

**THE ROLE OF WILD FOODS IN HOUSEHOLD INCOME AND FOOD
SECURITY IN MUFINDI DISTRICT, TANZANIA**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
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ABSTRACT

Wild foods comprise of all edible products that are found growing naturally in forests, woodlands or farms. They include both fauna and flora species that are consumed either as wholly or partly. This study was designed to investigate the role of wild foods to household income and food security at Mufindi district in Iringa region. Data were collected using both structured and non-structured interviews. Purposive sampling procedures were used to obtain six representative villages. At village level, 30 respondents each from different households were picked at random for the study; this led to a sample size of 180 respondents. The collected data were analyzed using SPSS software, where outputs from descriptive statistics cross tabulation and frequencies were used in verifying the magnitude of wild food consumption. In this study, wild food products were grouped into wild fruits, wild vegetables, edible stems and tubers, edible seeds, mushrooms, honey, edible insects and bush meat. The contribution of these products to the revenue was found to differ from one division to another; research finding revealed that earnings from wild food marketing in different divisions ranged from Tsh. 1 957 to 6 315 Such income is less to the minimum government wage of Tsh. 65 000 by more than 90%. Based on time spent in gathering, transporting, and marketing of these products, one can view that wild food marketing is not a worthy business unless some interventions are to be made. It is recommended that both government and private institutions should join hands in promoting better wild food management and marketing.

DECLARATION

I, **David Kasian Msola**, 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 in any other university.

.....

David Kasian Msola
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.....

Date

The above declaration is confirmed

.....

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.....

Date

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DEDICATION

This dissertation is dedicated to my late brother Michael Msola (2005) who brought me up and showed me the value of education.

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LIST OF ABBREVIATIONS AND ACRONYMS

DTU	Demographic Training Unit
FAO	Food and Agriculture Organization
HESLB	Higher Education Student Loan Board
HHFS	Household Food Security
HHL	Household level
ICRAF	International Research Centre for Agro forest
MKUKUTA	Mpango wa Kukuza Uchumu na Kupunguza Umasikini Tanzania
MKURABITA	Mpango wa Kurasimisha Rasilimali na Biashara Tanzania
MNRT	Ministry of Natural Resource and Tourism
MTC	Mufindi Tea Company
MVET	Mufindi Voluntary Environmental Control
NWFPs	Non Wood Forest Products
SPM	Southern Paper Mills
SPSS	Statistical Package for Social Science
TAGOs	Tanzania Government General Scale
TATEPA	Tanzania Tea Packers Limited
TBS	Tanzania Bureau of Statistics
TFNC	Tanzania Food and Nutrition Centre
Tsh.	Tanzanian Shilling equivalent to United States Dollar 0.0008 in June 2007
TTCL	Tanzania Tele-Communications Limited
UNICEF	United Nations International Children Emergency Fund
URT	United Republic of Tanzania

Kg

Kilogram

USD

United States of American Dollar

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The term 'Food Security' is defined as an aspect of ensuring that all people at all times have both physical and economical access to the food they need (FAO, 1989). The same report described household food security as a household having assured sets of entitlements from production, cash income, reserve of food or assets and or government assistance programs such that, in time of need they will be able to maintain sufficient nutritional intake for physical well being.

Studies have shown that many households in developing countries, including Tanzania, experience frequent food shortage due to myriad reasons including unreliable weather conditions, lack of access to reliable income generating activities and a high dependence ratio. According to Corbett (1988), people who live in conditions that put their main source of income at recurrent risk will develop self-insuring coping strategies to minimize risk to their household Food Security and livelihood. These strategies include dependency on relief food, disposal of personal assets, sale of firewood, sale of charcoal, migration and collection of wild foods

Wild foods comprise of naturally grown products that can be used in various forms as a source of food, they originate either from naturally grown fauna or flora species. Many of these natural grown foods are provided from forests, they are also grouped as Non-Wood Forest Products (NWFPs). According to FAO (1992), Non-Wood forest products (NWFPs) consist of goods of biological origin other than wood from the forest. NWFPs are often associated with subsistence uses that are not widely known (Kajembe *et al.*, 2004). Many households in developing countries have a

reliance on wild food plants as both a source of income and food, especially during famines.

The term income is defined as any gain that has a money value. Ashby and Wehmeier (2000) defined income as money received especially periodically or in a year from one's work, land investment etc. Isinika and Mdoe (2001) reported that an income of a household comprises of all earnings from both on farm and off farm activities. It may be tangible like the physical assets or intangible such as a social resource.

1.2 Nutritional Value of Wild Food Plants

According to Ruffo *et al.* (2002) malnutrition prevalence in Tanzania is evidenced by the fact that about 27% of Tanzanian children are underweight and some 2000 - 4000 children go blind each year due to lack of vitamin A in the diet. It has been estimated that 40% of people live in iodine deficient areas and about 1.6% suffer from goitre. The major cause of malnutrition is inadequate intake of nutrients.

Resource poor households are highly exposed to nutritional disorders, which would otherwise be minimized through better exploitation of wild foods that are reported to have high nutritive value. According to Ruffo *et al.* (2002) available data indicate that local vegetables and fruits have higher nutritive value than exotic vegetables and fruits mainly sold in markets. These authors cited an example of *Amaranthus spinosus*, *Biden pilosa* and *Sesamum angolense* as local vegetables which are high in protein, fat and minerals especially calcium and iron. Vooren (2006) found that, indigenous crop species such as *Amaranthus spinosus*, Black jack (*Biden pilosa*), Gallant soldier (*Galinsoga parviflora*) and Spider plant (*Cleome gynandra*) are believed to be an excellent source of micronutrient elements including vitamin A.

The same author reported that, the composition of B-Carotene (a precursor of vitamin A) per 100 gram of the edible portion of many wild leafy vegetable plants is 5716 milligrams times higher than that in cabbage.

Some wild fruits such as *Adansonia digitata*, *Annona senegalensis* and *Parinari curatelifolia* are high in protein and fat. Further more, the fruit of *Adansonia digitata* and *Ximenia caffra* have higher vitamin C content than mango (*Mangifera indica*). According to Maximillian (1998) who quoted FAO (1992), mushrooms are valued highly due to their nutritional content that are essential in various body functions, they supply up to 45g of protein per 100g dry weight, they also contain a substantial amount of essential minerals. Basing on the foresaid wild food potential, it is evidenced that, proper utilization of wild foods may result in minimizing the nutrition disorders of the population.

1.3 Problem Statement and Justification for this Study

Indigenous foods serve as food safety nets because they produce foods during the hungry period when there is a shortage of food between maize crops. They become even more important not only as source of food but also as a source of employment. When properly managed, wild food can contribute much to household income, a recent international research report, estimated the annual global market for natural products at USD 45 billion (Ruffo *et al.*, 2002). ICRAF (2004) reported on the effort made by its team in promoting indigenous food production and marketing in some selected areas in Tanzania, Malawi, Zambia and Zimbabwe. The project commenced in 1990 where farming groups especially women from selected districts was trained on issues relating to propagation, processing and marketing of wild

foods. The project report indicated an increased wealth among women groups dealing in wild fruit marketing in Tabora Tanzania and Kasungu in Malawi.

Mufindi is one of the seven districts in Iringa region with diverse varieties of vegetation ranging from grasslands and thickets to thick miombo forests. Such vegetations are rich in variety of wild food species. Despite the availability of such potential, the problems of income poverty and malnutrition have not been fully scrutinized. It is also not clear whether income generated through wild fruit trading has an impact on household food security or not. This study is confined in assessing the role of wild foods in household income and food security of people in Mufindi district. Emphasis will be highlighted on finding out on whether wild food use has a link with the welfare of the people within the district.

However various efforts have been advocated to empower Tanzanian communities in combating poverty. To mention a few, strategies such as the Millennium Development goal, poverty reduction strategies (MKUKUTA), National Strategy for Growth and Reduction of Poverty and legal formalization of asset and trade (MKURABITA). All these strategies aim at obtaining findings, which will enable stakeholders to mitigate poverty. This study is in line with the above-mentioned development strategies. It also aims at obtaining information relating on constraints that are linked with wild food management, such information will help as a tool for development planning not only for the Mufindi district, but also for the national at large.

1.4 Research Objectives

1.4.1 General objective

The major objective of this study was to assess the role of wild foods in household income and food security of the people in Mufindi district.

1.4.2 Specific objectives

The specific objectives were;

- a) To identify the wild foods available in the study area
- b) To estimate the collection and consumption of wild foods at household level
- c) To estimate the incomes generated through wild foods marketing in the selected villages
- d) To identify the link between wild foods use and household food security

1.5 Organization of the Study

This study is organized in five chapters. The first chapter covers the introductory part of the study, whereas the review of existing literature on the role of wild foods in the community welfare is presented in chapter two. The third chapter presents the research methodology; this chapter covers the location and characteristics of the study area, type and source of data, sampling technique and data analysis. Research findings and discussions are presented in chapter four whereas the conclusions and recommendations are presented in chapter five.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Essentials of Forest

Resources that give direct benefit to the surrounding communities are easily valued by such communities; it only requires proper policy that encourages a sound mechanism to ensure their sustainability. Forests are important for the humankind not only because they provide timber and the variety of Non-Wood Products (NWFPs) but because they influence various environmental factors (Dwivedi, 1993). However, NWFPs include all forest products rather than timber and firewood. They are also referred to as minor forest produce.

Despite the significant role of other valuable forest by-products such as medicinal value, the role of the forest as a source of food to human being becomes more rational. FAO (1992) reported that, inspite of the fact that, food derived from forests may not be consumed in great quantities in comparison to main food staples but, they are essential in adding variety to diet, improve the palatability of staple foods and provide essential vitamins, proteins and calories. The following are some natural foods that are frequently used in Tanzanian community.

2.1.1 Plants yielding edible fruits

There are a large number of forest plants including trees, shrubs, herbs and climbers, which yield edible fruits. These fruits are eaten in a variety of forms; some are eaten either ripe or unripe while others are consumed after cooking as curries. Some of these fruits are pickled and some are made into jams and other products (Dwivedi, 1993). In southern Zimbabwe, Campbell (1986) reported that wild fruits are an important supplementary food source. Edible parts of fruits varies basing on family

of a fruit plant, some possesses an edible pulp, gums and even pods while others are eaten as whole raw fruit.

Apparently, fruits are the most popular NWFP collected from the forest; they are eaten between meals as snacks (Kajembe *et al.*, 2004). Several reports indicate that children are highly involved in collecting wild fruits as compared to adults. Kajembe *et al.*, (2004) cited in Ogle and Grivetti (1985) observed that in Swaziland, children do collect and consume more fruits than adults. Ruffo *et al.* (2002) observed that women and children are the main wild food collectors.

Edible wild fruits species are reported from different places in Tanzania. Makonda (1997) identified 39 species of wild fruit that are consumed in Geita district. In Mbozi district Kajembe *et al.* (2004) reported on 33 fruit tree species that are commonly used by the population.

2.1.2 Plants yielding edible leaves

Several wild plants yield leaves, which can be consumed either raw or cooked; they are known to be good substitute for green vegetable. Some leaves such as *Murraya coenigii* (curry leaves) are used as flavoring agent, some leaves make a good soup, and some are picked and made into chutney (Dwivedi, 1993).

Vegetables are used for the dishes that are the main accompaniment to the staple; usually vegetables are cooked with a base of fried onions and tomatoes or the addition of legumes and pulse, such as, pounded groundnuts, simsim oil or coconut milk (Ruffo *et al.*, 2002). Herbaceous plants and young leaves are eaten as vegetables and provide essential vitamins. *Gnetum africanum* is a central African forest creeper, which bears edible perennial foliage that is consumed at large amount

by the local community in different places, these leaves are gathered and cut into thin slices eaten raw or even cooked with some spices (Nyingili, 2003).

