7.513	***
Distance from natural forest (DFRT)	0.210	-2.167	*
Owning farm near the natural forest (ONF)	0.036	0.422	NS
(Constant)	-13091	0.047	NS

R² = 0.50, * = Significant at p<0.05, *** = Significant at p<0.001, β = Regression coefficient.

4.10.3.1 Factors affecting income from natural forests

The regression model results revealed that socio-economic factors including sex, age, number of years in education, family size, and farm size were positively correlated with the magnitude of household income ($R^2=0.50$). DFRT and ONF were also correlated positively to the same variable (Table 17). From the regression equation, the null hypothesis that $H_0: HI \neq f(\text{SEX, AGE, MSTS, NUMED, FMSZ, FRM, ONF, DFRT})$ was rejected in favour of the alternative hypothesis that $H_1: HI = f(\text{SEX, AGE, MSTS, NUMED, FMSZ, FRM, ONF, DFRT})$ because none of the coefficients in the equation was equal to zero. These results imply that the model explained about 50% of the variations in the factors affecting household income in the study area. The remaining 50% of the cases were not correctly predicted by the regression equation. The results are comparable to that of Mkanta and Chimtembo (2002) who did the study on the contribution of natural forests to national income and obtained R^2 adjusted of 0.47 (47%).

4.10.3.1.1 Sex of the household head

The results revealed that sex was positively correlated to the dependent variable (Table 17). This implies that male-headed households earn more income from the forest resource base probably because cash earning activities based on forest products are mostly affected by the gender role whereby males involve themselves in these activities than females. The

relationship between men and women is determined by the gender. According to Balton (1994) gender refers to the relationship between men and women and the way this relationship is socially constructed. What is done within a specific socio group is influenced by gender (Katani, 1999).

4.10.3.1.2 Age of the household head

It was found that age of the household head in the study are was positively correlated to the household income (Table 17). This indicates that the older the household head the higher the income in that particular household. The plausible reason is that age influences creativity and also older household heads might have experienced more difficulties in taking care of their families hence have diversified ways of earning income that enable them to cope with the existing situation.

4.10.3.1.3 Marital status

Table 17 shows that marital status was negatively correlated to the household income. This indicates that unmarried household heads earn less income as compared to those who are married. The plausible reason for this is that unmarried people have many responsibilities, thus they devote less time to income generating activities related to forest resources. For instance, those people who involve themselves in the activity of sewing timber in most cases are required to stay in the forest for a month or so. This could have bad implication to those people who are not married.

4.10.3.1.4 Education level

The results show that the number of years in education is positively correlated with the household income (Table 17). This indicates that households with more number of years in education earn more income than those with less number of years. The probable reason

is that education enables them to utilize any available opportunity in their premises for the sake of earning income. Kajembe and Luoga, (1996) reported that there is no development without education.

4.10.3.1.5 Family size

The result shows that family size was positively correlated to household income (Table 17). This indicates that households with larger families earn more income from forest resource base than those with small families in the study area. The plausible relationship of family size and income is that household with larger family size have larger labour force that lead to easy participation in income generating activities related to forest resource base compared to small households.

4.6.3.1.6 Farm size

The results of this study revealed that farm size was positively correlated to the household income and was statistically significant at $p < 0.001$ (Table 17). This implies that households with large farm size earn more income than those with small farm size. This agrees with respondents' views that who reported that the larger the size of the farm the larger the quantity of harvested crops and vice versa. The amount of harvested crops plays the role towards the household income through selling surplus crops.

4.10.3.1.7 Distance to the natural forest

The results revealed that the distance from the natural forest is negatively correlated to the household income and it was significant at $p < 0.05$ (Table 17). The implication is that households that are found far away from forest resource base earn less income whereas

those who are close to the forests earn more income. The respondents reported that it is easier for people who are close to the forest to undertake various income generating activities related to forest produce unlike those who far away. The opportunity cost of time for those from far may well be very high as result they are not likely to undertake income generating activities associated with forest products.