2.1.3 Plants yielding edible seeds

Seeds of a large number of species are edible, some of them have high market value, seeds of chilgosa pine (*Pinus gerardiana*) Chiraunji (*Buchnania lanzan*) and Cashewnut (*Anacardium occidentale*) are one of the best fruits and are marketed at high rates (Dwivedi, 1993). Oil seeds especially the *Parinari curatellifolia* and *Telfaria pedata* seeds are reported to have wide application in cooking vegetables and other relishes (Kajembe *et al.*, 2004)

2.1.4 Plants producing edible stems, roots and tubers

Stems and tubers of several plants are edible, several species of bamboo are known to produce culms, which are eaten in different parts of the world, they make good curries and pickles. Tubers of certain species such as *Alocasia* are eaten as curries; some are eaten after being boiled (Dwivedi, 1993). *Cyperus rotundus* provides chewing tubers that can also be made into flour which is used to make porridge, tubers of *Satyrium spp.* are prepared and used as snack or as relish and eaten with a staple food mostly stiff porridge (Kajembe *et al.*, 2004). Children like chewing tubers especially during herding. Ming'oko (*Dioscorea spp.*) roots are prepared, cooked and eaten as main dish in times of food shortages. Kajembe *et al.* (2004) as cited in Missano *et al.* (1994) found that, in two villages of Mtwara region Ming'oko roots were consumed throughout a year. In Kenya, Kabuye (1986) found that, wild roots and tubers were consumed only as snacks during herding.

2.1.5 Edible insects

Higher termite species (*Macrotermes*) provide a useful protein in Tanzania. According to Chanyenga (2000), *Alates* locally known as Ng'umbi in Malawi are trapped in their dispersal normally at the onset of the rainy season. During this time of the year, a lot of local Ng'umbi (termites) occurs. However, quantities consumed or traded are yet to be determined. Termites are obtained from natural forests, plantations and other areas. Caterpillars are also reported providing substantial quantity of protein supplement to many house holds. Cunningham (1997) reported that, approximately 170 people in Kasungu district in Malawi participated in legal harvest and marketing of caterpillars during the 1991 season. Each person earned nearly USD 50 from the sale of caterpillars.

According to FAO (1992) cited in Maximillian (1998), Insects forms a major fraction of the animal biomass of the tropic forests and forestlands, and gives rise to a great variety of significant forest products. Caterpillars, termites, bee larvae and other soft- bodied insects are widely consumed as a protein food and dietary supplement. Same report indicated that, about 100g of termites could provide 561 calories of food energy, while bee larvae contain ten times more vitamin than egg yolk.

2.1.6 Bush meat

Wild animals form an important part of forest products, they are the cheap source of animal protein to the population. Traditional hunting offers a substantial role in to the community by providing food security through direct consumption. The role of wildlife is highly realized especially in areas close to natural forests, which are the natural habitat for most of wild animal species.

People in northern Malawi, where considerable area of forest exists, hunting is a good business. In spite of providing animal protein to the population, traditional hunting provide a reliable source of household income. Chanyenga (2000) reported that, in Malawi, one could fetch as high as USD 5 due to sale of one guinea fowl at the market. Finland reported the harvest of 276 000 fur-bearing animals in the 1994/95 hunting season the most important species were raccoon, American mink and red fox (Langner, 1998).

The nutritional value of bush meat is comparable to that of domestic meat. FAO (2002) pointed out that the most important game meat species are small animals like rodents, reptiles and insects; this is due to their naturally abundant and unrestricted hunting. Malaisse (1982) as cited by Kajembe *et al.* (2004) reported that rodents are major food components to residents of Zambezian woodlands. Consumption of some wild birds is also common in central parts of Tanzania particularly Singida and Dodoma region (Hamza, 1997).

Kajembe *et al.* (2004) identified three species of rodents and a number of birds that are commonly hunted in Mbozi district. Hunting to the above named species aimed also in obtaining cash, which assisted the community in meeting various household needs.

However, in many African countries local communities are not well enforced with the regulations to access natural resources available in forests. FAO (1992) reported that, many African countries are still practicing the colonial structure of centralized game systems and the access to the protected areas. This has created a barrier between wild life resources and local communities; in this case, sustainable wild life management becomes less appreciated by the local community. Same report is

proposing on participatory natural resource management as the appropriate measure in realizing sustainable wildlife resource utilization.

2.1.7 Mushrooms

Mushrooms in general have always been known to provide supplementary food, especially during the rainy season. They are highly valued as a delicious food in many countries. Harvesting of mushrooms involves uprooting the whole stem (Kajembe *et al.*, 2004). Most of these wild edible mushrooms grow on dead wood and leaf litter normally found in indigenous woodlands. FAO (1992) reported that, many kinds of mushrooms that are important in trade are normally adapted to a very particular kind of natural habitat under a narrow range of ecological conditions and microclimates. Same report identified the black mushroom specie (*Morchellus spp*) as an important commercial species, which is only grown in wooded areas of North-Central Pakistan and traded internationally.

Harconen *et al.* (2003) reported that, mushrooms differ from plants in their rapid growth. It takes only a few days or a week after the first rain for the mushrooms has from time to time to emerge. Same report indicated that, mushrooms have played an important role in the diet of rural people.

The common species of edible mushrooms found in East, Central and Southern Africa include those belonging to the genera *Termitomyces*, *Rusula*, *Amanita*, *Armillaria*, *Lactarius*, *Macrolepiota*, *Agaricus*, *Trichloma*, *Boletus*, *Xerocomus*, *Polyporus*, *Suillus*, *Afroboletus* and *Pleurotus* (Chimpopha, 1985)

The miombo woodlands are the major habitat for the most mushroom species. Miombo woodland covers more than 32 million hectares, which is about 96% of the

total forest area of Tanzania (MNRT, 1998). Most of the Mushroom in the Miombo woodland survives by forming Mycorrhizal association with tree roots, especially trees of the family Leguminosae in the sub families of *Caesalpinoidae*, *Mimosoidae* and *Papilionoidae* (Harkonen *et al.*, 1995). However, the indigenous forests are declining due to deforestation and as a result; yield of mushrooms obtained from the woodlands is declining.

2.1.8 Honey

Beekeeping industry is an important sector in the national economy, honey and beeswax are the two major by-product obtained from bee keeping. According to FAO (1992), honey is an insect product universally valued for its high-energy content; it contains more than 280 calories per 100g of honey. According to Makonda (1997), honey is almost valued everywhere for its high-energy content. Apart from food, honey is regarded as an important source of medicines, local beer and income. Makonda (1997) cited in Kowero and O'kingati (1990) indicated that, in the 1970's Tanzania was among the leading producers of beeswax with an annual output of 600 tones, bee products contributed 13% and 43% of the total forest based export valued in 1989/90 and 1990/91 respectively. On coastal areas of Tanzania mainland and Zanzibar, bee- keeping activities are carried out in mangrove forests.

Chanyenga (2000) reported that about 8000 people in Malawi are involved in bee keeping producing as much as 15 000 tones and 1000 tones of honey and bee wax respectively. The community consumes about 80% of the honey produced, marketing the remaining 20% in local market. At the time where the population pressure is not accounted by the increase in food production, the consumption of

wild foods becomes the major alternative source of food and household income to the disadvantaged communities.

2.2 The Role of Wild Foods in Household Income

According to Chanyenga (2000), cited in Saka and Msonthi (1994), indigenous fruit trees of the Miombo are used in generating income through the sale of fruits and fruits products. There are evidences indicating the potential of wild fruits in generating household income, which helps in ensuring better life standard in various African communities. Peter (2004) for instance, observed that some women in Tabora region were each raising between Tshs 33 000 to 140 000 per week from sale of processed fruits. Chanyenga (2000), reported that the demand of honey in Malawi is quit high, bee keeping associations from Mzuzu, Chimaliro and Blantyre, sells about 20 tones of honey to local market annually, earning substantial amount of cash. Further report indicates that the cost of bush meat is becoming high from time to time, for example an adult wild guinea fowls fetches up to USD 5 at the market, this implies that hunting in Malawi is quite a paying business.

The above evidence indicates how the population in other parts of the country like Tabora and even out side the country as for the case of Malawi, benefit much from exploiting wild foods. The people in Mufindi are also utilizing food resources available to their forest reserves. However, it is not documented on what role these Non-Wood forest products play to the surrounding community.

2.3 The Role of Wild Foods in Household Food Security

The concept of food security is complex; it covers a wide range of aspects from global food balance to nutritional adequacy of an individual. According to FAO

(2004), there is no one universal concept of food security. Maxwell (1996) reports that, food security concepts have developed considerably since it emerged in the 1970's. The concept would have shifted from high economic and quantitative considerations to a more humanistic and qualitative direction; it may be looked from macro level to micro concern, from the national food stock down to household level. FAO (2004) has defined food security as physical and economic access by all people at all times to sufficient safe and nutritious food to meet their dietary requirement for productive and healthy life. This definition has highlighted four major conditions; first food must be available through domestic production or importation. Secondly, the available food must be accessible by the people; this implies that people must have adequate resource to access the available food for consumption. Thirdly, the available food must be safe with adequate nutrient for a healthy and active life; finally, the accessed food must be sufficient to meet the dietary requirement of the population. Several factors contribute on food shortage to meet the dietary requirement to the population. URT/UNICEF (1990) argue that, some parts of Tanzania are facing

shortage of food due to drought, floods and absence of smooth transfer of food from surplus areas to deficit ones. Makundi (1996) and Ishengoma (1998) reported that, local brewing, overselling of food crops for family income, low house hold income, traditional dances and funerals contribute to household food security.

Dependency on wild foods is one of the most common coping strategies experienced in many food insecure households. Ruffo *et al.* (2002) reported that, most wild foods such as vegetables, fruits roots and tubers are important source of food during the period of food scarcity. Falconer and Anold (1991) and Tewari (1994) insisted that NWFPs provide food security to large low-income population particularly during period of drought.

In summary, authors have indicated the role of wild foods in generating household income and ensuring household food security. The population from Kasungu district in Malawi has been raising substantial earnings from wild foods marketing (Chanyenga, 2000). Same author found that in Tabora Tanzania farming groups are marketing processed foods thereby making good household income that substitute for some household expenditure. In addition wild foods are highly valued in terms of their nutrition contents, proper utilization of such foods can help in controlling nutritional diseases to the community (FAO, 1992). Despite the availability of good agro ecological condition that supports the growth of most of the valuable wild food species in Mufindi district, information concerning the role of wild foods in generating household income and food security to the community in Mufindi district is scanty.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area Description

This study was conducted in Mufindi district, which is one of the seven districts in Iringa region of Tanzania. The other districts of the region include Iringa urban, Iringa rural, Ludewa, Kilolo, Njombe and Makete.

3.1.1 Justification of selecting Mufindi district for the study

Mufindi district has diverse varieties of vegetation ranging from grasslands and thickets to thick miombo forests. The district has a land area of 712 200 hectares out of it 57. 03 (28%) hectares are covered with forests. These forests offer a substantial economical role to the surrounding population. Apart from wood products, Mufindi forests are highly recognised as a source of wild food species. The wild foods include vegetables, fruits, mushrooms, honey, edible insects, bush meat, edible roots and tubers. Despite the availability of potential forest diversity that favors the growth of wide range of wild foods, its role to the community welfare has not been fully scrutinized. This study was confined in assessing the role of wild foods in house hold income and food security of people in Mufindi district.

3.1.2 Geographical location

Mufindi district is located 80 kilometres South of Iringa Municipal. Geographically the district lies between Latitude 08° 42' 0 S to 9° 11' 0" S and longitude 34° 08' 0" E to 35° 20' E.

The district is bordered by Iringa district in the North, Morogoro region in the East, Njombe district and Mbeya region in the Southern and the Western parts respectively.

Administratively the district consists five divisions namely Kibengu, Kasanga, Malangali, Ifwagi, and Sadani. The district has 28 wards, 135 registered villages and 582 sub-villages.

3.1.3 Population and social economic activities

The main ethnic group is Hehe which constitute about 85% of the population in the district. The remaining 15% is mainly occupied by Bena, Pangwa, and Kinga. About 90% of people live in the rural areas where their major occupation is agriculture. Land for agriculture is about 6766 square kilometers, out of this 1332 square kilometers is cultivated where both cash and food crops are grown. Crops that are grown for cash include pyrethrum, tea and sun flower. Maize, beans, millet, wheat, sweet and round potatoes are the most commonly grown food crops. Most of the agricultural households are small-scale farmers with land holdings of about 1 to 2 hectares. The most commonly used farm implement is hand hoe. The use of tractor is very limited and their numbers have been declining annually (URT, 2005). Rain fed agriculture is a prominent farming system practiced by the majority of farmers.

3.1.4 Types of Vegetation cover

The district has 23 forest reserve areas covering 47 338 hectares and 18 catchments reserves, which cover 16 690 hectares (URT, 2005). Such forest covers are important in modifying the climate of the district, giving rise to cool weather with good rainfall distribution. Various valuable plant species are obtained from these forests.