4.10.3.1.8 Owning farm near the natural forest

The results show that owning farm near the natural forest was positively correlated to the household income (Table 17). The attribute here is that households with farms near the forest are likely to earn more income from forests and agricultural crops as opposed to those who do not own farms near the forest. It was reported by the respondents that if the farm is close to the forest enables the owner to access the forest and obtain forest products very easily hence more income from the forest resource base. It was reported that, soils which are found near the forests are known to be very fertile as compared to those which are far away from the forest. This has the implication on the amount of crops harvested as a result more income is obtained through the sale of surplus crops. According to Kessy (1998), forests are important to farmers as far as food security is concerned. Forests are considered so because they play a role towards livelihoods through ensuring availability of rain, maintaining soil fertility, and provision of wild foods.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Various economic activities that were undertaken by respondents in the study area in order to earn household income and sustain their ways of living were identified. Farming was found to be the leading activity in terms of generating cash income whereby 88.3% of the

respondents accrued money through selling surplus agricultural crops. Cash income generating activities based on forest products were the second from agriculture comprising 28.9% of the respondents in the study area implying that forests diversify income earning opportunities in rural areas.

Different FPDs were identified in the study area and were categorized into two groups namely as wood and non-wood FPDs. Utilization of some of these FPDs require the user to obtain licenses and/or permits from government officials. However, the study revealed that most of the people do not obtain them thus the utilization of these forest resources is likely to be unsustainable.

FPDs that were utilized by rural communities in the study area were quantified. The quantification was based on the quantity and assigned value per unit of each particular forest product utilized per household. By using this approach, the monetary value of utilized FPDs were estimated at TAS 186 815.47 per household per year. This indicates that forest resources are essential in enhancing households' livelihoods.

Forest resources were found to generate cash income for different households in the study area. The income derived from FPDs was found to contribute for 20.91% to the overall household income. This indicates that FPDs play a role to the livelihoods of the household through generation of cash income.

The regression model results showed that socio-economic factors including sex, age, number of years in education, family size, and farm size were positively correlated with the magnitude of household income ($R^2=0.50$). Distance of the household from natural forest and owning farm near the natural forest were also correlated positively to the same variable. From the regression equation, the null hypothesis was rejected in favour of the alternative because none of the coefficients in the equation was equal to zero. These

results imply that the model explained about 50% of the variations in the factors affecting household income in the study area.

Generally, the results of this particular study show that FPDs have great potential in sustaining household livelihoods thus contributing towards poverty reduction in the study area. However, it was found that some of rural people are denied access to forest resources due to strict rules and regulations consequently they fail to earn cash income from FPDs.

5.2 Recommendations

- i. It was found that FPDs have great prospects for contributing to the household income although communities are marginally involved in forest management. This calls for the suggestion that there is a great need of involving rural communities in conservation activities so as to ensure that forest resources are utilized at the sustainable level.
- ii. The study observed that FPDs which require the user to obtain the licenses and or permits prior to their use are utilized by most of the forest resource users without meeting this stipulation. In order to make sure that regulations are adhered to, the study suggests that rural communities should be involved in the activities of forest resources management. This will enable forest conservationists to share the information and management decisions as well as law enforcement thus attaining sustainable forest utilization and improved rural livelihoods.
- iii. The study revealed that the study area is endowed with a highly valuable plant species locally called Chikanda (Orchid tubers). It was also observed that the utilization of this potential plant species is likely to be unsustainable whereby there is no restriction regarding its growing trade. Therefore, this study recommends that the trade in orchid

tubers should be restricted and or conducted by abiding to the rules and regulations of CITES to avoid the extinction of this imperative species.

- iv. This study proposes that other studies have to be conducted on illegal harvesting of FPDs, the role of firewood in brick making and fish drying in order determine the extent to which FPDs are illegitimately harvested and the cash income generated through burning bricks and drying fish in relation to firewood.

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APPENDIXES

Appendix 1: Questionnaire for households' survey

Household questionnaire

Name of the enumerator

Date.....Questionnaire No.