Traditional healers depend much on these reserve in obtaining plant species with medicinal value that are used for healing different types of diseases (Magoma, A. G. Personal communication, 2006). Also wide range of traditional foods is obtained from these forests, such available wild food species are essential in ensuring household food security.

3.1.6 Transport and communication

There are 1235 kilometers of road network, from North to South the district is passed by the Tanzania-Zambia tarmac roadway and the Tanzania-Zambia railway line (TAZARA). The district has the total road network, which includes 118 kilometers of truck road, 217 kilometers of feeder roads and 85 kilometers of urban to urban roads. All the roads are passable though out the year. As regard to airways, three airstrips are used mainly for emergency purposes from Mufindi Tea companies. (URT, 2005).

Telephones are made available in most of the townships and the villages surrounding Tea companies, various service providers such as the Tanzania Tele-Communication Limited (TTCL), Celtel, Tigo and Vodacom have busted the service to many villages. Radio calls owned by Mufindi Education Trust (MET), exists in all divisions of the districts. Mufindi Voluntary Environmental Control Unit (MVEC) has radio calls at Kibengu and Sadani divisions. Tele - fax is also available at the post office in Mafinga, head quarter of district council and escapements (URT, 2005). As regard to power supply, Mafinga (district head quarter) is supplied with electricity from the national grid system, which has been extended to Igowole in Kasanga division. The extension line goes to Nyololo junction in Malangali division, Luganga and Kinyanambo villages in Ifwagi divisions (URT, 2005).

3.2 Sampling and Data Collection

3.2.1 Sampling

Purposive sampling procedures were used to obtain representative villages for data collection. Villages close to forest reserves and those with their population that rely much on wild food collection were included in the study. The sampling units for the study included the selected households, individual wild food collectors and vendors, key informants such as village leaders, health officers, extension officers, district agricultural officers and representatives from non-governmental organizations dealing with community well fare.

3.2.2 Sample size

Inventory of villages from the district commissioners office were used to identify villages that surround the forest reserves. Out of these, five representative villages were picked at random for the study. At village level, households relying on wild food marketing or consumption were identified such that 30 respondents each representing a separate household was then picked at random for the study, this led to the sample size of 150 respondents.

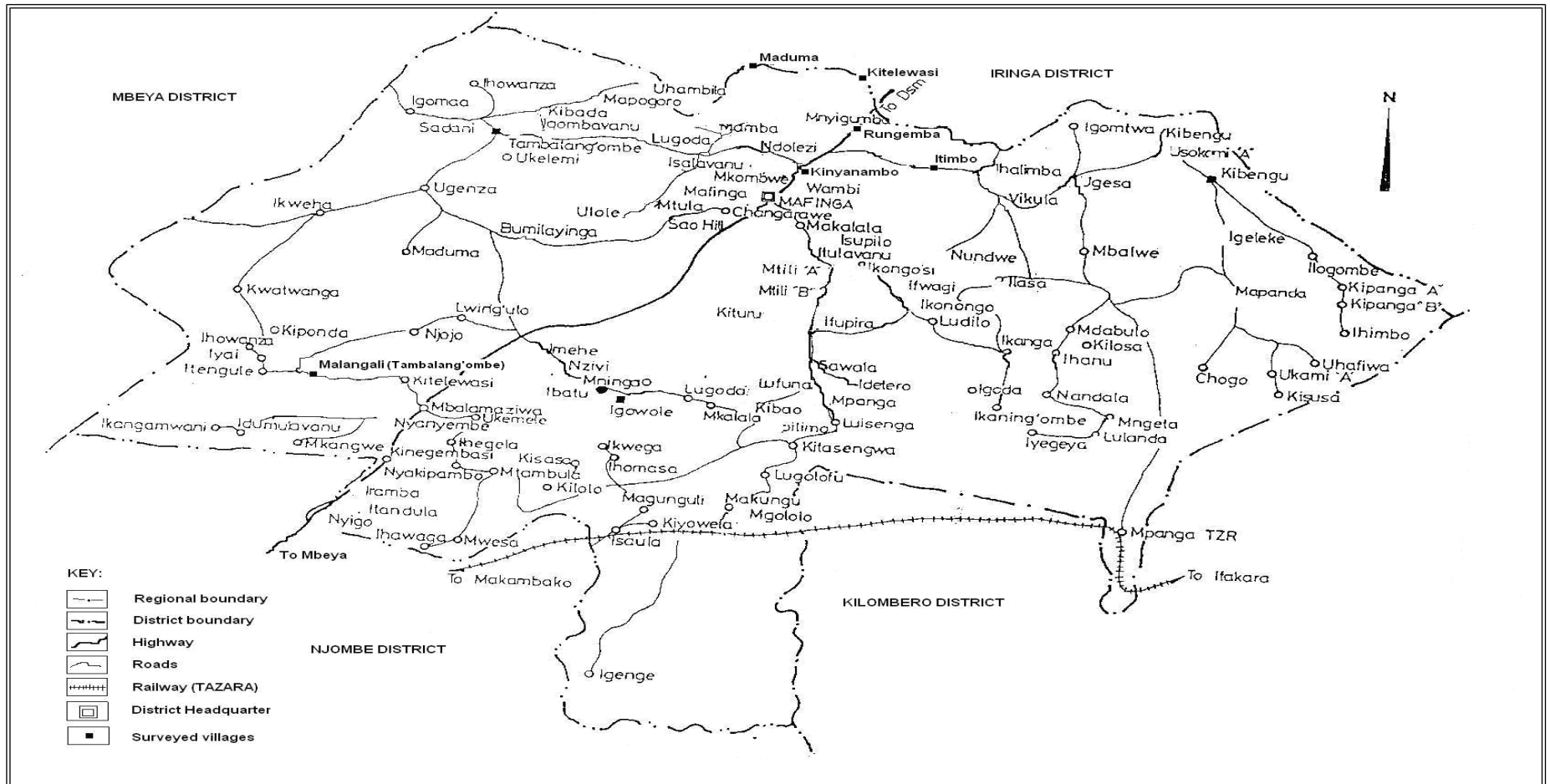


Figure 1: Sketch map of Mufindi district showing the district boundaries and the surveyed villages

3.2.3 Data collection method

Various approaches were employed to necessitate both quantitative and qualitative data collection where both structured and non structured interviews were used for this purpose. The uses of household interviews through structured questionnaires were employed in gathering quantitative data. The use of qualitative methods such as participatory approaches aimed in gaining the detailed understanding on the influence of wild food to the household welfare. The different methodological approaches that were used are summarized in appendix II.

3.2.4 Data analysis

The collected data were analyzed using Statistical Package for Social Science (SPSS) software, where outputs from descriptive statistics, cross tabulation and frequencies were used in verifying the magnitude of wild food consumption.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Social Economic Characteristics of the Respondents

4.1.1 Social characteristics

The social characteristics of the respondents comprised of age, sex, marital status, education level, household head, religion and tribe.

Table 1: Nature and characteristics of respondents in Mufindi district

Characteristics of the respondents	Frequency (N =180)	Percentage
Age of the respondent (year)		
Below 35	86	47.8
36 – 55	64	35.6
56 –75	27	15.0
Above 75	3	1.6
Gender		
Male	90	50.0
Female	90	50.0
Marital status		
Single	22	12.2
Married	144	80.0
Widow	12	6.7
Widower	2	1.1
Education level		
No formal education	36	20.0
Adult education	1	0.6
Primary school	142	78.6
Secondary school level	1	0.6
Household head		
Male headed household	127	70.6
Female headed household	53	29.0
Religion		
Christian	174	96.7
Muslim	4	2.2
Pagan	2	1.1
Tribe		
Hehe	143	79.4
Kinga	2	1.1
Bena	31	17.2
Pangwa	3	1.7
Nyasa	1	0.6

As indicated in Table 1, most of the respondents were youth and children aged below 35 years. This proportion occupied about 47.8% of all the respondents. Ruffo, *et al.* (2002)

who reported that many children in developing countries are found involved in collecting wild foods also supports this observation. Such experience might have been attributed by the availability of many youths in above age group. It was thought that youths are still energetic such that they can easily travel to different places in search of wild foods as compared to older people. In this study, elder people that were aged above 75 years occupied only about 2%. Their small proportion was attributed to, among other factors but the perception of wild food gathering. It was further thought that wild foods gathering are perceived as an inferior task. This drove most elder people to shy away from being involved as compared to youth.

For the case of marital status, the majority of the respondents (80%) were married; where as, small proportions of about 7% and 1% were occupied by widows and widowers respectively. The increased number of married couples in collecting wild foods is linked with the coping strategy to search for alternative means of feeding their families especially at the time of food shortage. Nyingili (2003) reported that, increased dependency on wild foods is among the concurrent indicators that reflect a coping strategy in overcoming food crisis. To the other hand widow and even the widowers could engage much in serving their lives through collecting and marketing wild foods due to their economic instability, which were caused by the loss of their partners who might have been taking charge in household decision-making.

Among all 180 respondents, about 79% had a primary school level of education; where as 20% did not have any formal education. On the other hand, only about 1% of respondent had a secondary school level of education. Such a large proportion of respondents with low level of education is due to the fact that in most cases both the formal and some of the informal sectors absorb workers with good education in

order to cope with technological changes. Individuals with low educational background find themselves at risk in competing for employment in the fore said sectors; the only alternative is farming and gathering wild foods as was observed in this study in Mufindi district. Decision making process is based on who makes the decision at the household level; in most cases the decision maker is a head of the household. Among all 180 respondents, about 71% reported to have male-headed household, females headed only 29% households. This reflects the persistence of patriarchy community where men are found dominating the decision making process (Agarwal 1988). For the case of religious matter, about 90% of respondents were Christians; Muslims occupied small proportion that comprised of 4%, pagan had only 1%. In this case, any interventional measure aiming in busting up some proper and sustainable management programs on wild foods may easily be adopted when religious groups having the majority of the respondents are fully involved.

Despite the availability of other tribes such as Kinga, Bena and Pangwa; Hehe is the dominant tribe in Mufindi. This fact was evidenced by large proportion of Hehe respondents as compared to other tribes. Out of 180 respondents, 79% were Hehe, 17 % Bena, about 2% Pangwa, 1% Kinga and lastly Nyasa tribe, which had only 1% respondents. Internal migration of individuals from one place to another has interfered with local tribes in a given locality. According to DTU (2003), internal mobility occurs when individuals are associated with spatial or permanent change of their usual residence between a clearly defined geographical location as for the case of Pangwa, Kinga, Bena and Nyasa who migrated from their districts to Mufindi. The study revealed that Pangwa and Bena migrated from Njombe district searching for fertile land for farming. Kinga migrated from Makete district for the same reason where as Nyasa people came from Nyasa in Ruvuma.

4.1.2 Social Economic activities of the respondents

4.1.2.1 Distribution of respondents by occupation

Based on the nature of occupation respondents were categorized into peasant, farmers, civil servant, technicians and students, as indicated in Table 2 below. The majority (63%) of the respondents was peasants; these individuals could produce farm products only enough for their household consumption. Rare surplus is obtained from their farm for marketing purpose. This group of people is prone to food shortage especially at the time of adverse weather condition; this drives them to depend much on wild foods for their livelihood.

Table 2: Distribution of respondents by occupation in Mufindi district

Occupation	Frequency (N=179)	Percent
Peasant	112	62.6
Farmer	54	30.2
Petty trader	9	5.0
Civil servant	2	1.1
Masonry	1	0.6
Student	1	0.6

Technical workers (Masonry) and students received the minimum proportion among all the respondents, only about 1% was reported for a technical worker, same case was reported for a student. Such minimal response could be caused by, among other factors but the time during when the interview were conducted to village members. In all the villages, interviews for respondents were carried out from 14.30 hours in the workdays. During this time of the day, students were still at school, however it was assumed that their response were represented by their parents who gave the general trend of household wild food consumption regardless of who collected it. Despite this low response, children are reported to be involved in collecting and consuming wild fruits than adults (Kajembe *et al.*, 2004).

For the case of masonry, their low response could be caused by the nature of their work that did not specify the time of being at home, as for the case of farmers who normally return at their home from their farms from 12.00 hours onwards. In this case, technician might have still been at their work place at the time of the interview.

4.1.2.2 Distribution of respondents by land ownership

It was observed in the study (Table 3) that, the majority (82%) of the respondents, owned land, where the remaining 18% had no land. Those that had no land obtained land through renting or even borrowing from landowners for farming purpose.