Division.....Ward.....Name of the village and its
identification number

Name of the head of the household.....

Section A: Background information

1. Respondent sex.....
 - 01 Male
 - 02 Female

2. Age.....years

3. Marital status
 - 01 single
 - 02 married
 - 03 divorced
 - 04 widow
 - 05 widower
 - 06 separated

4. Number of wives (for the case of males who are heads of households).
 - 01 one
 - 02 two
 - 03 three
 - 04 four and above

5. Religion
 - 01 Christian
 - 02 Moslem
 - 03 pagan
 - 04 traditional
 - 05 others (specify)

6. Tribe

- 01 Fipa
- 02 Sukuma
- 03 Nyika
- 04 Konongo
- 05 others (specify)

7. Education level (+ number of years in education)

- 01 no formal education
- 02 able to read and write.....
- 03 primary education
- 04 adult education
- 05 secondary education
- 06 others (specify)

8. Occupation

- 01 peasant
- 02 petty trader
- 03 civil servant
- 04 others (specify)

9. Family members (number of people in the household)

Age (years)	Age category	Number	Male	Female
	0 - 5 yrs			
	>5 - 18 yrs			
	>18 - 55yrs			
	Over 55yrs			

B: Economic activities

10. What is the main economic activity of your household?

.....

11. Apart from the main economic activity, which you have mentioned above what, are other activities in your household?

Activity	Yes/No	Who is/are involved (1.father 2. mother 3. children 4. the whole family 5. others-specify)	How often/Number/Size	Purpose (1. food 2. income 3. fuel 4. others-specify)
01 Farming				
02 Employment				
03 Beekeeping				
04 Fishing				
05 Petty business				
06 Forest products (charcoal, timber, fuel wood etc.)				
07 Others(Specify)				

12. How much money did you get in 2005/2006 season by source of income?

Source of income	Number/amount sold (animals/crops/forest products/fish)	Amount of money obtained (TAS)	Sub-total and total amount
Sale of forest products:			
Firewood			
Charcoal			
Timber			
Poles			
Honey			
Others (specify)			

Sub total- forest products			
Fishing			
Sale of crops			
Maize			
Beans			
Sunflower			
Groundnuts			
Finger millet			
Tomatoes			
Onions			
Irish potatoes			
Sweet potatoes			
Vegetables			
Fruits			
Rice/paddy			
Cassava			
Others (specify)			
Sub total -crops			
Livestock			
sale of cattle			
sale of milk			
sheep and goat			
chicken			
other poultry			
other livestock			
Sub total- livestock			
Other sources of income			
Salary			
Remittance			

Others (specify)			
Sub total- other sources of income			
GRAND TOTAL			

13. On average how much money do you earn from your off-farm activities (2005/2006)?

- 01 Below 30 000/=
- 02 31 000 – 100 000/=
- 03 101 000 – 150 000/=
- 04 Above 150 000/=
- 05 None of the above

14. How much money did you earn from farm activities (2005/2006)?

- 01 Below 30 000/=
- 02 31 000 – 100 000/=
- 03 101 000 – 150 000/=
- 04 Above 150 000/=
- 05 None of the above

15. What is the average annual income in your household?

- 01 Below 100 000/=
- 02 101 000 – 200 000/=
- 03 201 000 – 300 000/=
- 04 301 000 – 400 000/=
- 05 Above 400 000/=

16. In what ways do forest products contribute towards income in your household?

- 01 selling charcoal
- 02 selling firewood and poles
- 03 selling timber
- 04 selling honey
- 05 selling mushrooms
- 06 selling orchids
- 07 selling bush-meat
- 08 selling traditional medicine
- 09 selling wild fruits
- 10 saving money, which would have been used to purchase alternative sources of fuel (e.g. kerosene).
- 11 others (specify)