Table 3: Distribution of respondent by land ownership in Mufindi district

Owns land	Frequency (N=180)	Percent
Yes	147	82
No	33	18

Land is an essential entity in any farming business. The quality and quantity of land determines to a large extent the type of production that can be conducted in that particular place. Land is recognized by various financing organizations as a valuable resource that can be used as collateral when one applies for a loan that can be used as a capital for investment. For this matter, an individual with no access to land is likely not to be considered in accessing loans from some financial institutions if land is to be used as collateral.

4.2 Wild Foods that are Available in Mufindi District

Various types of edible wild foods were identified in the study area; respondents classified them into sub groups based on their nature and part of the plant that is usually consumed by human being as food. These species were categorized into; edible wild fruits, edible wild leaves, edible pods, edible stems, edible fungi

(mushrooms), bush meet, edible insects and insects products, and aquatic species. Dwivedi (1993) identified six categories of wild foods namely, edible fruits, edible stems and tubers, edible leaves, edible seeds, edible flowers and edible roots. On the other end, Ruffo *et al.* (2002), categorised these foods into; cereals, oil seeds, beverages, fruits, leafy vegetables, roots and tubers and spices. Harkonen *et al.* (2003), identified more than 15 genus of edible fungi that are found in Tanzania. The details on the identified wild food groups are discussed hereunder.

4. 2.1 Edible wild fruits

In this study, wild plant species were grouped based on family and plant characteristics, about 19 plant species were identified to bear edible fruits. These species were further classified into 12 families namely; Euphorbiaceae, Verbanaceae, Myrtaceae, Anacardiaceae, Cecropiaceae, Rosaceae, Passifloraceae, Moraceae, Clusiaceae, Rubiaceae, Olacaceae, Malyaceae, Icacinaceae, Flacourtiaceae and Chrisobalanaceae. Plants species under the named families were further defined based on their growth characteristics. In this case identified fruit plant had a growth characteristic that ranged from, trees, shrubs or herbs.

Most of these fruits were reported to be collected just from the end of rain season to wards the dry season (April to June). Fruit species such as *Vitex ferruginea*, *Rhus vulgaris*, *Rubus apetalus*, *Ficus sur*, *Garcinia buehneri*, *Multidentia crassa*, *Azanza garkeana* and *Alsodeiopsis schumanii* become mature ready for harvesting at this season of the year. Some fruits such as *Uapaca kirkiana*, *Fadogia ancyllantha* and *Parinari excelsa* are harvested during the dry spell of the year, normally from October to December and in some species, the harvesting period may extend to January as for the case of *Fadogia ancyllantha*. Respondents used vernacular names

in identifying these wild fruits. Table 4 below, indicates the most frequently used wild fruits in Mufindi district.

Table 4: Edible Wild fruits available in Mufindi district

Vernacular name	Scientific name	Family	Plant characteristics	Season
Mikusu	<i>Uapaca kirkiana</i>	Eurphorbiaceae	Semi deciduous tree	Oct - Dec
Misasati	<i>Vitex mombassae</i>	Verbanaceae	Deciduous tree/shrub	April - Sept
Mifudo	<i>Vitex ferruginea</i>	Verbanaceae	Shrub	April - June
Mivengi lulenga	<i>Syzygium cordatum</i>	Myrtaceae	Tree	Feb - April
Mivengi lutanana	<i>Syzygium guineense</i>	Myrtaceae	Tree	Feb - April
Wuhehefu	<i>Rhus vulgaris</i>	Anacardiaceae	Shrub/tree	April - June
Mfudza	<i>Myrianthus arboreus</i>	Cecropiaceae	Tree	Sep - Nov
Lumwino	<i>Rubus apetalus</i>	Rosaceae	Climbing perennial	Apr - June
Mabosoboso	<i>Passiflora edulis</i>	Passifloraceae	Shrub Crimping herb	Dec - April
Misombe	<i>Ficus sur</i>	Moraceae	Deciduous tree	Apr - June
Miduma	<i>Garcinia buchananii</i>	Clusiaceae	Tree	Apr - June
Mbewe	<i>Multidentia crassa</i>	Rubiaceae	Herb/shrub	Apr - June
Msambalawe	<i>Vangueria apiculata</i>	Rubiaceae	Herb/shrub	July - Oct
Kindokoli	<i>Fadogia ancylantha</i>	Rubiaceae	Shrub	Oct - Jan
Mtundwa	<i>Ximenia caffra</i>	Olacaceae	Shrub	Nov - an
Mtowo	<i>Azanza garkeana</i>	Malvaceae	Deciduous tree	Apr - June
Mvalambe	<i>Alsodeiopsis schumanii</i>	Icacinaceae	Shrub/tree	April - June
Mgola	<i>Dovyalis abyssinica</i>	Flacourtiaceae	Spiny shrub	Apr - May
Msaula	<i>Parinari excelsa</i>	Chrysobalanaceae	Tree	Nov - Dec

Wild fruits are seasonal plant products that are often eaten as snacks or made into juice. In some cases, fruits may form a very substantial part of the diet (Ruffo *et al.* 2002). In some places wild fruits are highly preferred than exotic fruit species. Makonda (1997) reported that, preference of wild fruits over grown fruit species might be due to their relative availability and the cost attached in accessing them. In most cases wild fruits are grown naturally, they are rarely managed by human being as compared to exotic species that are prone to weather change, diseases and pests.

In this study, it was revealed that wild fruit trees such as *Uapaca kirkiana*, *Vitex spp.* *Syzygium* and *Parinari excelsa* were left uncut during field preparation. Makonda (1997), who found that, wild fruit species such as *Vitex spp.*, and *Mangifera indica* were left standing during land preparation in Geita district when trees and shrubs are cut down, also support this observation. Campbell (1987), cited

in Makonda (1997) reported that, *Uacapa Kirkiana* plants are left deliberately by farmers during land preparation. In addition, Juma (1989), documented that in Bungoma district in Kenya, different species of wild edible fruits identified were maintained within their farms. This experience is highly encouraged as it offers better sustainable environmental conservation.

4.2.2 Edible wild leaves

The most common species that were identified to comprise of vegetables were found to belong from Solanaceae, Pedaliaceae, Compositae, Resedaceae, Tiliaceae, Amaranthaceae, Curcubitaceae, Musaceae and Polygonaceae. Most of these vegetable species were characterized by having a herbaceous stem. These included; *Solanum nigrum*, *Sesamum angolense*, *Bidens schimperi*, *Bidens pilosa*, *Caylusea abyssinica*, *Conchurus tridens*, *Amaranthus spinosus*, and *Celosia trigyna*, *Cucurmis figarrei* and *Rumex usambarensis* were found to be grouped as shrub stemmed plants. However, *Cucurmis figareii* had recognized to develop some tendrils from the nodes of the stems that help the species to support itself on other plants for the search of light. This peculiar characteristic has grouped it as a trailing shrub. Wild vegetables were identified through local or vernacular names for convenience of respondent. Harvesting period differs from one species to another based on ecological requirement for each species. Respondents could identify the specific harvesting season for each wild vegetable. It was revealed that, like many fruit species, most wild vegetable species are ready for plucking as from the mid rain season toward the dry season (February to April or just before June). Special case was recognized to *Ensete ventricosum*, a vegetable that produces edible leaves that are harvested throughout the year. The detailed groups of vegetable that were identified in the Mfindi are shown in Table 5 below.

Table 5: Edible wild vegetable available in Mufindi district

Vernacular name	Scientific name	Family	Plant characteristics	Season
Edible leaves	<i>Solanum nigrum</i>	Solanaceae	Annual herb	Feb - April
Muhaka				
Lilendi	<i>Sesamun angolense</i>	Pedaliaceae	Perennial herb	Dec - April
Nyatwanga	<i>Biden schimperi</i>	Compositae	Annual herb	April - June
Livanivani	<i>Bidens pilosa</i>	Compositae	Annual herb	April - June
Mkalifya	<i>Caylusea abyssinica</i>	Resedaceae	Perennial herb	Dec - April
Kimulikwi kidala	<i>Conchorus tridens</i>	Tiliaceae	Annual herb	Feb - May
Lifweni	<i>Amaranthus spinosus</i>	Amaranthaceae	Annual herb	Nov - June
Lifweni likomi	<i>Celosia trigyna</i>	e Amaranthaceae	Annual herb	Nov - June
Likombe	<i>Corchorus trilocularis</i>	e Tiliaceae	Herbaceous	Feb - April
Nyambede	<i>Cucurmis figarei</i>	Curcubitaceae	Perennial trailing shrub	Feb - April
Edible stems				
Linyimbili	<i>Ensete ventricosum</i>	Musaceae	False stemmed herb	Through out
Linyimbili	<i>Rumex usambarensis</i>	Polygoceae	Shrub	Dec - April

Edible leaves are commonly known as vegetables or source (Ruffo *et al.*, 2002). Dwivedi (1993) reported that, some vegetables are eaten raw while others are to be cooked. The role of wild vegetables are highly recognized not only as a substitute for a home grown green vegetables at the time of poor harvest, but also due to their high nutrient content that contributes much on improving health status of the population. As reported earlier wild foods have been analyzed for their nutritional content. Available data indicate that many local species including vegetables have a higher nutritive value than exotic species that are commonly sold at the markets (Ruffo *et al.*, 2002).

Several authors have reported on wild food consumption in different places. FAO (1989), found that, about 48 different species in Switzerland were eaten at least twice a week by more than half of the adults interviewed. Kajembe *et al.* (2004), reported on wild vegetable species that were identified in Mbozi district. He further

reported that, the population in the district commonly uses 11 different species of wild vegetables. According to Makonda (1997), who quoted Fleuret (1979), survey data obtained from Lushoto, Tanzania that, wild green leafy vegetables are an essential part of every day diets; it accounted for about 81.2% of all side dishes.

4.2.3 Edible pods and stems

Stem and tubers of different plant species are edible. Dwivedi (1993) reported that, several species of bamboo are known to produce culms, which are eaten in different parts of the world. In addition, pods of several species are important source of protein. Respondents identified *Dolichos trilobus* as an important annual herb that bears edible pods, the peas are collected and cooked while fresh, or may be left to dry in the sun and eaten with ugali or rice. It was also revealed that; groundnuts, pumpkin seed oil or even coconut milk might be added to make dish more palatable. Pods from *Dolichos trilobus* are normally harvested during dry season. *Ensete ventricosum* and *Rumex usambarensis* were recognized as wild plant species that bears edible stems, while *Ensete ventricosum* was found through out the year, and *Rumex usambarensis* were collected from December to April. Table 6 below indicates some characteristics of the above-mentioned species.

Table 6: Edible pods, stems and tubers in Mufindi district

Vernacular name	Scientific name	Family	Plant characteristics	Season
Edible pods				
Nyanandala	<i>Dolichos trilobus</i>	Papilionaceae	Annual herb	April - June
Edible stems				
Linyimbili	<i>Ensete ventricosum</i>	Musaceae	False stemmed herb	Through out
Linyimbil	<i>Rumex usambarensis</i>	Polygonaceae	Shrub	Dec – April
Edible tubers/roots				
	<i>Cyperus spp</i>	Cyperaceae	perrenial	Through out

 Sigwi

4. 2.4 Mushrooms

Respondents identified 14 different edible mushrooms species that are commonly used in the study area. These species were identified after their vernacular names as indicated in Table 7 below.

Table 7: Common edible Mushrooms found in Mufindi district

Vernacular name	Scientific name	Vernacular name	Scientific name
Wilelema	<i>Amanita loosii</i>	Unyakuvemba	<i>Lactarius pumilus</i>
Wigwingwi	<i>Amanita mafingensis</i>	Wimenda	<i>Lactarius xerampelinus</i>
Amakokogangi	<i>Amanita Muscaria</i>	Unyamikwe	<i>Russula congoana</i>
Wisimba	<i>Lactarius eduli</i>	Widongwe	<i>Termitomyces aurantiacus</i>
Wisimba	<i>Lactariusgymnocaoides</i>	Wikulwe	<i>Termitomyces letestui</i>
Wisigisa	<i>Lactarius kabansus</i>	Unyakigulu	<i>Termitomyces microcarpus</i>
Unyakuvemba	<i>Lactarius medusae</i>	Unyakuvemba	<i>Lactarius pumilus</i>

Most of mushroom species in Mufindi were reported to be harvested during the peak season that begins from November to March. These results conform to those of Kajembe *et al.* (2004) and Harkonen *et al.* (2003). Mushrooms are highly valued and considered as delicacy collection of mushrooms is reported as one of the important household activity (Kajembe *et al.*, 2004). The Czech republic was able to estimate collection of mushroom for personal consumption as an important family activity, In 1995 alone, 23 806 000 kilograms of mushrooms were collected from the natural forest (Langner, 1998).

Most people in Tanzania include mushrooms in their diet. There are however tribes such as the Chagga, Arusha, Meru and Massai who do not consume them (Harkonen *et al.*, 2003). However Harkonen *et al.* (1995) reported that, mushrooms are consumed every day among the Bena, Hehe, Makua, Nyamwezi, Nyiha and Sambia tribes during rain season. In most families mushroom is valued so highly, they are preferred to any other kind of food, most people consider it the best or just equal to meat.

Despite their nutritional importance, some species of mushrooms are poisonous; they contain chemical compounds that may interfere with normal metabolic processes of the human being after being ingested. Most local people are highly knowledgeable on isolating poisonous species from normal ones. In most African families women are responsible in identifying mushroom species before cooking. Kajembe *et al.* (2004) reported that, when mushrooms are brought home after sunset, they are not cooked until the next morning after being identified by women. Children are not allowed to cook mushrooms in the absence of their mothers nor adult woman, to avoid consumption of poisonous species.

4.2.5 Edible insects

Three species of edible insects were identified. These included; caterpillar, termites and the honeybee larva. Caterpillars are collected mainly from various species of trees, long grasses and even at the funnel of green maize plants, especially during rain season. Based on the study that was conducted in Mbozi, caterpillars were reported to be collected from some miombo trees such as *Brachystegia spiciformis*, *Brachystegia microphylla* and *Julbernardia paniculata* (Kajembe *et al.* 2004).

Caterpillars are mainly collected by children and women, and roasted before are used as a food.

Respondents reported further that, termites are mainly collected by women and children and fried before being consumed or sold at the market, they also reported to value honeybee larvae as an important source of protein. Honey bee larvae were collected from the bee combs that were left unextracted. They also reported that a good quality larva is that which has not started developing wings. After being collected, they are cooked or even fried before being used as food.

According to Kajembe et al. (2004), insects are good source of animal protein and make good substitute for meat or fish, which are too expensive for the smallholder farmers. Peter (2003) reported that, edible insects plays a big role as a source of nutrient to many African communities, he further notes that, despite of the critical role played, its consumption has not given much attention in western literature. FAO (1992) estimated that, 2000 insect species are consumed around the world; caterpillars and winged termites are fried and eaten as roadside snacks after removing wings, legs and brittles. Same report revealed that, Papua New Guinea is known for its nut flavored sago grubs (*Rhynchophorus ferrugineus papuanus*).

4.2.6 Bush meat

Bush meat is regarded as one of the most beneficial wildlife resources available to local communities. A wide range of rural and urban communities with a varied range of social economic background utilizes it. In Mufindi, six animal species were identifies to be used as source of bush meat, these included; the Giant Hog

(*Hylochoerus meinertzbagent*), Guviers Gazelle (*Gazelle dama*), Soeminerrings Gazelle (*Gazella soemmeringi*) and Antelop Hirola (*Beatrugus bunteri*).

They also identified small edible wild mammals that included, the Riverine Rabbit (*Binolagus monticolaris*) long eared flying mouse (*Idiurus macrotis*), giant climbing mouse (*Megadendromus nicolaus*) and mount oku mouse (*Lamottemys ocuensis*). In addition three birds that are commonly used for meat were also identified in this study, these included Wild Fowls and Doves. Kingdon (1997), reported on the above named wild animals as rare and endangered wild animal species of Africa. These wild life species are indicated in Table 8 below.

Table 8: Edible wild life species available in Mufindi district

Vernacular name	Common name	Scientific name
Ligubi lya mwihala	Giant Hog	<i>Hylochoerus meinertzbagent</i>
Kisungula	River rine Rabit	<i>Binolagus monticolaris</i>
Kiswangala	Guviers Gazzelle	<i>Gazelle dama</i>
Ifuno	Soemmerings Gazelle	<i>Gazella soemmeringi</i>
Kindzimba	Antelope Hirola	<i>Beatrugus bunteri</i>
Saka	Long Eared Flying Mouse	<i>Idiurus macrotis</i>
Ngonilolo	Giant Climbing Mouse	<i>Megadendromus nicolaus</i>
Gute	Mount Oku mouse	<i>Lamottemys ocuensis</i>
Wild birds		
Ing'wale	Red necked spur fowl	<i>Francolinus afer</i>
	Yellow necked spur fowl	<i>Francolinus leucoscepus</i>
Inziva	Red eyed dove	<i>Streptopelia semitorquata</i>

Respondents reported that, in most households, wild meat is preferred more than beef or even goat meat. They reported further that wild animals are hunted almost through out the year despite difficulties that are experienced during rain season.

Traditional hunting of wild animals offers food and protein supplements to many rural households, there by contributing positively in improving nutritional status in the community. Barnett (2000) reported that, bush meat plays a critical social

economical role to many people in developing countries. In 1993 about 7292 tones of meat were harvested from game species in Czech Republic, where Species like; Red Deer, Roe Deer, Fallow Deer, Wild Boar, and Hare were hunted (Langner, 1998). The rate of consumption of wild animal species in the world is increasing from time to time; this has a great effect on wild life population. According to FAO (2002), the increasing population pressure has caused many animal species to be hunted at a rate that out paces their ability to reproduce and replenish their population.

4.2.7 Honey

In this study, it was observed that, honey is always being collected from forest trees, traditional log beehives, underground caves and caves under big stones. Tree species preferred for hanging log bee hives include, Msombe (*Faidherbia albida*), Mkolongo (*Hyphaene petersiana*), Mvengi (*Syzygium spp*), Mninga (*Pterocarpus angolensis*), Mbuyu (*Ficus spp*), Mkwata (*Acacia spp*), Mhemi (*Sclerocarya birrea*) and Mdachi (*Afzelia quanzesis*). The above-mentioned species corresponds to those species that were proposed by Kihwele *et al.* (2001), as being ideal site for log hanging. Honey was reported to be eaten when raw or some times locally processed and packed for marketing. Respondents also reported to be using honey in treating coughs, heart burns and malaria. Burns are also smeared with honey to prevent blisters. Kajembe *et al.* (2004), who documented on uses of honey in Mbozi district, also reported this observation. The most common honey bee species in Mufindi included *Apis mellifera*, *A. adansonii*, and *A. monticola*. Sting less honeybee that includes Mlega (*Meligona spp.*) were also mentioned as one of the important species for honey production to the community.

Bee keeping industry is recognized as an important sector that contributes highly in generating national income. In 1989/90 and 1990/91 bee products contributed about 13% and 43% of the total forest based export respectively. Among the major recognized bee products are honey, bee wax and bee larvae that are valued as an important source of protein. Despite the value of bee wax and larvae, honey is ranked high in terms of its potential to mankind. Makonda (1997) reported that, honey is highly valued almost everywhere for its high-energy content. Apart from food, honey is regarded as an important source of medicines, local beer and income.

4.2.8 Aquatic species

Respondents identified Kambale (*Clarias gariepinus*) and Pelege (*Tilapia spp*) as an important fish species that are available in rivers, streams and natural ponds that are found in the study area. Cold-water crabs were also reported to be commonly used as a protein supplement, to some farmers. The use of traditional fishing gears was found to be the main option to the most anglers in most of Mufindi villages. Local fishing gears that are used in catching these species as mgonyi (a traditional fish trap that is constructed by bamboo steaks), Inyafu (fishnets) and Ndovano (hooks) that should be attached with an attractant, in most cases worm or even a piece of meat is used for this purpose.

4.3 Uses of Wild Foods at Household Level

Various communities use wild foods in several ways, some do use these wild species only as a source of food, some do process these products before marketing, some values wild foods as an important source of income. Some wild food species are also linked with traditional rituals. Basing on result from the survey, respondents

classified wild foods uses into two major categories namely direct and indirect uses as explained below.

4.3.1 Direct use of wild foods

Direct use refers to the way where wild food is defined basing on its immediate benefit to the community; it includes the way where the specie is either consumed as food or marketed to generate income.

Table 9: Alternative uses of wild foods in Mufindi district

Use of wild foods	Frequency (N= 180)	Percent
Selling for cash	1	0.6
Used as food	6	3.3
Multiple responses		
Used for food and also for cash	160	88.9
Used for food, some are processed	1	0.6
Used for cash and for processing	1	0.6
Used for food, cash and for processing	11	6.1

Respondents reported that, wild foods are highly valued due their contribution on serving as a source of food in their households. As indicated in Table 9 above, the majority (about 89 %) of the respondents were using wild foods not only for food but also as a source of income. About 3% of the respondents reported to be using wild species only for food. Such observation is supported by FAO (1989) and TFNC (1990), cited in Makonda (1997), that; the indigenous flora and fauna, found in forests and bush lands contribute to the local food systems in two ways, wild products might be collected for direct consumption or wild products might be sold to generate funds for food purchase or other expenditures.

Respondents also reported that wild food species are processed for further use, the most common species that were reported to have been undergoing processing, included green vegetables such as Night Black Shade (*Solanum nigrum*) and the Mushrooms. These products are washed and boiled before sun drying to remove moisture content to a level that can withstand microbial activities. They are then stored for use in the future during the period of scarcity. Despite of the fore said benefits only 0.6 % of the respondents reported to be using wild species for food and for processing. The other 0.6% reported to be processing wild species for future use while retaining some for immediate cash. In other instance 6.1 % reported to be using wild species as a source of food, cash and for processing.

4.3.2 Indirect use of wild foods

In the focus group discussion respondents reported other indirect uses of the wild food species; basing on the discussion it was revealed that wild edible plants bears the following indirect roles;

4.3.2.1 Medicinal value

Respondents reported that some of the wild food species are also important in curing injuries and even diseases, for instance; an extracted honey was reported to be used in curing buns and blisters. In some cases honey were also essential in treating malaria and cough mainly to children. In Mbozi district, Kajembe *et al.* (2004) reported that, buns and scalds are smeared with honey to prevent blisters and enhance quick recovery. Some plants that bear edible fruits and leaves are also used as medicinal plants, for example, an infusion from the roots of Mduma (*Garcinia burchananii*) were reported to be used as an aphrodisiac. This observation is also evidenced in Ruffo *et al.* (2002) who reports that, an infusion from the roots of

Garcinia burchananii is used as a lotion for sores and for aphrodisiac. In addition, leaves and stems of Lipembapemba (*Rumex abyssinicus*) are pondered and the juice drunk to treat pneumonia and cough, pondered leaves are good in dressing wounds.

Respondent also reported to be using leaves of Linyimbili (*Rumex usambarensis*) in treating stomach-ache and reducing constipation. In some cases, roots of Mikusu (*Uapaca kirkiana*) are boiled and its soup is used in treating intestinal problems. Ruffo *et al.* (2002) who reports that, roots of *Uapaca kirkiana* are boiled and the decoction is used as remedy for indigestion and intestinal problem supports the above observation. According to Shrestha and Shrestha (1999), reported that, about 2000 plants in Nepal have medicinal properties and 1463 plants are known to be used locally. Over 700 different medicinal and aromatic products are reported from Nepal (FAO 1992).

Tropical forests are by no means the only habitat that bound the forest-based medicines. Studies conducted in the forests of the Pacific North West of the USA, found that, the Bark of the western Yew tree (*Taxus brevifolia*) were harvested in quantities exceeding 350 tones a year. This plant were found yielding the drug taxol which were going clinical trials as an anti-cancer agent (FAO, 1992).

4.3.2.2 Ritual purposes

Respondents reported that, forest cover makes the major site for traditional spirit. Ritual ceremonies are conducted regularly under tree sheds. During the time of misfortune and natural calamities like drought, famine and disease outbreaks, elders conduct special ritual ceremonies that are accompanied by shedding lamb blood at the base of some sacred tree species. Trees mainly used for this purpose are Baobabs (*Adansonia digitata*), Fig trees (*Ficus spp*), Mtowo (*Azanza garckeana*),

Msaula(*Parinari curatellifolia*) and Mivengi (*Syzygium spp*). The above-mentioned species are also reported by Ruffo *et al.* (2002) as an important fruit species that are left un cut during land preparation.