17. How much do you earn per annum from each activity, which you have mentioned above?

Activity	Amount (TAS)		
	Below 50 000	51 000 – 100 000	51 000 – 100 000
01 Charcoal			
02 Timber			
03 Honey			
04 mushrooms			
05 Orchids			
06 Bush-meat			
07 Firewood and poles			
08 Traditional medicine			
09 Wild fruits			
10 Saving money through the use of forest products			
11 Others (specify)			

Section C: Forest products utilization

18. What can you say about the availability of the following natural forest products?

(use **A** for abundant and **S** for scarce)

- 01 charcoal
- 02 fire wood
- 03 bush-meat
- 04 timbers
- 05 traditional medicines
- 06 fruits
- 07 honey
- 08 mushrooms
- 09 orchids
- 10 others (specify)

19. Which of the following forest products do you utilize in your household?

Type of forest product	01 Yes 02 No	Main source 01 Forest Reserve 02 Public land 03 Own farms 04 From market 05 Others (specify)	Quantity and value per unit (M ³ /number/kg per week/litres/bags/etc.)	Availability 01 Abundant 02 Fair 03 Very little 04 Don't know	Tree species preferred
Charcoal					
Firewood					
Building materials					
Wild fruits					
Animal fodder					
Traditional medicine					
Vegetables					
Roots					
Honey					
Bush-meat					
Others (specify)					

20. Do you think it is beneficial to have natural forest(s) in your area? **Yes/No**

21. If your answer is Yes in Qn. 20. above what benefits do you get from natural forest(s)?

- 01 fuel wood
- 02 wild food
- 03 building materials
- 04 income
- 05 traditional medicine
- 06 employment
- 07 honey
- 08 fruits
- 09 continuous water flow from the forest(s)
- 10 mushrooms
- 11 others (specify)

22. If your answer is no what are the problems which are posed by the presence of natural forest(s) in your area?

- 01 forests act as habitat for vermin of crops
- 02 loss of human life and domesticated animals
- 03 others (specify)

23. Who is responsible for natural forest conservation in your area?
- 01 village government
 - 02 individuals of the community
 - 03 central government and local government
 - 04 no body is responsible
 - 05 others (specify)
24. Suppose you are given the task of comparing two types of meat (i.e. bush meat and livestock meat), which meat would you prefer?
- 01. Bush meat
 - 02. Livestock meat
25. Had you ever tested meat from the wild (i.e. bush meat)
- Yes [] No []
26. If yes mention the name of the wild animal species which provided that meat
- 01. Bush pig
 - 02. Hippopotamus
 - 03. Hare
 - 04 Dik-dik/Common duiker
 - 05 Others (specify)
27. What can you say about the contribution of forest products to living standards in your household?
- 01 I don't know
 - 02 Have no contribution to livelihoods of my household
 - 03 They contribute towards livelihoods of my household
28. Is there any factor(s) which hinders you to derive livelihoods from natural forests?
- Yes/No.....
- If yes what is/are these factor(s)?
- 01 forest resources are inaccessible due to strict rules and regulations of management
 - 02 forest resources are few
 - 03 poor technology and expertise with regard to utilization of forest resources
 - 04 lack of capital
 - 05 others (specify)
29. What do you think should be done in order to enable you derive sustainable livelihoods from natural forests in your area?
- 01 Management should be left in the hands of the government
 - 02 Management should be left in the hands of the community
 - 03 Rules and regulations should be amended so as to ease access to forest resources
 - 04 Communities should be involved in management activities
 - 05 Use of alternatives such as planting trees
 - 06 others (specify)

Part D: Management of natural resources

30. Do you play a role in management of natural resources in your area? (Yes/No)

If yes what do you do?

31. If it happens that all natural forests present in your area become depleted who will lose?

- 01 village government
- 02 central government and district government
- 03 individuals in the community
- 04 nation
- 05 none of the above

32. Do you think natural forests present in your area are utilized at a sustainable level?

- 02 Yes[]
- 02 No[]

33. If yes why do you think so?

- 01 No illegal utilization of natural forests in our area
- 02 The community is aware about the importance of natural forests
- 03 Government officials are enforcing laws properly
- 04 There are plenty of natural forests in our area which cannot be depleted by any means
- 05 Others (specify)

34. If no why do you think so?

- 01. Large number of flocks of livestock are grazed in your area
- 02. Many trees are cut for the purpose of charcoal, timber, poles and fuel wood.
- 03. Many people are practicing shifting cultivation which destruct natural forests
- 04. No body who is responsible for management of natural forests (there is free entry and free exit)
- 05. Others (specify).....

35. What do you suggest about sustainable utilization of natural forests?

- 01. Communities should be involved in management
- 02. Management should be left in the hands of the government (district council and central government)
- 03. Let nature take its own course
- 04. Use of alternatives such as planting exotic trees, reducing the number of livestock and investing in other areas which are more profitable and use of alternative source of energy (e.g. kerosene)
- 05. Others (specify).....

36. What do you think are the costs of conservation?

- 01. Educating people about sustainable use of natural forests
- 02. Patrolling and enforcing laws
- 03. Delineation of areas which need to be protected
- 04. Others (specify).....

37. Who incur the costs which you have mentioned in Qn. 29 above?

- 01. Individuals of the community
- 02. Village government
- 03. District council and central government

04. None of the above
38. Which wild animal(s) are problematic (problem animals) in your area?
- 01 Bush pig
 - 02 Hippopotamus
 - 03 Lion
 - 04 Hyena
 - 05 Leopard
 - 06 Others (specify)
39. How do you practice farming?
- 01 shifting cultivation
 - 02 farming on the same farm every season of the year
 - 03 others (specify)
40. Do you own farm near or within natural forest? Yes/No.....
41. How far are you from natural forest?
42. What can you say about Protected Areas (i.e. Forest Reserve and Game Reserve)?
- 01 their boundaries are clearly demarcated and well identified
 - 02 their boundaries are not clearly demarcated and well identified
 - 03 others (specify)
43. Do you have cattle in your household? If yes, how many cattle do you have in your household?
- Where do you graze your cattle?
- 01 open area
 - 02 in the forest
 - 03 both open areas and forest
 - 04 others
44. Are you aware about sustainable utilization of natural resources and sustainable livelihoods? 01 Yes [] 02 No []
45. If you are aware about sustainable utilization of natural resources and sustainable livelihoods what do you understand about these two terms?
- 01 utilizing whatever natural resource(s) available in your area
 - 02 utilizing natural resources at the level which will benefit the present generation without compromising the benefit of the future generation(s).
 - 03 getting super profit from natural resources
 - 04 utilizing natural resources while investing in other economic activities by using the profit obtained from the resource in question.
 - 05 none of the above
46. If you were to decide about utilization of natural forests what would be your decision?
- 01 Utilize all available natural forests which are profitable for the purpose of alleviating poverty for the present generation
 - 02 Not to utilize at all in order to have a lot of natural forests which will be used in future by the future generation(s)

03 Giving the rural communities who live with or neighbouring natural forests the mandate to decide on the level/quantity of natural resources which should be utilized

04 know how much natural forest resource base is available and how much should be utilized without depleting the stock

05 I don't know what I will decide

THANK YOU FOR YOUR COOPERATION

Appendix 2: Checklist for key informants

Governmental and Non-Governmental Organization:

1. Name of organization and/or project
2. Date when the organization and/or project started.....
3. Different types of forest products available in the study area.....
.....
.....
4. Who is responsible for management of forest resources?
5. What is the contribution of private companies such as Tourist hunting, to rural communities' standards of living?.....
.....
6. What are economic activities carried out in the communities?.....
.....
7. What are the benefits derived from forests?.....
.....
8. Are the forest resources accessible to communities?
9. What are threats of forest resources in the area and the strategies to counteract them?.....
.....
10. What is the relationship between forest products and income of households in the study area?.....
.....
11. Are there incidences of illegal utilization of forest products in the district?.....
.....
12. What are your suggestions for improving people's standards of living through sustainable use of natural resources?.....
.....
.....