Respondents reported further that, the main objectives of such ceremonies are to please gods and asking for blessings. These tree species are highly forbidden and it was believed that any attempt of cutting them down could lead into disappearance of an individual concerned into the forest. Only traditional leaders and elders, who had special traditional values, were allowed to cut these suckled trees under special circumstances. Elders reported that, in the past, women could seek consultations to the traditional elders regarding to preconditions of collecting firewood for fuel from these species. They could be avoided to their best, making noise as they reach the suckled places because the spirit could become angry as a result they may be confronted with severe misfortune or even being beaten by an invisible creature. This brought tense fear regarding to free exploitation of the forest products as a result forest biodiversity were highly conserved.

4.3.2.3 Pollination

The role of insects in pollination is highly recognized in plant breeding, despite of producing honey and wax, honey bees are essential pollinating agent to cross pollinated plants. Free and Williams (1977), O' ktingati and Kowero (1990), cited in Makonda (1997), found that; with the aid of honey bee pollination, the yield of coffee in Kenya can be increased by 54%. For sunflower, Falaleev and Antropov (1976) in O' ktingati and Kowero (1990), found the yield to increase by 16 percent following bee production activities. Respondents reported on being aware of such an important role of honeybee in crops productions. However, it was reported that the

increasing rate of deforestation is speeding up the threat on the availability of pollinating insects including honeybees.

4.4 Collection and Consumption of Wild Foods at Household Level

In the study, it was revealed that, wild foods are highly recognized as an important source of food for the local population. In some family, collection of wild species was a normal household activity. Wild foods are collected for the aim of being consumed at home; some are even sold for cash. Several authors have reported on collection of edible wild food species, For example, Longner (1998) reported that, in 1988 the amount of mushroom and bush meat collected for home consumption in the Czech Republic was 7292 and 23 806 tons respectively. Kajembe *et al.* (2004) found that, an individual annual average of (NWFPs) consumed in kg per household in Mbozi District, Tanzania were; 90 (Fruits), 59 (Vegetables), 44.8 (Mushrooms), 25.4 (Insect), 79 (Honey), 4 (Small animals), 2.3 (Birds) and 2.1 (Roots and Tubers). In Sweden, the inventory of wild berries recorded 500 million kilograms annual yield of wild berries from 1975 to 1980 (Longner, 1998).

Collection and consumption of wild foods is determined by priority option of the individuals concerned. In Mufindi, some species are preferred than others due to either their nutritional or economical values that are associated with them. The amount of wild foods that are collected and those that are consumed, are categorized into fruits, vegetables, mushrooms, bush meat and insects.

4.4.1 Collection of wild fruits at household level

Among all the edible fruits species that are available in the study area, respondents reported on 11 fruit species that were commonly used in their households. Basing on the survey result in Table 10 below; many respondents (64%) reported to be collecting Mikusu (*Uapaca kirkiana*) fruits, respondents were able to collect as high as 4854 kilograms of the fruit species in 2005/06 production season. Such large quantity of *Uapaca kirkiana* fruit collected might be caused by among other factors but the large diversity of the fruit species, which is favored by good weather condition in the study area, respondents reported to be collecting *Uapaca kirkiana* from October to January. This observation is also reported by Kajembe *et al.* (2004) who indicated that, the peak period for most wild fruits is between October to March.

Table 10: Collection of wild fruits in Mufindi district

Type of fruit	Collectors		Amount collected (kg)				
	Number of Collectors	Percent (N= 180)	Minimum	Maximum	Sum	Mean	Std Deviation
<i>Uapaca kirkiana</i>	116	64.0	1.0	140.0	4854.0	41.8	37.1
<i>Vangueria apiculata</i>	14	7.0	4.0	180.0	305.0	21.8	46.1
<i>Vitex mombassae</i>	44	24.0	2.0	120.0	975.0	22.6	30.2
<i>Synzigium cordatum</i>	5	3.0	3.0	80.0	138.0	27.6	31.5
<i>Passiflora edulis</i>	18	10.0	5.0	160.0	777.0	43.2	39.4
<i>Vitex ferruginea</i>	3	1.6	2.0	25.0	42.0	14.0	11.5
<i>Azanza garckeana</i>	11	6.1	2.0	40.0	136.5	12.4	10.9
<i>Parinary exselsa</i>	13	7.2	2.0	50.0	168.0	12.9	12.8
<i>Rhus vulgaris</i>	4	2.2	0.3	2.0	4.8	1.2	0.9
<i>Ximenia caffra</i>	4	2.2	6.0	20.0	45.0	11.3	6.4
<i>Multidentia crassa</i>	2	1.1	5.0	60.0	65.0	32.5	38.9

Despite its low percentage (7%) of respondents who reported to be collecting Misasati (*Vitex mombassae*) fruit, the fruit species was the second largely collected, about 975 kilograms of fruits were reported to be collected in the study area. Wuhehefu (*Rhus vulgaris*) obtained the lowest rank of all wild fruits collected where by 2% of respondents reported collecting 4.8 kilograms of the fruit species. It was thought that the marginal harvest of *Rhus vulgaris* were caused by poor preference

from the population, this specie is not highly valued nutritionally and rarely consumed by elder people but only children on their way for grazing consumes these fruits. With respect to standard deviation, it was found that; the deviation from the means of wild fruits collected differed from one species to the other. For instance, large variability (± 46.1 kilograms) were observed for *Vangueria apiculata* fruits which had the mean of 21.8 kilograms, followed by *Passiflora edulis* (± 39.4 kilograms) and *Multidentia crassa* (± 38.9 kilograms) which had the means of 43.16 and 32.5 kilograms respectively. Such deviation could be caused by among other factors but the extent of priorities experienced by the respondents. Species with large deviation from the mean reveals great diversity in food options as compared to those with a relatively low deviation as for the case of *Rhus vulgaris* (± 0.9 kilograms) which had the mean of 1.2 kilograms of the fruits.

4.4.2 Consumption of wild fruits at household level

In this study, it was observed that, the type and the nature of wild fruit species determines to the large extent the level of consumption of the respective fruits. As indicated in Table 11 below, many respondents (64%) reported to be using Mikusu (*Uapaca kirkiana*) fruits consuming a total of 1645 kilograms. Respondents reported that the preference in consuming *Uapaca kirkiana* was caused by the nature of the fruit itself, the fruits of *Uapaca kirkiana* are sweet and delicious. This observation was supported by Ruffo *et al.* (2002), who indicated that, the pulp of ripe fruit of *Uapaca kirkiana* is fleshy, sweet and are easily eaten raw it is delicious and is eaten by all age and gender group. The consumption of Mabosoboso (*Passiflora edulis*), Misambalawe (*Vangueria apiculata*), and Misaula (*Parinary excelsa*) amounted to, 243, 183 and 135 kilograms respectively.

Table 11: Consumption of wild fruits in Mufindi district

Type of fruit	Respondents		Amount consumed (kg)				
	Number of collectors	Percent (N=180)	Minimum	Maximum	Sum	Mean	Std deviation
<i>Uapaca kirkiana</i>	116	64.0	0.0	60.0	1645.0	14.2	11.6
<i>Vangueria apiculata</i>	14	7.0	4.0	90.0	183.0	13.1	22.4
<i>Vitex mombasae</i>	44	24.0	1.0	50.0	439.0	10.0	10.2
<i>Syzygium cordatum</i>	5	3.0	3.0	40.0	98.0	19.6	16.3
<i>Passiflora edulis</i>	18	10.0	2.0	40.0	243.0	13.5	10.0
<i>Vitex ferruginea</i>	3	1.6	2.0	25.0	42.0	14.0	11.5
<i>Azanza garckeana</i>	11	6.1	2.0	30.0	114.5	10.4	7.9
<i>Parinari exselsa</i>	13	7.2	2.0	25.0	135.0	10.4	7.7
<i>Rhus vulgaris</i>	4	2.2	0.3	2.0	4.8	1.2	0.9
<i>Ximenia caffra</i>	4	2.2	2.0	10.0	24.0	6.0	3.7
<i>Multidentia crassa</i>	2	1.1	5.0	60.0	65.0	32.5	38.9

Wuhehefu (*Rhus vulgaris*) were least preferred, only 4.8 kilograms were consumed. As for the case of wild fruits collection, respondent indicated some variability in terms of means of quantities consumed. Despite of few respondents (1.1%) who reported to consume the species, large deviation (± 38.9 kilograms) was revealed for *Multidentia crassa* which had the mean of 32.5 kilograms. The consumption of *Vangueria apiculata* as reported by 7% of the respondent revealed the second largest standard deviation (± 22.8 kilograms) from the mean of 13.1 kilograms. The lowest deviation (± 0.9 kilograms) was observed in *Rhus vulgaris* that had the mean of 1.2, only about 2% of the respondent reported to consume the species. Low priority of consuming *Rhus vulgaris* fruits might be caused by among other factors but the nature of the fruit itself, fruits are tiny and acidic when eaten unripe (Rufo *et al.* 2002). They also contain less edible pulp, in most cases the tiny fruit are consumed by the children, they are rarely preferred by elders.

Preference in consumption of wild species is also reported by Kajembe *et al.* (2004), who noted that, among wild fruits that are available in Mbozi, *Parinari curatellifolia*, *Cordia Monoica* and *Ximenia Caffra*, are highly preferred than others

because they are good for making beverages. This implies that wild fruit species that do not have an added economical value as for the case of *Rhus vulgaris* are rated low as compared to others. The quantity of other fruit species that are consumed in the study area are shown in Table 11.

4.4.3 Collection of vegetables and mushrooms

As indicated in table 12 below, many respondents (51%) reported to be collecting mushrooms, where a total of 2104 kilograms of edible mushrooms were collected. Muhaka (*Solanum nigrum*) were the second largely collected vegetable species, respondents (35%) of the respondent reported to collect as large as 1769 kilograms.

Table 12: Collection of vegetables and mushrooms at in Mufindi district

Type of vegetables	Collectors		Amount collected (kg)				
	Number of collectors	Percent	Minimum	Maximum	Sum	Mean	Std Deviation
<i>Solanum nigrum</i>	62	36.0	2.0	90.0	1769.0	28.5	20.9
<i>Amaranthus spinosus</i>	3	2.0	8.0	12.0	28	9.3	2.3
<i>Sesamum angolense</i>	4	2.3	3.0	60.0	82	20.5	26.9
<i>Caylsea abyssinica</i>	11	6.4	0.0	26.0	92	8.4	9.3
Mushrooms	92	51.1	3.0	70.0	2104.0	22.9	18.0

Few respondents (2%) reported to be collecting *Amaranthus spinosus*, in this case, only 28 kilograms of the vegetable specie were collected. It was not clearly known as to why collection of *Amaranthus spinosus* ranked low, despite of its nutritive value it contains. However, one can think on its limited ecological requirement as being among the factor that hinders its availability. Despite moisture requirement, *Amaranthus spinosus* grow better in fragile fertile soils unlike other species, they are

normally found growing in soils with substantial amount of decomposed organic matter, these conditions are normally lacking in many places.

For the case of variability in means, *Sesamum angolense* which had a mean of 20.5 kilograms, indicated large standard deviation (± 26.9 kilograms), followed by *Solanum nigrum* and mushroom that accounted means of 28.5 (± 20.9 kilograms) and 22.9 (± 17.9 kilograms) respectively. Species with large deviation from the mean as for the case of *Sesamum angolense* (± 26.9 kilograms), reveals great diversity in food options for respondents as compared to those with a relatively low deviation as for the case of *Amaranthus spinosus* (± 2.3 kilograms) which had the mean of 9.3 kilograms.

4.4.4 Consumption of vegetables and mushrooms

Respondents could consume mushrooms highly than vegetables, edible insects, fish or even bush meat. Table 13 below, indicates that, many respondents (51%) were able to consume 796.5 kilograms of mushrooms at their households. This amount was higher than those of vegetable species, for instance; few respondents (36%) reported to consume a total of 612 kilograms of *Solanum nigrum*.

Table 13: Consumption of vegetables and mushrooms in Mufindi district

Type of vegetables	Respondents		Amount consumed (kg)				
	Number of collectors	Percent (N=172)	Minimum	Maximum	Sum	Mean	Std deviation
<i>Solanum nigrum</i>	62	36.0	2.0	40.0	612.0	10.0	6.0
<i>Amaranthus spinosus</i>	3	2.0	8.0	12.0	28.0	9.3.0	2.3.0
<i>Sesamum angolense</i>	4	2.3	3.0	30.0	52.0	13.0	12.6
<i>Caylsea abyssinica</i>	11	6.4	2.0	30.0	103.0	9.4	9.7
Mushroom	92	51.1	0.5	0.5	6.5	8.7	7.3

Mushrooms are highly preferred food in many African countries, they are valued higher than any kind of food, most people consider mushrooms the best, equal to meat, most of all chicken (Harkonen *et al.*, 2003). To the other end, *Amaranthus*

spinosus ranked lower in terms of its consumption, where 2% of respondents reported to consume a total of 28.0 kilograms of the species.

As for the case of mushrooms collection, variability in means consumed were revealed in different species, for instance, *Sesamum angolense* which had a mean of 13.00 kilogram, indicated large standard deviation (± 26.9 kilograms), followed by *Solanum nigrum* and mushroom that had means of 28.5 (± 20.9 kilograms) and 22.9 (± 17.9 kilograms) respectively. Species with large deviation from the mean as for the case of *Sesamum angolense* (± 26.9 kilograms), reveals great diversity in food options among respondents as compared to those that reports low variations as for the case of *Amaranthus spinosus* which had a mean of 9.3 (± 2.3 kilograms).

4.4.5 Collection of fish, insects and bush meat

Fishing, collection of edible insects and hunting are among several means of obtaining animal proteins for the population. In Mufindi, fishing activities takes place in Ruaha, Lyandembela and Msiwasi rivers. Several natural dams such as Nzivi, Ngwazi and Kihanga were identified as an essential fishing sites that harbors substantial amount of fish species. Despite their role as an important source of food to the population, relatively low number of respondents reported to be involved in fishing, hunting and collecting edible insects as compared to other edible species. As indicated in table 14 below, only about 6% of respondents reported on collecting termites where a total of 35.5 kilograms of such insect species were collected.

Table 14: Collection of fish, insects and bush meat in Mufindi district

Type of product	Collectors		Amount collected (kg)				
	Number of collectors	Percent (N=180)	Minimum	Maximum	Sum	Mean	Std Deviation
Termites	11	6.11	1.0	5.0	35.5.0	3.22	1.5
Fish	4	2.22	5.0	14.0	34.0	8.5	3.9
Bush meat	3	1.70	1.0	2.0	4.0	1.3	0.7
Grasshoppers	4	2.22	0.15	1.0	2.0	8.5	0.3

Few respondents (2%) reported to collect a total of 34 kilograms of fish where Bush meat was collected by much less respondents (1.7%) who reported to collect only 4 kilograms. However, in comparison with other products, termites were highly preferred than other food species where about 6% respondents reported to collect a total of 35 kg for consumption at their household level. Kajembe *et al.* (2004) and FAO (2002) indicated that, traditional hunting of wild animals and the collection of edible insects offers a substantial animal protein supplement to the population.

4.4.6 Consumption of fish, insects and bush meat at household level

Table 15 below shows the consumption of fish, edible insects and bush meat in Mufindi district. In this table one will note that, all quantities of termites, fish, bush meat and grasshopper that were collected, were all consumed by the household members.

Table 15: Consumption of fish, insects and bush meat in Mufindi district

Type of the product	Respondents		Amount consumed (kg)				
	Number of collectors	Percent (N=180)	Minimum	Maximum	Sum	Mean	Std Deviation
Termites	11	6.1	1.0	5.0	35.5	3.22	1.52
Fish	4	2.2	5.0	14.0	34.0	8.5	3.87
Bush meat	3	2.0	1.0	2.0	4.0	1.3	0.70
Grasshopper	4	2.2	0.2	1.0	2.0	8.5	0.30

Hunting were reported to be taking place in minimum occasions as compared to the past, respondents reported that, the increased human population has caused the destruction of the natural habitats for the wild animal species, thereby accelerating their scarcity. Only 4 kilograms of bush meat were reported to be consumed by respondents (about 2%) at their households. Despite of such constraints, hunting is recognized as an important source of food to the population. According to Langner (1998), hunting and fishing is used as an important source of animal protein for the local population. The same report found that, from 1995 to 1998 the production of bush meat for both commercial and local consumption in Sweden amounted to 2 600 000 kilograms. In the same period, 1 597 000 kilograms of fish were produced.

4.5 Wild Food Marketing in Mufindi District

Marketing of wild foods in Mufindi was among the important household activities to some families, respondents reported that fruit species, vegetable and mushrooms are highly demanded at local market. They added further that one could even buy a lamb or even a bag of industrial fertilizer from wild foods marketing. However, the study revealed an even distribution of household income obtained through wild food marketing from one division to another. As indicated in Appendix 1, respondents from Ifwagi division reported to earn a total of Tsh. 520 000 from sales of 2714 kilograms of wild fruits.

The earnings from Ifwagi, varied with those of Malangali and Sadani in the way that, respondents from Malangali could earn Tsh. 86 350 from sales of 618 kilograms of the wild fruits where, those from Sadani could make up to Tsh. 62 400 from the sale of 360 kilograms of fruit species. For the case of mushrooms and vegetables, respondents from Ifwagi ward reported to offer about 1023 kilograms of these products for sale earning a total of Tsh. 237 800. In Malangali, respondents could be able to make a total of Tsh. 54 900 for sale of 187 kg of mushrooms and vegetables. For the case of Sadani, respondents reported that 119 kilograms of the named food species were sold earning a total of Tsh. 20 300.

4.5.1 Market price for wild foods in Mufindi

Table 16 below gives details on the amount of wild foods that were marketed in the study area. One may note that prices per kilogram in some wild foods do vary from one ward to another, as for the case of mushrooms and *Vitex mombasae*, for instance, in Ifwagi and Sadani ward the price per kilogram of mushrooms were Tsh.500 Same product could worth Tsh. 300 in Malangali. *Vitex mombassae* were sold at Tsh. 100 per kilogram in Ifwagi, but one could earn only Tsh. 50 through sale of the same amount of the product at Malangali or Sadani.

Variation of such prices was thought to be influenced by among other factors the forces of demand and supply that are attached to these species. Ifwagi ward encompasses villages such as Kinyanambo and Rungemba that are passed along Dar es salaam - Zambia road. Passengers traveling through this road, normally adds the demand to these products, they do buy some wild foods that are sold by the roadside on their way to their destination.

Mafinga is a sub town where the district headquarters are located. The place has several industries, majority of them deals with timber production, others includes, Tanzanian Tea Packing (TATEPA), and the Pyrethrum processing industry which is situated in Kinyanambo, these industries absorbs a substantial number of employees who adds up the need for wild food consumption. In addition, the availability of social services such as health and education has added the population in Mafinga, this has increased the demand for wild foods driving up the price of mushrooms and that of *Vitex mombasae* fruits in Ifwagi ward as compared to Sadani and Malangali wards.

Table 16: Income earned through wild foods marketing in Mufindi district

Ward	Number of collectors (%)	Gross income (Tsh.)	Net Income per season (Tsh.)	Monthly income (Tsh.)	Percentage income per minimum wage (Tsh 65 000)
Ifwagi	40 (22%)	757 800.00	18 945.00	6 315.00	9.7
Malangali	16 (8.8%)	141 250.00	8,828.00	2 942.00	4.5
Sadani	14 (7.8%)	82 200.00	5,871.40	1 957.00	3.0

Respondents from Sadani reported that the supply of Mushrooms during rain period (Dec- March) is so high, one can easily collect them just from around home steady, due to this, its price becomes low (Tsh. 200 per kilogram). In this case, one can make good earning from mushroom if he transports the product to Mafinga, (about 27 kilometers) for marketing. In Malangali the price of Mushrooms are influenced by the availability of the monthly open market (Gulio), which gathers many traders dealing in both industrial and agricultural products. This kind of market attracts also many consumers for wild foods like mushrooms thereby increasing its market price.

Basing on data collected, one can easily estimate a monthly income obtained through wild food marketing in Mufindi district. As indicated in Table 16 and appendix 1, about (22%) of the respondents from Ifwagi could earn an income of Tsh. 757 800, where those from Malangali (9%) and that of Sadani (8%) could raise

a respective income of Tsh. 141 250 and Tsh. 82 200. In the study area, it was observed that, the peak period for most wild fruits, vegetables and mushrooms is from November to April. However, Kajembe *et al.* (2004) and Ruffo *et al.* (2002) found that, the peak period for most wild food species are in the rain season (October to April).

Despite the findings, respondents noted further that, with an exception of *Solanum nigrum*, an effective marketing for most wild foods is in December, January and February. Appendix I, summarizes the total monthly earnings one can raise due to wild food marketing in different wards of the study area. In this case, Ifwagi ward reported the highest earnings where one could make a monthly income of Tsh. 6,315.00 due to wild food marketing, Malangali and Sadani reported a respective income of Tsh. 2 942 and 1 957 per month. These findings are below the monthly potential income of Tsh. 3 700 000 which was reported by Makonda (1997) in Geita forest reserves. It is also below a daily income of Tsh. 30 000 reported by Kajembe *et al.* (2004) in Mbozi district.

4.5.2 Contributions of wild food marketing to the household income

Based on minimum government wage of Tsh. 65 000 per Month (TGOS, 2005), one can be able to verify the contribution of wild food marketing to household income for Mufindi community. The result (Appendix; I) showed that Ifwagi division had the highest (9.72%) monthly contribution to the household income, followed by Malangali (4.53%) and Sadani (3%). These results are bit lower than those reported by Prasad (1999) who found that, in part of West Bengal, communities derive as much as 17% of their annual household income from NWFP most of them being wild foods. Same report argued further that, small-scale forest based enterprises,

many of which rely on NWFPs provide up to 50% of their income to about 25% of Indians rural labour force.

4.6 Food Security Status in Mufindi District

The finding of the study revealed that, majority (66%) of the respondents experienced food shortage in year 2004/05 production season, this mean that only 35% of the respondents were food secure. The survey noted also that, despite of good infrastructure; Kinyanambo village had many respondents (13%) who reported being food unsecured, followed by Maduma and Tambalang'ombe village each of which had 23 respondents (Table 17).

Table 17: Response on experience of food shortage in Mufindi district

Name of village	Experienced food shortage	
	Frequency (N = 118)	Percentage
Kinyanambo	24	13.3
Maduma	23	12.8
Itimbo	18	10.0
Rungemba	11	6.1
Kitelewasi	19	10.5
Tambalang'ombe	23	12.8
Total	118	65.6

It was not clearly known on why Kinyanambo had such high percentage of food shortage as compared to other villages. How ever, one can think on increased family size as caused by rural to urban migration as a driving force for such food shortage. Kinyanambo village is bounded with Mafinga town, where many youth migrate from various villages searching for employment. Due to limited vacancies in both formal and non-formal sectors, these population end up being dependant to nearby

relatives or even friends exploiting the available food resource there by reducing the expected expenditure time.

In other cases respondents reported that the prolonged drought of year 2006, local brew making for traditional dances, ritual ceremonies and overselling of maize for income generation are some of the common causes of food insecurity to some households. This is in agreement with Makundi (1996) and Ishengoma (1998) who reported that, local brewing, overselling of food crops for family income, traditional dances and funerals contribute to household food insecurity. Nyingili (2003) argued that, some parts of Tanzania face food shortage due to drought, floods and absence of smooth transfer of food from surplus areas to deficit one.

4. 6.1 Responses to household food shortage

Households facing regular incidences of food shortage normally develop a mechanism, which help them to cope with the stress. Respondents (Table 18) reported on six alternatives that were used as coping strategies during the period of food shortage, many respondents (34%) reported to sell their labour power in exchange of food and cash.

Table 18: Alternative means used in overcoming food shortage in Mufindi district

Alternative means employed	Frequency (N=124)	Percent
Selling labour force	42	34.0
Obtained reserve food aid from the government	5	4.0
Petty trading	10	8.0
Selling livestock	16	13.0
Collecting wild food for food	39	32.0
Selling local beer	3	2.3
Selling firewood and collecting wild foods	5	4.0
Selling labour, selling wild food	4	3.2

About 39% of the respondent reported to be collecting wild foods for home consumption, while 16% respondents had to dispose their livestock for sale, about 10% respondents reported on conducting petty trading in order to generate income that could be spent for food. In addition, respondents reported on other mechanisms such as the dependence in reserve food offered from strategic reserve food programme (5%), selling firewood and collecting wild foods (5%), selling labour and wild foods (5%) and lastly, selling local beer (3%).