B. Local people

10. Is the community aware on natural resources conservation?.....
.....
2. How do the community perceive on natural resources conservation?.....
.....
3. Are there any institutions and other groups dealing with forest resources conservation in your area?.....
.....
4. What are the constraints with respect to livelihoods derived from forests in your area?.....
.....
5. What are the sources of energy, building materials, income and protein in your area?.....
6. What are the major economic activities related to forest products in your area?.....
7. Do the community in your area access forest resources without experiencing any difficulties in your area?.....
.....
8. Is there any advantage(s) for being near or close to the forest(s) in your community?.....
9. What are problems faced due to the presence of forest(s) in your area?
.....
10. What are your suggestions for improving households' income through sustainable use of forest products?
.....
.....
.....

THANK YOU FOR YOUR COOPERATION

Appendix 3: A list of useful tree/shrub species identified in the study area

Vernacular name/local name	Scientific name
Tree species preferred for traditional medicines	
Mnyekenyeke	Unidentified
Msima	<i>Julbernardia globiflora</i>
Muombwi	<i>Acacia polyacantha</i>
Mtembo	<i>Khaya anthotheca</i>
Msu	<i>Syzygium cordatum</i>
Takana	<i>Catha edulis</i>
Mwanga	<i>Dovyalis spp.</i>
Mzobazoba	Unidentified
Kusambei	Unidentified
Mkupakiwa	Unidentified
Msangula	<i>Rhus natalensis</i>
Msenga	<i>Faurea saligna</i>
Mzombo	<i>Brachystegia spiciformis</i>
Mninga	<i>Pterocarpus angolensis</i>
Mpangala	<i>Dichrostachys cinerea</i>
Nansimba	<i>Lobelia giberroa</i>
Mtonga	<i>Strychnos spinosa</i>
Mfumbe	<i>Piliostigma thonningii</i>
Species preferred for wild vegetables	
Mlenda	Unidentified
Mkoa	Unidentified
Sambwe	Unidentified
Nakole	Unidentified
Kasoso	Unidentified
Tree species preferred for wild fruits	
Kabamba	Unidentified
Mwula	<i>Parinari curatellifolia</i>
Msuku	<i>Carissa edulis</i>
Nyefi	Unidentified
Nkolongo	Unidentified
Yunga	<i>Syzygium owariense</i>
Mufita	<i>Vitex mombassae</i>
Mtonga	<i>Strychnos spinosa</i>
Mbungo	Unidentified
Mtwetwe	Unidentified
Mtwai	Unidentified
Msu	<i>Syzygium cordatum</i>
Mtobo	Unidentified
Mlalambo	<i>Syzygium guineense</i>

Appendix 3: Continued

Tree species preferred for timber

Mpilipili	<i>Schinus spp.</i>
Mninga	<i>Pterocarpus angolensis</i>
Mlembela	unidentified
Mtembo	<i>Khaya anthotheca</i>
Mlalambo	<i>Syzygium guineense</i>

Tree species preferred for poles and tool handles

Mbanga	<i>Pericopsis angolensis</i>
Mlembela	unidentified
Kabamba	unidentified
Mswanya	unidentified
Mtomola	unidentified
Msense	<i>Acacia hockii</i>
Mwula	<i>Parinari curatellifolia</i>
Lurea	unidentified
Mpilipili	<i>Schinus molle</i>
Kalunguti	unidentified
Msuku	<i>Carissa edulis</i>
Nachipa	<i>Protea spp.</i>
Mhongoi	Unidentified
Myenge	Unidentified
Msusuka	Unidentified
Takana	<i>Catha edulis</i>

Tree species preferred for charcoal

Mzombo	<i>Brachystegia spiciformis</i>
Mbanga	<i>Pterocopsis angolensis</i>
Mlembela	Unidentified
Kabamba	Unidentified
Kifuku	Unidentified
Nzungwa	<i>Kigelia Africana</i>