Copping strategies may differ due to variations in local conditions but there is a common pattern in the sequence of response. According to Nyingili, (2003) various mechanisms are used in coping with food shortage. These include; collection of wild foods, use of inter house transfers and loans, use of credits from merchants and money lenders, rationing of food consumption, sale of possessions, migration from rural to other rural areas for employment, use of food distributed through relief programs, sale of productive assets, break up of the household and distress migration. In addition, Ishengoma *et al.* (1998) reported on other responses that are commonly followed by various the household

members to cope with food shortage as the change of structure of income by involving multiple agricultural and off-farm activities, raising income levels by labour selling and varying assets to smooth consumption. Despite the mechanisms advocated by the household members to cope with food stress at the period of food shortage, the findings obtained from focus group discussion revealed that these strategies are not effective in supporting adequate food need to the family members.

4. 6. 2 Contribution of wild foods in household food security

It was revealed in the study that, the population obtained food for household use mainly from agriculture where food crops are grown and the produce is used for food. In addition, foods were found to be sourced through purchasing from the market, obtaining reserve grains, and through collection of wild foods. Based on average weight of food intake per household per day, it was revealed through focus group discussions that, wild foods contribute about 11% (Figure 2) of the total household food consumed.

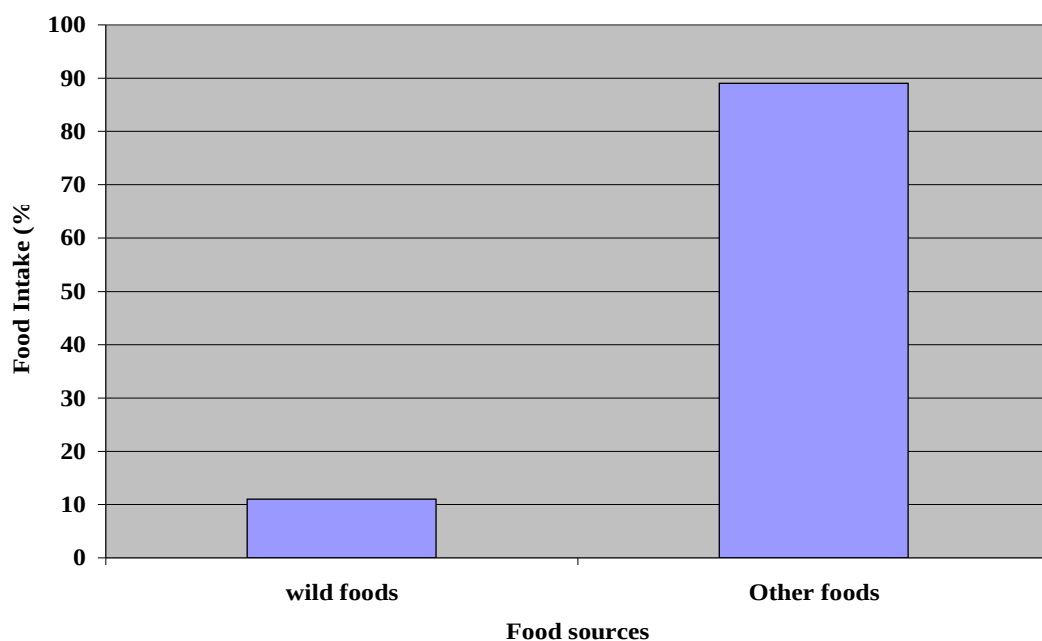


Figure 2: The contribution of wild foods to the daily household food intake in Mufindi district.

This observation is lower when compared to that reported by Kajembe *et al.* (2004) for Mbozi, in which the contribution of wild foods was 12.7%. Studies conducted in other places of Tanzania revealed that wild foods are important to meet subsistence needs. Kajembe *et al.* (1994) and Maximillan (1998) insisted that wild foods are as important to diet to day as ever before. In addition, Makonda (1997) as cited in (MLTRT, 1989) reported that, in Tanzania the gross income of NWFPs contributed about 50% of the forest based earnings in 1988 and it was projected to reach 72.3% in 2003.

4.6.3 The status of wild foods in Mufindi

It was reported in focus group discussion that wild foods species are becoming scarce from time to time. Discussants revealed further that, the status of the wild food species has declined significantly as compared to the past years because of poor farming practices that takes no care to the sustainable environmental conservation. The increased rate of deforestation caused by shifting cultivation and uncontrolled fires that are set during land preparation were identified as the major cause of such a decline. In addition, unreliable rainfall that has prolonged a severe drought was cited as a cause for declining of wild food species. Rufo *et al.* (2002) reported that, with an increasing deforestation, exploitation and changes in land use, the diversity of natural vegetation in Tanzania is declining and many of these wild foods and fruits are no longer readily available. Some of the wild species are now becoming rare, this predicts the distinction of these species in a near future.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

Mufindi district has vast number of NWFPs that are collected from the forests, fallow land, swamps and rivers. Most of these NWFPs offer a substantial role in providing wild foods to the population. The contribution of wild foods to the household income and food security to the study area is significantly diversified and valued, ranging from direct provision of food to generation of income for various household uses. Wild foods that were identified in the study area included fruits, vegetables, mushrooms, honey, bush meat, fish and edible insects.

This study has shown that, about 66% of the respondents was food insecure leaving only 34% with enough food. Families that were prone to periodic food shortage were reported to have developed some mechanisms of reducing food stress, these included the collection of wild foods for food and cash, selling of labour, petty trading, selling of local beer, collecting and selling of fire wood and disposing livestock in exchange of food or cash. It was also shown that, the community in Mufindi district has relied in wild foods especial at the time during grain shortage. Such food species has both the direct and indirect contribution in household food security.

Directly, wild foods offered an important food source to the community. In addition, wild food products are marketed for cash, such earned income can be used in substituting the food deficit for family use. However, the study revealed that there

was a decreasing availability of wild food products due to low rainfall, deforestation, high population and over exploitation of natural resources.

5.2 Recommendations

In view of the roles played by wild foods in the community, the following are recommended.

5.2.1 Community empowerment

There is a great need for the government, the Non Governmental Organizations (NGOs), private sectors and other stakeholders to empower the community of Mufindi with simple appropriate technologies for harvesting and processing wild fruits into different products such as jams, marmalades, juices and pickles. This will enable the local people improve cash income earnings giving more food purchasing power to the community. Drying technologies for vegetables and mushrooms should also be advocated to reduce spoilage and improve storage practices. This will help in adding value to the products and thereby ensuring better handling and thereafter better markets.

5.2.2 Creation of awareness on environmental conservation

Awareness should be raised on the importance of NWFPs for rural development and the environment biodiversity. Communities should be encouraged to plant desired tree species near home and around fields to minimize pressure on the forests and woodland. Efforts are to be made to sensitize the community on both the immediate effect and the long term benefit of domesticating wild food species to the community.

5.2.3 Focusing on more Research on Wild foods management and marketing

Research on wild foods marketing should be encouraged in order to motivate better management and preservation of these edible species. The government through the Ministry of Natural Recourse and Tourism (MNRT) should allocate a sound budget on research for the overall NWFPs management practices to ensure its sustainability.

5.2.4 Incorporating traditional values in natural resource management

Traditional values should be recognized when addressing issues related to NWFPs, the government and other stake holders should incorporate the existing values that are respected by the surrounding community for sustainable management programs. Most of the sacred forests and rivers are treated with fear, their accesses require a prior attention from elders, and these places are believed to have super natural power that can harm trespassers who does not abide to the set conditions. Most of the sacred forests contain fruits and medicinal plants that are found growing in catchment areas. It is from this understanding that; such knowledge can be supported to reduce over exploitation of natural resources.

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APPENDICES

Appendix 1: Wild food marketing in Mufindi district

Type of wild food	Quantity (kg) of household foods collected per division								
	Ifwagali Sadani			Malangali					
	Quantity (kg)	Price (Tsh/kg)	Gross income	Quantity (kg)	Price (Tsh/ kg)	Gross income	Quantity (kg)	Price (Tsh/ kg)	Gross income
Fruits									
<i>Uacapa kirkiana</i>	1,880	200	296,000	473	200	74,600	302	200	60,400
<i>Vitex mombasae</i>	356	100	35,600	45	50	2,250	4.00	50	2,000
<i>Passiflora edulis</i>	628	300	188,400	0.0	-	-	0.00	-	-
<i>Syzygium cordatum</i>	0.0	-	-	40	100	4,000	0.00	-	-
<i>Vitex ferruginea</i>	0.0	-	-	10	50	500	0.00	-	-
<i>Ximenia caffra</i>	0.0	-	-	50	100	5,000	0.00	-	-
Sub total (a)	2,714		520,000	618		86,350	306		
Mushrooms and Vegetables									
Mushrooms	279	500	139,000	181	500	54,300	42	300	12,600
<i>Solanum nigrum</i>	988	100	98,800	6	100	600	77	100	7,700
Sub total (b)	1,023		237,800	187		54,900	119		20,300
Total(a+b)	3,337		757,800	805		141,250	425		82,200

Appendix 2: Matrix for data collection method

No	Objectives	Research techniques
1	To identify the wild foods available in the study area	Semi structured interviews, Documentary search, Checklist for scientific identification, available foresters as botanists
2	To estimate the collection and consumption of wild foods to the surrounding communities	Structured interviews, Semi-structured interviews
3	To estimate the incomes income generated through wild foods marketing in the selected villages	Structured interviews, wealth mapping, Market survey
4	To stress out the link between wild foods use and house hold food security in Mufindi District	Focus group discussion, Structured interviews, Semi-structured interviews

**Appendix 3: Structure questionnaire (guide) for collection general
characteristics of the respondents**

Household's information

Name of Enumerator.....

Date.....Questionnaire number.....

Village.....Division.....Ward.....

Household identification number.....

Section A: General characteristics of respondents

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

2. Name of respondent.....

3. Age.....years

4. Sex

01. Male

02. Female

5. Marital status

01. Single

02. Married

03. Divorced

04. Widow

6. Education Level

01. No formal education.

02. Adult education

03. Primary School education

04. Secondary school education

05. Graduate from a university

06. Others (Specify)

7. Occupation

- 01. Peasant
- 02. Farmer
- 03. Petty trade
- 04. Civil Servant
- 05. Others (specify)

Section B: Types of farming systems

8. Do you own land?

- 01. Yes
- 02. No

9. Does the land satisfy your annual house hold food needs?

- 01. Yes
- 02. No

10. What are other sources of income?

No.	Type of activity	Quantity obtained (unit)	Market price Tsh/kilogram	Marketing cost	Net income

Section B: Information on wild food management

11. Do you know any wild food specie grown around the village?

- 01. Yes
- 02. No

16. Do you normally process your food products before marketing?

01. Yes

2. No

17. If No (question 27), why?

01. I am not aware about the processing technology

02. It is not worthwhile

03. The technology is expensive

04. It is difficult to process

05. I don't know

06. Others (Specify)

18. Have you attended any seminar or training in wild fruit processing?

01. Yes

02. No

19. If No (question 18 above), why?

.....

.....

.....

20. What kind of incentives did you get to promote domestication programs of wild fruits in your area?

01. Training on seed testing

02. Training on nursery management

03. Training on propagation

04. Training on field management

05. Offering planting material

06. All of the above

07. Others (Specify)

21. Give detailed information regarding to wild foods marketing in the table provided bellow.

No	Type of wild food sold	Source of the product	Amount sold /day/unit	Price(Tshs)Per unit	Amount sold per season.
1					
2					
3					
4					
5					

22. Where do you sell these wild food products.....

.....

.....

Appendix 4: Checklist (guide) for focus group discussion

Part A: Health/medical officers

1. Name of the hospital/health center/dispensary.....
2. Is there any nutritional diseases reported in your center?
 01. Yes
 02. No.
3. If yes, what was these diseases most affecting the population?
 - a).....
 - b)
.....
 - c).....
.....
4. What are the most vulnerable group in the population.....
5. How do you advocate on the control of nutritional disorders to the surrounding community?.....
.....
.....
.....
.....

Part B: District agricultural officers, extension officers, Non Governmental Organizations and farmers

1. Name of the organization/institution.....
2. What is the current status of wild food availability in your area/village/district as

compared to 10 years ago.....

.....
.....

3. If the availability of wild food species is not the same as that of 10 years ago, what has caused such a change?.....

.....

4. What role do wild foods play in the livelihood of the people in your area.....

.....
.....
.

5. In your opinion what is to be done to restore the natural food availability in our areas.....

.....

6. In your opinion what role do cultural values have played in sustaining natural resource management in your area.....

.....
.