Tree species preferred for firewood

Mzombo	<i>Brachystegia spiciformis</i>
Mbanga	<i>Pterocopsis angolensis</i>
Mlembela	unidentified
Kabamba	unidentified
Kifuku	unidentified
Kafuya	unidentified
Msasa	unidentified
Mswanya	unidentified
Mchese	<i>Acacia albida</i>
Muombwi	<i>Acacia polyacanta</i>
Msikasi	unidentified
Mtomola	unidentified
Mswenya	unidentified
Mlomba	unidentified

Appendix 4: Tree/shrub species with combined uses in the study area

Vernacular or local name(s)	Scientific name/Common name	Uses of the plant
Mlama mwenge	<i>Combretum molle</i>	Charcoal, Firewood, Medicine.
Masaka (Mkenge)	<i>Albizia versicolor</i>	Firewood, T. medicine, Charcoal, Timber, Tool handles, Bee hives, Utensils.
Asaninga (Mninga)	<i>Pterocarpus angolensis</i>	Timber, Firewood, Charcoal, Poles, Curving, T. Medicines, Tool handles
Kivuzi	<i>Ficus sycomorus</i>	Firewood, Curving, Food (Fruit), T. Medicine, Bee hives
Msu	<i>Syzygium cordatum</i>	Timber, Food (fruit), Drink (fermented fruits), T. Medicine
Msuku	<i>Carissa edulis</i>	Firewood, Food (fruit), T. medicine
Mwula	<i>Parinari curatellifolia</i>	Fruits, Charcoal,
Miika	<i>Stephania abyssinica</i>	Firewood, Charcoal, Traditional medicine
Mzombo	<i>Brachystegia spiciformis</i>	Firewood, Charcoal
Nzungwa	<i>Kigelia africana</i>	Charcoal, Firewood
Nakuwawa	<i>Cordia spp.</i>	Fibres, Fuelwood
Kaselenge	<i>Acacia hockii</i>	Firewood, Dry fencing, Fibres (bark).
Chikanda	<i>Orchid spp.</i>	Food (bites)
Matete	Reeds	Mats, fencing, decorations, baskets, local ceiling boards, mattresses, floor cover.
Mufita	<i>Vitex doniana</i>	Timber, Fruits, T. medicine, Firewood, Charcoal

Appendix 5: Wild animal species preferred for bush-meat in the study area

Vernacular name/local name	English name(s)	Scientific name
Nguruwe pori	Bush pig	<i>Potamochoerus porcus</i>
Tunko	Common mole	<i>Cryptomys hottentotus</i>
Nsya	Duiker – common	<i>Sylvicapra grimmia</i>
Nyati	Buffalo	<i>Syncerus caffer caffer</i>
Ngiri	Warthog	<i>Phacochoerus asthiopicus</i>
Boko	Hippopotamus	<i>Hippopotamus amphibious</i>
Mbawala	Bushbuck	<i>Tragelophus scriptus</i>
Sungura	Hare	<i>Oryctolagus cuniculus</i>
Tembo	Elephant	<i>Loxodonta Africana</i>
Kongoni	Hartbeest	<i>Alcelaphus buselaphus cokei</i>
Swalapala	Impala	<i>Aepyceros melampus</i>
Nungunungu	Porcupine	<i>Hystrix galeata</i>
Bata	Wild ducks	unidentified
Kanga	Guinea fowl	<i>Numida spp.</i>
Kwale	Francolin	<i>Francolinus francolinus.</i>
Korongongo	Roan antelope	<i>Hippotragus aequinus</i>
Pofu	Eland	<i>Taurotragus oryx</i>
Kuro	Waterbuck (common/defassa)	<i>Kobus ellipsiprymnus/Kobus defassa</i>

Appendix 6: A list of edible mushrooms in the study area

Vernacular/local name	Family name	Scientific name
Mushrooms		
Uyoganembo	<i>Termitomyces</i>	unidentified
Simbo	<i>Termitomyces</i>	<i>Amanita tanzanica</i>
Utuso	<i>Termitomyces</i>	unidentified
Tente	<i>Termitomyces</i>	<i>Termitomyces letestui</i>